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Adolescent Interest and Physical Activity Fluctuation in Technology-Integrated Physical Education

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ADOLESCENT INTEREST AND PHYSICAL ACTIVITY FLUCTUATION IN

TECHNOLOGY-INTEGRATED PHYSICAL EDUCATION

by

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ABSTRACT

ADOLESCENT INTEREST AND PHYSICAL ACTIVITY FLUCTUATION IN TECHNOLOGY-INTEGRATED PHYSICAL EDUCATION

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This study examined the situational interest and physical activity fluctuation of middle school students during technology-integrated physical education. The researcher utilized a quasi-experimental design where 6^{th} grade students were placed into an experiment group that utilized technology-integrated resources during physical education, or a comparison group that did not utilize technology-integration during physical education. The students participated in five physical education lessons with content based upon the conceptual understanding of relative physical activity intensity, heart rate measures, energy expenditure and the FITT principles. Student's physical activity levels were tracked over the five-lesson research period by accelerometers. Situational interest was assessed through a questionnaire students completed at the end of each physical education lesson. The sample consisted of 53 students, 26 in the experiment group and 27 in the comparison group. The researcher hypothesized (a) that students participating in the technology-integrated physical education lessons would have increased situational interest; (b) that there would be no statistically significant difference in physical activity levels between the technology-integrated lessons and the comparison lessons; (c) that the situational interest in the technology-integrated lessons would decline over time; (d) that there would be no statistically significant change in physical activity levels over time for students participating in the technology-integrated physical education lessons. The

physical activity and situational interest data was analyzed using descriptive statistics, Pearson-product moment correlational analysis and multivariate analysis of variance (MANOVA) with repeated measure in both the technology-integrated physical education lessons and those of the comparison group. Overall, the students participating in the technology-integrated physical education lessons reported significantly lower amounts of time participating in MVPA, took less steps during each lesson and had less physical activity related energy expenditure. In addition, the students in the experiment group did not report higher situational interest with the introduction of technology-integrated resources into their physical education lessons. The findings suggested that utilizing technology-integration to increase a students' situational interest or physical activity level may not be the most effective method in a relatively short duration of physical education lessons. One explanation for the findings is that the research lesson technologies required little or no physical activity to engage; rather they required cognitive thinking and execution to complete the instructional tasks and fulfill the goal of increasing students' conceptual content knowledge which may have negatively affected the students' physical activity and interest levels. Future research should employ a crossover longitudinal approach where the trends in interest and physical activity measures can be analyzed over time.

This thesis is dedicated to my husband, Michael Dragon, the most supportive and helpful person I know, who encourages me on a daily basis to achieve my goals.

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CHAPTER I: INTRODUCTION

In physical education, students learn a variety of sports and physical activities which enhance physical fitness including cardiovascular, flexibility, and muscular endurance. A majority of students in elementary physical education enjoy partaking in these lesson activities; however, students' participation, interest and drive to succeed typically slows as they progress through secondary physical education programs (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002). Possible reasons for this decrease can result from a lack of interest in physical education, low self-esteem, a general dislike for physical activity, or a low interest to find success within the physical education setting, among others (Zhu & Chen, 2013). Physical educators have the responsibility to assist students in developing interest in physical activity through engaging them in a variety of lesson activities.

Student interest can be personal and situational (Hidi & Renninger, 2006). Situational interest is a learners' short-term appeal to a specific activity during interaction. Invoking this type of interest in the physical education setting has been shown to impact student engagement and interest change (Shen & Chen, 2006). Student performance in physical education can be impacted by the use of situational interest as well (Shen & Chen, 2006; Zhu, Chen, & Parrott, 2014). Hence, teachers can use situational interest as a tool to engage students in the activities they normally do not find interesting. Personal interest refers to the enduring disposition toward an activity. Personal interest in physical education may vary due to the range of lessons including sports, fitness, cooperative games and rhythmic movements. For example, a student may show personal interest in a soccer unit, but may not be interested in participating in a yoga unit. Personal interest typically develops over a relatively long period of time through numerous practices and participation in the activity.

Technology is a resource that has been integrated into classrooms, engaging students through situational interest, and has increased their motivation to participate in lesson activities (Hall, 2012). In general, children and adolescents are regularly connected through digital devices and computers in the 21st century. This connectedness can lead to even more sedentary time when children choose to play video games or sit behind a computer as opposed to participating in physical activities. Using this close connection with technology to the educator's advantage has a high potential in the education setting. In physical education, teachers have begun to embrace interactive video games, mobile applications and other digital technologies to enhance student interest and physical activity levels. Research has shown that effective technology integration can have a significant impact on student engagement and assist in enhancing student learning in physical education (Casey & Jones, 2011).

Research in the field of physical education has shown that not all teachers are proficient at integrating digital technologies into the classroom (Woods, Karp, Miao, & Perlman, 2008). In fact, many teachers are using the current technology to increase their professional productivity to enter attendance, calculate grades, and create lesson plans; however, teachers can also integrate technology into their physical education lessons to benefit students by increasing student interest and engagement in physical activity. Teachers who are interested in effectively integrating technology into physical education can refer to the National Association for Sport and Physical Education (NASPE) position statement on the topic of appropriate use of instructional technology in physical education (NASPE, 2009), which provides guidelines for effectively integrating technology in the physical education setting.

When used appropriately in physical education, technology integration can spark student's situational interest in physical activity (Sun, 2012). To the researcher's knowledge, limited studies are available that evaluate students' physical activity levels and interest fluctuation with the use of technology-integrated physical education lessons. The majority of studies reviewed in Chapter II did not evaluate students' physical activity levels over time, or did not include a comparison group. The proposed study will assess students' physical activity levels during five alternating physical education lessons over ten days, which will be effective for drawing conclusions regarding the activity levels of technology-integrated physical education over time. In addition, the study will compare the activity levels of students who are participating in the same physical education lessons without technology-integration (i.e., the comparison group) which will provide relevant information regarding the effectiveness of technology-integrated lessons to influence physical activity levels.

The evaluation of student situational interest over time is another important aspect of this research. Only one study (Sun, 2012) examined situational interest in the technology-integrated physical education setting; this study only measured situational interest twice, not multiple occasions, thereby limiting its ability to capture the fluctuations over time. In the proposed thesis, the researcher intends to investigate whether or not student interest fluctuates over time, which can provide valuable information to researchers and educators alike. For example, if interest in technology-integrated lessons declines over time, teachers may need to modify the type of technology or physical activity they are implementing to ensure that student interest remains at the highest level possible. Specific to the research context, this study is relevant to the proposed school district through its alignment to the local curriculum and state standards as well as the school division's objective to incorporate 21st century skills in all subject areas, including physical education.

Purpose Statement

The purpose of this research was to examine the fluctuation of students' interest and physical activity levels during technology-integrated physical education lessons. Specifically, students' physical activity levels during five technology-integrated physical education lessons were compared to the physical activity levels of students participating in the same five lessons without technology-integration. Upon completion of each lesson, the participants answered a questionnaire regarding their situational interest during their physical education lesson. Upon conclusion of the study, it was intended that the following questions were answered: (a) Compared to the comparison group, would students report higher situational interest in the technology-integrated lessons? (b) Compared to the comparison group, would students have significantly different physical activity levels in the technology-integrated physical education lessons? (c) Did interest in technology-integrated physical education lessons decline over time? (d) Did physical activity levels remain the same or decline over time in technology-integrated physical education lessons? It was hypothesized (a) that students participating in the technology-integrated physical education lessons would have increased situational interest; (b) that there would be no statistically significant difference in physical activity levels between the technology-integrated lessons and the comparison lessons; (c) that the situational interest in the technology-integrated lessons would decline over time; (d) that there would be no statistically significant change in physical activity levels over time for students participating in the technology-integrated physical education lessons.

Methods

This study utilized a quasi-experimental design where participants were placed in either the experiment or the comparison group depending upon their class. Participants for the research were 6th grade students at a local middle school. The researcher expected to recruit 150 students for participation in order to combat potential attrition and improve the statistical power. However, only 53 students were enrolled to participate in the research study. Students in the experiment group participated in the technology-integrated physical education lessons, while students in the comparison group participated in the same physical education lessons without the use of technology. The study period lasted approximately two weeks, and the lesson activities took place every other day for a total of five lessons. The content of the physical education lessons focused on the conceptual understanding of relative physical activity intensity, heart rate measures, and energy expenditure. The lessons also addressed the FITT principle; how often you exercise (i.e. frequency), what percentage of your target heart rate is utilized (i.e., intensity), the mode of exercise you are participating in (i.e., type), and how long you exercise per day (i.e., time) to obtain the health enhancing benefits.

Students in the experiment group participated in the technology-integrated physical education lessons using three applications on a school provided iPad. Quick response (QR) codes were scanned using a QR reader and the directions for the physical activity students were required to participate in appeared on the electronic device. While participating in the lesson activity, students assessed their intensity level through an instant heart rate application or talk test and entered their findings into an online physical activity log via Edmodo. The comparison group of students participated in the same five physical education lessons, but without the technology-integrated resources. Instead, students in the comparison group were given verbal directions for each of the fitness activities that they were required to participate in by their physical education teachers. After participating in the physical activities, students assessed their intensity levels through a heart rate calculation or talk test, and recorded it onto a physical activity log with a pencil and paper.

Student physical activity levels were recorded using GT3X ActiGraph™ tri-axial accelerometers. The accelerometer attached to a cotton fabric belt was worn on the hip and offered an objective measure of the physical activity counts, intensity levels, time, steps, and physical activity energy expenditure. At the start of each research lesson, students attached and wore accelerometers to track their physical activity during the experiment and comparison lessons. The accelerometers were returned to the physical education teacher upon completion of the lesson. During the lesson closure, students completed a short survey assessing their situational interest in the daily lesson activities. Student interest was measured using the Situational Interest Scale. The scale was developed by Chen, Darst, and Pangrazi (1999) to measure students' situational interest during physical activities in the physical education setting. The scale measured 5 dimensions of situational interest, Novelty, Challenge, Exploration Intention, Instant Enjoyment, and Attention Demand. This scale was shortened to focus primarily on overall situational interest to minimize the complication of the interest and physical activity measures, and meet the needs of the specific research context. Students completed the scale at the end of each physical education research lesson during the 10 day period. Both the GT3X accelerometer and the situational interest scale have been tested for reliability and validity (details documented in Chapter III).

Upon completion of the data collection, data was analyzed to draw conclusions about the variables and to answer the research questions. Specifically, descriptive statistics were used to describe the sample through the measures of central tendency and variability. A Pearson product-moment correlational analysis was used to identify significant correlations between the two variables of physical activity and situational interest. Finally, inferential statistics were used to perform a multivariate analysis of variance (MANOVA) with repeated measure on the variables of situational interest and physical activity in both the technology-integrated physical education lessons and those of the comparison group.

Assumptions and Limitations

During the research period, the researcher assumed that the physical education teachers participating in the study followed the lesson plans they were given. For the experiment group, this meant that the teachers used the technology-integrated physical activities as outlined in the lesson plans. For the comparison group, the teachers were required to follow the lesson plans and refrain from using technology-integration during the physical education activities. If this assumption was met, the data generated from the measures should have accurately reflected the physical activity and interest levels of students using technology in physical education and those that were not. Regardless, limitations to the study still existed, and the researcher intended to minimalize the influence of these limitations throughout the research period.

The use of accelerometers could be a limitation if they were not used properly. The researcher provided detailed instructions and a demonstration for the teachers on how to use the accelerometers. Prior to the start of data collection, the researcher used a small group of students to pilot the use of accelerometers. Also, students were given the opportunity to use the accelerometers in class before the start of research to ensure that they were comfortable using the tool during physical education. With this protocol in place before data collection began, the researcher assumed that the accelerometers were used properly and that the data collected regarding physical activity levels was accurate. Since the accelerometers were considered technological devices and were used with both groups, another possible limitation was created. This could have been problematic considering the comparison group was participating in physical activities without technology-integration. This limitation was accounted for because data provided by the accelerometers was used only for statistical analysis and not for student feedback regarding performance during lesson activities for either the experiment or comparison group; the accelerometer did not provide any immediate feedback to the students.

Another limitation to this study was the use of technology-integrated applications which might take time away from the physical activity levels of the experiment group. To minimize this effect, the researcher instructed the teachers to have the students download the applications for the QR reader, Heart Rate Calculator and Edmodo prior to the start of the study. The students practiced using the applications and inputting data in the health education setting (i.e., in the classroom) the week before the technology-integrated physical education lessons began. This gave teachers and students the opportunity to troubleshoot the technology elements and solve potential problems before they arose during the research lessons. By having the teachers and students practice using the technology applications, the researcher partially mitigated the effects of using technology applications on the experiment group's physical activity levels.

A fourth limitation to the study was the length of the Situational Interest scale. Student responses to the original 24 item scale may not have been as accurate if they were quickly answering the questionnaire to finish the lengthy form repetitively for each research lesson. To accommodate this, the researcher used the full version twice, and used a modified version of the Situational Interest Scale focusing on the overall perceived situational interest to ensure that students responded considerately to each of the questions. Throughout the course of the research, the researcher assumed that the students recorded their answers truthfully when completing the Situational Interest scale.

An additional limitation to discuss was if the hypothesis was accepted that the participants' situational interest was higher during the technology-integrated physical education and declined over time, as well the hypothesis that student physical activity levels were the same in both groups; potential benefits for the use of technology-integrated physical education must be addressed. The researcher planned to address this aspect of the research after data collection and analysis was completed. Future research may specifically address the need to vary the technology-integration to ensure that student interest is sustained as well as determine how physical activity levels can be significantly increased with the use of technology-enhancement.

