

The Integration of Technology in Physical Education and Teacher Perceptions of the Effect on
Participation of K-12 students.

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Title of Synthesis Project

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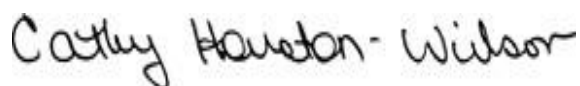


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Abstract

Receiving regular physical activity is beneficial to the physical, mental, and social aspects of health among adolescents. Overall schools, and Physical Education, are essential in achieving health literacy in a population, and they contribute to the achievement of public health goals. However, in recent years, there has been a decrease in physical activity and a decrease in participation in Physical Education. The COVID-19 pandemic has been a catalyst for technology integration, as all educational disciplines were forced virtual. Technology integration in Physical Education has been slow; however, technology provides a means to promote physical activity and participation. The purpose of this synthesis is to review the literature on the effect of the integration of technology on student participation, and the perceptions of teachers and students towards technology use in Physical Education. It was concluded that wrist worn technology is one of the easier technologies to implement into a classroom, and is becoming accepted as one of the easiest strategies to help combat the problem of obesity. It was also concluded that teacher perceptions of implementing technology depend on their prior trainings, experiences, and their environment, and teachers are unlikely to implement technology if they have not had sufficient training. Finally, it was concluded that student perceptions are affected by how teachers implement the technology, which can be both positively and negatively affect participation.

Key Words: Physical Education, Technology, Participation, Motivation

Chapter 1- Introduction

Receiving regular physical activity is beneficial to the physical, mental, and social aspects of health among adolescents (Abildsnes et al., 2015). Participation also positively associates with students' academic performance. When children are physically active at a young age, they have the higher probability to be physically active in their adulthood.

Overall schools are essential in achieving health literacy in a population, and they contribute to the achievement of public health goals in conjunction with their educational commitments (Abildsnes et al., 2015). Students are more likely to enjoy participating in Physical Education when they have a choice of activities, feel competent, in control and supported by their peers and teachers. Participation in Physical Education plays a critical role in how the class functions and the overall experience within the class.

Unfortunately, it has been reported that there is a general decrease in physical activity in Physical Education (Centeio 2021). With low participation, students are unlikely to acquire “the knowledge, skills, and confidence to enjoy a lifetime of healthful physical activity.” (Centeio 2021). With physical activity levels declining, strategies need developing to engage students and motivate them in Physical Education (Centeio, 2021). One such strategy is the integration of technology. However, traditional Physical Educators often perceive technology to be counterproductive due to the practical nature of Physical Education as an academic discipline (Almusawi 2021).

As technology use has increased, technology in education has been an emerging trend. Today, the use of technology has become more readily available and more advanced. In 2018, 110 million devices were bought (Nation-Gringer, 2017). And of these devices, wrist worn technology is a form of technology for which there is already an increase in students use outside

of school. This suggests a positive perception, and that students may be motivated to use this form of technology. In fact, wrist-worn platforms are now considered a means to address the current health epidemic (Nation-Gringer, 2017). It is unknown whether an effective use of technology could impact participation.

One explanation that may suggest technology can affect participation students is Self-Determination Theory. Self-Determination Theory explains the extent to which individuals are willing to pursue goals and challenges, and directly relates to student motivation. When a student is self-determined, they used intrinsic motivation, extrinsic motivation and amotivation (Chen, 2015). Depending on the student and their personality, their motivation may be different, but all students would be expected to have some form of motivation that correlates to participation. (Chen 2015).

Technology has been successfully integrated into general education, where students typically receive form of technology by the first year they are in school. The first year is usually Kindergarten, and in many districts the first type of technology students receive are laptop computers. Using computers, students will follow along with lessons during class time, or complete self-directed work. However, in Physical Education, technology integration has been slower. Evidence suggests that traditional educators frequently view technology as counterproductive for Physical Education due to the practical nature of Physical Education as a subject (Almusawi et al., 2021), and there is a considerable gap in relation to the connection between digital technology and pedagogy (Jastrow et al., 2022). It is unclear whether an effective use of technology could impact participation in Physical Education.

In 2020, the COVID-19 pandemic affected the whole world, and changed education as well. When COVID-19 emerged, education turned to online strategies that created challenges for

teachers and students, especially in Physical Education. “Suspending schools disrupted Physical Education in particular where online instruction proved to be problematic for Physical Education teachers and their instruction delivery” (Almusawi et al., 2021).

During COVID, Physical Education was forced to rely on technology. Since the pandemic, the integration of technology in Physical Education has happened much more rapidly. And now, teachers have experience and a different perspective on technology. Like in general education, computers are typically used. For example, students have used videos on YouTube for warm-ups or as part of the lesson. Other common forms of technology used includes pedometers, heart rate monitors, and wrist worn technology. By utilizing technologies in Physical Education, students may be motivated to participate in Physical Education class and may learn to appreciate how participation in physical activity can help maintain a healthy lifestyle.

Statement of the Problem

Physical Education teaches students “the knowledge, skills and confidence to enjoy a lifetime of healthful physical activity” (SHAPE America, 2020). In addition, technology use is rising and is being used to address the nation’s health needs. This suggests that students have a positive perception of technology, and it may be a useful tool to motivate students to participate in Physical Education. Unfortunately, traditional physical educators often have a negative perception of technology. Regardless, the COVID-19 pandemic forced all educators to rely heavily on technology. And since, the use of technology in Physical Education has increased. It is unknown the extent of which technology use has influenced student participation, student perception, and teacher perception.

Purpose of the Study

The purpose of this synthesis is to review the literature on the effect of the integration of technology on student participation, and the perceptions of teachers and students towards technology use in Physical Education.

