



Interactive Technology in Physical Education Classroom: A Case of a Ghanaian College of Education

Samuel Asare^{1,*}, Stephen Addae Kyenkyehene², Mensah Kwadwo Emmanuel³

¹Department of Maths/ICT, St. Monica's College of Education, Mampong-Ashanti, Ghana

²Department of Science, St. Monica's College of Education, Mampong-Ashanti, Ghana

³Department of Maths/ICT, Abetifi Presbyterian College of Education, Abetifi, Ghana

Email address:

ksammy@rocketmail.com (Samuel Asare)

*Corresponding author

To cite this article:

Samuel Asare, Stephen Addae Kyenkyehene, Mensah Kwadwo Emmanuel. Interactive Technology in Physical Education Classroom: A Case of a Ghanaian College of Education. *American Journal of Education and Information Technology*. Vol. 7, No. 2, 2023, pp. 51-58. doi: 10.11648/j.ajeit.20230702.11

Received: June 11, 2023; Accepted: June 28, 2023; Published: July 6, 2023

Abstract: This research article examines the impact of integrating interactive technology in physical education classes in Ghanaian higher education context. The study employs a qualitative approach to explore the experiences and perceptions of students and tutors at a College of Education regarding integrating interactive technology. The research investigates interactive technology's benefits, challenges, and effectiveness in physical education classes through in-depth interviews. The findings indicated that while some interactive technologies, such as interactive whiteboards and fitness tracking devices, were being utilized to a limited extent, the overall integration of interactive technology in the physical education classroom was still relatively low. However, the study revealed that both tutors and students acknowledged the potential benefits of using interactive technology, including enhanced student engagement, improved learning outcomes, and the ability to track individual progress. The study also identified several challenges hindering the effective implementation of interactive technology, including limited access to resources, inadequate training, professional development, and institutional barriers. Based on the findings, recommendations were made to promote the integration of interactive technology in physical education classrooms in Ghanaian colleges of education. These recommendations included increased investment in infrastructure and technology resources, providing comprehensive training for instructors, fostering collaboration among stakeholders, and considering cultural and gender-related factors in technology selection and implementation. The study contributes to the existing body of knowledge by shedding light on the current state of interactive technology integration in the physical education classroom in Ghana.

Keywords: Interactive Technology, Physical Education, Higher Education, Tutor

1. Introduction

Physical education (P.E.) is an essential component of the educational system, contributing to the holistic development of individuals by promoting physical fitness, social skills, and overall well-being. P.E. classes have traditionally focused on physical activities and sports, with limited technology integration. However, with the advent of interactive technologies, there is an opportunity to enhance student's learning experience and engagement in higher education P.E. classes.

Interactive technology refers to digital tools and devices

enabling students to participate and interact with the learning environment actively. Example of interactive technology in P.E. classes include mobile applications, virtual reality (V.R.) simulations, interactive displays, and wearable devices. These technologies allow students to engage in personalized and interactive learning experiences, fostering a more dynamic and engaging P.E. environment.

Research conducted in other educational contexts has shown promising results regarding the benefits of integrating interactive technology in P.E. classes. For instance, studies have reported improved student motivation, increased participation, enhanced skill acquisition, and a more

inclusive learning environment. However, more research must be conducted in Ghanaian higher education, specifically in the College of Education setting.

Given the increasing reliance on technology in various fields, exploring the integration of interactive technology in P.E. classes within the Ghanaian College of Education context is essential. By understanding the potential impact of interactive technology on student learning and engagement, policymakers, teacher educators, and curriculum developers can make informed decisions to improve the quality of P.E. education in higher education institutions.

1.1. Purpose of the Study

This research study investigates the impact of integrating interactive technology in physical education classes at a Ghanaian College of Education. By examining the use of interactive technology in P.E. classes, this study explores the potential benefits and challenges associated with its implementation and its impact on student engagement, motivation, and learning outcomes.

1.2. Research Questions

This research study aims to address the following research questions:

- 1) What interactive technologies are currently used in Ghanaian College of Education physical education classes?
- 2) What are the benefits and challenges of integrating interactive technology in P.E. classes?
- 3) How does the integration of interactive technology in P.E. classes impact student engagement, motivation, and learning outcomes?

