



E-sport in physical education: A systematic review

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Article Info	Abstract
<p>Article type: Review Article</p> <p>Article history: Received: 14 April 2024 Revised: 18 May 2024 Accepted: 08 June 2024 Published online: 01 July 2024</p> <p>Keywords: e-sports, literature review, physical education.</p>	<p>Background: Research shows that new technologies have increased the tendency to use electronic sports in physical education activities. Studies on physical education activities and e-sports are relatively new and scattered in their focus. However, universities and professionals are growing interested in further research in this area.</p> <p>Aim: The purpose of this study is to systematically review the research done in e-sports and physical education.</p> <p>Materials and Methods: A search was made using EBSCO, Scopus, and Web of Science databases to collect information on the articles. More than 250 scientific articles from 2000 to 2024 were reviewed. The keywords used were: ("Internet sports" or "electronic sports" or "online sports" or "virtual sports" or "E-sport") and ("physical training" or "sports training" or "fitness training" or "Exercise instruction" or "Sports education" or "physical education"). After removing duplicates, 200 articles were screened by reviewing titles and abstracts, resulting in the exclusion of 100 articles that did not meet the inclusion criteria related to integrating electronic sports and physical education. The full texts of the remaining 100 articles were assessed, leading to the exclusion of 36 more articles due to insufficient data or lack of relevance, leaving 64 articles selected for detailed analysis based on their comprehensive coverage and relevance to the study. Then, the selected items were fully studied and finalized, and the items that were more complete than the others were chosen as references.</p> <p>Conclusion: The study identified critical organizational, technological, individual, and environmental factors influencing the implementation of e-sports. It also highlighted nine mediators' factors essential for effective execution. Strategies like gamification, e-sport fitness challenges, cross-training, team building, health education, e-sport analysis, and smartening education were proposed to support the model's implementation. The expected outcomes of applying this model in physical education include improved cognitive skills, increased physical activity, enhanced social interaction, inclusivity, and technology skill integration. The study emphasizes that considering these factors and strategies will aid in successfully implementing the conceptual model.</p>

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1. Introduction

In recent years, the landscape of physical education has changed significantly, reflecting the evolving interests and activities of today's youth [1]. One of these transformations has been the development of the use of new technologies. Using new technologies in sports and education can significantly help the growth and development of students. These technologies increase students' motivation and participation by creating attractive and interactive educational environments. Tools like augmented and virtual reality can help students hone their athletic and technical skills in simulated and safe environments [2].

Also, online educational programs and mobile applications can facilitate access to educational resources and provide personalized learning for students. This helps improve students' physical and mental performance and strengthens their technological and digital skills, which are vital today. Combining technology and sports can provide a suitable platform for comprehensive and comprehensive education of students [3]. This paradigm shift raises intriguing questions about the intersection of technology, fitness, and skill development, prompting educators and policymakers to explore innovative approaches to engage students in physical activity [4].

Physical education aims to promote physical fitness [4], cultivate sportsmanship, and instill lifelong wellness habits among students [5]. Historically, this has been achieved through structured athletic activities, emphasizing teamwork, coordination, and physical endurance [6]. However, the rise of digital technologies and the proliferation of video gaming have introduced a new dimension to physical

activity. E-sports, which involve competitive gaming facilitated by electronic systems, offer a distinct avenue for students to engage in physical exertion, albeit in a non-traditional form [4].

One of the key arguments supporting the integration of e-sports into physical education is its potential to broaden participation and inclusivity. While traditional sports may not appeal to every student for various reasons, such as skill level, interest, or physical ability, e-sports offer a more accessible platform [7]. Unlike traditional sports, which often require specific physical attributes or prior experience [8], e-sports are inherently inclusive, allowing individuals of diverse backgrounds and abilities to participate equally. This inclusivity fosters a sense of belonging and encourages students who may have previously felt marginalized in traditional physical activities to actively engage in learning.

Moreover, e-sports present unique opportunities for skill development and cognitive engagement. Contrary to popular misconceptions, competitive gaming requires physical dexterity, strategic thinking, and quick decision-making skills [9]. Players must exhibit precise hand-eye coordination, spatial awareness, and adaptability to navigate virtual environments effectively. These cognitive demands mirror those of traditional sports, highlighting the potential for e-sports to promote similar skills while catering to the interests of digitally savvy students [10].

Furthermore, integrating e-sports aligns with the evolving nature of physical activity in the digital age. With sedentary behaviors and screen time on the rise among youth, educators face the challenge of reconciling the allure of technology with the imperative of physical health [11]. Rather than viewing

e-sports as antithetical to physical activity, proponents argue for a more nuanced perspective that acknowledges the potential synergies between digital engagement and physical well-being. By leveraging students' enthusiasm for gaming and integrating it into structured physical education programs, educators can bridge the gap between virtual and physical realms, promoting holistic development [12].

Critics of e-sports integration in physical education raise valid concerns regarding sedentary behavior and screen addiction. They argue that promoting gaming as a form of physical activity may exacerbate existing health issues associated with prolonged screen time, such as obesity and eye strain. Additionally, there needs to be more certainty about the potential displacement of traditional sports and outdoor activities, valued for their tangible health benefits and social interactions [13]. Addressing these concerns requires a balanced approach incorporating e-sports as a comprehensive physical education curriculum component rather than a wholesale replacement for traditional activities.

In this context, electronic sports models include individual and team competitions in video games that require strategic skills, team coordination, and quick reactions. The benefits of electronic sports in physical education include improving concentration and accuracy, strengthening memory and analytical thinking, and developing social skills through interaction with others [6]. Also, e-sports provides an opportunity for people who may not be able to participate in traditional sports due to physical limitations but can still enjoy the benefits of competition and intellectual activity. Due to their easy access and universal appeal, these new sports models play an essential role in

attracting the young generation to sports activities and maintaining mental and physical health [10].

