

Physical literacy needs in esports: literature review

Necesidades de alfabetización física en los deportes electrónicos: revisión de la literatura

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Abstract. This study aims to identify the needs and the importance of physical literacy in esports and to develop a new understanding of the forms of physical literacy that can be applied to esports athletes. This qualitative research used literature review approach from various databases in the Esports Research Network (ERN), Frontier, MDPI, PLOS, Human Kinetick, PubMed, ResearchGate, and Taylor & Francis. There are 12 research results from the databases. The results identified crucial physical needs for esports athletes, such as strength, endurance, balance, and flexibility. In addition, this study also found several existing forms of physical literacy, such as directed physical exercise programs and health education, but not necessarily all athletes have sufficient access or understanding of this literacy. Based on these findings, it is recommended to develop a physical exercise program which suits individual needs, and attention should be paid to the packaging of physical literacy with the right media to be delivered to athletes effectively. The implications of this study include benefits for esports athletes, coaches, esports organizations, researchers, media, and the public in increasing understanding of the importance of physical health and physical literacy in esports. By following the suggestions proposed, more effective efforts can be made to improve the health, performance, and well-being of esports athletes in the future.

Keywords: esports, physical literacy, physical activity, athlete performance

Resumen

Este estudio tiene como objetivo identificar las necesidades y la importancia de la alfabetización física en los deportes electrónicos y desarrollar una nueva comprensión de las formas de alfabetización física que se pueden aplicar a los atletas de deportes electrónicos. Esta investigación cualitativa utilizó un enfoque de revisión de la literatura de varias bases de datos en Esports Research Network (ERN), Frontier, MDPI, PLOS, Human Kinetick, PubMed, ResearchGate y Taylor & Francis. Hay 12 resultados de investigación de las bases de datos. Los resultados identificaron necesidades físicas cruciales para los atletas de deportes electrónicos, como fuerza, resistencia, equilibrio y flexibilidad. Además, este estudio también encontró varias formas existentes de alfabetización física, como programas de ejercicio físico dirigido y educación para la salud, pero no necesariamente todos los atletas tienen suficiente acceso o comprensión de esta alfabetización. Con base en estos hallazgos, se recomienda desarrollar un programa de ejercicio físico que se adapte a las necesidades individuales, y se debe prestar atención a englobar la alfabetización física con los medios adecuados para que se entregue a los atletas de manera efectiva. Las implicaciones de este estudio incluyen beneficios para los atletas, entrenadores, organizaciones de deportes electrónicos, investigadores, medios de comunicación y el público en general al aumentar la comprensión de la importancia de la salud física y la alfabetización física en los deportes electrónicos. Siguiendo las sugerencias propuestas, se podrán realizar esfuerzos más efectivos para mejorar la salud, el rendimiento y el bienestar de los atletas de deportes electrónicos en el futuro.

Palabras clave: deportes electrónicos, alfabetización física, actividad física, rendimiento de los atletas.

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Introduction

The rapid development of information and communication technology has brought significant changes in various aspects of life, including in the field of sports. One of the phenomena that emerged from this development is esports or electronic sports. Esports is a form of competition that utilizes video games, where players or teams compete against each other on various platforms and games (Amor et al., 2022). The popularity of esports continues to increase along with the increasing number of fans, tournaments, and awards given out (Rahmanty, 2023). However, behind the popularity and rapid growth of esports, various challenges need to be considered, one of which is the needs of physical literacy for esports players.

Physical literacy is basically a person's ability to identify, understand, and use information related to health and physical activity to improve personal well-being (Souza et al., 2022; Mashud et al., 2024). In the context of esports, physical literacy includes the knowledge and skills necessary to maintain physical health, including an understanding of

good posture, stress management, a healthy diet, and an appropriate physical exercise program. Given that esports activities often involve long periods of play in a static sitting position, physical literacy becomes a crucial aspect in preventing injuries and other health problems that may arise (Bayrakdar et al., 2020; Aman et al., 2022).

Physical needs are very important for esports athletes as they often spend hours in a static sitting position, which can lead to health problems such as back pain and overuse injuries (Tang et al., 2023). In addition, good physical health by increasing stamina, strength, and reflexes can affect performance (McNulty et al., 2023). Physical exercise also helps manage stress and mental health, which is especially important in the competitive environment of esports (Acebes-Sánchez et al., 2023). Healthy lifestyles, including good nutrition and adequate sleep, are also encouraged through physical literacy. Good endurance allows players to stay focused during long games, while an understanding of personal health helps them manage their health conditions independently (Gaasedal et al., 2024). All of those aspects help extend the careers of esports athletes by minimizing

the risk of long-term injury and chronic health problems so they can remain competitive over a longer period.