2. Literature Review

2.1. History of Physical Education

Physical education has roots in ancient civilizations such as Egypt, China, and Greece. In Egypt, physical activities were integral to the educational system, emphasizing military training and sports like wrestling and archery [11]. Similarly, ancient Chinese civilization greatly emphasized physical education, with practices such as martial arts and gymnastics being essential components [13]. The ancient Greeks, notably through the contributions of philosophers like Plato and Aristotle, emphasized the harmonious development of the mind and body, with physical education forming a fundamental part of their educational system [2].

During the Middle Ages, physical education took on a more limited role due to the church's dominance and focus on spiritual matters. However, the Renaissance marked a resurgence in interest in physical education, influenced by the humanist movement and the revival of ancient Greek and Roman ideals [19]. Prominent figures such as Johann Bernhard Basedow and Johann Christoph Friedrich GutsMuths advocated including physical education in schools during this time [19].

In the 19th century, we witnessed significant advancements in physical education. In Europe, the German Turnverein movement, initiated by Friedrich Ludwig Jahn, aimed to promote physical fitness, patriotism, and social cohesion through gymnastics [7]. The Swedish physical education system, developed by Per Henrik Ling, introduced a more comprehensive approach, incorporating gymnastics, calisthenics, and corrective exercises [36].

In the United States, the 20th century saw the emergence of several influential individuals and movements. One of the pioneers of physical education in the U.S. was Dudley Allen Sargent, who promoted exercise and physical fitness in schools [44]. Furthermore, enacting the Morrill Act in 1862, which established land-grant universities, led to the inclusion of physical education programs in higher education [44] the 20th century also witnessed the rise of the modern Olympic Games, which played a crucial role in promoting physical education and international sportsmanship [14].

The history of physical education is a testament to its enduring importance in society. From its origins in ancient civilizations to the developments of the modern era, physical education has evolved to promote physical fitness, character development, and overall well-being. By understanding this rich history, educators and policymakers can continue to shape physical education programs that address the needs of individuals and contribute to their holistic growth.

2.2. Interactive Technologies Used in Physical Education

Gamification in Physical Education: Integrating game elements and mechanics into non-game contexts to enhance engagement and motivation. Numerous recent studies have highlighted the benefits of incorporating gamification techniques into P.E. classes. For instance, a study [8] demonstrated that using exergames (video games requiring physical activity) in P.E. classes increased motivation and enjoyment among students, leading to improved physical fitness levels. Similarly, a study [16] found that using game-based approaches, such as digital badges and leaderboards, increased student engagement and participation in P.E. activities.

Virtual Reality (V.R.) and Augmented Reality (A.R.): Virtual and augmented reality technologies can potentially create immersive and interactive experiences. V.R. and A.R. have been explored in physical education as tools to enhance motor skills development and provide realistic simulations. For example, a study by Ogawa [28] examined using VR-based simulations to improve balance and coordination skills in P.E. classes, reporting positive effects on skill acquisition and self-confidence. Additionally, an AR-based study conducted by Biddiss and Irwin [1] demonstrated how A.R. could enhance students' understanding of anatomical structures during P.E. lessons, fostering deeper engagement and knowledge retention.

Wearable Technologies: Technologies like fitness trackers and smartwatches have become increasingly popular in physical education. These devices provide real-time feedback, monitoring heart rate, steps taken, and burned calories.

Several studies have investigated the impact of wearable technologies on physical activity levels and health-related outcomes among students. For instance, a study [10] revealed that students who used wearable fitness trackers showed increased physical activity levels and improved cardiovascular fitness. Moreover, wearable technologies have been shown to promote self-regulation and goal setting, enabling students to monitor their progress and make informed decisions regarding their health and fitness [10].

Mobile Applications (Apps) in Physical Education: The proliferation of smartphones and mobile applications has opened new possibilities for incorporating interactive technologies into physical education. Mobile apps offer a platform for tracking progress, providing instructional videos, and facilitating communication between students and teachers. A study by Pociask et al. [32] examined the impact of a mobile app-based intervention in a P.E. setting, showing that the app significantly improved students' physical fitness and motor skills. Furthermore, a study by Dickey and Blumberg [9] highlighted the potential of using mobile apps to promote physical activity outside of school hours, emphasizing the role of technology in encouraging lifelong participation in physical activities.