Also, it should be stated that there is no accurate statistics on the number of electronic sports users and its use in physical education. But based on the available statistics, it can be said that the global e-sports market is expected to reach \$4.3 billion in revenue by 2024. This market is expected to reach a market size of USD 5.7 billion in 2028 at a compound annual growth rate (CAGR) of 7.10% during the period 2028-2024. The United States generates the largest revenue in the e-sports market, with a market size expected to reach \$1,070 million in 2024. In terms of number of users, the e-sports market is expected to have a total of 856.5 million users by 2028. The user penetration rate is 11.7% in 2024 and is expected to increase to 13.7% by 2028. The average revenue per user (ARPU) is also projected to be \$6.01 [14].

Finally, in the field related to this issue, various theories have been expressed. Social Cognitive Theory and Motivation Theory are two vital theoretical perspectives that can be used to examine the intersection of electronic sports and physical education [13]. Social Cognitive Theory explains how people acquire new skills and abilities by observing, imitating, and modeling others. This e-sports and physical education theory suggests that students can enhance physical and digital skills in a mutual learning environment by observing classmates and professionals [4].

Motivation Theory examines the role of motivation in enhancing students' interactions and shows how e-sports can help increase student motivation through intrinsic pleasure and extrinsic rewards. Using game-like elements in electronic sports can increase the motivation and

interaction of students in physical education classes.

Holistic Development Theory points to the importance of comprehensive physical, cognitive, and social development. It states that electronic sports can help develop cognitive skills and social interactions, which can be integrated into physical education programs. This theory emphasizes the transfer of skills between e-sports and physical education. Skills such as teamwork and strategic planning developed in e-sports can be transferred to physical activities and vice versa. By creating curricula integrating e-sports into physical education, we can help balance physical and digital activities and provide a more holistic approach to student development [11].

In conclusion, integrating e-sports into physical education represents a paradigm shift in how we conceptualize and approach physical activity in educational settings. By harnessing the inherent appeal of gaming and technology, educators can innovatively engage students in physical fitness and skill development [4]. The value proposition is why customers prefer a company over other companies. Each value proposition consists of a selected package of products or services that meet the needs of a segment of customers [15]. However, this integration must be approached thoughtfully, considering the diverse needs and concerns of students, educators, and stakeholders. Ultimately, the goal remains unchanged: to foster a culture of wellness and lifelong physical activity that transcends traditional boundaries and embraces the evolving landscape of digital engagement [16].

A review of the research literature on electronic sports and physical education shows that each study has only mentioned aspects of electronic sports. For example, some studies have emphasized on

influential factors [4, 7, 8], solutions and strategies [7, 13], consequences [11, 12], and on mediators' factors [2, 13]. Meanwhile, a comprehensive conceptual model can provide a better picture of how to implement electronic sports in physical education. Providing a comprehensive model with a combination of these factors can effectively achieve this goal. A topic that has yet to be discussed in the research literature.

According to these topics, the main goal of this research is a systematic review of the literature related to sports and physical education. For this purpose, in this research, the following goals are tried to be investigated:

- Identifying the influential factors on e-sport and physical education
- Identifying mediators factors affecting e-sport and physical education
- Identification of e-sport strategies on physical education
- Identification of e-sport strategies on physical education outcomes

2. Materials and Methods

The research on integrating electronic sports in physical education is inherently interdisciplinary, blending concepts from technology and sports. This study aims to review the existing literature to understand this integration systematically. The methodology employed in this research follows a structured approach, adhering to recognized guidelines such as the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) framework (Figure 1) to ensure a comprehensive and transparent review process.

2.1. Search strategy

The literature search used three major academic databases: EBSCO, Scopus, and Web of Science. These databases were

chosen due to their extensive collections of scholarly articles and their relevance to electronic sports and physical education

fields. The search spanned publications from 2000 to 2024 to encompass the evolution of research in this area.

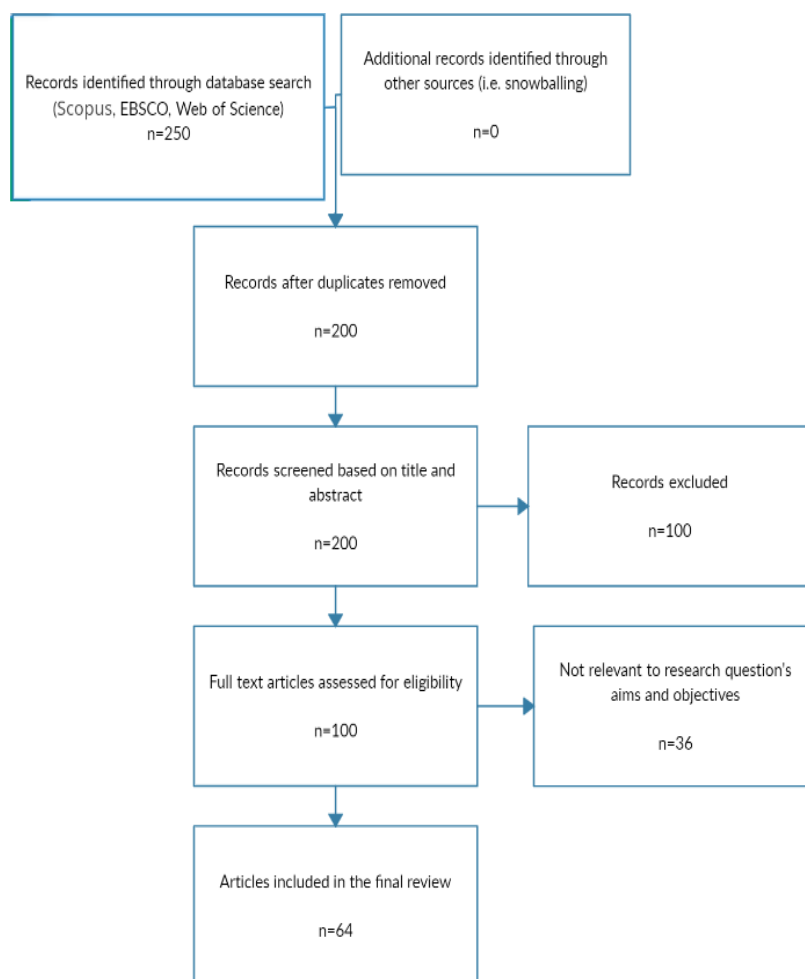


Figure 1. PRISMA to select articles

2.2. Keywords and Search terms

A combination of keywords was used to identify relevant articles. The primary search terms included:

- Electronic sports keywords: "Internet sports", "electronic sports", "online sports", "virtual sports", "e-sport".
- Physical education keywords: "physical training", "sports training", "fitness training", "exercise instruction", "sports education", "physical education".