A final limitation was the confounding variable of teacher instruction. Each teacher in the department had individuality in his/her instruction and varying levels of experience in teaching physical education. Even though they were provided with the same detailed lesson plans, the teachers experience with technology and ability to integrate the activities successfully may have had an effect on the outcomes of the study. In addition to helping them become familiarized with the lesson plans and the technology, the researcher assisted the teachers as often as possible and observed the physical education lessons to ensure that the lessons were being delivered effectively and faithfully for both the technology-integrated and comparison groups.

Definitions of Terms

Technology-Integrated Lessons: physical education lessons that integrate digital technology into lesson activities and instructional tasks.

Situational Interest: a learners' short term appeal to a specific activity during interaction.

Quick Response (QR) Code: a matrix barcode that can be scanned by a smartphone camera with a QR code reader that will take the user to a website URL, Youtube video or plain text among other destinations.

Edmodo: is a social learning platform for teachers, students and parents, which allows students to respond to polls, submit assignments, create learning groups, and take quizzes.

FITT Principles: fitness guidelines (Frequency, Intensity, Type and Time) that encompass how often you exercise, what percentage of your target heart rate is utilized, the mode of exercise you are participating in, and how long you exercise per day.

Moderate-to-Vigorous Physical Activity (MVPA): moderate and vigorous levels of physical effort required to perform an activity or exercise; widely accepted as a level of health enhancing physical fitness.

Physical Activity: a group measure including activity counts, steps, calories, the time spent participating in light physical activity, moderate-to-vigorous physical activity, and sedentary physical activity.

CHAPTER II: LITERATURE REVIEW

This study was guided by interest theory and the physical activity that is necessary for student engagement in physical education as well as demanded by public health needs, particularly moderate-to-vigorous physical activity for greater health benefits. In this section, interest theory and its application in physical education; physical activity in physical education classes; and the relation of interest and physical activity in technology-integrated contexts were reviewed and synthesized to form research questions and hypotheses for the thesis.

Interest

Interest is defined as a psychological state characterized by a high level of attention, intensive effort, and prolonged engagement with an activity accompanied by feelings of pleasure and a sense of achievement (Hidi & Renninger, 2006). This psychological state involves focused attention, increased cognitive functioning, persistence, and affective involvement (Shen & Chen, 2006). Interest can be characteristically referred to as individual or situational depending upon the value and development one has toward a subject or task. Individual interest is a subject's personal preference for activities. This type of interest is relatively stable with an invested learner who intrinsically values the task. Situational interest refers to the short term appeal of an activity from an individual during interaction. Both individual and situational interests have shown to have a significant influence on student motivation during learning (Chen, Darst & Pangrazi, 2001). Research has shown that the role of situational interest may depend on the activity or task in which an individual is engaged (Zhu, Chen, Ennis, Sun & Hopple et al., 2009).

Hidi and Renninger (2006) proposed a four phase model of interest development. During the first phase of interest, triggered situational interest, the introduction of new material sparks an interest that is typically viewed as novel, new and interesting to the learner. This type of interest can be produced through engaging lesson introductions, technology or surprising activities among others. In this phase, learners typically prefer for teachers to explain how to complete assignments in as few steps as possible. The second phase of interest, maintained situational interest, occurs when the initial spark of situational interest is sustained over time. Learners are personally involved in a variety of activities that continue to maintain situational interest. It is critical that learners are given the support they need to explore their own ideas regarding the topic. During the third phase of interest development, emerging individual interest begins to develop and the learner is more likely to seek reengagement in the content where prior knowledge is activated to increase their understanding of subject material. The learner may begin to seek knowledge on their own and describe the time spent engaged in content as effortless as they begin to acquire well developed individual interest. Finally, during the fourth phase of interest development, well-developed individual interest, the learner values the opportunity to reengage in the content and seeks to find answers to critical questions, even in spite of difficulty. It is important to note that if interest development is neglected at any point during the four phases it may regress to a previous stage or disappear completely. Interest in all phases of development needs to be cultivated and sustained (Renninger, 2009).

An alternative approach to the Four Phases of Interest Development is the Model of Domain Learning (MDL) theory. The MDL is an integrated perspective that explains the interrelation of prior knowledge, strategies and interest for a specific content domain. This theory describes interest development in relation to a person's developing expertise in academic domains (Alexander & Murphy, 1998). In the MDL, development in a particular field of study is characterized as a progression from an acclimated or naive stage of learning, to a more competent stage, and potentially, to one of proficiency or expertise (Alexander, Jetton, Tamara & Kulikowich, 1995). During the accumulation stage, the learner has limited knowledge that is generated by situational interest. In the next phase, competency, there is an intermediate level of knowledge where situational interest gradually becomes individual interest. During this stage, an individual should recall important, central ideas within the domain as opposed to more interesting, less important ideas surrounding the topic. A key aspect of MDL is that after individual interest is developed situational interest will no longer be as important. The final stage of the MDL is the proficiency stage; this stage is characterized by mastery of subject knowledge and the singular motivator of individual interest. Relatively few learners reach this stage which is the most advanced level of domain learning (Alexander et al., 1995).

Interest in Physical Education

For the purposes of this research, the researcher focused on the four phases of interest development proposed by Hidi and Renninger (2006), primarily because the model has developed an extensive depiction of situational interest which is often used in education, specifically physical education. In the physical education setting, teachers have an exceptional opportunity to develop situational interest because of the variety of activities and skills available in sport and physical activities. A lack of student interest during physical education can lead to students attaining less information, non-mastery of skills, behavior issues, and even decreased activity and dislike for physical education or physical activity indefinitely. The use of situational interest in physical education may impact the future intentions of students to participate in a wide range of physical activities. Shen and Chen (2006) determined that situational interest impacted student engagement and accounted for interest change. A correlation was found between students who had prior individual interest in an activity and situational interest ($r = .30$, $p < .05$). Although both individual and situational interests have an impact on student motivation, physical education lessons are typically centered upon situational interest due to the difficult nature of differentiating lessons to appease the personal interests of a diverse group of learners.

Interest is quantified through a variety of measures using Likert-type scales with written descriptors. An example of a perceived total interest measurement follows; ''My physical education classes are. . . very fun (4), somewhat fun (3), rather boring (2), very boring (1)" (Zhu et al., 2009). Individual interest can also be measured by responding to a variety of questionnaires about specific activities and rating them on a scale of least interesting to most interesting. Chen and Zhu (2005) studied children's interest as inferred from the parents' observation of their children's choice of the activities they engaged in during their free time. Parents responded to questions similar to "Child A prefers to spend his/her free time reading, playing video games, or watching TV. Child B prefers to spend his/her free time riding a bike, swimming, and playing sports. Is your child more like Child A, more like Child B, or similar to both Child A and Child B?" This example measurement was used to determine whether participants' intuitive interest lied in physically active or sedentary activities. For the purposes of this paper, the researcher will used the Situational Interest Scale which asked students to evaluate their experiences with an activity using a 5 point Likert scale ranging from 1 to 5 (1 = strongly disagree, 5 = strongly agree) in regard to Total Interest, Novelty, Challenge, Attention Demand, Exploration Intention, Instant Enjoyment, and Total Interest (Chen et al., 1999, 2001). The Situational Interest Scale will be discussed more extensively in the methods section (Chapter III).

Physical education teachers can facilitate situational interest and activate individual interest through a variety of teaching strategies. Data from Chen & Shen (2004) depicted a relationship between task orientations and interest in contact sports and alternative activities such as table tennis and speedball. Teachers are responsible for assisting students in the application of learning strategies during physical education, as well, situational interest can activate student's prior knowledge to increase the use of multiple learning strategies during physical education, which allows a student acquire new knowledge and skills to solve problems and enhance achievement. In a recent study, situational interest was accounted for by the use of various learning strategies; however, prior knowledge was not correlated with either situational interest or learning strategy (Shen & Chen, 2006). Accordingly, students do not need to have previous experience with a sport in physical education in order to activate their situational interest and increase the likelihood that they will use learning strategies to enhance critical thinking in the physical education environment. Instructional conditions or the learning environment can enable the development of an emerging individual interest (Hidi & Renninger, 2006). In order for teachers to foster individual interest, lesson activities must be planned to spark situational interest and continue to increase knowledge to retain the likelihood that students will participate in activities beyond physical education lessons. A recent study showed significant effects of increased cognitive demand on situational interest and performance (Zhu, In Review). When students performed the Progressive Aerobic Capacity Endurance Run (PACER) with modified arm movements they were significantly more interested in the activity, but their performance began to decrease with the increased cognitive demand. It is important to find a balance between engaging a student's situational interest and the incorporation of cognitive capabilities without negatively affecting their performance of a skill or task.

Gender has a well-documented influence on student's individual interests in physical education. For example, 67% of males' interests lied in physically active activities as opposed to females where only 61% of interest lied in physically active activities (Chen & Zhu, 2005). To close the gender gap, physical educators must be cognizant to create situational interest for female students to further engage them in physically active lessons. Gender also has a strong social influence on the interest or preference of students to participciple in certain activities. During a dance unit in physical education, male subjects were more actively engaged than females; however, females scored higher on skill tests and cognitive assessments for the same unit (Shen, Chen, Tolley & Scrabis, 2003). The results suggested that although situational interest was effective at engaging students during the lesson, the female's personal interest facilitated greater increase in cognitive knowledge and skills during a lesson that may be deemed gender inappropriate for male students. During multiple stages of learning, males and females differ on which type of interests engages them during physical activity. Chen and Darst (2002) suggested that female students were at a lower competency stage of basketball skills which resulted in their engagement stemming from situational interest. Conversely, male students, who were performing skills at a more proficient level, reported their interests to be increasingly individual in nature. Butt, Weinberg, Breckon & Claytor (2011) reported that male adolescents ($M = 14.7$, $SD = 3.18$) had more fun than female adolescents ($M = 14.1$, $SD = 3.39$) participating in activities where they can exert the physical characteristics of physical activity such as getting out of breath. During activities of moderate to vigorous physical activity, it is imperative that physical educators find a way to engage female students to shift from situational interest to personal interest for increased cardiovascular benefits in and out of school. Future research is necessary to increase our understanding of ways to assist females in adhering to physical activity programs that provide sufficient cardiovascular benefits. Zhu and colleagues (2014) found that student's gender had a significant effect on their interest in the PACER, a common test administered during physical education classes to assess cardiovascular endurance. Male students had significantly higher situational interest in the PACER when compared to females ($\eta^2 = .07$, $p < .05$); the findings of this study suggest that this particular fitness test may be viewed as more gender appropriate for males rather than females. In order to ensure that males and females are equally engaged in cardiovascular physical activities, educators must plan lessons that sustain male's personal interests as well as invoke the immediate responses of situational interest for female participants.

Interest in physical activities is widely influenced by factors of family conditions. Among children who preferred physical activities, a majority of their parents involved them in playing some form of sports or engaging in physical activities (Chen & Zhu, 2005). Because individual interest can begin to be formed at a young age, the earlier students are involved in physical activities prior to physical education the more successful they will be in the physical education setting. Although home life has a strong influence on children's physical activity interest; environment and school life accounted for a much larger percentage of influence on activity interests. In low-socioeconomic neighborhoods, children were less likely to participate in physical activities when compared to similarly aged students in neighborhoods they considered safe (Chen & Zhu, 2005). To minimize the influence of poverty on children's participation in physical activities, parents are responsible for providing them with safe resources to spark situational interest and create individual interest in the healthful benefits associated with physical activity.

Interest in physical education has been shown to be affected by variations in teaching styles. Mouratidis, Vansteenkiste, Sideridis, and Willy (2011) suggested that student's interest in physical education is related to changes in differentiated and directive teaching styles. Students were found to have higher levels of interest in physical education when they were provided with choice activities and participated in lessons that incorporated cooperation, initiative and autonomy. Elementary physical education curriculum is typically responsible for teaching students' independence and enjoyment through autonomous physical activities. It was also reported that students who participated in physical activities in an efficacious environment had higher levels of physical activity and increased enjoyment in physical education lessons (Gao, Lochbaum & Podlog, 2011). Moreover, the motivational climate had a positive influence on student's engagement and motivational intentions in physical education. Teachers should evaluate their predominant classroom strategies on a regular basis to ensure they are engaging and sparking interest in all learners. Adolescents who participate in extracurricular physical activities may find increased interest in the same lessons that are performance oriented because they are at a higher skill level than a majority of students during physical education classes. Physical educators can differentiate lessons to nurture these students' personal interest in activities in which they are proficient. Although this is true, students may find alternative activities more situationally interesting at the mastery level if they are unfamiliar with new skills and they are presented in a manner that engages situational interest. Due to the transient nature of physical education units, teachers may find a limited amount of students have personal interest in more than one sport.

Interest in physical education is thought to be an important factor that can predict a student's performance in the learning environment. When students are actively engaged in interesting physical education lessons, it seems logical that they will show enhanced performance and contribute increased effort during lesson activities. Shen and Chen (2006) found a moderate correlation between situational interest and the amount of steps taken in class ($r = .48$, $p < .01$). The amount of steps a student took in class was mostly accounted for by situational interest. This data suggests that if students find interest during an in class activity, they are likely to be more active during the physical education lesson. In another recent study, personal interest was found to account for 19% of variance in student performance during cardiovascular fitness testing (Zhu et al., 2014). Although interest accounted for a small amount of enhanced performance, this could determine the difference for passing or failing to pass an adolescent physical fitness test.