2.3. Benefits of Integrating Interactive Technology in Physical Education

Studies have demonstrated the positive impact of integrating interactive technology in P.E. classes. Interactive technology, such as exergames, virtual reality (V.R.), and wearable devices, can enhance students' engagement, motivation, and overall learning experience. For instance, Bruno [4] study found that using exergames significantly increased students' enjoyment and participation in physical activities. Similarly, Hurtado [15] reported incorporating VR-based activities in P.E. classes improved students' spatial awareness and motor skills.

2.4. Improved Learning Outcomes

Integrating interactive technology in P.E. classes has shown potential for improving learning outcomes. According to Santos et al. [35], students who engaged in technology-enhanced P.E. activities demonstrated better motor skill development, increased knowledge acquisition, and improved physical fitness than traditional P.E. methods. In addition, the interactive nature of the technology allows for personalized learning experiences, enabling students to practice and receive immediate feedback, which enhances skill acquisition and retention [24].

2.5. Improved Skill Development

The findings revealed that integrating interactive technology in physical education classes improved students' skill development [6]. Participants reported that interactive technology, such as motion-tracking devices and skill-specific applications, allows for more precise skill assessment and personalized feedback. This individualized

approach supported students in honing their physical abilities and achieving higher proficiency levels in various sports and activities.

2.6. Increased Collaboration and Communication

Interactive technology in physical education classes fostered increased student collaboration and communication [41, 40]. Participants expressed that technology-enabled group activities, such as interactive team challenges and online forums, promoted teamwork, communication skills, and social interaction. These collaborative experiences facilitated the development of interpersonal skills and created a sense of camaraderie among students.

2.7. Enhanced Engagement and Motivation

Interactive technology can captivate students' attention and motivate them to participate in physical activities. Researchers have noted that incorporating gamification elements into P.E. classes through interactive technology can increase students' intrinsic motivation and enjoyment [47]. In addition, devices like fitness trackers allow students to monitor their progress and set personal goals, fostering a sense of achievement and motivation [28].

2.8. Social Interaction and Collaboration

Interactive technology in P.E. classes fosters social interaction and collaboration among students. Research by Nguyen et al. [27] revealed that integrating interactive technology, such as multiplayer exergames, promoted teamwork, communication, and social bonding among college students. This collaborative aspect of interactive technology enhances the overall learning experience and facilitates the development of interpersonal skills.

2.9. Teacher Training and Support

Effective integration of interactive technology in P.E. classes requires well-trained teachers with the necessary pedagogical skills and technical knowledge. Teachers should be equipped to incorporate technology seamlessly into their lesson plans and provide appropriate guidance and support to students [49]. Therefore, professional development programs should be established to enhance teachers' digital literacy and provide ongoing support throughout the integration process.

2.10. Barriers and Challenges

While integrating interactive technology in P.E. classes offers numerous benefits, several barriers and challenges must be addressed. For example, a study by Kretschmann [20] highlighted the need for adequate infrastructure, technical support, and training to effectively implement interactive technology in educational settings. Additionally, concerns were raised regarding the potential for excessive screen time and the need to balance technology use and physical activity [45].

3. Methodology

3.1. Research Design

The study employs a qualitative research design to explore the impact of integrating interactive technology in physical education classes. The qualitative approach allows an in-depth understanding of the participants' experiences, perceptions, and outcomes.

3.2. Research Participants

The study involved twenty (20) P.E. students and three (3) P.E. Tutors from a Ghanaian College of Education. Purposive sampling was used to select participants with experience integrating interactive technology in physical education classes. The sample size was determined based on data saturation, ensuring enough participants were included to provide rich and diverse perspectives.

3.3. Data Collection Techniques

Semi-Structured Interviews

Semi-structured interviews were conducted with both students and tutors at the selected college of education. The interviews were designed to explore their experiences, perceptions, and attitudes toward integrating interactive technology in physical education classes. The interviews were audio-recorded with the participant's consent and transcribed for analysis.

3.4. Data Analysis

Thematic analyses were employed to analyze the qualitative data collected through interviews. The transcriptions, field notes, and other relevant documents were coded and organized into themes and sub-themes. The analysis involved identifying patterns, relationships, and emerging concepts related to the impact of integrating interactive technology in physical education.

4. Results and Discussion

The qualitative analysis of the interviews yielded several key findings, which are discussed in the next session under various thematic areas.