Operational Definitions

1. Physical Education class: A sequential, curriculum-based core subject area in primary and secondary schools.
2. Physical Activity: The time students are moving and increasing their resting heart rate.
3. Participation: Being involved during Physical Education class 80% of the time.
4. Technology: A category learning aid that can increase learning and retention for a learner.
5. Technology Integration: The inclusion of one of more forms of technology into a Physical Education lesson.

Research Questions

1. What is the best technology to increase participation?
2. What is the perception of students regarding technology use?
3. Has technology use changed the perceptions of teacher?

Delimitations

1. The articles used for this synthesis were all peer reviewed articles.
2. The articles used for this synthesis were all published in the last 10 years.

Chapter 2-Methods

The purpose of this synthesis is to review the literature on the effect of the integration of technology on student participation, and the perceptions of teachers and students towards technology use in Physical Education. The studies that were used for this synthesis were located on the EBSCO database from the SUNY Brockport's Drake Library. This synthesis is positively impacted by using up to date articles, which were available from 2013-2023. Selection was based on articles being peer-reviewed and full text referenced. Within the EBSCO database the following databases were used and searched: EBSCO SPORTDiscus, Directory of Open Access Journals (DOAJ), Taylor & Francis Social Science & Humanities Library, and Gale Academic OneFile. Besides the use of EBSCO database, there were two studies used that were from Google Scholar.

The EBSCO database was used to search all databases simultaneously with the keyword *technology*. This resulted in 26,625,858 articles. Additional keywords of *Physical Education*, *Participation* reduced the number of articles to 11,215 articles. When the peer-reviewed criterion was applied, and a date range of 2013-2023 was applied, the number of articles was reduced to 8,429. Starting with 8,429 articles, articles titles were reviewed for all keyword terms, articles that had all keywords were selected for further review. Selected articles were picked for the critical mass by considering how closely they related to the research questions in this study. After forty articles were reviewed for keyword matches and relevance to these research questions, ten articles were selected for the critical mass.

In addition, Google Scholar was another database that was used for this synthesis. When on Google Scholar the words that were used in the first search were *Technology Integration in Physical Education, K-12*. This resulted in 188,000 articles. From that the dates were limited to

2013-2023. Again, articles titles were reviewed for all keyword terms, and articles that had all keywords were selected for further review. Selected articles were picked for the critical mass by considering how closely they related to the research questions in this study. Once the initial search was completed, two articles that were selected to be included in this study.

Ten articles were used for the literature review within this synthesis. The list of databases and the number of articles found within those databases are as follows: EBSCO SPORTDiscus had six studies used for this synthesis. Taylor & Francis Social Science & Humanities Library had one article. The database Gale Academic OneFile also had one article. The Directory of Open Access Journals had two articles. And Google Scholar had two articles.

Each article was picked for this synthesis with the following keywords: *technology, integration, K-12, motivation, and participation*. Each article was peer-reviewed, and each article was published from 2009- present. Finally, each article specifically addressed the research questions in this study.

The ten articles used in this synthesis include: *Innovation in Physical Education: Teachers' perspectives on readiness for wearable technology integration (Almusawi, 2021); The effects of role modeling on technology integration within Physical Education teacher education (Baert, 2014); A comparison of physical activity from Actigraph GT3X+ Accelerometers worn on the dominant and non-dominant wrist (Buchan et al., 2018); The success and struggles of Physical Education teachers while teaching online during the COVID-19 pandemic (Centeio, et al., 2021); Validity and comparability of a wrist-worn accelerometer in children (Ekblom, et al., 2012); Information and communication technology as an enabler for implementing nonlinear pedagogy in Physical Education: Effects on students' exploration and motivation (Komar, 2022); Integration of Information and Communication Technology and pupils' motivation in a*

*Physical Education setting (Legrain, et al., 2015); It's just PE' till 'it felt like a computer game':
Using Technology to Improve motivation in Physical Education (Nation-Gringer, et al., 2017);
perceptions of heart rate monitor use in High School Physical Education classes (Patridge, et
al., 2011); Using smart bracelets to assess heart rate among students during Physical Education
lessons: Feasibility, reliability, and validity study (Sun et al., 2020).*

Chapter 3- Review of the Literature

The purpose of this synthesis is to review the literature on the effect of the integration of technology on student participation, and the perceptions of teachers and students towards technology use in Physical Education. The purpose of this chapter is to explore the integration of technology integration in Physical Education, and the effects it has on student participation, and teacher perceptions and student perception. Technology in education is an emerging trend that is growing momentum as the years have gone on. With technology becoming faster, easier, and more readily available, integrating it into PE can affect student enjoyment positively or even negatively.

Teacher perspectives on Integrating Technology

The teacher's perspective is extremely important because they facilitate the lessons; they would be the ones that need to be trained, and they are affected by their own experience with technology. Kretchmann (2015) investigated the relationship between Physical Education teachers' computer literacy and their technology use in Physical Education class. A survey of 57 high school level Physical Education teachers (26 males and 31 females) was used to assess the Physical Education teachers' computer literacy and instructional technology and media use in Physical Education. Out of the teachers within the group, 10 (17.55%) were assessed at low-level computer literacy; 26 (45.61%) were at an average computer literacy, and 21 (36.84%) were at high level of computer literacy. There were no significant differences in teacher literacy between males and female knowledge, but there was a significant correlation between age and computer literacy. It was concluded that Physical Education teachers do not demonstrate worse or better computer literacy than other school subjects. However, teachers may not integrate technology due to there is a traditional belief among Physical Education teachers that technology integration

may lead to a reduction of movement. A decent level of computer literacy, an assumed interest in literacy, and an assumed interest in instructional technology does not always lead to a trend in integrating technology into Physical Education. The authors recommend that the factors that influence teacher's technology use in classes should be integrated into a comprehensive study designed to explore Physical Education class setting, and that this topic has not been sufficiently researched.