Another study revealed a negative effect of situational interest on physical fitness performance due to the increased cognitive demands of the task (Zhu, In Review). Students participated in a fitness testing activity that was modified to increase interest and enjoyment but their performance on the physical fitness test decreased as opposed to performing the task without the modified activities. While students found the activity more interesting during the situation, their performance suffered which could have detrimental effects, increasing reluctance to participate in the same activity again. Alexander and Murphy (1998) found that interest alone in an academic domain was not enough to predict optimal performance. The integration of knowledge, interest and strategic ability marked optimal performance. In the physical education setting, it is imperative that students regularly experience success through personal investment during lesson activities so they may continue to participate in a variety of lifetime physical activities.

Technology

Technology and Interest

Often, adolescents are connected to the internet through the use of smartphones and computers on a regular basis. Educators have been finding ways to utilize this drive for connectedness to facilitate student interest in a variety of school activities. Technology is constantly evolving and its uses in the field of education are seemingly endless. Integration of effective technology can engage students in lesson activities, assist in tracking student progress over time, and allow students to communicate with each other through a variety of formats. In recent years, new and innovative computer programs have been used in education that engage students in learning though interactive environments (Hall, 2012). Nevertheless, the use of technology in education should be practical and purposeful in order for it to be effective. Research has shown that effective technology integration can have a significant impact on student engagement and assist in enhancing student learning in physical education (Casey & Jones, 2011).

Sun (2012) investigated the effect of Exergames on students' situational interest in physical education. Exergames are technological devices, used for entertainment, that involve physical engagement. Students participated in an Exergame unit and physical fitness unit and their physical activity and situational interest levels were tracked over a four week period. Situational interest was measured by using student responses to the Situational Interest Scale to determine the initial level of interest and retained level of interest. The Exergame unit was more effective than the fitness unit at engaging students' initial situational interest in Attention Demand ($\eta^2 = .097, p < .05$), Challenge ($\eta^2 = .38, p < .01$), Exploration Opportunity ($\eta^2 = .13, p < .01$), Instant Enjoyment ($\eta^2 = .11, p < .01$) and Novelty ($\eta^2 = .14, p < .01$). However; these effects were not retained for all areas of situational interest by the end of the Exergame unit. Retained situational interest for the Exergame unit was higher than that of the fitness unit for Challenge ($\eta^2 = .122, p < .01$), Exploration ($\eta^2 = .10, p < .01$) and Instant Enjoyment ($\eta^2 = .09, p < .01$). These findings suggest that students enjoy the Exergame lessons and a majority of the situational interest they promote is sustained over time.

Technology in Physical Education

The idea of technology and a computing savvy person may not necessarily bring to mind the idea of a physically active individual; however, digital technology in physical education is an exciting platform that is on the rise in many school programs. An array of technologies, for example, pedometers, smartphones, virtual reality simulators and heart rate monitors are being used in physical education, sport, and physical activity to enhance engagement, pedagogy, and performance (Hall, 2012). Physical educators who are incorporating technology into daily lesson plans are finding a way to utilize technology that typically promotes sedentary lifestyles into a tool to encourage physical activity.

The National Association for Sport and Physical Education (NASPE) released a position statement on the topic of appropriate use of instructional technology in physical education (NASPE, 2009). Four guidelines were created to ensure that technology-integrated physical education was directly related to the national physical education standards and developmentally appropriate instruction.

> Guideline 1: The use of instructional technology in physical education is designed to provide a tool for increasing instructional effectiveness (NASPE, 2009; p.2). Guideline 2: The use of instructional technology in physical education is designed to supplement, not substitute for, effective instruction (NASPE, 2009; p.3). Guideline 3: The use of instructional technology in physical education should provide opportunities for all students, versus opportunities for few (NASPE, 2009; p.4). Guideline 4: The use of instructional technology in physical education can prove to be an effective tool for maintaining student data related to standards-based curriculum objectives (NASPE, 2009; p.4).

Physical educators have multiple resources that can be used to provide information to students to enhance their instructional effectiveness. Technology use by students must be closely monitored. If technology is utilized for research purposes, teachers must guide students in locating valid and reliable information regarding the specific topic. When technological equipment is integrated into a physical education lesson, it requires teacher interaction with students to ensure that curricular objectives are being met and physical education is not turned into free play or recreational time. Students must be given equal access to all equipment, regardless of technology implementation, in order to adhere to best practices for physical educators. Tracking student progress with the use of accelerometers, pedometers or motion-analysis software can offer concrete data which are valid for individualized assessments of student progress. Educators who are using or wish to begin using technology to enhance their physical education lessons should ensure that they are following these national guidelines in order to utilize technology effectively to deliver a quality physical education program.

In the field of physical education, the use of technology begins with the teachers' ability to integrate technology into purposeful lessons. Woods, Karp, Miao, and Perlman (2008) examined 114 physical education teachers' perceived technology proficiency, current technology use, where they learned to use technology and the challenges they face to implement technology. The teachers completed the Physical Education Technology Usage Survey for Physical Education Teachers (PETU-PE), an online survey that was emailed to the physical education teachers that addressed general and specific technology aptitude in physical education. The ANOVA results indicated that male teachers perceived themselves to have higher levels of technology competence than females ($F\,(1, 111) = 10.51, p < .05$; Woods et al., 2008). In secondary physical education programs, departments are often made up of male and female teachers. It would behoove female teachers to take the time to improve technology competency to ensure that all students are getting the benefits associated with effective technology integration in physical education, regardless of having a male or female teacher. Teachers reported that they learned to use technology during internships, at personal gym and health organizations, in exercise science courses, and/or through sport participation (Woods et al., 2008). Of the 114 participants, 50% of teachers rated themselves proficient at using activity monitors such as pedometers and accelerometers; however 66.7% believed they were beginners at transferring the data from devices for further analysis. Teachers must be trained to use the data from educational technology effectively in order to gain valuable information from the technology they integrate into physical education lessons. Physical education teachers (67.5%) rated their competency of personal digital assistants (PDA) and associated software devices as beginner. With a majority of students using smartphones and associated hand held devices, it is important that teachers learn to incorporate these everyday devices into technology-integrated physical education lessons. Naturally, the more recent physical education graduates should be highly trained in the area of integrating-technology in the physical education setting. Major limitations to technology integration include financial concerns and accessibility, lack of class time, training needs and inadequate space (Angers & Machtmes, 2005; Woods et al., 2008). Teacher planning time is a key underlying factor in determining the extent to which technology gets used (Angers & Machtmes, 2005). Inadequately trained teachers may not use their planning time effectively to successfully integrate technology into physical education lessons. Many physical education teachers share these concerns, but should seek creative opportunities to work around these issues as opposed to using them as excuses to avoid the implementation of technology within physical education.

When teachers begin to integrate technology effectively into their physical education lessons, we can examine the effects of technology on student interest and engagement. Casey and Jones (2011) utilized digital video technology in an effort to increase the engagement of students who were categorized as having a low engagement level. The students were introduced to the technology and data was analyzed to determine the impact the video had on intellectual quality, quality learning environment and significance. The teacher believed that the students demonstrated a greater depth of knowledge about throwing and catching skills as a direct result of the use of technology (Casey & Jones, 2011). The students were able to better understand the task as well as refer back to the video regarding verbal cues on how to properly perform the physical education task. The technology used in their research also gave students the knowledge they needed to critique others performance in relation to the throwing and catching activity. This research is a positive step toward further engaging students in physical education lessons with technology-integrated activities; unfortunately, the qualitative study did not offer numerical data to determine precisely how student engagement changed with the technology-integrated throwing and catching lessons.

Physical Activity

Physical Activity in Physical Education

The US Department of Health and Human Services and US Department of Agriculture (2005) recommend that children and adolescents are physically active for a minimum of 60 minutes per day. The report suggests that adolescents should be participating in physical activity that improves cardiovascular endurance, muscular strength and bone strength. Physical education is an excellent resource to assist children and adolescents in meeting the minimum guidelines set forth by public health officials. In order for students to get the optimal health-enhancing results from physical education, the program must provide quality lessons for students to participate in. Quality physical education is defined by the NASPE as providing students with the opportunity to learn through meaningful content, appropriate instruction and assessment (NASPE, 2004). Within the quality physical education program, students should be assisted in developing health-related fitness, physical competence, cognitive understanding and positive attitudes about physical activity so that they can develop healthy and physically active lifestyles (NASPE, 2004).

The duration that students are physically active during physical education varies due to activities during class that take time away from being physically active; examples of these include time spent dressing out, demonstration/instructional time, and transition time between activities. Culpepper, Tarr and Killion (2011) found that students in a 70 minute, middle school physical education class obtained an average of 1995.35 steps (SD= 857.01); according to the report, this is equivalent to running less than a mile. Flohr, Todd, & Tudor-Locke (2006) reported similar results when assessing the average number of steps (M = 2046, SD = 945) taken in a 50 minute physical education class by 44, grade 7 students. The minimal amount of steps taken during an entire physical education class are sometimes alarming; equally as alarming is the amount of time spent participating in moderate to vigorous physical activity (MVPA) during physical education lessons. Strand and Reeder (1993) reported that 55 middle school students spent a majority of physical education class time (M = 62.71%) engaged in physical activity at a level below the MVPA threshold. The time spent below the recommended training zone accounted for approximately 21.4 minutes of a 45 minute class session. Fortunately for quality educators, there is conflicting data about student's MVPA levels in physical education classes. Gao, Lee, Solmon, Kosma, Carson, Zhang, and Moore (2010) reported that 155 middle school students were found to have spent 66.89% of class time engaged in MVPA as measured via accelerometer. Time spent engaged in MVPA varies greatly depending upon the type of activity students participate in during physical education lessons; soccer and walking/jogging being the most effective at achieving MVPA as opposed to line dancing and kick ball which were the least effective (Gao et al., 2010). Due to the multitude of variables that effect physical activity time in physical education classes, continual research is necessary to determine the amount of time students are physically active during quality physical education classes.

Physical Activity and Technology

The amount of time being physically active during physical education can be positively affected by the incorporation of technology in daily lesson activities. Fogel, Miltenberger, Graves, and Koehler (2010) performed a study to examine the effects of Exergames on children's levels of physical activity during physical education. The students who participated in the study were categorized as not meeting the minimum guidelines for acceptable physical activity levels in class (defined as spending at least 30% of the time available to participate in physical activity either standing, sitting, or watching others). The Exergames used for the physical education lessons included Dance Dance Revolution™, Nintendo Wii™ games, and Sony Play Station™ games, among others. When participating in the technology-integrated activities, all of the students increased their physical activity time during the Exergame condition ($M = 9.2$ min) as opposed to physical activity time during the physical education condition (*M* = 1.6 min). Similar results were found by Shayne, Fogel, Miltenberger, and Koehler (2012) where each student participating in the study increased their physical activity engagement time during the Exergames physical education units (*M* = 82.5%) as opposed to the physical education classes without technology-integration (*M* = 48.8%). Although these studies offer promising data to indicate increasing physical activity in the physical education setting, it should be noted that small sample sizes (*N* = 4) were used in both studies. Sun (2012) analyzed the differences in physical activity levels and situational interest during a 4 week Exergame unit and a 4 week fitness unit in physical education. The results suggested the students did not meet recommendations for MVPA during the Exergames unit as measured in units of Metabolic Equivalent of Task (MET) (*M* = 2.14, *SD* = .65), but did meet the recommendations during the fitness unit reported in MET units (*M* = 4.1, *SD* .93). The recommendation for health enhancing, moderate intensity activities is to perform a task at >3MET (U.S. Department of Health and Human Services, 1999). The need for students to meet the current recommendations for MVPA outweighs the desire to implement technology enhanced activities into physical education lessons. In order for technology to be an effective tool, it is important that student activity levels remain within the acceptable limits for quality physical education. Limited research and differing results indicate that further investigation into changes in physical activity levels during technology-integrated physical education lessons is warranted.

In physical education, interest is an important subject that is affected by a student's gender, family influence, goal orientations and teaching strategies (Chen & Shen, 2004; Hidi & Renninger, 2006; Chen & Zhu, 2005; Shen et al., 2003; Chen &

Darst, 2002; Butt et al., 2011; Mouratidis et al., 2011; Gao et al., 2011; Zhu et al., 2014). Interest research in physical education continues to be performed to assess the interaction of each of these variables as well as interests influence on physical activity. When students are engaged in physical education lessons through situational or personal interest, one could assume that they are more likely to reach the national standards of becoming physically educated individuals. These standards, created by the NASPE are the guiding principles physical educators use to develop physically educated individuals who have the knowledge, skills and confidence necessary to enjoy a lifetime of physical activity (NASPE, 2004). Each physical education lesson has the unique opportunity to engage students, increase their physical activity levels, and assist them in acquiring personal interest in a variety of healthful activities. Instead of inspiring students with great athlete role models, we should direct their attention to daily, hands-on physical activities to nurture their interest (Chen & Zhu, 2005). Nurturing students' interest in physical education though the array of digital technologies present in their everyday lives can promote increased physical activity and assist students in developing individual interest in physically active activities. Not every student will develop personal interest in physical activity to the point of becoming a professional athlete; however, all students should be given the opportunity to find interest in a physical activity that can help them maintain or achieve wellness through a life-long appreciation of physical activity.

The Current Study

The purpose of this study was to examine students' situational interest and physical activity levels during technology-integrated physical education lessons. After reviewing relevant literature regarding situational interest theory, physical activity levels and technology integration in physical education, the researcher planned to investigate students' interest and physical activity in technology-integrated physical education lessons and determine whether students' interest and physical activity levels increased, decreased or remained stable within the technology-integrated lessons over time. The experiment group of students participated in five technology-integrated lessons focused upon the conceptual understanding of relative physical activity intensity, heart rate measures, energy expenditure and the FITT principles using QR codes and digital data tables where they logged their physical activity intensity via Edmodo. The comparison group of students participated in the same five lessons, but without the technology-integrated resources. Students were given verbal directions for each of the fitness activities that they were required to participate in and recorded their intensity levels onto a physical activity log with pencil and paper.