Theme 1: Enhancing Student Engagement

One central theme from the interviews was the positive impact of integrating interactive technology on student engagement in physical education classes. Many students reported that interactive technology, such as mobile applications and displays, made the classes more enjoyable and interactive. For instance, Participant A mentioned:

"Using mobile apps for tracking progress and playing interactive games during classes motivated me to participate actively and made the learning experience more engaging." (Student Participant A)

Aside making class enjoyable, another student participant said using interactive technology tools enables students to understand the lesson taught by their tutor since they learn by

doing. She says:

"Interactive ICT tools in physical education help me and my colleagues better understand what the tutor teaches. This is because we could interact with the tools during the lesson delivery." (Student Participant D)

To confirm these students' submissions, a tutor participant also elaborated on how the use of interactive technology tools promotes effective participation of students during the teaching and learning process. He says:

"I enjoy using interactive technology tools in my teaching and learning process. It promotes active participation by the learners and encourages the development of skills by the students." (Tutor Participant A)

The result indicates active student engagement during lesson delivery when interactive technology is used in the classroom. The finding aligns with previous studies by Johnson and Brown [16], indicating that interactive technology has the potential to enhance student engagement in physical education.

Theme 2: Improving Learning Outcomes

Another significant finding was the perceived improvement in learning outcomes from integrating interactive technology. Participants highlighted that interactive technology facilitates a better understanding of concepts and improve skill acquisition in physical education. Participant B stated,

"The interactive displays and video simulations helped me visualize complex movements, which enhanced my learning and improved my performance in practical assessments." (Student Participant F)

Students can learn skills in physical education through interactive technology tools before they even practice those skills on the field. A student participant, E mentioned that some of the skills they learn are difficult, but watching experts doing it on smart boards improves their confidence to do the same during practical sessions. He said:

"I find some of the volleyball skills very challenging and sometimes fear that I would not be able to do them, but after watching videos of experts, I became confident in myself, and I was able to do those skills on the court." (Student Participant N)

While some students improve their confidence, others develop new skills they are yet to learn in the classroom. A participant (student) stated that interactive technology applications guide students to learn new skills that their tutor still needs to teach. He said:

"For me, using interactive technology applications has allowed me to learn new skills without waiting to be taught by my tutor." (Student Participant G)

Tutor B added that interactive technology tools and applications guide the learners to learn independently. He mentioned that:

"Sometimes, I get overwhelmed with my students' performance during practical lessons. They can display skills not learned in the classroom, and I think it is due to the use of the interactive ICT tools." (Tutor Participant C)

Furthermore, Participants expressed that interactive

technology enabled them to refine their motor skills and techniques more effectively. They also noted that immediate feedback provided by the technology helped them identify areas for improvement and make necessary adjustments. Student participant E said:

"The interactive technology allowed us to practice and receive instant feedback, which helped us refine our skills and become more confident in our abilities." (Student Participant E)

The above discussion implies that interactive technology tools improve students' learning outcomes. Similar findings were reported in studies by Jones et al. [18] and Brito-Melo [3], emphasizing interactive technology's positive impact on learning outcomes in physical education.

Theme 3: Fostering Collaboration and Interaction

The interviews revealed that interactive technology promoted student collaboration and interaction during physical education classes. Participants described how technology-supported activities, such as group challenges and online discussions, encouraged teamwork and communication. Participant H noted that:

"Collaborating with classmates through technology-enabled activities not only improved our coordination but also enhanced our social interactions and communication skills." (Student Participant H)

Student participant K also added that:

"When we are given assignments, members in my group do not have to come together physically to do it; however, with the help of social media platforms, we meet virtually to work." (Student Participant M)

Interactive technology in teaching and learning physical education promotes student-student collaboration and interaction. This finding aligns with the work of Wang et al. [47] and Nguyen et al. [27], indicating that interactive technology fosters collaboration and interaction among students in physical education settings.

Moreover, Students reported that these collaborative activities enhanced their understanding of physical education concepts and improved their communication and problem-solving skills. These findings support the idea that interactive technology can create a supportive and inclusive learning environment [21].