When the COVID pandemic emerged, teachers of all disciplines were forced to go virtual. Centeio (2021) investigated Physical Education teachers' perceptions of implementing Physical Education virtually during the COVID-19 Pandemic, and explored their support needs for future teaching experiences. The participants within this study included 4,302 Physical Education teachers: 2238 (52%) taught elementary, 597 (14%) Middle School, 469 (11%) high school, and 998 (23%) multilevel. All 50 states within the United States were represented, with 23% of teachers from Northeast, 25% from the Midwest, 33% from South, and 19% from the West. In addition, locations were categorized as 23% rural, 35% suburban, and 42% urban, Teachers were presented four open-ended questions regarding successes and struggles in distanced learning, and future concerns and needs. The author reported three subcategories of results. The teachers reported the biggest category of success was overcoming and learning technology (20% of the participants), and the ability to create good content for students (15%). A quote from teacher 2397 stated "Being able to transition to a digital learning environment has been my success. To go from the normal teaching style and switching with little preparation has been a learning experience" (Centeio, 2021). However, several teachers expressed a level of concern when it came to student participation in a virtual setting. A common theme for this data indicated teachers would get frustrated because they did not know if their students were

participating. Finally, 35% of participants expressed their greatest concern was the fear of the upcoming year. While forced to go virtual, it did create successes, but it also created challenges.

COVID-19 has been a catalyst for innovation in many sectors, including education. Wearable technologies such as fitness trackers (e.g. Fitbit Charge and Garmin Viviosport) and smartwatches provide the Physical Education teacher with innovative means for instruction. Research suggests that these digital innovations have received high interest in monitoring a user's health and fitness, and can be used to improve teaching and learning experiences. In an article by Almusawi (2021), the author explored Physical Education teachers' perspectives on their readiness for wearable technology integration and developed a conceptual model for integrating wearable technology as digital innovation in Physical Education. The author reported that technology continues to have four main roles in context of education, which are (1) educational technology for teaching and learning, (2) instrumentation of metrics and measurements, (3) technologies for communication and networking, and (4) as a new discipline or subject area. It was concluded that an understanding of a Physical Education teacher perspectives on their readiness for wearable technology integration can provide technical and innovative solutions to enhance Physical Education instruction and contribute to wearable technology design space for seamless integration in Physical Education, especially in view of current global shift towards distance and e-learning caused by the ongoing pandemic. The author emphasized that technology in schools has been an important driver of innovation in educational environments.

Gawrisch et al. (2020) investigated Physical Education Teachers need proper experiences to feel comfortable to integrating technology into their own lessons. "PE teacher education (PETE) programs are encouraged to develop teachers capable of delivering technology

integrated learning experiences.” The authors explained how teachers’ beliefs and practices end up influencing teachers’ anticipatory socialization experiences during formative education.

Teachers who have positive experiences with technology, may be more inclined integrate technology into their classroom, which can become a trickle-down effect as the time goes on in their career. The authors concluded that there needs to be a development of a technological pedagogical content knowledge, known as a TPACK. TPACK is a model for understanding how technology can integrate into the learning process, grounded in a conceptualization of teacher knowledge, which identifies the intersection between pedagogical and content knowledge.

TPACK is about to include “connections, interactions, affordances, and constraints between and among content, pedagogy, and technology” (Gawrisch et al., 2020). The author states that many preservice PE teachers have not experienced quality technology integration, and that training on technology is critical for teachers to implement into a lesson.

Similarly, Baert 2019, investigated the current state of TPACK to find the most appropriate way for new teachers to learn how to integrate technology effectively. Using teacher education students at three points on their academic path – freshman, junior, and senior – the author used a survey that measured six parts of the TPACK framework; Technology Knowledge, Content Knowledge, Pedagogy Knowledge, Pedagogy Content Knowledge, Technology Content Knowledge, and Technology Pedagogy and Content Knowledge, and asked “how TPACK has been modeled by their instructors and cooperating teachers in the field” (Baert, 2019). It was concluded that senior students had a higher perceived level of TPACK than juniors; that most pre-service teachers appeared to perceive a high level of all seven constructs, including the technology infused constructs; and that all students were confident in their ability to use technology. The author emphasized that pedometers, heart rate monitors and digital video are

examples of Physical Education technologies that provide K-12 with instant feedback and can help them become efficient movers.

Student perspectives on the Integration of Technology

Equally important are student perspectives on the integration of technology, and how it may affect their participation within a Physical Education class. Student perspectives on technology include any form of communications technologies such as mobile applications, computers, software, and other media applications that provides information to users in a digital form, known as ICT (Komar, 2022). This can mean the use of heart rate monitors, video feedback, the use of an interactive walls, or wrist-worn technologies.

In a study by Nation-Grainger (2017), student perspectives towards implementing wrist worn technology for six weeks into their Physical Education class was explored. The aim of this study was (1) to explore the impact of an intervention using biofeedback on motivation to be physically active in Physical Education; (2) to determine if the intervention could improve physical activity levels in Physical Education; and (3) to gain a better understand of the relationship between motivation and physical activity in Physical Education lessons. Within this study there were four research questions. (1) What is the influence of biofeedback on student's motivation? (2) What is the influence of biofeedback on exercise levels in Physical Education? (3) Does change in motivation result in a change in exercise levels in Physical Education? And, (4) how and why does receiving biofeedback result in changes in exercise behavior? It was concluded that monitors can support and provide extensive feedback, which can be richer and more individualized for students, and can create a connection by providing instant feedback. Furthermore, technology implemented into a lesson can create competition within themselves or between peers within their class, improving student competence and motivation during Physical

Education. Students expressed that they did feel the need to work harder while wearing the wrist worn technology, and referred to it as playing a computer game.