The researcher analyzed the data from the experiment group (technology-integrated physical education) in contrast with a comparison group that participated in the same physical education activities without the technology-integration to draw conclusions about students' physical activity and interest fluctuation in the physical education lessons. From this study, the researcher intended to answer the following research questions: (a) Compared to the comparison group, would students report higher situational interest in the technology-integrated lessons? (b) Compared to the comparison group, would students have significantly different physical activity levels in the technology-integrated physical education lessons? (c) Did interest in technology-integrated physical education lessons decline over time? (d) Did physical activity levels remain the same or decline over time in technology-integrated physical education lessons? It was hypothesized (a) that students participating in the technology-integrated physical education lessons would have increased situational interest; (b) that there would be no statistically significant difference in physical activity levels between the technology-integrated lessons and the comparison lessons; (c) that the situational interest in the technology-integrated lessons would decline over time; (d) that there would be no statistically significant change in physical activity levels over time for students participating in the technology-integrated physical education lessons. The null hypothesis was that there would be no statistically significant differences in student interest or physical activity levels between the experiment and comparison group following the implementation of technology-integrated physical education lessons.

CHAPTER III: METHODS

Participants

Students participating in the research lessons attended a middle school located in a suburban area of the Mid-Atlantic United States. As of 2012, the school was fully accredited, and enrolled students in grades 6-8. The school district was one of the largest in its region hosting 56 elementary schools, 14 middle schools and 11 high schools with multiple secondary/post-secondary specialty centers.

In the middle school, enrolment for the 2011-2012 school year was 1,129 students, including sixth grade (374), seventh grade (403), and eighth grade (366). Gender demographics indicated that 47.9% of students are female and 52.1% of students are male. Students at the middle school were predominately Caucasian (63.7%) followed by African American (17.5%), Hispanic (8.9%), Multi-racial (6.4%), Asian (3.2%), Native Hawaiian (0.2%) and American Indian (0.1%). Additional student characteristics included 33.4% labeled economically disadvantaged, 11.5% receiving special education services, 12.7% categorized as gifted and 3.1% with limited English proficiency.

Students chosen for the research participated in five physical education lessons based upon relative physical activity intensity, heart rate measures, energy expenditure and the FITT principles. The experiment group participated in five technology-integrated physical education lessons and the comparison group participated in the same five lessons without technology-integration. To detect the effect of time across five measurements and the group effect (technology-integrated vs. comparison) on situational interest and physical activity, a priori power analysis suggests that the minimum sample size should be 90 in order to detect the effect size of $f = .25$, while maintaining $\alpha = .05$, power $(1 - \beta)$

= .95. To combat potential attrition and improve the statistical power, the researcher expected to recruit 150 6th grade students to participate in the current research. Unfortunately, only 53 students signed up to participate in the research study. Sixth grade students were chosen as the participants for the research because they had not been previously introduced to the technology-integrated physical education lessons the specific school was using. Using students who had already participated in the school's technology-integrated physical education lessons could have altered their interest levels and skewed the statistical analyses.

Research Context

The philosophy of the city-wide physical education program supported the division's mission and aims to ensure that each student was empowered with the knowledge and skills necessary to meet the challenges of the future. This philosophy was achieved through the secondary physical education curricula designed to meet the goals of the middle school physical education objectives. For the purposes of this study, we focused on the secondary physical education curriculum, specifically grade 6, which was a sequence of enduring understandings to be met through a variety of suggested movement activities. The enduring understanding for grade 6 movement skills was for students to demonstrate proficiency and competency in all fundamental movement skills and several specialized movement patterns. The intent of this standard was for students to know the critical elements of basic locomotor, non-manipulative, and manipulative skills. Grade 6 students are expected to use locomotor, non-manipulative, and manipulative skills in cooperative games, modified games, and rhythmic activities. The enduring understanding for grade 6 sports and wellness literacy was for students to identify and use appropriate cognitive information to enhance motor skill acquisition and performance. The intent of this standard was for students to vary speed of movement, force and trajectory to improve performance. The enduring understanding for grade 6 fitness was for students to achieve and maintain a health enhancing level of fitness. The intent of this standard was for students to identify physical activities available at school, home and in the community. The enduring understanding for 6th grade responsible behaviors was for students to know and use responsible personal and social behaviors in physical education settings. The intent of this standard was for students to understand the positive and negative influence of peer pressure on decisions and actions in physical activity settings (Department of Curriculum and Instruction). Each of the enduring understanding and intentions were further broken down into performance objectives and enabling objectives that corresponded to state and national physical education standards.

The physical education classes where this study took place were taught by five physical education specialists ranging from 3 years to 34 years of experience teaching physical education. Students attended daily physical education for 50 minute blocks; the first and last 8-10 minutes of each bell were spent having students dress in the locker room. With dressing time accounted for, students were potentially active for a maximum of 30-34 minutes per class. Each of the teachers typically began their lessons with a warm up and exercise routine consisting of cardiovascular endurance, muscular strength and flexibility exercises. Students were then given instruction for the activities for the remainder of the lesson. Lesson activities were typically centered on team and individual sports, fitness concepts and cooperative activities. At the end of the physical education class, students returned equipment to the designated area, lined up based upon gender, and were dismissed into the locker rooms.

Physical education units typically lasted two weeks (ten days) and students rotated to health education for one week (five days). The three week schedule lent itself well for students to be in the health education classroom for one week, the auxiliary gym for one week and the full sized gym for one week. Students were assigned to specific teachers who team taught as partners and rotated with the students through each of the three week cycles. Teachers were paired based on gender so that the locker room facilities were attended at all times by a male teacher for both classes' male students and a female teacher for both classes' female students.

The physical education department had ample equipment for a variety of physical education units. A majority of the equipment available was for team and individual sports including basketball, volleyball, tennis, soccer, socci, football, field hockey, floor hockey, rugby and ultimate Frisbee. In addition to sports equipment, there was fitness equipment including step aerobics platforms, in-motion mats, weight lifting machines, resistance bands and fitness testing equipment. The physical education department had sufficient equipment for the planned research lesson activities. As for equipment for the implementation of technology applications, the school follows the division policy of Bring Your Own Device (BYOD) where students are allowed to bring their own electronic device into the academic setting in order to access the school divisions wireless network. Although students were permitted to bring their own devices into the classroom, students were provided with school iPads to limit the variation of devices used during the research period. The school had two iPad carts for a total of 60 iPads that were available to use within the building to meet the student's needs during the technology-integrated physical education lessons.

Study Design

This study utilized a quasi-experimental design where participants were placed in the experiment or comparison group by class. Students in the experiment group participated in technology-integrated physical education lessons while students in the comparison group participated in the same physical education lessons without the use of technology. The study period lasted approximately two weeks, 10 days, and the lesson activities took place every other day for a total of five lessons. Students' physical activity levels and interest levels were tracked daily during the research lessons.

Both groups of students, experiment and comparison, participated in physical education lessons through a variety of physical activities that related to the enduring understanding for 6^{th} grade fitness. This enduring understanding was for students to achieve and maintain a health-enhancing level of fitness. Lesson activities focused specifically on relative physical activity intensity, heart rate measures, energy expenditure and the FITT principles (Frequency, Intensity, Type and Time). The FITT principles are important for developing any type of physical activity plan. The principles encompass how often you exercise, what percentage of your target heart rate is utilized, the mode of exercise you are participating in, and how long you exercise per day. Lesson activities were centered upon the type of exercise students participate in and the intensity of the daily physical activities. Students learned to assess their physical activity intensity though two measurements, the Talk Test and manually counting the number of times their heart beat per minute. Students assessed their intensity level during lesson activities and recorded the information on an exercise log.

The experiment group of students participated in the technology-integrated physical education lessons. QR codes were scanned using an iPad and the directions for the physical activity students were required to participate in appeared on the electronic device. A quick response code is a matrix barcode that can be scanned by a smartphone camera with a QR code reader that will take the user to a website URL, Youtube video or plain text among other destinations. Directions from the QR code included the equipment used during the activity and how many repetitions of the activity the student was required to perform. The physical education teachers were available for assistance with activity directions and to troubleshoot any problems that arose during the technology-integrated lessons. Immediately after participating in the physical activity, students assessed their heart rate using the talk test or Instant Heart Rate Calculator. They utilized a digital data table via the Edmodo application to enter their heart rate and analyze changes during the varying levels of physical activity. Students were familiarized with the QR codes, Instant Heart Rate Calculator and Edmodo prior to participating in the lesson activities. Each of the technology-integrated resources used in the physical education lessons had free, downloadable applications for ease of use on the iPads.

The comparison group of students participated in the same five relative physical activity intensity, heart rate measures, energy expenditure and FITT lessons, but without the technology-integrated resources. Students were given verbal directions for each of the fitness activities that they were required to participate in by their physical education teachers. After participating in the lesson activities, students assessed their intensity levels through a heart rate calculation or talk test, and recorded it onto a physical activity log with pencil and paper. Table 1 below summarizes the major differences between the lessons used for the experiment and comparison groups.

Table 1. *The Technology-Integrated and Comparison Lessons*

Lesson Activities	Technology-integrated	Comparison
Activity directions	Quick Response (QR) code for activity directions	Teacher instruction for activity directions
Task sheet completion	Edmodo: Digital data table	Paper and pencil data table
Heart rate calculation	Instant Heart Rate application	Manual calculation

Table 2 below describes the physical activities and content presented to both the experiment and comparison groups during each of the five research lessons.

Table 2. *The Physical Activities and Content in the Lessons*

Lesson	Content	Physical Activity
Lesson One	Relative Intensity	Walk Talk Test, Fitness Stations
Lesson Two	Heart Rate and Intensity	Walk & Talk w/ Heart Rate, Fitness Stations
Lesson Three	Energy Expenditure I	Walk/Jog & Talk w/ Heart Rate, Fitness Stations
Lesson Four	Energy Expenditure II	Walk/Jog/Run & Talk w/ Heart Rate, Fitness Stations

Lesson Five	Energy Balance	Walk & Talk w/ Heart Rate, Fitness Stations

Instruments

Interest

Student interest was measured using the Situational Interest Scale. The scale was developed by Chen et al. (1999) to measure students' situational interest during physical activities in the physical education setting. The scale measures 5 dimensions of situational interest Novelty, Challenge, Exploration Intention, Instant Enjoyment, and Attention Demand. Examples of these five items follow: "this activity is new to me" (Novelty), "this activity is difficult to do" (Challenge), "I'd like to find out more about how to do it" (Exploration Intention), "this activity is exciting" (Instant Enjoyment), and "I was focused" (Attention Demand). The scale is comprised of 24 items that subjects respond to on a Likert scale ranging from 1 (very unture) to 5 (very true) regarding their feelings toward a specific activity. The internal consistency coefficients, Cronbach's α, are .78, .80, .90, .91, .90, and .95 for the respective dimensions of Novelty, Challenge, Attention Demand, Exploration Intention, Instant Enjoyment, and Total Interest (Chen & Darst, 2002). These results suggest that when used appropriately, the Situational Interest Scale is likely to be valid and reliable in assessing situational interest in each of the 5 dimensions. Student responses to the original 24 item scale may not have been as accurate if they were rapidly completing the questionnaire to finish the lengthy form repetitively for five continuous lessons. Therefore, for the purposes of this study, the researcher used the complete version twice and used the modified/shortened version of the Situational Interest Scale focused on the overall perceived situational interest for ease of administration, and to ensure that students responded considerately to each of the questions. The first questionnaire that students completed contained an additional section asking students about the type of technology (if any) they had been previously exposed to during physical education courses. This information was valuable during analyses to determine the effect (if any) that participation in technology-integrated physical education had on the variables of situational interest and physical activity levels.

Physical Activity

Student physical activity levels were recorded using GT3X ActiGraph™ tri-axial accelerometers. The small (3.8 x 3.7 x 1.8cm), lightweight device (27g) is often used in physical activity research. The accelerometer attaches to a cotton fabric belt that is worn on the hip and offers an objective measure of the frequency, intensity and duration of physical activity. The device measures activity counts in the vertical, anterior-posterior and medio-lateral planes (Sasaki, John, & Freedson, 2011). Hänggia, Phillips and Rowlands (2013) used 49 children, ages 10-14 to assess the validity of the GT3X ActiGraph™. The results indicated that data from the GT3X accelerometer were significantly correlated with oxygen consumption ($r = 0.88, p < 0.001$), an accurate measure of energy expenditure. The study also found that the GT3X correctly classified the participants' activity levels in the MVPA category in 86% of cases. Another study using 36 participants found that the subject's speed was highly correlated to both METs ($r = 0.77, p < 0.05$) and the GT3X accelerometer ($r = 0.86, p < 0.05$; Sasaki et al., 2011). The results of this study indicated that the accelerometer accurately assessed the subjects METs during bouts of physical activity using varying treadmill speeds.

In a recent study researchers asked adolescents for their perspectives about wearing accelerometers to measure physical activity levels (Audrey, Bell, Hughes, & Campbell, 2012). Students in the focus groups suggested that accelerometers were difficult during physical activity, they did not like the way the accelerometers looked and they would have been more willing to wear the devices if they were provided with personalized activity graphs. It is important to note that the students in the focus group were asked to wear the accelerometers all day except for while sleeping. For the current study, students were only required to wear accelerometers for five lessons during their physical education class. Still, the focus group recommendation of providing students with personalized activity graphs brings up the idea of reactivity while wearing accelerometers. A reactivity effect from wearing accelerometers may threaten the validity of the device to accurately measure students' physical activity levels. Tampering and reactivity have been reported with the use of pedometers that display the number of steps adolescents take throughout a given research period (Scott, Morgan, Plotnikoff, Trost & Lubans, 2013). Yet the researcher was unable to locate applicable research studies that suggested that the use of accelerometers produced a reactivity effect in adolescents that would affect the validity of the current research. In order to further negate any potential reactivity, the researcher did not provide students with feedback regarding their physical activity levels and both the experimental and comparison groups used accelerometers during the physical education research lessons.