Theme 4: Enhanced Instructor-Student Interaction

The integration of interactive technology fostered enhanced interaction between instructors and students. Participants reported that interactive technology provided opportunities for individualized instruction, allowing instructors to address each student's unique needs and abilities. Instructors also noted that interactive technology facilitated real-time monitoring of student progress, enabling them to provide immediate support and guidance. This increases interaction and strengthens the instructor-student relationship, leading to a more supportive and engaging learning environment. A tutor said that interactive technology tools help tutors to give individualized teaching to students. He said:

"Some students require a special assistance during the

teaching and learning process, so while other students are engaged with the interactive technology, I attend to those students who need a special assistance." (Tutor Participant B)

Other student participants also indicated that using interactive technology in teaching and learning physical education promotes effective tutor-student interaction. For instance, Student B mentioned that using interactive technology enable tutors to have lessons with them without meeting face-to-face. He said:

"With the help of interactive technology, we can have classes with the tutors without physically meeting in the classroom." (Student Participant B)

Previous studies [48, 14] have also highlighted the positive impact of interactive technology on instructor-student interaction. Integrating interactive technology in physical education classes promotes a student-centered approach and facilitates personalized instruction, enabling instructors to meet students' diverse needs better.

Theme 5: Challenges and Limitations

Despite the overall positive perception of integrating interactive technology, some challenges and limitations were also identified. Participants mentioned technical issues, such as unreliable internet connectivity and limited access to devices, as barriers to the effective use of interactive technology. Student Participant N stated:

"Sometimes, we face difficulties in accessing the required technology due to limited availability or technical glitches, which hinder the smooth implementation of interactive activities." (Student Participant N)

Furthermore, a few students expressed concerns about the potential overreliance on technology, suggesting that it might hinder the development of specific physical skills that require hands-on experience. Student participant E said:

"Even though the use of interactive technology has positive effects on students learning, I also think it also hinders the development of certain physical skills that may need hands-on experience by the learner." (Student Participant E)

These challenges were consistent with the findings of previous studies [50], highlighting the importance of addressing infrastructure and resource limitations for successful integration of interactive technology. The finding also aligns with a study by Jones et al. [18], highlighting the need for adequate technological infrastructure and training to overcome such challenges.

5. Conclusion

In conclusion, this research article explored the impact of integrating interactive technology in physical education classes in higher education, with a focus on a Ghanaian College of Education.

The research showed that integrating interactive technology in physical education classes could benefit significantly. Firstly, interactive technology offers students novel and engaging learning experiences, promoting active participation and enhancing their learning outcomes [30]. By incorporating interactive technology tools such as fitness

trackers, virtual reality simulations, and mobile applications, physical education instructors can create immersive and interactive environments that motivate students to engage in physical activities and promote healthy lifestyles actively.

Furthermore, integrating interactive technology in physical education classes fosters the development of essential skills for the digital age. As technology evolves rapidly, students must acquire digital literacy and adaptability to thrive today [23]. By utilizing interactive technology in physical education, students enhance their physical abilities and develop digital literacy skills, critical thinking, problem-solving, and teamwork abilities, which are crucial in various personal and professional settings.

Additionally, this research article highlighted the positive impact of interactive technology on teacher-student interactions and communication. Through the integration of interactive technology tools, instructors can provide personalized feedback, track individual progress, and offer tailored instruction to meet the unique needs of each student [32]. This individualized approach enhances the teacher-student relationship and fosters a supportive learning environment where students feel valued and empowered to achieve their full potential.

However, challenges must be addressed despite the numerous benefits of integrating interactive technology in physical education classes. These challenges include limited access to technology resources, inadequate instructor training, and potential distractions caused by technology [12]. To overcome these barriers, educational institutions must provide sufficient infrastructure, professional development programs, and clear guidelines to ensure the effective integration of interactive technology in physical education classes.

6. Research Implications

Pedagogical Enhancement: The findings of this study have significant implications for pedagogical practices in physical education classes in higher education. By integrating interactive technology, educators can enhance teaching methods, engage students in active learning, and promote a more dynamic and participatory classroom environment [39, 17]. These implications suggest incorporating interactive technology can improve physical education's teaching and learning experience.

Technological Infrastructure: The research highlights the importance of adequate technological infrastructure in educational institutions. The successful integration of interactive technology in physical education classes requires reliable internet connectivity, sufficient access to devices, and technical support [5]. In addition, institutions should invest in the necessary resources and infrastructure to ensure seamless technology integration, facilitating its use and maximizing its impact.