These keywords were tailored for each database to maximize the search results. A combination of the terms "education",

"learning" (To focus on physical education e-learning tools) and "training" was also included to capture studies related to the educational aspects of physical education.

2.3. Database search results

The initial search yielded a total of over 250 articles. The breakdown of the articles retrieved from each database is as follows:

- EBSCO: 85 articles
- Scopus: 110 articles
- Web of Science: 55 articles.

After removing duplicate entries, 200 unique articles remained.

2.4. Screening and Selection process

The selection process involved several steps to ensure the relevance and quality of the articles included in the review:

Title and Abstract screening: The titles and abstracts of the 200 articles were reviewed against predefined inclusion and exclusion criteria. Articles that did not directly relate to integrating electronic sports and physical education were excluded. This step resulted in the exclusion of 100 articles.

2.5. Inclusion and Exclusion criteria

Inclusion criteria: Articles published in English, studies focusing on integrating electronic sports within physical education, and those that provide empirical data or substantial theoretical insights.

Exclusion criteria: Articles not available in full text, those published in languages other than English, and studies outside the scope of the research focus (e.g., purely technical aspects of gaming without

educational integration).

Full-Text review: The remaining 100 articles were subjected to a thorough full-text review. This stage involved assessing the depth of coverage and relevance to the study's objectives. As a result, 36 articles were excluded due to insufficient data or lack of focus on the study topic.

2.6. Final selection

After the rigorous selection process, 64 articles were deemed suitable for detailed analysis. These articles were selected based on their comprehensive coverage and relevance to studying electronic sports in physical education. Each selected article was meticulously reviewed to extract relevant data and insights contributing to the research objectives.

The distribution of these articles by year of publication shows the recent increase in research activities in this area, especially in 2018, 2021, and 2023 (Figure 2).

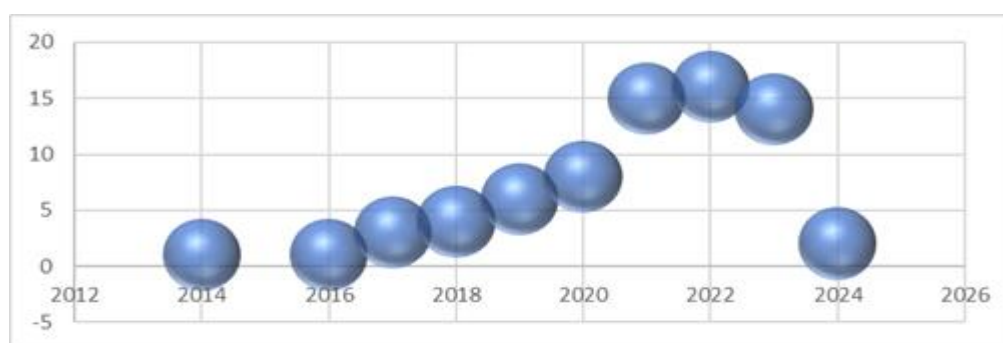


Figure 2. Distributions of the articles in publishing years

Drawing inspiration from Ngai et al. (2015), we meticulously examined articles to delineate the research methodologies, theories, frameworks, and constructs prevalent in e-sport and physical education literature [17]. Subsequently, we constructed an integrative causal-chain framework from our comprehensive analysis of these articles. Leveraging this framework, we formulated several

propositions, utilizing the methodologies outlined by Hughes et al. (2019) [18] and Duan et al. (2019) [19], to provide a roadmap for future research endeavors in e-sport and physical education.

3. Results

This segment delves into the literature identified within our review. Initially, it examines the research methodologies

employed in the literature review, shifting focus to the prevalent theories and models elucidated in these works. It then conducts an in-depth analysis of the constructs utilized in e-sports and physical education research. Insights gleaned from this analysis underpin the development of the integrated framework, which is elucidated towards the conclusion of this section.

3.1. Research methods used in the reviewed literature

First, we reviewed the research methods used in the reviewed articles. Most articles use a single analytical approach: quantitative (n= 42) and qualitative (n= 5).

Seventeen studies used mixed methods. As defined in this study, quantitative research uses empirical evaluation based on numerical measurements, while qualitative methods include interpreting text or other materials without relying on numerical measurements [20]. A survey was used most in the data collection for quantitative methods. As might be expected, interviews and case studies were the most used methods in the qualitative method. Mixed method studies apply surveys and several qualitative approaches [21]. A descriptive review of the articles based on the method is presented in the form of Table 1.

Table 1. Methods used in journal articles

Method	References
Quantitative	[4, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61]
Qualitative	[62, 63, 64, 65, 66]
Mixed	[7, 13, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81]

3.2. Theories and Models used in the reviewed literature

Integrating theories and models from physical education into e-sports represents a significant advancement in understanding and optimizing performance in competitive gaming. While e-sports primarily focus on cognitive and motor skills rather than physical exertion, applying relevant theories can enhance players' abilities, well-being, and overall experience within the digital arena [8].

One of the critical theories applied in e-sports from physical education is the Ecological Systems Theory, formulated by Urie Bronfenbrenner in 1977. This theory emphasizes the dynamic interaction between individuals and their environments, highlighting the importance of considering multiple layers of influence [82]. In the context of e-sports, this means examining not only the individual player's

internal factors, such as cognitive abilities, reaction times, and decision-making skills, but also the external factors, such as team dynamics, gaming equipment, and the broader gaming community [46]. By understanding and addressing these various influences, coaches, and educators can better support players in reaching their full potential [83].