Data Collection and Procedures

Following approval of the thesis proposal, the researcher obtained permission to perform research with human subjects from the University Human Subjects Review

Committee. An application for the use of human subjects for research purposes was sent to the Old Dominion University Institutional Review Board (IRB). Upon approval, the researcher obtained permission from the specific public school system and individual middle school's administrator in charge of research conducted by educational institutions. Information that was collected was kept confidential as outlined by the Old Dominion University Social and Behavioral Responsible Conduct of Research Modules. Reports including any personal information had all identifying characteristics removed and the use of pseudonyms was existent. The storage of all data prior to disposal was on a locked and secured computer system. All data would be destroyed after the project was finished.

In preparation for the research period, the researcher met with each of the participating teachers to discuss the lesson plans and protocol to be followed during both the technology-integrated and comparison physical education lessons. During this time, the teachers were taught to use the accelerometers and technology-integrated applications correctly. Teachers also reviewed the Situational Interest Inventory scale and learned to answer any questions that the students may have had during the research period. The researcher, who worked in the proposed building, visited the physical education classes regularly during the research period to ensure that the lessons were being delivered accurately for each of the groups.

During the research period, students reported to their regularly scheduled physical education classes. The teachers informed them that a research study was being performed in the health and physical education department and that their participation was voluntary, not required, and that the student's health and physical education grade would neither be reflected nor affected by participation during the study. Students received a written consent form to take home for their parents to review, sign and approve before returning it to the school if they wished to participate in the study. Students and parents were able to decide to have their child removed from the study during any point within the data collection process. Students who did not wish to participate in the study continued to perform all physical activities in class, but the data received from their participation was not included in the statistical analyses.

Prior to the commencement of research, the group of students participating in the technology-integrated lessons was familiarized with the QR, Heart Rate and Edmodo applications that were utilized during the research phase. The reason for this was to ensure that students were capable of accessing the applications and performing the required, fundamental actions of the technology-integrated experiment group. Students participating in the comparison group were not required to be acquainted with the QR, Heart Rate and Edmodo applications prior to the beginning of research because they were not using the technology-integrated elements during their lesson activities.

At the beginning of each lesson, students entered the gym and sat in their assigned squads. Accelerometers were placed at each student's squad and they were given directions on how to appropriately use the physical activity monitor in addition to its function in the research context. The physical education teacher was trained in properly dispensing, using and collecting the accelerometers during the physical education lessons.

During the research period, students in the experiment group participated in a variety of technology-integrated physical education lessons guided by the conceptual understanding of relative physical activity intensity, heart rate measures, energy expenditure and the FITT principles. Students in the comparison group participated in the same lesson activities without the technology-integrated elements. These lessons directly related to the local 6th grade physical education fitness objectives in addition to the 6th grade state standards of learning for fitness. The district's strategic plan to equip students with the skills they need to succeed as 21st century learners, workers and citizens was addressed though the technology-integrated physical education lessons. Becoming an effective communicator and collaborator of information literacy through the use of digital technology was satisfied through the use of mobile applications in the technology-integrated physical education lessons. The experiment and comparison groups enhanced their communication skills through the need to articulate ideas and information clearly through a digital or hand written medium during each of the physical education lessons. Through participation in the research lessons, students likely gained invaluable knowledge regarding their current and future choices for the type of physical activity in which they participate.

Following the research lesson activities, students' interest levels were measured using a modified version of the Situational Interest Scale (Chen et al., 1999). Students in both the technology-integrated and comparison groups responded to the paper survey with a pencil and returned it to the physical education teacher prior to dismissal to the locker room. The responses collected by the physical education teacher were given to the researcher on a daily basis and kept in a confidential manner (according to the IRB) for future analysis.

Data Analysis

Through data analysis, the researcher's objective was to answer the following research questions: (a) Compared to the comparison group, would students report higher situational interest in the technology-integrated lessons? (b) Compared to the comparison group, would students have significantly different physical activity levels in the technology-integrated physical education lessons? (c) Did interest in technology-integrated physical education lessons decline over time? (d) Did physical activity levels remain the same or decline over time in technology-integrated physical education lessons? Data collected from the physical education classes were analyzed using descriptive and inferential statistics.

To begin data analysis, descriptive statistics were used to describe the sample through the measures of central tendency and variability. A frequency analysis and tests of normality were conducted to determine whether the variables of interest and physical activity were normally distributed and whether extreme outliers needed to be removed from the sample. The data was further analyzed using a Pearson product-moment correlational analysis to identify any significant correlation between the two variables of physical activity and situational interest. Finally, inferential statistics were used to perform a MANOVA with repeated measure on the variables of situational interest and physical activity in both the technology-integrated physical education and comparison groups. The results from these tests allowed the researcher to draw conclusions about the variables and make assumptions to answer the research questions.

CHAPTER IV: RESULTS

Descriptive Statistics

There were a total of 53, sixth grade students who participated in the research lessons. Table 3 depicts the descriptive data for students' age, height and weight by experiment and comparison group as well as the average of all students participating in the research lessons. For the total sample, the students' ages ranged from 10-12 years old with the average student being 11.04 (*SD* = .33) years old. The average student height was 58.94 (*SD* = 2.73) in. with the maximum of 67 and minimum of 52 in. Student's weight, in pounds, ranged from 67-249 with an average of 101.77 (*SD* = 31.90) lbs.

Table 3. *Descriptive Statistics of the Sample for Age, Height and Weight (Mean ± SD)*

Variable	Experiment Group	Comparison Group	Average
Age	11.11 ± .31	11.04 ± .34	11.04 ± .33
Height	59.16 ± 2.38	58.73 ± 2.74	58.94 ± 2.73
Weight	98.11 ± 24.96	101.04 ± 26.95	101.77 ± 31.90

Overall, the sample included 38 females (71.69%) and 15 males (28.30%); the sample did not represent a gender-balanced population. Based upon students' self-reports, the sample was made up of 7.54% Asian, 9.43% African American, 18.86% Latino, 62.26% Caucasian, and 1.88% other students. Table 4 shows the descriptive data of students' race and gender for the experiment and comparison group including the total of all students participating in the research lessons.

Table 4. *Descriptive Statistics of the Sample for Gender and Race*

Variable	Experiment Group	Comparison Group	Total
Male	7 (25.93%)	8 (30.77%)	15 (28.30%)
Female	20 (74.07%)	18 (69.23%)	38 (71.69%)
Asian	2 (7.41%)	2 (7.69%)	4 (7.54%)
African American	1 (3.70%)	4 (15.38%)	5 (9.43%)
Latino	10 (37.04%)	0 (0.00%)	10 (18.86%)
Caucasian	14 (51.85%)	19 (73.07%)	33 (62.26%)
Other	0 (0.00%)	1 (3.84%)	1 (1.88%)

The student's interest during the research lessons was indicated by the completion of a situational interest inventory scale immediately following each of the research lessons. Students in the experiment group reported a five lesson average of 3.38 (SD = .92) on the situational interest scale as opposed to the comparison group which reported a five lesson average of 3.65 (SD = .87) on the situational interest scale. Levene's test for equality of variances showed that equal variances of the comparison and experiment group data were assumed for the situational interest scores (F=.97, p = .47). Overall, students in the comparison group reported higher situational interest than the technology-integrated group.

The students' physical activity levels during the research lessons were measured through the number of minutes participating in light physical activity, MVPA, number of steps taken, and energy expenditure. As shown in Table 5, on average throughout the five lessons, the students in the experiment group spent 18.27 (SD = 3.85) mins participating in light physical activity, 8.25 (*SD* = 2.79) mins participating in MVPA, took 1034.40 (*SD* = 177.07) steps, and their physical activity energy expenditure averaged 30.69 (*SD* = 9.92) Kcals. Throughout the five lessons, the students participating in the comparison group on average spent 18.46 (*SD* = 3.33) mins participating in light physical activity, 14.36 (*SD* = 2.67) mins participating in MVPA, took 1241.12 (*SD* = 169.81) steps, and burned 49.86 (*SD* = 27.85) Kcals. Overall, students took more steps, spent more time participating in MVPA and expended more energy in the comparison than the experiment group.

Table 5. *Descriptive Statistics of the Physical Activity Variables across Five Lessons (Mean ± SD)*

Variable	Experiment Group	Comparison Group	Total
Light Physical Activity#	18.27 ± 3.85	18.46 ± 3.33	18.37 ± 3.59
MVPA#	8.25 ± 2.79	14.36 ± 2.67	11.36 ± 4.10
Steps Taken	1034.4 ± 177.07	1214.12 ± 169.81	1139.71 ± 201.68
Energy Expenditure*	30.69 ± 9.92	49.86 ± 27.85	40.46 ± 23.11

Note. * kcal, # min

The Pearson-product moment correlation coefficients between the study variables are presented in Table 6. MVPA had a strong, positive correlation with the number of steps taken ($r = .79$), and moderate correlation with energy expenditure ($r = .47$). Students who reported higher MVPA time took an increased numbers of steps and had higher energy expenditure than those who report lower MVPA time. A statistically significant, moderate correlation was found between the number of steps and amount of energy expenditure ($r = .32$). The more a student moved, the more energy they expended during physical education. Low correlations were found to exist between student interest and the number of steps taken ($r = .21$) or the amount of time spent participating in MVPA ($r = .15$). Student interest was not found to be significantly correlated with energy expenditure ($r = -.09$) or the amount of light physical activity ($r = -.05$) students participated in during the research lessons.

Table 6. *Pearson Product-Moment Correlation Coefficients between the Variables*

Variable	1	2	3	4	5
1. Light Activity	1	-.25	-.17	.01	-.05
2. MVPA	-.25	1	.79*	.47*	.15
3. Steps Taken	-.17	.79*	1	.32*	.21
4. Energy Expenditure	.01	.47*	.32*	1	-.09
5. Situational Interest	-.05	.15	.21	-.09	1

Note. * $p < .05$

Group Differences in Physical Activity and Situational Interest

The group differences in light activity time, MVPA, energy expenditure, steps, and situational interest were examined using MANOVA. MANOVA with repeated measures indicated that there was a statistically significant, between-group effect (Pillai's $\lambda = .65$, $F(5, 251) = 94.51$, $p < .05$, $\eta^2 = .65$). The result suggested that students in the experiment group spent a statistically significant lower amount of time participating in

MVPA when compared to the comparison group. Specifically, as shown in Table 7, there was no significant difference in light activity time, but there were statistically significant differences in the number of steps taken, amount of energy expenditure, time spent participating in MVPA, and student's situational interest.

Table 7. *Tests of Group Effects for the Physical Activity and Interest Measures*

Variable	d.f.	MS	F	p	Partial η^2
Light	1	2.48	.25	.62	.00
Steps	1	2829958.35	149.07	.00	.37
EE	1	24336.63	54.05	.00	.18
Interest	1	4.75	5.81	.02	.02
MVPA	1	2475.69	389.83	.00	.61

Note. MS = Mean Square; EE = Energy Expenditure; MVPA = Moderate to Vigorous Physical Activity

Students participating in the technology-integrated lessons took a statistically significant lower amount of steps, averaging approximately 180 less steps than students in the comparison group. Students who participated in the comparison group burned an average 16 more kcals than those students who participated in the technology-integrated physical education lessons. When reviewing the MANOVA results, there was no statistically significant difference found between the groups for the amount of time students spent participating in light physical activity. The results from MANOVA suggested that the technology-integrated physical education lessons did not have a positive impact on the amount of time students spent participating in physical activity at health-enhancing levels or on students' perceived situational interest.

Lesson Variation in Physical Activity and Situational Interest

The within-lesson differences for light physical activity time, MVPA, energy expenditure, steps, and situational interest were examined using MANOVA. As shown in Table 8, MANOVA with repeated measures indicated that there was a statistically significant, within-lesson effect (Pillai's $\lambda = .43$, $F(20, 1016) = 6.08, p < .05, \eta^2 = .11$). The results suggested that there were significant differences among the lessons regarding light physical activity time, number of steps taken and amount of time participating in MVPA. Post hoc tests (Tukey's HSD) were run to identify the differences.

Table 8. *Tests of Lesson Variations for the Physical Activity and Interest Measures*

Variable	d.f.	MS	F	p	Partial η^2
Light	4	36.91	3.74	.01	.06
Steps	4	593736.82	31.28	.00	.33
EE	4	323.67	.72	.58	.01
Interest	4	.05	.06	.99	.00
MVPA	4	70.07	11.03	.00	.15

Note. MS = Mean Square; EE = Energy Expenditure; MVPA = Moderate to Vigorous Physical Activity

The post hoc tests (Tukey's HSD) suggested that there were significant differences in the amount of time participating in light physical activity, MVPA, and number of steps taken. Significant differences were in light physical activity between lessons 1 and 2 as well as lessons 2 and 4. Statistically significant differences for the number of steps taken were found between lesson 1 and each of the following 4 physical education lessons, whereas there were no significant difference amongst lessons 2, 3, 4, and 5. The highest amount of light physical activity time occurred during lesson 1. Students reported the lowest amount of time spent participating in light physical activity during lesson 3. The final set of significant differences were in MVPA between lesson 1 and the following 4 physical education lessons. Of the five lessons, lessons 3 and 5 produced the highest amount of time spent participating in MVPA. During lesson 1, students reported the lowest amount of time spent participating in MVPA. There were no statistically significant differences between the lessons for the variables of energy expenditure or students' situational interest.