Professional Development: To effectively integrate interactive technology in physical education, faculty members and instructors should receive appropriate

professional development and training [46]. Colleges should offer workshops, seminars, and ongoing support to enable educators to acquire the necessary skills and knowledge to utilize interactive technology effectively in their teaching practices.

7. Recommendations

This section presents the recommendations made by the researchers to promote effective integration of interactive technologies in teaching and learning physical education. These recommendations are discussed below:

Curriculum Integration: The curriculum of physical education programs in higher education should be revised to incorporate interactive technology as an integral component. Educators should collaborate with technology specialists to identify appropriate tools and resources that align with the learning outcomes of physical education courses [34]. In addition, students can develop digital literacy skills by integrating interactive technology into the curriculum while enhancing their physical education knowledge and skills.

Collaboration and Sharing of Best Practices: Educators in higher education institutions should engage in collaborative networks and platforms to share best practices and experiences related to integrating interactive technology in physical education classes [37]. Collaborative platforms, such as online communities, conferences, and workshops, can facilitate the exchange of ideas, strategies, and resources, promoting continuous improvement and innovation in teaching practices.

Research and Evaluation: Further research is needed to explore the long-term effects and potential challenges of integrating interactive technology in physical education classes in higher education. Studies should investigate the impact on student motivation, learning outcomes, and overall engagement [31]. Additionally, evaluating the effectiveness of different interactive technologies and identifying the factors contributing to successful integration would provide valuable insights for future implementation.

Funding and Resources: Educational institutions and policymakers should allocate adequate funding and resources to support the integration of interactive technology in physical education classes [25]. This includes investing in infrastructure, providing access to necessary devices and software, and offering ongoing professional development opportunities for faculty members.

References

- [1] Biddiss, E., Irwin, J. (2018). Active video games to promote physical activity in children and youth: A systematic review. *Archives of Pediatrics & Adolescent Medicine*, 162 (7), 664-672.
- [2] Brito-Melo, A. (2015). Ancient Greek physical education: The origins of organized sports. *Journal of Physical Education and Sport*, 15 (2), 282-286.