The positives and negatives regarding implementing technology was investigated further by Partridge et al. (2011), using heart rate monitors in Physical Education with high school students. Three questions/statements were explored. (1) What were the good things about wearing a heart rate monitor during Physical Education class? (2) What were the bad things about wearing heart rate monitors during Physical Education class? (3) And, were students more active during Physical Education class because they used a heart rate monitor, and why or why not? Students were asked to wear the heart-rate monitors during their class under graded conditions. To get a grade, their heart rate had to maintain a specific level for a specific time. After the lesson, the students had to fill out a questionnaire about their perspectives.

Mixed perspectives regarding this technology use were reported. For example, one student stated, “Because you have to get like a certain amount of time [on the heart rate monitor] and if you don’t get that time, then you get a bad grade” (Partridge et al., 2011). This suggests that when there is grading involved, perceptions may turn negative, which may affect their perceptions of physical activity or their motivation to participate regarding physical activity during Physical Education. In particular, lowered levels of enjoyment and motivation were reported for females during class. Since the classes were single sex classes, there may be an interaction between sex, technology, and grading on perceptions. The authors stated that, “Incorporating technology into the Physical Education curriculum is becoming a popular strategy in which teachers can assess, motivate and provide feedback to students regarding their physical activity participation during class” (Partridge et al., 2011). However, the article concluded that

“the increased effort required to move the heart rate into the target zone (as fitness levels increased) was seen as a negative and undesirable situation” (Patridge et al., 2011).

In a study written by Komar, 2022, the effect of using ICT on student activity and engagement in PE, with specific focus on examining how ICT supports Pedagogical innovation as previously stated, ICT is defined as various communication technologies, such as mobile applications, computers, software, and other media applications that provides information to users in a digital form. Thirty participants from 5 international Physical Education classes (16 females and 14 males) participated in a climbing lesson. The participants within this study were all considered novice, having only had with only having 1 prior cycle of climbing. The ICT used in this experiment was a wall that would light up, creating instant feedback, and measuring the number of touches. To measure motivation, all the participants completed an Intrinsic Motivation Inventory and Situational Motivational Scale. It is important to note that even in an environment where there was increased exploration allowed within the learning environment, the participants did not feel threaten or anxious, which then results in the students being able to learn in the presence of a safe exploration environment, but the results of this study did not lead to significant increases in intrinsic motivation levels. However, with the introduction of ICT within Physical Education, it was suggested that ICT enhanced student learning through increased student motivation and engagement. Practitioners should explore ways to integrate technology tools into their practices to foster pedagogical innovation and encourage learning in meaningful ways.

Another study that investigated student perceptions on technology in Physical Education written by Legrain et al., 2015. The purpose of this study was to test an integrative model regarding the impact of information communication technology (ICT) on achievement in

Physical Education, with an aim to examine the influence of ICT integration into Physical Education lessons and the perceptions pupils have on the autonomy support from their teacher on their cognitive skills and motor performance in a gymnastics unit. Ninety-six adolescents (44 boys and 52 girls) with the mean age of 12.4 years and no prior gymnastics lessons were randomly assigned to two control groups: ICT and traditional teaching. Pretest measurements and instructions, six physical practice sessions, and posttest measurements were completed. They received this pretest by a Physical Education teacher that was blind to the experiment and that teacher tested them on four different motor tests, which included tone, coordination, upper limb explosive strength and balance within four different stations. The participants were also asked to complete a questionnaire that measured their use of new technology within their daily life. In the study, the Physical Education teacher that was trained to integrate ICT into the Physical Education lessons taught all the lessons for both groups. In the ICT group, participants practiced within an ICT learning environment, comprised of two televisions with video cassette recorders, two camcorders, ten pocket computers for recording and reviewing their Performances, and an interactive whiteboard connected to a computer. Within the traditional teaching group, participants practiced the same skills but did so within a more traditional instructional learning environment using diagrams and written instructions. Each group was given three 15-minute training sessions with their respective to help them practice the gymnastic exercises in small groups. At the posttest, the participants were given and completed a Perceived Autonomy Support Scale for Sport Setting. It was concluded that ICT teaching conditions lead teachers to support children's autonomy and were associated with an increase in students' self-regulation of learning, visual animation may help children's perceptions and actions to be more finely tuned as

they progress through learning, ICT is still a very much untapped resource for enhancing young people's ability to participate in a wide range of sports and other movement-based activities.

Chapter 4- Discussion, Conclusion, & Recommendation

The purpose of this synthesis is to review literature on the effect of the integration of technology on student participation, and the perceptions teachers and students towards technology use in Physical Education. The purpose of this chapter is to present the results of the review of literature on the effect of the integration of technology. In addition, recommendations for future research as it relates to the integration of technology on student participation and the perceptions teachers and students have been presented.

The results of this review of literature indicated multiple conclusions. First, wrist worn technology is one of the easier technologies to implement into a classroom. Furthermore it is becoming accepted as one of the easiest strategies to help combat the problem of obesity. Second, teacher's perceptions of implementing technology depend on their prior trainings, experiences, and their environment. Teachers are unlikely to implement technology if they have not had any training due to concerns about how technology helps the lesson, without hindering the outcome. Third, students' perceptions are affected by how teachers implement the technology. If teachers implement technology in a negative way, students tend to form negative perceptions regardless of the technology. For example, using wrist worn technology under graded conditions can negatively affect students to work harder compared to others.