Bandura's Social Learning Theory also plays a crucial role in e-sports within physical education. This theory posits that individuals learn through observation, imitation, and modeling of others' behaviors. In e-sports, players can enhance their skills by observing top competitors, analyzing their strategies, and emulating their techniques. Additionally, social learning occurs within team environments, where players collaborate, share knowledge, and provide feedback to one another. Coaches and educators can

leverage this theory by facilitating collaborative learning environments, encouraging peer-to-peer mentoring, and providing opportunities for constructive feedback, all of which contribute to skill development and performance improvement [28].

Furthermore, the Transtheoretical Model of Behavior Change offers insights into promoting healthy gaming habits and well-being among e-sports participants [84]. This model identifies various stages of behavior change, including pre-contemplation, contemplation, preparation, action, and maintenance [85]. By recognizing where individuals are in their behavior change journey, coaches and educators can tailor interventions to meet their specific needs and support them in adopting and maintaining healthy gaming practices. This includes promoting physical activity outside gaming sessions, encouraging breaks and proper ergonomics during gaming sessions, and fostering a balanced lifestyle that includes adequate sleep, nutrition, and social interaction, reassuring the audience about the well-being of e-sports participants.

Another relevant model is the Self-Determination Theory, which emphasizes the importance of intrinsic motivation, autonomy, and competence in driving behavior and well-being [86]. In e-sports, fostering a sense of autonomy and competence can enhance players'

motivation and engagement [16], leading to improved performance and satisfaction. Coaches and educators can support autonomy by allowing players to make choices and decisions regarding their training regimen, gaming strategies, and team dynamics. Additionally, providing opportunities for skill development and mastery can enhance players' sense of competence and self-efficacy, further fueling their motivation and commitment to excellence [45].

Finally, some research focuses on the TAM model to describe the technology-oriented concept of E-sport in education [16, 87]. This model emphasizes that implementing basic technological phenomena should first involve paying attention to the acceptance of technology and, from this point of view, changing and accepting it in different systems [88].

In summary, applying theories and models from physical education in e-sports represents a valuable approach to optimizing performance, promoting well-being, and cultivating a positive gaming environment. By understanding and addressing the various factors that influence players' experiences, coaches and educators play a crucial role in supporting the holistic development of e-sports athletes. Their guidance ensures players' success inside and outside the digital arena, making them feel valued and integral to the process.

Table 2. Theories and models used in journal articles

Theories / Models	References
Ecological Systems Theory	[7, 13, 23, 25, 27, 29, 32, 34, 36, 38, 45, 47, 48, 49, 50, 51, 62, 63, 66, 69, 70, 71, 74, 75, 77, 81]
Social Learning Theory	[7, 13, 26, 28, 30, 31, 33, 35, 36, 39, 42, 44, 51, 52, 53, 54, 55, 56, 57, 58, 64, 67, 68, 72, 73, 76, 78, 79, 80]
Transtheoretical Model of Behavior Change	[25, 45, 70, 74]
Self-Determination Theory	[4, 8, 23, 24, 32, 73, 44, 75]
TAM Model	[22, 28, 37, 41, 43, 45, 46, 58, 60, 61, 65, 74]

3.3. *E-sport and Physical education*

In the modern landscape of education and sports, a new phenomenon has emerged: the fusion of electronic sports (e-sports) and physical education [6]. Once seen as distinct entities, e-sports and physical education are recognized for their potential to complement each other, offering a holistic approach to personal development [72]. This synergy between virtual competition and physical activity challenges traditional notions and opens up avenues for innovation in education and sports culture [12].

E-sports, characterized by competitive video gaming, have rapidly gained prominence, captivating millions of enthusiasts worldwide. Games like League of Legends, Dota 2, and Counter-Strike: Global Offensive attract massive audiences and offer players opportunities for skill development, teamwork, and strategic thinking [47]. The effects of video games are numerous in such a way that it has even had an effect on people's physical literacy and self-concept [89]. While e-sports are often associated with sedentary behavior and prolonged screen time, their integration with physical education creates a paradigm shift.

On the other hand, physical education emphasizes bodily movement, fitness, and overall well-being [74]. Traditionally centered around traditional sports such as basketball, soccer, and athletics, physical education now embraces e-sports as a legitimate component of its curriculum. This integration recognizes the cognitive and social benefits of gaming while addressing concerns related to sedentary lifestyles and excessive screen exposure [6].

One of the key benefits of combining e-sports and physical education is promoting a balanced lifestyle. By incorporating e-

sports into physical education programs, educators can encourage students to engage in both mental and physical activities [90]. This balanced approach fosters holistic development, nurturing cognitive skills through gaming and promoting physical fitness through exercise routines and outdoor activities [51]. Moreover, the integration of e-sports can enhance inclusivity within physical education programs. While traditional sports may not appeal to every student, e-sports offer diverse gaming experiences accessible to individuals with varying interests and abilities [7]. This inclusivity promotes participation and engagement among students who may not excel in traditional athletic pursuits, fostering a more inclusive and supportive learning environment [16].

Furthermore, e-sports provide unique opportunities for collaboration and teamwork, essential skills in virtual competitions, and real-life scenarios [91]. In team-based games, players must communicate effectively, strategize, and coordinate their actions to achieve common objectives [92]. These collaborative experiences translate seamlessly into physical education settings, where students learn the value of cooperation and collective effort in achieving fitness goals and overcoming challenges [90]. Incorporating e-sports into physical education also encourages the development of critical thinking and problem-solving skills [6]. Video games often present complex challenges that require analytical thinking, adaptability, and creative problem-solving. By engaging in strategic gameplay, students sharpen their cognitive abilities, learning to evaluate situations, anticipate outcomes, and make informed decisions—a valuable skill set applicable to various aspects of life [93].

Furthermore, the competitive nature of

e-sports fosters resilience and perseverance. In gaming, setbacks and defeats are shared, requiring players to bounce back, learn from their mistakes, and strive for improvement [5]. This resilience mindset translates into physical education, where students learn to embrace challenges, push their limits, and persist in adversity—a crucial mindset for personal growth and success in any endeavor. Additionally, integrating e-sports can enhance students' technological literacy [60], preparing them for the digital age. As technology permeates every aspect of society, proficiency in digital tools and platforms becomes increasingly essential. E-sports provide a platform for students to familiarize themselves with gaming technology, software interfaces, and online collaboration tools, equipping them with valuable skills for future academic and professional endeavors.