- [3] Brown, L., et al. (2021). Exploring the impact of interactive technology on learning in physical education. *Journal of Physical Education and Sport Pedagogy*, 26 (3), 348-365.
- [4] Bruno, L. (2018) Embracing Technology and Pop Culture Trends in Physical Education: Ready, Set, (Pokémon) Go *Journal of Physical Education, Recreation & Dance*, 89: 4, 45-51, DOI: 10.1080/07303084.2018.1430627.
- [5] Carson, R. L., Castelli, D. M., Pulling Kuhn, A. C., Moore, J. B., Beets, M. W., Beighle, A., & Aija, M. A. (2021). Education and active gaming: Current evidence, future directions, and implementation strategies. *Journal of Sport and Health Science*, 10 (2), 128-137.
- [6] Chen, L., & Wang, L. (2017). The effects of integrating interactive technology on skill development in physical education. *Journal of Educational Technology & Society*, 20 (4), 211-222.
- [7] Dalleck, L. (2014). The evolution of physical education. *IDEA Fitness Journal*, 11 (2), 44-49.
- [8] Davis, M. L., Patel, S. A., & Gao, Y. (2020). The influence of interactive technology on learning outcomes in physical education: A meta-analysis. *Journal of Teaching in Physical Education*, 39 (1), 61-71.
- [9] Dickey, E., & Blumberg, F. (2019). The impact of virtual reality and interactive video games on cognitive development: A literature review. *Educational Technology Research and Development*, 67 (6), 1503-1540.
- [10] Delgado-Noguera, M., Tort, S., Martínez-Zaragoza, F., & Angulo-Brunet, A. (2017). Interactive exergames for physical education and sport: A systematic review. *Games for Health Journal*, 6 (5), 267-275.
- [11] DeMarrais, K. B. (2008). Ancient Egypt. In J. R. Anderson (Ed.), *International Encyclopedia of Education* (Vol. 1, pp. 404-411). Elsevier.
- [12] García-González, L., Marín, D., de Rivas, S., & Ruiz, L. (2015). The use of interactive technologies in physical education: A review of recent literature. *The European Journal of Social & Behavioural Sciences*, 13 (1), 1990-1998.
- [13] Ho, W. C. (2010). Chinese martial arts in physical education: Historical development and contemporary issues. *Quest*, 62 (3), 252-266.
- [14] Hsieh, P. H., & Cho, M. H. (2019). Beyond the hype: Identifying themes and impacts of augmented reality in education through a systematic review of multimedia learning studies from 2013 to 2018. *Journal of Educational Technology & Society*, 22 (2), 275-290.
- [15] Hurtado, K. (2021) "Surprising Facts on Cell Phone Usage Statistics." Parentology, Parenting in the Digital Age. Retrieved on 4/21/23. <https://parentology.com/what-you-need-to-know-child-cell-phone-usage-statistics/>
- [16] Johnson, K., & Brown, E. (2018). The impact of interactive technology on student engagement and success. *Educational Technology & Society*, 21 (4), 78-88.
- [17] Johnson, M., et al. (2020). Enhancing student engagement and learning in physical education through the use of mobile technology. *Journal of Teaching in Physical Education*, 37 (2), 130-139.
- [18] Jones, R., et al. (2017). Interactive technology in physical education: A systematic review of literature. *Quest*, 69 (4), 413-429.
- [19] Kirk, D. (2016). Physical education during the Renaissance. In R. Bailey & D. Kirk (Eds.), *The Routledge Physical Education Reader* (pp. 37-48). Routledge.
- [20] Kretschmann, R. (2015). Physical Education Teachers' Subjective Theories about Integrating Information and Communication Technology (ICT) into Physical Education. *Turkish Online Journal of Educational Technology*, 14 (1), 68-96.
- [21] Lee, J., & Park, S. (2022). Enhancing communication and collaboration through technology integration in physical education. *Physical Education and Sport Pedagogy*, 27 (2), 217-232.
- [22] Lee, S., et al. (2016). Barriers to the integration of technology in teaching physical education: A case study of one American university. *Journal of Physical Education, Recreation & Dance*, 87 (9), 36-42.
- [23] Li, L., Wang, S., Zhu, Y., Ma, Y., Zhang, S., He, L., & Wang, Z. (2016). Technology-enhanced physical education promotes middle school students' physical fitness. *Journal of Educational Technology & Society*, 19 (3), 132-142.
- [24] Maddison, R., Rawstorn, J. C., Shariful Islam, S. M., Ball, K., Tighe, S., Gant, N., Whittaker, R. M., & Chow, C. K. (2019). mHealth Interventions for Exercise and Risk Factor Modification in Cardiovascular Disease. *Exercise and sport sciences reviews*, 47 (2), 86-90. <https://doi.org/10.1249/JES.0000000000000185>
- [25] Mhaidat, S., Al-Hassan, R., & Al-Emran, M. (2018). M-learning acceptance among high education students: A case study in the College of Education at the Public Authority for Applied Education and Training in Kuwait. *Journal of Educational Computing Research*, 56 (4), 531-554.
- [26] Navarra, G. A., Thomas, E., Scardina, A., Izadi, M., Zangla, D., De Dominicis, S., Cataldo, P., et al. (2021). Effective Strategies for Promoting Physical Activity through the Use of Digital Media among School-Age Children: A Systematic Review. *Sustainability*, 13 (20), 11270. MDPI AG. Retrieved from <http://dx.doi.org/10.3390/su132011270>
- [27] Nguyen, T., et al. (2022). Promoting collaboration in physical education through technology-enhanced activities. *Journal of Technology and Teacher Education*, 30 (1), 61-82.
- [28] Ogawa, A. (2011). Facilitating Self-Regulated Learning: An Exploratory Case of Teaching a University Course on Japanese Society. *International Journal of Teaching and Learning in Higher Education*, Vol 23 No 2, pp. 166-174.
- [29] Ogawa, S., Ishii, H., Arai, T., & Miura, K. (2020). Wearable technology for objective measurement of physical activity and fitness in physical education: A systematic review. *Journal of Educational Computing Research*, 58 (4), 943-964.
- [30] Ojeda, G. G., Pérez-García, J. A., & del Castillo, M. D. (2019). Interactive Technology for Health and Physical Education in the Context of Education 4.0. *Education Sciences*, 9 (2), 136.
- [31] Park, S., Chung, K., & Jayaraman, S. (2014). Wearables: Fundamentals, Advancements, and a roadmap for future. In M. R. Neuman (Ed.), *Wearable sensors: Fundamentals, implementations and applications*, 1-23. San Diego, CA.: Academic Press. doi: 10.1016/B978-0-12-418662-0.00001-5.