Interpretations

As part of this literature review, multiple research questions were posed. The first research questions that was examined is, what is the best technology to increase participation? The results of this study indicate that wrist worn technology is the best to increase participation. The wrist worn Actiwatch appears to be valid and reliable for estimating energy expenditure and physical activity in children 8 to 10 years old (Ekblom, 2012). Wrist worn technology such as

this is being used to address the current health epidemic (Nation-Grainger, 2017). Since many students throughout the day will have some form of wrist-worn technology, wrist-worn technology is being used to address the epidemic because of the accessibility students have in and outside of school, and it monitors and provides extensive feedback, which is richer and more individualized. Furthermore, the use of technology can sometimes create competition with themselves or other which can relate to intrinsic and extrinsic motivation and a possible increase in participation (Nation-Grainger 2017).

The second research question in this study is, investigated perceptions of students regarding technology use. From the literature, there were mixed the perceptions. There are many students had positive perceptions regarding technology. For example, students learn that to be more physically fit, students had to exercise harder to elevate their heart rate into a standardized zone. When students learn this, this perception can get carried over into a knowledge bank that students can apply in their daily life to achieve a goal of Physical Education to promote lifelong movers. Students even stated when technology was implemented that, “Two years ago, I didn’t even like Physical Education. But now, I am more interested in it” (Patridge 2011). Having some form of technology, such as wrist worn technology, can be an informational source for some students in Physical Education settings. However, some students had negative perceptions. For example, a female student stated “Heart rate monitors were kind of a burden to me because it was like you had to get your heart rate up cause if it went down you had to stop whatever it was you were doing so it would be active all through Physical Education ... it is hard to get your heart rate up, and it’s hard to keep it up” (Patridge 2011).

The third research question is investigating whether technology has changed the perception of teachers. Again, it was a mixed perception. The COVID pandemic, especially

impacted Physical Education teachers in many ways, both negative and positive. With COVID teachers were able to find successes in their ability to learn technology. Some teachers felt positive transitioning into a digital space with little preparation; whereas teachers were concerned about students participated (Centeio 2021). Finally, if a teacher had little prior experience, the probability of them implementing technology was low. On the other hand, if a teacher had a positive experience with technology, they were more likely to implement it.

Implications

The literature review in this synthesis examined the perceptions students and teachers on technology. These results can offer implications regarding technology integration and how it may affect participation in PE, and ultimately a student's lifelong Physical Activity.

Recommendations for Future Research

In reviewing the literature on technology integration and the perceptions of students and teachers, the following limitations were noted. Teacher resources were limited for technology training. Another limitation includes administration resource to provide students with technology. Based on the limitations and other factors related to the literature, the following recommendations for future research should be considered.

1. Future research should investigate student choice regarding type of technology. When students did not have a choice and felt forced, their perceptions may become negative.

This is impacted by resources available to the Physical Education teacher, which is often an indicator of the importance of an academic discipline within a curriculum.

2. Furthermore, future research should investigate strategies to encourage Physical Education teachers to consider technology within their lessons in an effort to promote student engagement. As strategies and environments using technology are better

understood, the impact of these strategies on participation in Physical Education and physical activity will become stronger.

Summary

The purpose of this synthesis was to review literature on the effect of the integration of technology on student participation and the perceptions teachers and students have towards technology use in PE. Delimitations were used to do an extensive data-based search which yielded ten articles. These ten articles then were systematically used to determine how integration of technology may affect student participation and the perceptions teachers and students towards technology use in Physical Education.

Research revealed that technology has both positive and negative effects on student participation. In addition, teachers and students have mixed perceptions regarding implementation it into a classroom setting. As technology is an emerging trend, it is important that teachers continue to learn about technology and how it can be used successfully in a Physical Education class. Students will have indifferent opinions on technology use in Physical Education, especially if it is not implemented in a meaningful way that students feel secure and safe while using it.

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Appendix

Author	Title	Source	Purpose	Methods & Procedures	Findings	Discussion/ Recommendations Research Notes – Commonalities/Differences
Chen	Relationship between Motivation and Learning in PE and After-School Physical Activity	SHAPE America	Background information about participation Use info in chapter 1	Brockport Lib Website Words Used: Participation, Physical Education	1. Primary goal of PE is to develop physically literate individuals with the knowledge, skills, and confidence necessary to enjoy a lifetime of healthful physical activity 2. Learning is a multidimensional process that involved the interplay of multiple sources of motivation 3. Known information is that student’s engagement and learning in PE class are influenced and sometimes determined by both dispositional and situational motivation.	<ul style="list-style-type: none"> - The knowledge students gain in PE, will help further their choices in making wise decisions about their PA participation. - Situational Interest plays a huge role: there will be an immediate impact on the learner if it has some interest to them, if it does not have any interest to them, it is likely they will not participate. - Situational interest is defined as: the appealing effect of a learning task on the learner.