In conclusion, the symbiosis of e-sports and physical education represents a progressive approach to education and sports culture [6]. By bridging the gap between virtual competition and physical activity, educators can provide students with a holistic learning experience that promotes cognitive development, physical fitness, teamwork, and resilience. This integration challenges traditional norms and prepares students for the demands of the digital age, empowering them to thrive in an ever-evolving world.

3.4. The antecedents

In recent years, the landscape of physical education has been evolving rapidly, embracing new avenues to engage students in meaningful ways. One such avenue gaining traction is the integration of e-sports into physical education curricula. However, this integration is influenced by various factors spanning organizational,

technological, individual, and environmental domains. Understanding these factors is crucial for effectively incorporating e-sports into physical education programs.

3.4.1. Organizational factors

Curriculum Integration. Effective integration of e-sports into physical education requires curriculum alignment emphasizing physical activity and cognitive development [29]. Educators must design curriculum frameworks that integrate e-sports seamlessly into existing physical education structures, ensuring that learning objectives are met while fostering skills such as teamwork, decision-making, and strategic thinking [47].

Policy and Regulation. Clear policies and regulations are essential to govern the incorporation of e-sports into physical education [81]. These guidelines should address acceptable game content, competition standards, and student participation criteria to ensure a safe and inclusive environment for all students [71].

Funding and Resources. Securing adequate funding and resources is paramount for establishing e-sports programs within educational institutions [48]. This includes investment in gaming hardware, software licenses, dedicated gaming spaces [49], and educator training. With sufficient resources, the potential for meaningful e-sports integration may be expanded [34].

Management Support. Administrative support is crucial for successfully implementing e-sports in physical education [25]. School administrators must recognize the educational value of e-sports and provide support in policy advocacy [71], resource allocation, and professional development opportunities for educators [70].

3.4.2. Technological factors

Hardware and Software Infrastructure. Access to high-quality gaming hardware and software is fundamental for facilitating e-sports activities in physical education settings [59]. Schools must invest in robust infrastructure supporting immersive gaming experiences while ensuring compatibility with educational objectives [37].

Technological Literacy. Both educators and students require adequate technological literacy to navigate e-sports platforms and tools effectively [41]. Training programs should be implemented to enhance educators' digital skills and provide students with the necessary knowledge to engage responsibly in e-sports activities [60].

Security and Privacy. Ensuring the security and privacy of students' data and online interactions is paramount in e-sports education [22]. Schools must implement robust cybersecurity measures and educate students about online safety practices to mitigate risks associated with gaming environments [65].

Network Connectivity. Reliable network connectivity is essential for seamless e-sports gameplay and communication [45]. Schools must invest in robust network infrastructure to prevent disruptions during gaming sessions and facilitate student collaborative interactions [74].

3.4.3. Individual factors

Student Interest and Motivation. The success of e-sports integration hinges on students' interest and motivation to participate [32]. Educators should leverage students' passion for gaming by designing engaging e-sports experiences that align with their interests and provide opportunities for skill development and personal growth [23].

Skill Level and Experience. Students' varying skill levels and experiences in gaming should be considered when designing e-sports activities [73]. Differentiation strategies can ensure that all students are appropriately challenged and supported in their e-sports journey, fostering a sense of achievement and competence [8].

Physical Fitness and Health. While e-sports offer cognitive and social benefits, educators must prioritize students' physical health and well-being [44]. Balancing e-sports activities with traditional physical exercise is essential for promoting holistic development and mitigating the sedentary effects of prolonged screen time [4].

3.4.4. Environment factors

Access to Technology. Equitable access ensures that all students can participate in e-sports activities [63]. Schools must address disparities in access by providing sufficient resources and support to underserved communities [7].

Physical Space. Dedicated gaming spaces within educational institutions provide students the infrastructure to engage in e-sports activities comfortably and safely [37]. These spaces should accommodate gaming equipment, promote collaboration, and foster community among participants [49].

Social Support Networks. Building supportive communities around e-sports can enhance students' experiences and promote positive social interactions [13]. Schools should encourage the formation of e-sports clubs and leagues, providing students with opportunities to connect, collaborate, and share their passion for gaming [38].

Laws and Regulations. Compliance with relevant laws and regulations is essential for ensuring the legality and

ethicality of e-sports integration in physical education [66]. Educators must stay informed about legal frameworks governing student data privacy [22], intellectual property rights, and online conduct [81].

3.5. Strategies for using e-sport in physical education

Physical education is pivotal in promoting overall health and well-being among students. However, traditional approaches to physical education often struggle to captivate the attention of digitally native generations [25]. Recognizing the evolving landscape of physical activity and leisure pursuits, educators increasingly turn to innovative strategies, including those inspired by e-sport methodologies, to reinvigorate physical education programs [94]. This paper examines various e-sport strategies and their potential applications in physical education, aiming to offer insights and practical recommendations for educators seeking to optimize student engagement and outcomes.

Gamification of Exercise. Gamification entails integrating game elements into non-game contexts to motivate participation and enhance user experience [56]. In physical education, gamifying exercise routines can make fitness activities more enjoyable and rewarding for students [57]. By incorporating elements such as points, levels, challenges, and rewards into workouts, educators can foster a sense of achievement and progression, encouraging students to participate actively in physical activities [64].

E-Sport Fitness Challenges. E-sports fitness challenges leverage the competitive nature of e-sports to encourage physical activity and healthy competition among students [40]. These challenges may involve completing designated workout

routines, achieving specific fitness milestones, or participating in virtual fitness competitions. Educators can promote regular physical activity by tapping into students' affinity for gaming and competition while fostering camaraderie and sportsmanship [64].

Cross-Training. Cross-training involves engaging in diverse physical activities to improve fitness and prevent monotony [79]. E-sport-inspired cross-training programs may incorporate various activities, including traditional sports, fitness classes, outdoor recreation, and e-sport simulations. By exposing students to various physical pursuits, educators can help them discover and develop diverse interests while promoting well-rounded fitness and skill development [33].