Group × Lesson Interaction

The group and lesson interactions for light physical activity time, MVPA, energy expenditure, steps, and situational interest were examined using MANOVA. As displayed in Table 9, MANOVA with repeated measures indicated that there was a statistically significant, group and lesson interaction effect (Pillai's $\lambda = .40$, $F(20, 1016) = 5.59$, $p < .05$, $\eta^2 = .10$). Statistically significant lesson and group interactions occurred between the variables of light physical activity time, number of steps taken, and amount of time spent participating in MVPA. There were no significant interactions found between the variables of energy expenditure and students' situational interest.

Table 9. *Tests of Group and Lesson Interaction for the Physical Activity and Interest Measures*

Variable	d.f.	MS	F	p	Partial η^2
Light	4	182.34	18.46	.00	.23
Steps	4	176574.53	9.30	.00	.13
EE	4	136.07	.30	.88	.01
Interest	4	.87	1.06	.38	.02
MVPA	4	16.17	2.55	.04	.04

Note. MS = Mean Square; EE = Energy Expenditure; MVPA = Moderate to Vigorous Physical Activity

As seen in Figure 1, a significant lesson and group interaction occurred for light physical activity time during the physical education lessons. Students in the experiment group had an increased amount of light activity time that decreased through lessons 2 and 3, and then rose again during lessons 4 and 5. In contrast, the comparison group began lesson 1 with a lower amount of time spent participating in light physical activity which decreased slightly during lesson two and increased substantially during lesson 3. The amount of time students spent participating in light physical activity steadily declined during lessons 4 and 5 for the comparison group.

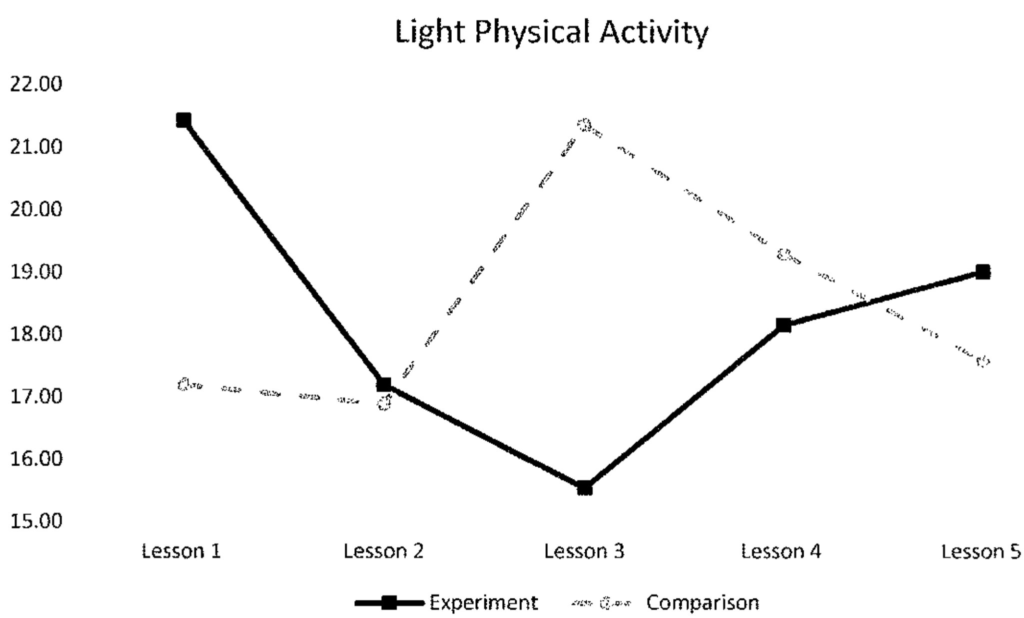

Figure 1. Students' Light Activity Time across the Lessons

During each of the five physical education lessons, students in the comparison group took more steps when compared to the number of steps taken by the experiment group. As seen in Figure 2, a significant lesson and group interaction occurred for steps taken during the physical education lessons. Students in the experiment group had a gradual increase in the number of steps taken throughout each of the five technology-integrated physical education lessons. The comparison group of students had a significant increase in the number of steps taken between lessons 1 and 2 and a sizable decrease in the number of steps taken between lessons 2 and 3. The number of steps taken by the comparison group gradually increased during lesson 4 and decreased again during lesson 5.

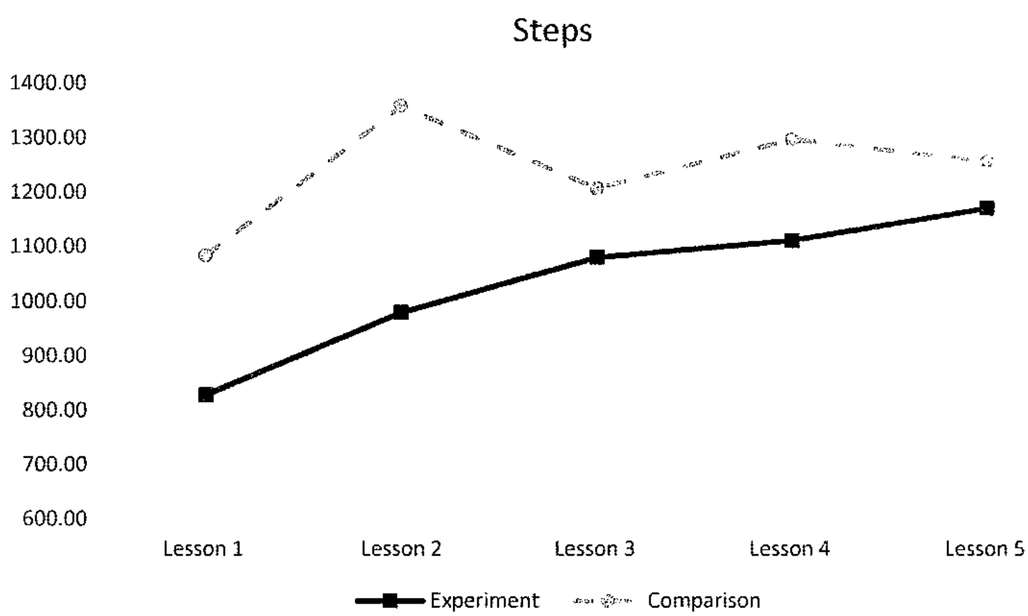

Figure 2. Steps Taken during the Five Physical Education Lessons

Overall, students in the comparison group spent more time participating in MVPA when compared to those in the experiment group. Students who participated in the technology-integrated physical education lessons had a substantial increase in the amount of time spent participating in MVPA from lesson 1 through lesson 3; whereas students in the comparison group increased their MVPA from lesson 1 to lesson 2, then their MVPA decreased from lesson 2 to lesson 3. As illustrated in Figure 3, a significant lesson and group interaction occurred for the variable of MVPA during the physical education lessons. It appeared that students' MVPA remained relatively stable after lesson 3, retaining relatively distinctive time of MVPA between the groups.

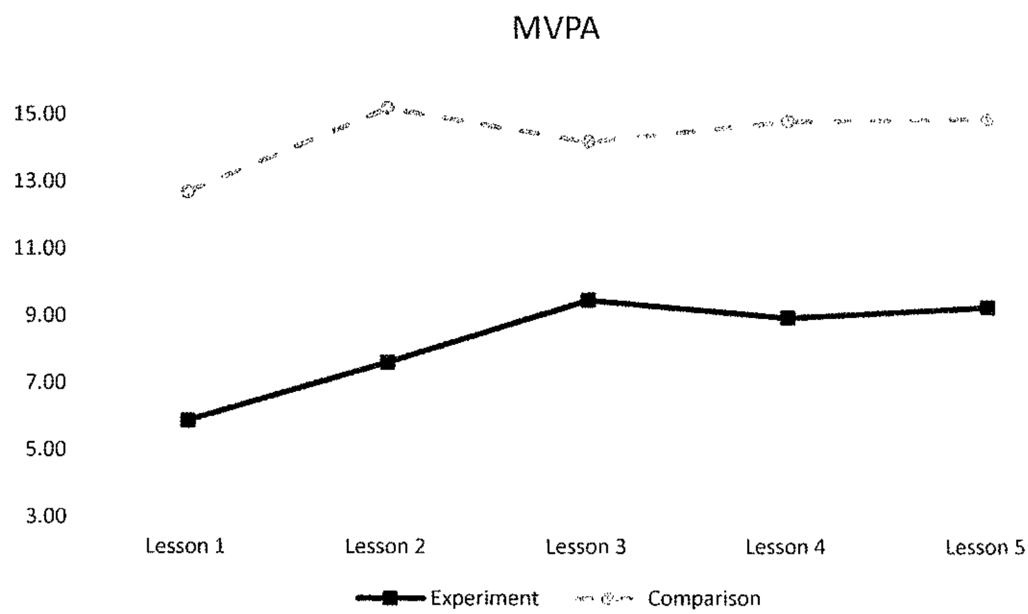

Figure 3. Student MVPA during the Five Physical Education Lessons

In summary, the technology-integrated physical education lessons did not positively impact the amount of time students spent participating in health-enhancing physical activities. Compared to the comparison group, students who participated in the technology-integrated physical education lessons reported significantly lower amounts of time participating in MVPA, took fewer steps during each lesson and had less physical activity related energy expenditure. Furthermore, the students in the experiment group did not report a higher situational interest with the integration of technology into their physical education lessons.

CHAPTER V: DISCUSSION AND CONCLUSIONS

The purpose of this study was to answer the following questions about students participating in technology-integrated physical education lessons: (a) Compared to the comparison group, would students report higher situational interest in the technology-integrated lessons? (b) Compared to the comparison group, would students have significantly different physical activity levels in the technology-integrated physical education lessons? (c) Does interest in technology-integrated physical education lessons decline over time? (d) Do physical activity levels remain the same or decline over time in technology-integrated physical education lessons? The findings suggested that the technology-integrated physical education lessons did not positively impact the physical activity measures reported by students. Students in the experiment group spent less time participating in MVPA, took fewer steps per lesson, and expended less energy than the comparison group. Students' situational interest in the technology-integrated physical education lessons was also significantly lower than those in the comparison group.

Interest

A students' situational interest has been found to relate to student engagement (Casey & Jones, 2011) as well as increase their physical activity levels (Shen & Chen, 2006) during physical education lessons. Situational interest may change often depending upon the variety of activities students are required to participate in physical education. It was hypothesized that students' situational interest levels in the physical education lessons with the implementation of technology would be higher than those in the comparison group who did not participate in technology-integrated lessons. The results indicated that students in the comparison group reported higher situational interest in the physical education lessons; therefore, this hypothesis was not supported. This finding is atypical from Sun (2012) who found that students participating in a technology-integrated Exergame unit reported higher situational interest than they did when participating in a fitness education unit. There were two major factors that might have divergent effects on the outcomes of study on students' situational interest. First, while Sun's (2012) study focused on physical activity promotion using Exergames, the lessons in this study focus on the conceptual understanding of relative physical activity intensity, heart rate measures, energy expenditure and the FITT principles. Even though the technology-integration was designed to assist student learning of these concepts, it did not resemble the structure of a traditional physical education lesson where physical activity and games play a central role. The second factor is of the technology usage itself. Exergames required students to be physically engaged in the physical activities; the iPad or application (App) based technologies in the current study required little or no physical activity to engage, rather they required cognitive thinking and execution to complete the instructional tasks and fulfill the instructional goals of increasing students' conceptual understanding of relative physical activity intensity, heart rate measures, and energy expenditure. As reported by Zhu (2013), for adolescents in middle schools, the first thing that they expect to learn or do in physical education is to have fun participating in physical activities, whereas learning the conceptual knowledge is the least expected to learn or do. Consequentially, the result appeared not as shocking that in the current study context, students did not report situational interest as high when compared to Sun's (2012) study.

Students' perceived interest is interrelated with their knowledge and skill in one specific domain (Alexander et al., 1995). The personal interest growth and accumulation of knowledge and skill usually takes a long period of time. In the current study, situational interest was reported by students after each physical education lesson and tracked over the five lessons during the research period. The impact that technology-integrated physical education had on student's situational interest may have been limited by the short duration of lessons (5) that students participated in. It was encouraging that although student interest was significantly lower during the technology-integrated physical education lessons, the levels of student interest increased over time and the differences between the two groups decreased.

It was hypothesized that students' interest in the technology-integrated physical education lessons would decline over time; the results from data analyses did not support this hypothesis. For students participating in the technology-integrated physical education lessons, interest was found to increase substantially from lesson 1 to 2 and decline gradually over lessons 2-4 before increasing again during lesson 5. This hypothesis was not supported by the data as the trend for student interest over the five physical education lessons was an overall increase in student interest in the technology-integrated physical education lessons. This result was similar to that of Sun (2012) who found that a majority of student's situational interest was sustained over time when participating in an Exergame unit during physical education.

The significant differences in student interest for the experiment group were found between lesson 1 and the following four lessons. One explanation for the low level of interest reported during lesson 1 may be that the initial lesson of technology-integration took time away from students participating in what they believed were interesting activities that were replaced by issuing iPads and troubleshooting problems that occurred with the applications; similar results were reported by teachers and students in recent research (Woods et al., 2008). During lesson observations, the teachers reported that a substantial amount of time was taken away from activity time due to checking out iPads, logging into computers, troubleshooting problems and security features that limited accessibility. However, the teachers mentioned that they appreciated the ability of students to work at their own pace during the interactive activities. Gradually, the students were able to complete activities on their own and ask their teachers and peers for assistance when an issue arose. Another explanation for the lower level of interest reported during the initial technology-integrated lesson, may have been due to frustration with the technology itself. A learning curve is associated with integrating new technology applications that may have accounted for the low level of reported interest (Angers & Machtmes, 2005; Woods et al., 2008). Had this been the case, the situational interest reported during lesson one would not accurately reflect students' interest in participation in activities with fully integrated technology elements. Anecdotally, the teachers who led the technology-integrated lessons felt that after the initial introduction of the technology elements, the QR codes and heart rate application were easy to access and user friendly within the physical education environment.