<p>Gawrisch “Pre-service”</p>	<p>Integrating Technology in PE teacher Education</p> <p>Aim of study: Is to propose a conceptual framework for helping preservice physical educators develop TPACK that is grounded in occupational socialization theory.</p>	<p>Quest</p>	<p>Possibly Critical Mass Article</p> <p>Possibly a background article</p>	<p>Brockport Lib Website</p> <p>Words Used: Physical Education, Technology, Participation</p>	<p>1. PE Teacher Education programs are encouraged to develop teachers capable of delivering technology integrated learning experiences 2. Pre-Service teachers: may not have experienced quality technology integration related to resource access, institutional and administrative support, training and experience....Which if that is the case does this turn them off to the idea of integrating? 3. Preservice teachers need to be prepared to integrate technology in schools where admin and veteran colleagues may not understand or appreciate its role in the teaching and learning process</p>	<p>- It may be hard to begin integrating it into a classroom setting, but in the end, it will be important to the students. - When implemented properly into an educational setting it can be extremely effective in enhancing the students learning experience in PE - Educational goals change each year, it is important that further technology integration in PE will better preservice teachers to meet the educational goals in the 21st century and so on.</p>
<p>Jastrow “students”</p>	<p>Digital Technology in Physical Education: A</p>	<p>Ger J Exerc Sport Res</p>	<p>Background/Fluff information</p>		<p>-Exergaming units are very common but do not meet the criteria we are looking at</p>	<p>Useful Quotes: - “Digital Media is associated with opportunities and risks, such as</p>

	<p>systematic Review of Research 2009 to 2020</p>		<p>Critical Mass article possibly</p>		<p>-Video and teacher feedback delivers the most positive overall results and significant improvements in motor skill -All the studies showed that there is an association between the use of digital media and physical fitness of students showed a positive result</p>	<p>insufficient physical activity or addiction” -“PE has to now also deal with media education topics” - “There is a considerable gap in relation to the connection between digital technology and pedagogy.” “This means that while a teacher can design the learning environment and thus prepare and support the learning process, the completion of the learning process, is dependent on the student acting accordingly as a self-forming individual subject” -“Digital media was used to counteract obesity either by creating motivating movement possibilities for student or by imparting knowledge about health related aspects” -“The use of video feedback led to improved articulation and a deeper understanding of throwing and catching skills” -“Besides physical activity, motivation, and situational interest were among the most researched topics in terms of digital media in PE” -“As early as 2009, as a main finding of their study, Weir and Connor noted that the use of digital media</p>
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						<p>was suitable for maintaining student engagement”</p> <p>-“Overall, many studies have indicated that motivation and situational interest in PE can be increased for a short period of time. In the long term, however, there are indications that situational interest declines over time. (Sun, 2012, 2013) This may be due to the digital medium used or to its novelty in P.E”</p>
<p>Nation-Grainger</p> <p>“students”</p>	<p>It is just PE till it felt like a computer game: Using technology to improve motivation in PE</p>	<p>Research Papers in Education</p>	<p>Critical Mass Article</p>	<p>Brockport Lib Website</p> <p>Words Used: Physical Education, Technology, Participation</p>	<p>1. Motivating children to participate in exercise and physical activity is becoming increasingly important due to a rise in obesity but can be prevented through PE.</p> <p>2. Self-Determination theory has enjoyed increasing popularity within the field of Physical Educators and has been found useful in exploring motivation within PE</p> <p>3. 110 million devices were bought in 2018.</p>	<p>- Wrist worn platforms are being used to address the current health epidemic</p> <p>-Monitors can support and provide extensive feedback, which is richer and more individualized, then supporting the basic psychological needs.</p> <p>-The use of technology can sometimes create a competition with themselves or others and that can support a student’s competence during PE because of the competition and feedback that the intervention created.</p>

<p>Ekblom "students"</p>	<p>Validity and Comparability of Wrist Worn...</p>	<p>Journal of Physical Activity and Health</p>	<p>Critical Mass Article</p>	<p>Brockport Lib website peer Reviewed Article Words Used: Technology, Physical Education, Participation</p>	<p>1. The wrist- worn Actiwatch appears to be valid and reliable for estimating energy expenditure and PA intensity in children 8 to 10 years. 2. Choices of activities in any protocol will likely influence the association between activity counts and energy expenditure estimates. 3.Active children (and adults) spend most of their time in sedentary or light-intensity activities.</p>	<p>-Calibration when using wrist worn technology should always happen for quality control -Wrist- worn monitors can be an alternative to hip-worn monitors for PA assessment in children 8 to 10 years.</p>
<p>Kretschman "teacher"</p>	<p>Effect of P.E teachers computer literacy on tech.</p>	<p>The Physical Educator</p>	<p>Critical Mass Article</p>	<p>Brockport Lib Website peer Reviewed Article Words used: Physical Education, Technology, Participation</p>	<p>1. Teacher's computer literacy has been identified as. A factor that determines their technology use in their class. 2. Field of technology and PE, the empirical evidence is limited, and few empirical studies are available. 3. Lack of (PE) teacher's ICT skills have even</p>	<p>- Aim of study: to investigate the effect of PE teacher's computer literacy on their technology use in PE. - Even with literacy and interest being high, it does not always mean integrating technology into a PE class/classroom -Gender can play a role in integrating technology. Example: Dance Dance Revolution, male teachers may NOT use it because they are uncomfortable dancing, but</p>

					been identified as a barrier for ICT implementation in the classroom	females MAY use it because they are comfortable with the lesson.
Patridge "students"	perceptions of Heart Rate Monitor Use in High School PE Classes	Gale Academic Refined Dates to 2009-2023	Critical Mass Article	Brockport Lib Website Database Gale Academic Words Used: PE, technology, motivation	1. The National Association for sport and PE (NASPE, 2004) has recommended that every student from kindergarten through twelfth grade should have the opportunity to participate in quality, daily PE. 2. "Some people just walk up and down stairs. And they, you know, just don't have to do hardly any activity and its [heart rate] up, other people have to sprint to keep it up high enough to get points" – important to realize especially if using it as a grading technique. Everyone will be effected different dependent on their PA levels. 3. According to the article, increased effort	- Purpose of this study was to gain a greater understanding of high school students' perceptions of heart rate monitors during PE class. - Three questions that were used to assess the topic...1.) Tell me the good things about wearing a heart rate monitor during PE class. 2.) Tell me the bad things about wearing heart rate monitor during your PE class. 3.) Do you think you were more active during physical activity class because you used a heart rate monitor? Why or why not? - In this study, they used heart rate monitors to grade their students. Students had single gender classes. Females struggled more with the idea of using it as a grading system. Males enjoyed it or "didn't even notice it".