Team Building. Team building activities are integral to fostering collaboration, communication, and interpersonal skills among students [13]. E-sport team-building exercises may involve cooperative gaming sessions, team-based fitness challenges, or group discussions on e-sport strategies and tactics. By emphasizing teamwork and cooperation in both virtual and physical domains, educators can cultivate a supportive and inclusive learning environment that encourages mutual respect and collective achievement [80].

Health Education. Health education is essential to physical education, providing students with the knowledge and skills to make informed health and well-being decisions [44]. E-sport-based health education initiatives may incorporate topics such as nutrition, exercise physiology, mental health, ergonomics, and injury prevention in the context of gaming and physical activity [58]. Educators can enhance relevance and engagement by

contextualizing health education within e-sports while promoting lifelong health literacy [36].

E-Sport Analysis and Strategy. E-Sport analysis and strategy involve critical thinking, problem-solving, and decision-making skills transferable to various domains, including physical education [7]. Educators can incorporate e-sport analysis and strategy elements into physical activities by encouraging students to analyze gameplay footage, devise game plans, and adapt real-time strategies. Educators can enhance students' cognitive abilities by fostering strategic thinking and tactical awareness while reinforcing the connection between e-sports and physical fitness [67].

Smartening Education. Innovative education integrates technology and data analytics to optimize learning outcomes and performance [31]. In physical education, smartening initiatives may involve wearable fitness trackers, mobile apps, virtual reality simulations, and other digital tools to monitor progress, provide feedback, and personalize learning experiences [68]. By harnessing the power of technology, educators can empower students to take ownership of their health and fitness journey while embracing innovation and lifelong learning [78].

Integrating e-sport strategies into physical education offers a promising approach to engaging students, promoting physical activity, and enhancing health education outcomes. By leveraging gamification [57], e-sport fitness challenges, cross-training, team building, health education, e-sport analysis and strategy, and smartening education, educators can create a dynamic and inclusive learning environment that resonates with digitally native generations. Through thoughtful integration and

implementation, e-sport-inspired physical education programs have the potential to foster lifelong fitness habits and empower students to lead healthier, more active lives.

3.6. Mediators

Mediators such as age, gender, socioeconomic status, and cultural context significantly influence participation and engagement in e-sports within physical education.

Age. Younger individuals, particularly adolescents and young adults, tend to show higher engagement levels due to their familiarity with technology [53]. Older age groups may exhibit less interest due to generational differences and traditional views on physical activity [36].

Gender. Males traditionally dominate the e-sports landscape due to societal norms associating gaming with masculinity [42]. Challenging these stereotypes is necessary to encourage female participation and diversify the e-sports community [53].

Socioeconomic Status. Access to resources like gaming consoles and reliable internet connectivity varies based on socioeconomic status [74]. Individuals from higher-income households may have better access, leading to enhanced opportunities for engagement compared to those from lower-income backgrounds [54].

Cultural Context. Cultural and social factors have always been considered as an important factor in physical activities [95]. Cultural norms and values shape attitudes toward e-sports in physical education [72]. Cultures prioritizing physical activities may resist e-sports integration, while those embracing technology may show greater acceptance and enthusiasm [30].

3.7. Moderators

The integration of e-sports into physical education is influenced by mediating

factors such as engagement [36], social interaction [13], skill development [28, 73], and health outcomes [52]; these factors contribute to students' sustained involvement, promote teamwork and communication, facilitate cognitive and digital skill development, and can positively impact health when balanced with physical activity. Recognizing and leveraging these mediating factors are crucial for enriching e-sport experiences within physical education settings and fostering holistic development and student engagement.

3.8. Outcomes of e-sport on physical education

In recent years, integrating e-sports into physical education programs has garnered significant attention due to its potential to offer students a unique blend of cognitive, physical, and social benefits. One key advantage observed is enhancing cognitive skills [51]. Engaging in e-sports requires players to utilize various cognitive functions such as strategic thinking, decision-making, problem-solving, and spatial awareness. Through continuous gameplay and competition, students can develop and refine these skills, which are essential in gaming and academic and real-life situations. Research indicates that students participating in e-sports demonstrate improved cognitive abilities, including enhanced memory, attention, and executive functions.

Moreover, incorporating e-sports in physical education has increased physical activity levels among students [32]. While e-sports may not involve traditional forms of physical exertion, like traditional sports, it encourages movement and activity through gameplay. E-sports titles often require players to be mentally alert and physically engaged, leading to increased heart rates and calorie expenditure. Some

educational institutions have also introduced e-sports fitness programs, combining gaming with physical exercises to promote overall health and wellness. By providing an alternative avenue for physical activity, e-sports can appeal to a broader spectrum of students, including those who may not typically participate in conventional sports [51].

Furthermore, e-sports fosters enhanced social interaction and inclusivity within the physical education landscape [32]. E-sports competitions and collaborative gameplay offer opportunities for students to communicate, collaborate, and build relationships with peers. Inclusive by nature, e-sports transcends physical barriers such as gender, athleticism, or physical disabilities, allowing diverse students to participate and excel. Additionally, e-sports leagues and clubs promote teamwork, leadership, and sportsmanship, nurturing essential social skills transferable to various life aspects [96]. By embracing e-sports, physical education programs can create inclusive environments that celebrate diversity and provide a platform for all students to thrive [28].

In conclusion, the integration of e-sports into physical education offers a multitude of benefits, including improved cognitive skills [36], increased physical activity [32], enhanced social interaction [23], opportunities for inclusivity [70], and the development of technology skills. By recognizing and harnessing the potential of e-sports, educators can enrich their physical education curriculum and provide students with a holistic learning experience that promotes physical and mental well-being. As the education landscape evolves, embracing innovative approaches like e-sports can pave the way for a more engaging, inclusive, and effective learning

environment [28]. Finally, a summary of the investigated research and the factors

identified in each one is presented in Table 3.