Hall (2012) reported that interactive lessons in physical education have the potential to introduce new and previously unimaginable possibilities in lesson activity creation. The seemingly endless possibilities of technology-integrated lessons may increase students' situational interest. Overall, the teachers participating in the research lessons believed that technology, when used appropriately, could be a great motivational tool to assist in engaging students in physical education activities that they may not have situational interest in otherwise. However, teachers participating in the research study were also concerned that students often became more interested in the technology itself rather than its practical application in the classroom where the instructional goal was to gain the conceptual understanding of specific skills. Whether it was the case that students were more interested in the technology than physical education itself remained unclear without multiple direct interviews or other interaction with the students. It was certainly a valid concern from the teachers' perspective that whatever technological tools they use during instruction should not replace the content of the instruction or "steal its thunder" becoming the focal point of situational interest.

Physical Activity Levels

Quality physical education programs should provide students with an ample amount of time participating in MVPA. It is recommended that a minimum of 50% of class time in physical education be spent participating in MVPA (U.S. Department of Health and Human Services, 2010). The amount of time spent participating in MVPA in physical education varies depending on lesson content, time spent dressing out, instructional time, and transition time between activities. In this study, the amount of time students spent participating in MVPA in the experiment group (8.25 mins) equated to approximately 16% of the total in class time. This result indicated that a majority of students' physical education class time was spent participating in activities below the MVPA threshold. This finding was similar to that of a physical education class where Strand and Reeder (1993) reported 21.4 minutes of a 45 minute physical education class period was spent below the MVPA training zone. The low level of time spent participating in MVPA was also similar to Sun (2012) who found that Exergaming stations in physical education did not provide adequate MVPA, even though it did spark and maintain students' situational interest in the technology-integrated physical activities. It is important to note that when calculating the time students spent participating in MVPA (8.25 mins) that the total amount of time available for engaging in physical activity was approximately 30 mins. This would mean that students were participating in MVPA for approximately 28% of the total time allotted for physical activity. However, the studies reviewed did not report whether or not the time spent participating in MVPA accounted for engaged physical activity time or total class time.

Fogel et al. (2010) reported that students participating in Exergame activities had significant increases in their physical activity time during the technology-integrated physical education unit when compared to their typical in class physical activity levels. One of the major differences to be noted between Fogel et al.'s (2010) study and the current study was that the current study's lesson content was conceptually based as opposed to the Exergame unit which primarily included activities such as Dance Dance Revolution™, Nintendo Wii™ games and Sony Play Station™ games, with no cognitive learning focus. Students who participated in the current study participated in lessons that taught relative physical activity intensity, heart rate measures, energy expenditure, energy balance and the FITT principles. The amount of time spent teaching these conceptual understandings, in addition to time used to integrate new technology applications may have caused a decrease in the time available for MVPA.

The number of steps students take during physical education is another indicator of the amount of physical activity students participate in during physical education. Research suggests that a wide range of steps are taken during physical education classes (Culpepper et al., 2011; Flohr et al., 2006). Students participating in the technology-integrated physical education lessons took an average of 1034.40 (*SD* = 177.07) steps over the five lesson research period. This average was almost 50% less steps than Flohr et al. (2006) reported where grade 7 students took an average of 2046 (*SD* = 945) steps during a 50 minute physical education lesson. An explanation for the small number of steps taken by students in the experiment group is the recurring theme of technology applications taking time away from students' physical activity time. Flohr et al. (2006) also utilized pedometers to measure student's physical activity levels as opposed to accelerometers which may account for the differences in steps taken during the physical education lessons as well. Anecdotally, both physical education teachers mentioned that getting over the initial lesson and newness of the technology-integrated activities was the most difficult part. They believed that as students became more comfortable using technology in physical education, as well as other subjects, the adjustment period would become easier with each unit.

While many studies have reported and compared students' physical activities levels in a variety of physical education lessons (Culpepper et al., 2011; Flohr et al, 2006; Gao et al., 2010; Strand & Reeder, 1993), no study has specifically reported the physical activity variation within similar types of technology-integrated lessons. One purpose of the current study sought to analyze the differences in the number of steps students took during technology-integrated physical education lessons. It was hypothesized that students' physical activity would remain stable over the five physical education lessons. This hypothesis was not supported by the data. During data analysis, it was revealed that the number of steps students took during the technology-integrated physical education lessons increased significantly over the five lesson research period. Students reported taking 827.88 (*SD* = 123.09) steps during lesson one and 1172.16 (*SD* = 156.39) steps during lesson five at the end of the research lessons. This increase could have been in part due to students becoming more familiar with the use of the instructional technology and being able to spend more time participating in physical activities than troubleshooting and becoming familiarized with the technology-integrated elements of the lesson.

The hypothesis that students participating in the technology-integrated physical education lessons would not have a significant difference in physical activity levels when compared to the comparison group was not supported. Students participating in the technology-integrated lessons reported significantly lower amounts of physical activity (steps and MVPA) than those in the comparison group. These results are contrary to Shayne et al. (2012) where the students participating in an Exergame unit significantly increased their physical activity time. Individual differences in lesson content, technology applications and sample size may account for the dissimilarity in findings between these two studies. As mentioned earlier, the lesson content for the Exergame activities was not centered upon increasing student knowledge. It can be argued that the students participating in the Exergame research lessons may have been more active, but knowledge acquisition from the two research studies might be different considering that the lesson activities were designed differently. One may infer that the lesson concepts from the current study were more closely aligned with or focused more upon aspects of the achievement standards of the physically literate individual (NASPE, 2014) than those found in an Exergame unit, where physical activity appears to be the sole focus.

In the era of physical inactivity and high prevalence of childhood obesity, the need for students to participate in MVPA typically outweighs the desire to integrate new and innovative technology applications in the physical education classroom. Even so, during lesson observations the teachers who delivered the technology-integrated lessons reported an overall sense of importance to integrate technology in their physical education lessons in order to meet the school division's technology standards. Although there were significant differences found between the two groups in MVPA, the gap in time spent participating in MVPA narrowed as the students in the experiment group became acclimated with the technology-integrated elements of the physical education lessons. Furthermore, as students gained familiarity with the lesson activities, the number of steps taken by the experiment group increased over the five lesson period whereas the number of steps taken by the comparison group increased initially but remained relatively stable throughout the five lesson research period. Thus, it appeared that both the teachers and students needed to become more familiarized with the technology and applications before the lessons could reach their full potentials. Earlier studies have suggested that many physical education teachers felt competent in using several types of technologies (Woods et al., 2008; Angers, & Machtmes, 2005). In this study, it appeared that even with the initial training, after the five lessons it was difficult to tell whether the teachers and students were using the technologies to their fullest potential.

It is important to note that contextual limitations of the school setting may have affected the outcome of the results from the study. Physical activity and interest levels may have been affected by general class dynamics. Students in the experiment group were two combined classes that attend physical education at the same time in the same gym. This situation differed from the comparison group in that two combined classes accounted for approximately 65-75 students in the gym as opposed to 35-40 in the single classes for the comparison group. The time of day that students attend physical education can also effect the variables of interest and physical activity. The schedule for 6th grade students separates their physical education classes, so the first class attends physical education before lunch and the second class attends physical education after lunch. For the comparison group, one class attended physical education before lunch and three classes attend physical education after lunch. The experiment group had four classes attending physical education before lunch and four classes after lunch. The number of students in the gym during each bell as well as the time of day they were scheduled for physical education could have positively or negatively affected the results of the study by participation level, attention and behavioral aspects among others. Another contextual limitation to take into consideration that may have affected the effectiveness of the technology applications is the location of each gym. Teachers from the technology-integrated group reported that difficulties arose with accessing the wireless internet during the week of research lessons in the auxiliary gym. These difficulties could have caused an increase in light activity time and decrease in number of steps taken and time spent participating in MVPA due to the limited internet access that occurred during the initial two lessons. These limitations were not taken into account prior to the start of the research lessons and may have affected the results of the physical education research lessons.

In conclusion, the data from the current research study suggested that technology-integrated physical education might not always be effective for increasing students' physical activity levels over a short duration of time, particularly when the lessons focused on conceptual learning. While some reports indicated positive results for Exergames (Sun, 2012), this study suggested that iPad and computer applications in physical education may not be able to produce a positive effect in a short term. If a physical education teacher aims to immediately increase students' time spent participating in MVPA or the number of steps taken during class, the integration of these types of technology may not necessarily be effective. Other forms of cardiovascular endurance activities, with or without technology, may be just as effective at promoting physical activity in health-enhancing levels (Zhu, 2014).

In physical education, traditionally physical activity has been the educational medium. The use of technology-integration to promote student situational interest may not receive immediate effects when the technology is not directly related to physical activity or games like Dance Dance Revolution™ or other Exergames. The findings of this study using iPads and other Apps served as an example where it was possible that the central focus of situational interest might be on the technology rather than physical education as concerned by the teachers. In addition, engaging students in physical education through situational interest with the use of technology-integration may not be effective in a short duration as well. Teachers should anticipate that the challenges of familiarizing students with new instructional technology may lead to an initial decrease in interest that may rise as students become acclimated with the technological applications. It is important to consider the needs of individual students and classroom dynamics to realistically evaluate the constraints that technology-integrated physical education lessons may pose in the physical education environment.

The results from this study may have been different had a longitudinal crossover design been applied where the trends in interest and physical activity measures could have been analyzed over ten research lessons. The crossover aspect of this approach would allow both groups of students to utilize the technology-integrated resources and each student would be their own comparison measure. This study design may provide a more accurate assessment of students' situational interest and physical activity measures due to the personal factors that are present in both of these variables. These individual factors may not have been accounted for with the present design where students were randomly assigned to the experiment or comparison group. The data collected may be more suitable to reach conclusions regarding each of the research questions and accompanying hypotheses.

Future research in technology-integration should continue to focus on the use of iPads and mobile devices in the physical education environment. These devices are commonly used by students in and out of school and have the potential to promote health-enhancing physical activity when used appropriately. Technology-integration research in physical education typically focuses on the use of Exergames, pedometers and accelerometers (Casey & Jones, 2011; Hall, 2012; Fogel et al., 2010; Sun, 2012; Shayne et al., 2012). When pedometers and accelerometers are utilized during research studies to assess physical activity levels and collect data, students should be given feedback from these devices to further promote increased physical activity levels. Not only can feedback increase the likelihood that students will put forth more effort during physical education lessons, it may assist students' in becoming accountable for their own physical activity levels. Typically, Exergames, pedometers and accelerometers are not as accessible to students as App based technologies on their smart phones and tablets. A recent study found that 39.4% of teachers surveyed had access to an iPad or Kindle with digital applications at school that can be utilized to integrate-technology into all classrooms as well as physical education (Kervin, Verenikina, Jones, & Beath, 2013). However, Kervin et al. 2013 reported that less than 5% of teachers used the available iPads and similar devices on a daily basis. Physical education research should concentrate the use of mobile devices and Apps on improving concept based technology-integration for the positive reform of physical education classes and promoting health related concepts in the current era of increased physical inactivity and prevalence of obesity.

Research is also needed to address the multitude of smartphone applications that can be used to track physical activity measures to determine how effective they are at increasing out of class physical activity after being introduced to students in the classroom. As schools continue to implement technology standards in all areas of instruction it is important for educators to attend courses and locate resources that can assist them in integrating technology in their daily lessons. While our lives become increasingly more dependent on technology, it is important to educate children on how to use technology effectively to increase their levels of health-enhancing physical activity.

REFERENCES

Alexander, P., Jetton, T., Tamara, L., & Kulikowich, J. (1995). Interrelationship of knowledge, interest, and recall: Assessing a model of domain learning. *Journal of Educational Psychology, 87,* 559-575. doi: 10.1037/0022-0663.87.4.559

Alexander, P., & Murphy, P. (1998). Profiling the differences in students' knowledge, interest, and strategic processing. *Journal of Educational Psychology, 90,* 435-447. doi: 10.1037/0022-0663.90.3.435

Angers, J., & Machtmes, K. (2005). An ethnographic-case study of beliefs, context factors and practices of teachers integrating technology. *The Qualitative Report, 10,* 771-794.

Audrey, S., Bell, S., Hughes, R., & Campbell, R. (2012). Adolescent perspectives on wearing accelerometers to measure physical activity in population-based trials. *European Journal of Public Health,* 1-5. doi:10.1093/eurpub/cks081

Butt, J., Weinberg, R. S., Breckon, J., & Claytor, R. R. (2011). Adolescent physical activity participation and motivational determinants across gender, age, and race. *Journal of Physical Activity & Health, 8,* 1074-1083.

Casey, A., & Jones, B. (2011). Using digital technology to enhance student engagement in physical education. *Asia-Pacific Journal of Health, Sport and Physical Education, 2,* 51-66.

Chen, A., & Darst, P. (2002). Individual and situational interest: The role of gender and skill. *Contemporary Educational Psychology, 27,* 250–269. doi:10.1006/ceps.2001.1093

Chen, A., Darst, P., & Pangrazi, R. (1999). What constitutes situational interest?

Validating a construct in physical education. *Measurement in Physical Education and Exercise Science*, *3*, 157-180.

Chen, A., Darst, P., & Pangrazi, R. (2001). An examination of situational interest and its sources. *British Journal of Educational Psychology*, *71*, 383-400.