					required to move the heart rate into target zone (as fitness levels increased) was seen as a negative and undesirable situation rather than a beneficial condition.	
Centeio “teachers”	The success and struggles of PE Teachers while Teaching online During the COVID-19 Pandemic	EBSCO SportDisucs	Critical Mass and Background Articles	Brockport Lib Website Keyword used: Technology, Physical Education, Participation Database: EBSCOhost SportDiscus Years 2009-2023 Articles Found 15,596 peer-Reviewed	1. PE is a natural place to address public health concerns including decreases in PA resulting from the pandemic- especially considering the current goal of PE to assist students in acquiring “the knowledge, skills and confidence to enjoy a lifetime of healthful physical activity” (SHAPE America, 2020) 2. When teachers were asked to share successes.... <i>Overcoming and learning technology (28%), engaging students in online learning (20%), and their ability to create good content for students (15%).</i>	- Purpose of the Study: Was to investigate PE teachers’ perceptions of implementing PE during the COVID-19 Pandemic as well as explore their needs about support for future teaching experiences. Methods: 4,302 PE teacher participated in the study of which 2,238 (52%) taught elementary, 597 (14%) Middle school, 469 (11%) high school, and 998 (23%) multilevel. Categorized as 23% rural, 35% suburban, 42% urban. All 50 U.S states were represented, with 23% teachers from Northeast, 25% from the Midwest, 33% from South, and 19% from the West. -The open-ended questions in this study were...1 “What has been your biggest success in a distanced learning environment?” 2. “What has been your biggest struggle in distanced learning?” 3. “What is

				<p>Quote 1: “Being able to transition to a digital learning environment has been my success. To go from the normal teaching style and switching with little preparation has been a learning experience.” (Teacher 2397)</p> <p>3. Several teachers did express concern over <i>the lack of participation of students</i>.</p> <p>Quote 2: “I am only getting 35%-40% response rate- PE is NOT graded. We use S (satisfactory/ U (unsatisfactory) categories only. Therefore, unless they click on our folder in their learning management system, the assignment goes unnoticed” (Teacher 505)</p> <p>4. The fear of the unknown was frustrating and all-consuming for teachers. 35% of the</p>	<p>your biggest overall concern as you plan and prepare for next year?” 4. “What is your biggest PD need for next school year?”</p> <p>-What researchers found reliable within this study...Researchers had interrater reliability of 77% on the first round of pilot testing. On the second round of data coding, researchers achieved an 85% interrater reliability. Researchers coded the remaining 98% of the database.</p>
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					study group expressed that the greatest concern about the upcoming year was not knowing what their situation was.	
J. Komar	Information and communication Technology as an enabler for implementing Nonlinear Pedagogy in Physical Education: Effects on students' exploration and motivation	Brockport Library Website	Critical Mass Article	<p>Keywords Used: Physical Education, Technology, motivation</p> <p>Database: Elsevier Science Direct Journals Complete</p> <p>Years: 2013-2023</p> <p>Articles 7,542</p>	<ol style="list-style-type: none"> 1. The introduction of ICT (Information communication technology) in PE has shown to enhance students' learning through increased student motivation and engagement when ICT supports the lessons that are carefully designed and delivered properly. 2. Even with increased exploration allowed by the learning environment, participants in 	<ul style="list-style-type: none"> - Aim of study: Was to investigate the effect of using ICT on student activity and engagement in PE, with specific focus on examining how ICT supports pedagogical innovation. - ICT Definition: Refers to various communication technologies such as mobile applications, computers, software and other media applications that provides information to users in a digital form. - Participants: 30 participants from 5 different PE classes in an international school with approximately equal gender breakdown (16 females; 14 males) - There is a need to understand how information and communication technology are impacting learning opportunities.

					<p>this specific study did not feel threaten or anxious as depicted by the significantly lower tense subscale score as the similar subscale of perceived competence, which meant that participants were able to learn within the presence of a safe exploration environment.</p> <p>3. Practioners should explore ways to integrate technology tools into their practices, to purposefully foster pedagogical innovation when it supports content delivery and encourages</p>	<ul style="list-style-type: none">- Although variability in practice is essential for learners to explore new movement patterns, an excessive amount of variability could also impair the motor learning process.
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					learning in meaningful ways.	
Legrain	Integration of Information and Communication Technology and Pupils' motivation in a Physical Education Setting	Brockport Library Database: EBSCO SportDiscus	Critical Mass Article	Database: EBSCO SportDiscus Keywords: Physical Education, Motivation, Technology Dates: 2009-2023 peer-Reviewed articles	-Hypothesis in this study: (a) perceptions of autonomy support from teachers satisfies pupils' basic psychological needs; (b) basic needs satisfaction in turn leads to greater self-determined motivated which (c) contributes to the enhancement of cognitive skills and motor Performance -“Time” is seen as a major barrier in using ICTs in PE, because the time needed to set up equipment was limited” -“ICT in PE may have an impact on pupils motivation and, also may directly or indirectly-through motivation influence Performance” -IMPORTANT: To date, no study could be found that examined the effects	-Purpose of study: Was to test an integrative model regarding the impact of information and communication technology (ICT) on achievement in PE -Aim of the study: Was to examine the influence of ICT integrated into PE lessons and pupils' perceptions of autonomy support from their teacher on their cognitive skills and motor performance in gymnastics. -Finding 1: Showed that ICT teaching conditions lead teachers to support children's autonomy and were associated with an increase in students' self-regulation of learning -Finding 2: Visual animation may help children's' perceptions and actions to be more finely tuned as they progress through learning. -Finding 3: ICT is still very much untapped resource for enhancing young people's ability to participate in a wide range of sports and other movement-based activities.