Table 3. Constructs used in e-sport and physical education research

Constructs	Reference
Organizational factors	
Curriculum integration	[27, 29, 47]
Policy and regulation	[62, 71, 81]
Funding and Resources	[34, 48]
Management support	[25, 70]
Technological factors	
Hardware and software infrastructure	[37, 43, 59]
Technological literacy	[41, 60]
Security and Privacy	[22, 61, 65]
Network connectivity	[45, 74]
Individual factors	
Student interest and Motivation	[23, 32, 75]
Skill level and Experience	[8, 73]
Physical fitness and Health	[4, 24, 44]
Environment factors	
Access to technology	[7, 63, 69]
Physical space	[49, 77]
Social support networks	[13, 38, 50]
Laws and Regulations	[62, 66, 81]
Mediators' factors	
Engagement	[36, 51]
Social interaction	[13]
Skill development	[28, 35, 73]
Health outcomes	[39, 52]
Moderator factors	
Age	[42, 53]
Gender	[42, 53]
Socioeconomic status	[39, 54, 55]
Cultural context	[30, 72, 76]
E-sport strategies on physical education	
Gamification of exercise	[64, 56, 57]
E-sport fitness challenges	[40, 67]
Cross-training	[33, 79]
Team building	[13, 26, 80]
Health education	[44, 58]
E-sport analysis and Strategy	[7, 40, 67]
Smartening education	[31, 68, 78]
Outcomes	
Improved cognitive skills	[36, 45, 51, 74]
Increased physical activity	[23, 32, 75]
Enhanced social interaction	[23, 25, 32, 70, 75]
Opportunities for inclusivity	[25, 45, 70, 74]
Integration of technology skills	[28, 46]

3.9. Framework mapping

The dimensions and components were identified and presented in Figure 3 based

on a research literature review. This figure shows four individual, organizational, environmental, and technological factors

are presented as influential factors in the model. Also, in this model, demographic and social factors are proposed as moderator dimensions. Finally, indicators of engagement, social interaction, skill development, and health outcomes have been proposed as mediators' variables. Also, based on the research literature, the strategies of using electronic sports in physical education were expressed as

Gamification of Exercise, E-sport Fitness Challenges, Cross-Training, Team Building, Health Education, E-Sport Analysis and Strategy, and Smartening education. Finally, factors such as Improved Cognitive Skills, Increased Physical Activity, Enhanced Social Interaction, Opportunities for Inclusivity, and Integration of Technology Skills are presented as outcome factors.

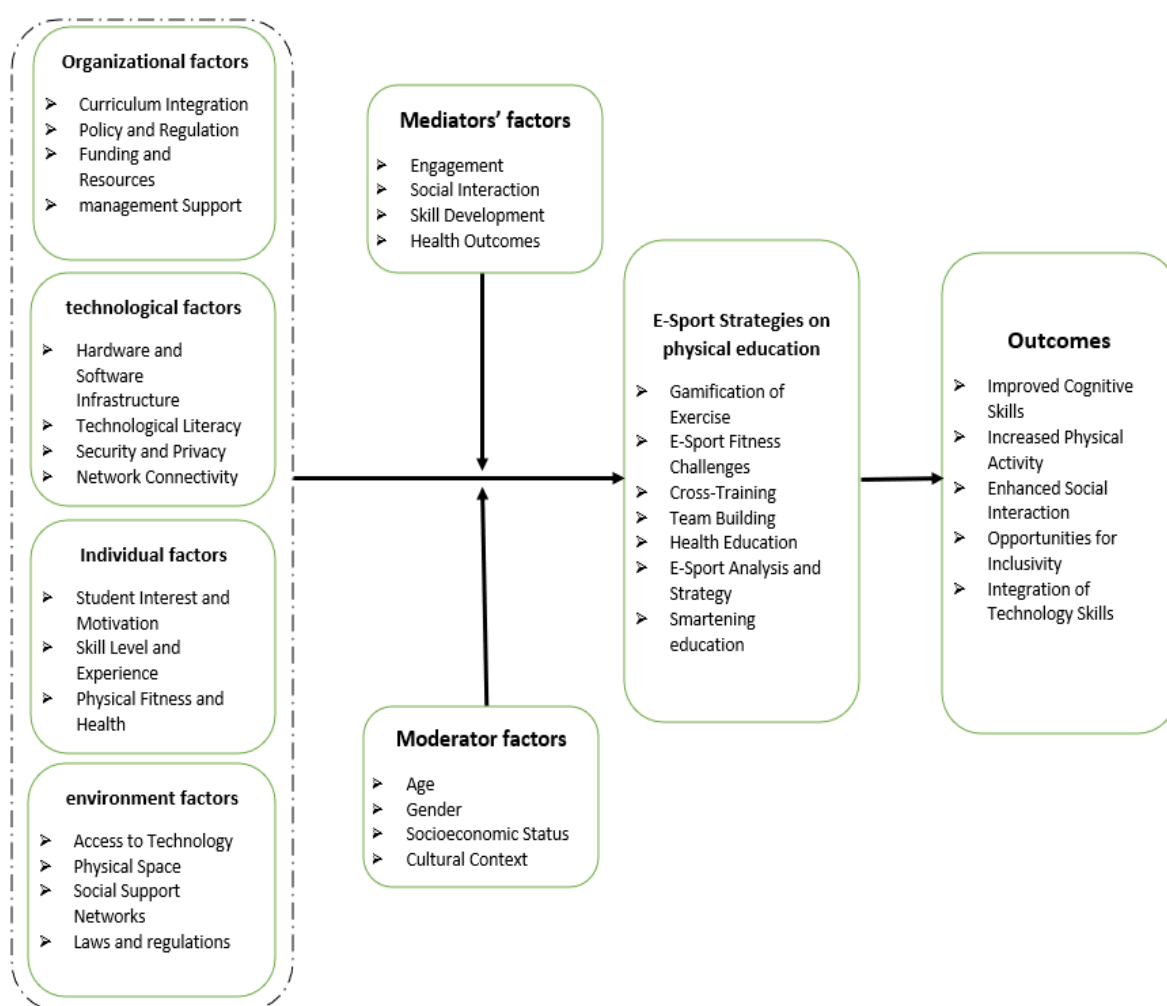


Figure 3. Integrated framework for e-sport and physical education research

4. Discussion

This study aimed to systematically review the literature on e-sport and physical education. The discussion of incorporating electronic sports (e-sports) into physical education requires a comprehensive understanding of various factors

influencing its implementation and outcomes. This discussion will delve into the organizational, technological, individual, environmental, mediating, and moderating factors, along with the strategies for using e-sports in physical education and the expected outcomes.