Chen, A., & Shen, B. (2004). A web of achieving in physical education: Goals, interest, outside-school activity and learning. *Learning and Individual Differences, 14,* 169-182. doi:10.1016/j.lindif.2004.02.003

Chen, A., & Zhu, W. (2005). Young children's intuitive interest in physical activity: Personal, school, and home factors. *Journal of Physical Activity & Health, 2*, 1-15.

Culpepper, D. O., Tarr, S. J., & Killion, L. E. (2011). The role of various curriculum models on physical activity levels. *Physical Educator*, *68,* 163-171.

Flohr, J., Todd, M., & Tudor-Locke, C. (2006). Pedometer-assessed physical activity in young adolescents. *Research Quarterly for Exercise and Sport, 77*, 309-315.

Fogel, V., Miltenberger, R., Graves, R., & Koehler, S. (2010). The effects of exergaming on physical activity among inactive children in a physical education classroom. *Journal of Applied Behavior Analysis, 43*, 591-600.

Gao, Z., Lochbaum, M., & Podlog, L. (2011). Self-efficacy as a mediator of student achievement motivation and in class physical activity. *Perceptual and Motor Skills, 113*, 969-981. doi: 10.2466/06.11.25.PMS.113.6.969-981

Gao, Z., Lee, A. M., Solmon, M. A., Kosma, M., Carson, R. L., Zhang, T., & Moore, D. (2010). Validating pedometer-based pysical activity time against accelerometer in middle school physical education. *Journal Of Research, 5*, 20-25.

Hall, T. (2012). Emplotment, embodyment, engagement: Narrative technology in support of physical education, sport and physical activity. *Quest, 64,* 105-115. doi:10.1080/00336297.2012.669324

Hänggia, J., Phillips, L., & Rowlands, A. (2013). Validation of the GT3X ActiGraph in children and comparison with the GT1M ActiGraph. *Journal of Science and Medicine in Sport, 16,* 40–44.

Hidi, S., & Renninger, K. (2006). The four-phase model of interest development. *Educational Psychologist, 41*, 111-127. doi:10.1207/s15326985ep4102_4

Jacobs, J., Lanza, S., Osgood, D., Eccles, J., & Wigfield, A. (2002). Changes in children's self-competence and values: Gender and domain differences across grade one through twelve. *Child Development, 73,* 509–527.

Kervin, L., Verenikina, I., Jones, P., & Beath, O. (2013). Investigating synergies between literacy, technology and classroom practice. *Australian Journal of Language and Literacy, 36,* 135-147.

Mouratidis, A., Vansteenkiste, M., Sideridis, G., & Willy, L. (2011). Vitality and interest–enjoyment as a function of class-to-class variation in need-supportive teaching and pupils' autonomous motivation. *Journal of Educational Psychology, 103*, 353-366. doi:10.1037a/0022773

National Association for Sport and Physical Education. (2004). Moving into the future: National standards for sport and physical education (2nd edition). Reston, VA: National Association for Sport and Physical Education.

National Association for Sport and Physical Education. (2009). Appropriate use of instructional technology in physical education [Position statement]. Reston, VA:

Author.

National Association for Sport and Physical Education. (2014). National standards & grade-level outcomes for K-12 physical education. Reston, VA: Author.

Renninger, K. (2009). Interest and identity development in instruction: An inductive model. *Educational Psychologist, 44,* 105-118. doi:10.1080/00461520902832392

Sasaki, J., John, D., & Freedson, P. (2011). Validation and comparison of ActiGraph activity Monitors. *Journal of Science and Medicine in Sport, 14,* 411–416.

Scott, J., Morgan, P., Plotnikoff, R., Trost S., & Lubans, D. (2014) Adolescent pedometer protocols: examining reactivity, tampering and participants' perceptions. *Journal of Sports Sciences, 2,* 183-190. doi:10.1080/02640414.2013.815361

Shayne, R., Fogel, V., Miltenberger, R., & Koehler, S. (2012). The effects of exergaming on physical activity in a third-grade physical education class. *Journal of Applied Behavior Analysis, 1,* 211–215.

Shen, B., & Chen, A. (2006). Examining the interrelations among knowledge, interests, and learning strategies. *Journal of Teaching in Physical Education, 25*, 182-199.

Shen, B., Chen, A., Tolley, H., & Scrabis, K. (2003). Gender and interest-based motivation in learning dance. *Journal of Teaching in Physical Education, 22*, 396-409. Strand, B., & Reeder, S. (1993). Analysis of heart rate levels during middle school physical education activities. *Journal of Physical Education, Recreation and Dance, 64*, 85-91.

Sun, H. (2012). Exergaming impact on physical activity and interest in elementary school children. *Research Quarterly for Exercise and Sport, 83*, 212-220.

U.S. Department of Health and Human Services, Centers for Disease Control and

Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Adolescent and School Health. (2010). Strategies to improve the quality of physical education. Available: www.cdc.gov/HealthyYouth.

U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Nutrition and Physical Activity. (1999). Promoting physical activity: a guide for community action. *Human Kinetics*, Champaign, IL.

U.S. Department of Health and Human Services and U.S. Department of Agriculture. (2005). *Dietary Guidelines for Americans, 6th,* Washington, DC: U.S. Government Printing Office.

Woods, M., Karp, G., Miao, H., & Perlman, D. (2008). Physical educators' technology competencies and usage. *The Physical Educator, 65*, 82-99.

Zhu, X. (2013). Exploring students' conception and expectations of achievement in physical education. *Measurement in Physical Education and Exercise Science,17*(1), 62-73. doi:10.1080/1091367X.2013.741368

Zhu, X. (2014). Situational interest and physical activity in fitness testing: A need for pedagogical engineering. *International Journal of Sport and Exercise Psychology, 12*(1), 76-89. doi:10.1080/1612197X.2013.792519

Zhu, X., & Chen, A. (2013). Motivational cost aspects of physical education in middle school students. *Educational Psychology, 33*(4), 465-481. doi:10.1080/01443410.2013.785043.

Zhu, X., Chen, A., Ennis, C., Sun, H., Hopple, C., Bonello, M., Kim, S. (2009). Situational interest, cognitive engagement, and achievement in physical education. *Contemporary Educational Psychology, 34*, 221-229. doi:10.1016/j.cedpsych.2009.05.002

Zhu, X., Chen, S., & Parrott, J. (2014). Adolescents' interest and performances in aerobic fitness testing. *Journal of Teaching in Physical Education, 33*(1), 53-67. doi:10.1123/jtpe.2013-0107

Appendix A.

SAMPLE LESSON PLAN

Lynnhaven Middle School *Learning Plan for* Mrs. Dragon	**Date:** Research Day I
	Unit/Topic: Fitness/FITT Principle Relative Intensity
	☐ **Health Science** ☒ **Physical Education** **GRADE 6**

Stage 1 – *Desired Results*

Established Goal: **G**

6.3 The student will use personal fitness tools and data to improve physical fitness.

a) Use measurement and assessment tools and data (e.g., criterion-referenced health-related fitness standards, Internet, software data-management systems, heart-rate monitors, pedometers, skinfold calipers) to develop goals for improvement in at least two fitness components.

b) Describe and apply basic principles of training (e.g., FITT [Frequency, Intensity, Time, Type], overload, progression) and their relationship to implementing safe and progressive personal fitness programs

VBO's:

6.12 - Participate in regular physical activity at school, home and in the community.

6.12.1 - Document participation in physical activities at school, home and in the community by using journals, portfolios, and/or charts.

Understandings: **U**	**Essential Questions:** **E**
♦ Enduring Understanding: Students will achieve and maintain a health enhancing level of fitness	♦ What is a target heart rate? ♦ How else can I assess my exercise intensity? ♦ **What am I trying to change/improve? What is my strategy?**

SWBAT:

- *Accurately gauge exercise intensity during physical activities*
- *Evaluate heart rate and energy expenditure during a variety of physical activities*
- *Enhance personal fitness levels*

Stage 2 – *Assessment Evidence*

Teacher Observation
Student Responses/Edmodo

Stage 3- *Learning Plan*	
L **<u>Introducing the lesson</u>** **(Activate, engage, hook)** Introduce lesson for this week FITT Principle/Intensity: Today we will learn to measure our relative intensity using the "talk test". This is a simple measurement you can use without any equipment necessary to gauge the level of intensity you are participating in. **Light**: If you can sing you are participating in "light: activity-step it up a notch! **Moderate**: If you can talk without losing your breath you are at a "moderate" intensity of physical activity **Vigorous**: If you cannot speak a sentence because you are out of breath you are at a "vigorous" intensity What types of activities can you think of that fall into each of these categories? How can we increase our intensity if we are participating in a Light activity? How should we transition from Vigorous activity to light activity?	<u>Materials / Strategies:</u> ☐ Textbook ☐ Promethean Board ☐ Journal/ Writing ☐ Socratic Seminars ☐ C-Thinking/P-Solving ☐ Collaboration ☐ 2-column note taking ☐ Cornel Notes ☐ Foldable ☐ Experiential Activity ☐ Exit Ticket ☒ Other: BYOD, IPAD Cart, Accelerometers

<u>Scope and Sequence of Learning Activities</u> *Take Roll - Seating based on squads / groups*
(Explore, discover, assess)

<u>Introduce / Teach / Explain</u>
1. When students enter the gym have the pre-programed accelerometers set out in squads and assist students in putting them on (practice week prior to lesson). Be sure that students come equipped with devices (QR Reader and Edmodo apps already downloaded-practice inputting info week prior to lesson). Devices should be stored next to cones in bins divided by squad line for ease of access when the students are ready to use them.

2. <u>Walk and Talk</u>: Students will start the lesson by walking laps in the gym. The teacher will discuss how to use the talk test to measure relative exercise intensity. Students will complete walking two laps and gauge their intensity using the talk test, students will record this measurement onto their physical activity log when they reach their device on the second lap. Upon completion of entering data students should begin walking again. When all students have re-entered the activity haven them increase their exercise intensity by lightly jogging two laps and entering their intensity on their devices again after the second lap. Upon completion of entering data students should begin walking again. When all students have re-entered the activity haven them increase their exercise intensity by running two laps at top speed and gauging their intensity upon completion, students should cool down by walking a lap prior entering their final intensity level on their devices.

3. <u>Fitness Stations:</u> Students will be divided into 6 groups to participate in exercise fitness stations. The 6 stations will be set up in the gym with QR codes. The students will begin at a station and scan the code using their electronic device. Students will follow the given directions to perform the activity and transition to the next station when prompted by the teacher. Students should travel in a clock wise direction throughout the gym and complete each of the 6 fitness stations once. The fitness stations should be displayed randomly and each group should be given a letter to scan at each station. Fitness activities will be chosen from the 5 combinations of fitness QR codes.

Key Question: *What level of intensity am I participating in during each activity?*
Concluding the lesson *(Closure, reflection)* Students will complete the Situational Interest Inventory and return accelerometers prior to being dismissed into locker room.
Homework: None

Appendix B.

SITUATIONAL INTEREST SCALE

You are invited to help us evaluate some characteristics in physical activities. This is NOT a test or exam of any school course work. You answer will be confidential, and will NOT affect your grade.

Please read each of the statements carefully and **rate each on how well the statement describes what you felt about the lesson you just did.** Please rely on your first impression when making your choice and you must finish the survey independently. **Circle only ONE** of the numbers below each statement (1 = "Disagree" → 5 = "Agree").

1. What we were doing was exciting.

(Disagree) 1 2 3 4 5 (Agree)

2. What we were doing was complex.

(Disagree) 1 2 3 4 5 (Agree)

3. What we were doing was complicated.

(Disagree) 1 2 3 4 5 (Agree)

4. What we were doing demanded my high attention.

(Disagree) 1 2 3 4 5 (Agree)

5. What we were doing looked fun to me.

(Disagree) 1 2 3 4 5 (Agree)

6. I was very attentive all the time.

(Disagree) 1 2 3 4 5 (Agree)

7. I like to find out more about how to do what we did today.

(Disagree) 1 2 3 4 5 (Agree)

8. What we did was an exceptional activity.

(Disagree) 1 2 3 4 5 (Agree)

9. I wanted to analyze and have a better handle on what we were doing today.

(Disagree) 1 2 3 4 5 (Agree)

10. What we were doing was appealing to me.

(Disagree) 1 2 3 4 5 (Agree)

11. It was fun for me to try what we were doing.

(Disagree) 1 2 3 4 5 (Agree)

12. What we were doing was a new-fashioned activity for me to do.

(Disagree) 1 2 3 4 5 (Agree)

13. What we did was enjoyable for me.

(Disagree) 1 2 3 4 5 (Agree)

14. There were many tricks in what we did today.

(Disagree) 1 2 3 4 5 (Agree)

15. What we did today was fresh.

(Disagree) 1 2 3 4 5 (Agree)

16. What we did today was new to me.

(Disagree) 1 2 3 4 5 (Agree)

17. What we were doing today demanded my focus.

(Disagree) 1 2 3 4 5 (Agree)

18. What we were doing demanded my concentration.

(Disagree) 1 2 3 4 5 (Agree)

19. What we were doing was interesting for me to do.

(Disagree) 1 2 3 4 5 (Agree)

20. What we were doing today was demanding.

(Disagree) 1 2 3 4 5 (Agree)

21. What we were doing attracted me to participate.

(Disagree) 1 2 3 4 5 (Agree)

22. What we were doing was interesting.

(Disagree) 1 2 3 4 5 (Agree)

23. What we were doing was hard for me to do.

(Disagree) 1 2 3 4 5 (Agree)

24. I would like to know more details of how to do what we were doing.

(Disagree) 1 2 3 4 5 (Agree)