					of ICT in the PE domain on pupils' need satisfaction and self-determined motivation	-Participants: 96 adolescents from the same school. 44 Boys and 52 girls; mean age 12.4 yrs old -Two control groups: ICT vs. traditional teaching. Assigned randomly.
Baert Abigail Stewart "Pre-Service Teachers"	The Effects of Role Modeling on Technology Integration within Physical Education Teacher Education	Google Scholar	Keyword: Technology integration in Physical Education K-12 Date: 2013-2023 Articles: 188,00	Critical Mass article	1. The benefits of infusing technology within education can be endless when technology is properly infused within the instructional process 2. Research shows that pedometers, heart rate monitors and digital video are examples of PE technologies that provide K-12 with instant feedback and can help them become efficient movers. 3. Guidelines addressing proper technology inclusion adhering to the national standards were put in place to ensure that teachers gain the necessary skills and knowledge to use	-Aim of study: To examine the perception of the level of technology within a PETE program -Data within this study showed that only 50% of faculty believed a specific PE technology course should be embedded. But these findings could have been due to the lack of knowledge on what a course would look like.

					technology effectively to improve learning.	
Almusawi	Innovation in Physical Education: Teachers' perspectives on readiness for wearable technology integration	Google Scholar	<p>Google Scholar</p> <p>Keyword: Technology Integration in Physical Education and participation in K-12</p> <p>Articles: 139,000</p> <p>Date: (2013-2023)</p>	Critical Mass article	<ul style="list-style-type: none"> - Wearable technologies, such as fitness trackers (e.g. Fitbit Charge and Garmin Viviosport) and smartwatches provide teacher with innovative means for instruction since research suggests that these digital innovations have received interest in monitoring users health, fitness, and surroundings, and have been used to improve teaching and learning experiences - Diverse design and practical perspectives, along with educational 	<p>-Aim of the study: Is to explore PE teachers' perspectives on their readiness for wearable technology integration and to develop a conceptual model for integrating wearable technology as digital innovation in PE.</p> <p>- Evidence suggests that over the past twenty years or so, digital innovations have offered more options to facilitate learning within and beyond class setting.</p> <p>-While technology may not necessarily imply innovation in educational practices, its presence in schools has become an important driver of innovation in educational environments.</p> <p>- In regards to COVID: SusPENDING schools have disrupted PE in particular where online instruction proved to be problematic for PE teachers and their instruction delivery.</p> <p>-Evidence suggests that traditional educators frequently view technology as counterproductive for PE due to the practical nature of PE as a subject.</p>

					<p>affordances of wearable technology to highlight how various wearable technologies can be used and integrated in education.</p> <ul style="list-style-type: none"> - COVID- 19 has often been a catalyst for innovation in many sectors including education. 	
Kretchmann	<p>Effect of Physical Education Teachers' Computer Literacy on Technology Use in PE</p> <p>2015</p>	Brockport Lib Database	<p>Keyword: Technology, Physical Education, Participation</p> <p>Database: EBSCOhost Academic Search Complete</p>	Critical Mass Article and Background Article	<p>1.) Aim of study: To investigate the relationship between PE (PE) teachers' computer literacy and their technology use in PE.</p> <p>2.) A survey was used to assess the PE teachers' computer literacy and instructional technology and media use in PE.</p> <p>3.) Methods: A study group consisted of 57 high school level PE</p>	<p>Results/Discussion:</p> <p>1.) Data suggests that PE teachers do not show worse or better computer literacy than other school subject teachers.</p> <p>2.) Another common belief among PE teachers that may cause less technology use is that integrating technology leads to a reduction in movement time.</p> <p>3.) In this study in particular the PE teachers did not have the tendency to use technology to begin with.</p>

				<p>teachers (M= 48.84 years.) Among the PE teachers 26 were male (45.5%) and 31 were female (54.5%). A questionnaire was used that contained a section for personal data (age, gender), a section for computer literacy, and a section for instruction technology (old and new media) use in PE. They were on 5-point Likert-type scale (5=very good, 1=very poor) and included aspects according to computer hardware and software functionalities. Sample covered mostly established PE teachers who had been in service for several years.</p> <p>Results: 57 PE teachers, 10 (17.55%) were assessed low-level computer literacy, 26 were on an average computer literacy level (45.61%), and 21 were</p>	<p>4.) A decent level of computer literacy and an assumed interest in instructional technology seems not to lead to a trend in integrating more technology into PE. Even with literacy and interest it does not always mean integrating technology.</p> <p>5.) Only high school level PE teachers participated in this study and that can limit the results/. Primary school PE has different structures and principles than secondary school PE which would lead to different applications and rationales.</p> <p>6.)PE teacher sample who has a relatively negative attitude toward technology use in PE, would have different results compared to a teacher sample with a positive attitude toward technology.</p> <p>7.) The factors influencing teacher's technology use in classes should be integrated into comprehensive study designs to shed more light on their relationships in the PE setting.</p>
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					<p>grouped into a high level of computer literacy (36.84%).</p> <p>No significant differences in the PE teacher's literacy regarding gender. Age and computer literacy was significantly correlated.</p> <p>The PE teachers' computer literacy influenced their technology use in PE for portable ICT (laptop, internet, and digital camera) on a statistically significant level. The higher the computer literacy it was the more likely the PE teacher would integrate the respective technologies into PE.</p>	
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