As we said, organizational factors are pivotal in successfully integrating e-sports into physical education programs. Curriculum integration ensures that e-sports activities align with educational goals, fostering holistic development. Policy and regulation frameworks guide the responsible use of e-sports, addressing concerns such as screen time and content appropriateness. Funding and resources are essential for acquiring necessary hardware, software, and training materials. Management support provides leadership and advocacy for e-sports initiatives, facilitating their implementation and sustainability. Technological factors are fundamental in shaping the e-sports landscape within physical education. Hardware and software infrastructure must be robust and up-to-date to support immersive gaming experiences. Technological literacy among educators and students ensures effective utilization of e-sports tools and platforms [60]. Security and privacy measures safeguard sensitive data and protect users from potential risks [22]. Network connectivity enables seamless participation and collaboration in e-sports activities [74].

Individual factors such as student interest, motivation, skill level, and experience influence engagement and performance in e-sports-based physical education [36]. Catering to diverse interests and abilities fosters inclusivity and participation. Attention to physical fitness and health ensures that e-sports activities contribute positively to overall well-being, addressing concerns about sedentary behavior and promoting active lifestyles [4]. Environmental factors encompass access to technology, physical space, social support networks, and compliance with laws and regulations [38]. Equitable access to technology minimizes disparities and

ensures equal opportunities for participation [7]. Adequate physical space accommodates e-sports setups and facilitates collaborative gameplay [49]. Social support networks provide encouragement and camaraderie, enhancing the overall experience [8, 38]. Adherence to laws and regulations ensures ethical and responsible use of e-sports resources and platforms [66].

Mediating factors such as engagement [16], social interaction [13], skill development [35], and health outcomes [52], shape the impact of e-sports on physical education. Engaging gameplay experiences motivate students to participate and pursue skill mastery actively. Social interaction within e-sports communities fosters teamwork, communication, and relationship-building. Skill development through e-sports enhances cognitive abilities, problem-solving skills, and strategic thinking [35]. Positive health outcomes result from balanced e-sports engagement, including improved mental well-being and stress relief [52]. Moderating factors such as age, gender [53], socioeconomic status [54], and cultural context influence the effectiveness and accessibility of e-sports in physical education [30]. Tailoring e-sports activities to diverse demographics and cultural preferences ensures relevance and inclusivity. Addressing potential financial constraints or cultural stigmas promotes equitable participation and benefits.

Strategies for integrating e-sports into physical education encompass gamification of exercise [57], fitness challenges, cross-training [33], team building [80], health education [58], e-sport analysis, and smartening education. These strategies leverage the inherent appeal of e-sports to promote physical activity, skill development, and health awareness among

students [35]. The anticipated outcomes of integrating e-sports into physical education include improved cognitive skills [51], increased physical activity levels, enhanced social interaction [23], opportunities for inclusivity [28], and the integration of technology skills [46]. By harnessing the potential of e-sports, physical education programs can adapt to students' evolving needs and interests, promoting holistic development in the digital age.

5. Conclusion

This article has systematically reviewed 96 articles in the field of electronic sports and physical education. The comprehensive analysis presented in this study provides identifiable theories, methods, and constructs to create an integrated framework for future research to help understand and guide the integration of e-sports in physical education. The results show that recent studies emphasize the factors affecting the use of physical education by athletes and the effect of electronic sports and evaluate demographic and environmental considerations as the main criteria.

According to the obtained results, organization, technology, and individual factors play an essential role in shaping the role of electronic sports in physical education. Organizational factors such as curriculum integration, management support, financial resources and regulations, and technological factors such as hardware and software infrastructure, technological literacy, and security and privacy have been identified as critical elements. Also, individual factors, including students' motivation and interest, skill level and experience, and physical health, play a significant role.

Environmental factors such as access to technology, physical space, social support

networks and laws and regulations have also been identified as essential platforms for the successful implementation of electronic sports. On the other hand, mediating factors such as social interaction, skill development, and health outcomes facilitate improved interaction and athletic achievement.

Strategies for implementing electronic sports in physical education include gamification of sports, electronic fitness challenges, mutual exercises, team building, health education, and analysis and strategy of electronic sports, which can improve cognitive skills, increase physical activity, strengthen social interactions, learning, and integration opportunities. Technology skills lead.

In order to achieve the successful integration of e-sports in physical education, it is recommended that educational institutions and sports organizations focus on developing technological infrastructure, such as high-speed networks and modern equipment. It is necessary to strengthen technological literacy among teachers and students through training courses and specialized workshops. Also, curricula should be designed to include e-sports as an engaging and interactive educational tool. Adequate financial resources and establishing supportive policies and regulations, including management support, are critical to facilitate this integration. In addition, enhancing students' motivation and interest through gamification and e-sports challenges can lead to increased participation and improved learning outcomes. Finally, emphasizing the importance of social support and cultural collaborations helps create a supportive and inclusive environment for all participants. These measures can improve students'

cognitive and social skills and lay the foundation for sustainable and innovative development in physical education.

Finally, while the main goal of e-sports is to improve education, between 2018 and 2022, a shift towards co-creation and innovation has been observed. Although there is agreement on the role of electronic sports in physical education, there are differences in strategies and implementation methods that indicate the need for more research and the development of appropriate strategies. This ongoing need for research and development invites all stakeholders to actively participate in shaping the future of physical education.

Conflict of interest

The authors declared no conflicts of interest.

Authors' contributions

All authors contributed to the original idea, study design.

Ethical considerations

The authors have completely considered ethical issues, including informed consent, plagiarism, data fabrication, misconduct, and/or falsification, double publication and/or redundancy, submission, etc.

Data availability

The dataset generated and analyzed during the current study is available from the corresponding author on reasonable request.

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