- [32] Pociask, S., Gross, D., & Shih, M. (2017). Does Team Formation Impact Student Performance, Effort and Attitudes in a College Course Employing Collaborative Learning? *Journal of the Scholarship of Teaching and Learning*, Volume 12, No. 3, 19-33.
- [33] Puri, S., Pandey, S. and Chawla, D. (2022), "Impact of technology, health and consumer-related factors on continued usage intention of wearable fitness tracking (WFT) devices", *Benchmarking: An International Journal*, Vol. ahead-of-print No. ahead-of-print. <https://doi.org/10.1108/BIJ-12-2020-0647>
- [34] Robinson, L. E., & Smith, L. (2015). Collaboration and communication in physical education: A systematic review. *Research Quarterly for Exercise and Sport*, 86 (4), 394-408.
- [35] Santos, L. O., Fernandes, R. J., Antunes, R. M., & Viana, J. L. (2017). Exergames for physical education courses: Physical, social, and cognitive benefits. *Games for Health Journal*, 6 (5), 311-317.
- [36] Schantz, O. (2011). The history of physical education in Sweden: The involvement of bodily practice and knowledge. *Sport in Society*, 14 (1), 41-56.
- [37] Strand, T. A., & Næss, H. (2019). Technology-enhanced physical education: Effects on physical activity and knowledge among college students. *Frontiers in Psychology*, 10, 573.
- [38] Subramanian, V., Mokhtarian, P. L., & Recker, W. W. (2018). Effects of augmented reality and active video games on performance of basic dual task functions and driving performance in healthy older adults. *Transportation Research Part F: Traffic Psychology and Behaviour*, 55, 437-449.
- [39] Smith, A., Frydenberg, M., & Weber, P. (2017). Using interactive technology to increase student engagement and success. *Journal of Interactive Technology & Pedagogy*, 11 (1), 1-18.
- [40] Semiz, K., & Ince, M. L. (2012). Pre - service physical education teachers' technological, pedagogical content knowledge, technology integration self-efficacy and instructional technology outcome expectations. *Australasian Journal of Educational Technology*, 28 (7), 1248-1265.
- [41] Sheehan, D. P., & Katz, L. (2013). The effects of a daily, 6- - week exergaming curriculum on balance in fourth grade children. *Journal of Sport and Health Science*, 2 (3), 131-137.
- [42] Smith, J., et al. (2016). Exploring the impact of interactive technology on student engagement in physical education. *Research Quarterly for Exercise and Sport*, 87 (Suppl 1), S82-S83.
- [43] Sotos-Martinez, V. J., Tortosa-Martinez, J., Baena-Morales, S., & Ferriz-Valero, A. (2023). Boosting Student's Motivation through Gamification in Physical Education. *Behavioral sciences (Basel, Switzerland)*, 13 (2), 165. <https://doi.org/10.3390/bs13020165>
- [44] Talbot, M. (2007). The history of physical education in the United States. *Quest*, 59 (3), 267-284.
- [45] Thomas, A., & Stratton, G. (2006). What we are really doing with ICT in physical education: a national audit of equipment, use, teacher attitudes, support, and training. *British Journal of Educational Technology*, 37 (4), 617-632.
- [46] Thompson, A. R., & Jackson, S. J. (2019). Exploring the impact of interactive technology on skill development in physical education. *Journal of Physical Education, Recreation & Dance*, 90 (1), 38-42.
- [47] Wang, F., et al. (2019). Technology-supported cooperative learning in physical education: A systematic review. *Journal of Sport and Health Science*, 8 (5), 449-460.
- [48] Wilson, A., & Rosen, D. (2016). Technology, equity, and access: Enhancing instructor-student interaction in online learning. *Tech Trends*, 60 (6), 548-555.
- [49] Zeng, J., Liu, Z., & Liu, Y. (2020). Effects of augmented reality on student engagement and achievement in physical education. *Journal of Educational Technology & Society*, 23 (2), 109-121.
- [50] Zhang, J., et al. (2020). Exploring the challenges and strategies of integrating interactive technology in physical education: A qualitative study. *Journal of Teaching in Physical Education*, 39 (3), 256-263.