In previous studies, physical literacy are proven helping individuals understand the importance of physical activity and how to do it properly, improving general fitness and reducing the risk of chronic diseases such as diabetes and heart disease (Carl et al., 2022). It also prevents injury by teaching correct posture and safe exercise techniques. Physical literacy improves athletic performance by providing knowledge of appropriate exercise programs. In addition, regular physical activity has a positive effect on mental health, reducing stress and anxiety (Porter et al., 2023). Physical literacy also encourages a healthy lifestyle by integrating physical activity into daily routines and teaching the importance of good nutrition and adequate sleep (Buja et al., 2020; Dlugonski et al., 2022). Physical literacy also helps develop motor and coordination skills, which are important for children in developmental stages and adults who want to maintain their physical abilities (Grauduszus et al., 2023; Pavez-Adasme et al., 2024). With physical literacy, individuals can more independently manage their health, make better decisions about physical activity, and take the necessary actions to maintain health and fitness. Finally, physical literacy helps maintain a higher quality of life by maintaining mobility and independence as people age.

This study aims to identify and collect information from various relevant studies to conclude the needs for physical literacy in esports through the literature review method. It is important to understand the extent to which physical literacy has been considered in the context of esports and what aspects which still need to be improved. It is expected that this study give real contribution to improving physical literacy among esports players, so they can play more

healthily and sustainably. Good physical literacy will not only improve a player's performance but will also have a positive impact on their long-term health.

Methods

Search Strategy

Data collection and processing in the meta-analysis were carried out in three steps, namely identification, selection, and abstraction. Identification was the step of collecting research reports that would be included in the meta-analysis. Selection was an assessment of the quality of research journals. The research journals obtained from the identification step were then selected for inclusion in the meta-analysis. The selected research journals, based on title and abstract screening, were then reviewed in their entirety to determine their suitability to the specified criteria. Abstraction was the quantification of the results of each study, which is then combined in a meta-analysis. The research data generated from each unit of analysis at the identification and selection stage, at this stage, were identified and processed for meta-analysis.

In this study, the databases of Esports Research Network (ERN), Frontier, MDPI, PLOS, Human Kinetic, PubMed, ResearchGate, Scimago, and Taylor & Francis were used to gain information. The literature search strategy was carried out systematically using three main keywords in English, namely esports, literacy, and physics. Then, it was expanded by including pronouns that have similar meanings or are close to keywords. For example, esports was expanded by including the word esports and electronic sports. In addition, search operators were used to improve methodological accuracy (Table 1).

Table 1.

Keywords Input

No.	Keywords	Expansion	Logic Operator
1	Esports	esports, esports, electronic sports	esports OR esports OR "electronic sports"
2	Literacy	training, education, exercise, performance, activity	training OR education OR exercise OR performance OR activity
3	Physic	-	-
4	Keyword Combination of esports, literacy, physics, and its extensions	(esports OR esports OR "electronic sports") AND (training OR education OR exercise OR performance OR activity) AND (physical literacy" OR "physical training" OR "physical education" OR "physical performance" OR "physical exercise" OR "physical activity")	

This search was conducted in accordance with the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) guidelines. In addition, PRISMA is known for emphasizing review reports that evaluate randomized trials, which can also serve as a foundation for reporting systematic reviews of other types of research (Snyder, 2019; Samala et al., 2023).

Inclusion and Exclusion Criteria

Scoping focused on physical needs or physical literacy that was suitable for esports players. Articles published in peer-reviewed journals provided clear and measurable outcomes related to physical literacy in esports. Research conducted in the last 5 years, namely in 2019 - 2024, were used

to ensure the relevance of data in Indonesian or English.

The study of research articles was excluded if it did not specifically focus on esports (for example, studies on video games). It was also excluded if it did not provide clear results or measurements related to physical literacy, only focused on mental or psychological aspects without discussing physical needs, and if the study had been published for more than 5 years or were not published in peer-reviewed journals, such as blogs or opinions.

Procedure

Initially, 1,421 publications were identified through database searches. After meeting the inclusion and exclusion criteria, only 12 articles remain (Figure 1). Most

of the articles were discarded because they needed to explain the physical needs or physical literacy that are suitable for esports players. All articles were extracted from the source and analyzed through Mendeley software to eliminate duplication of articles.

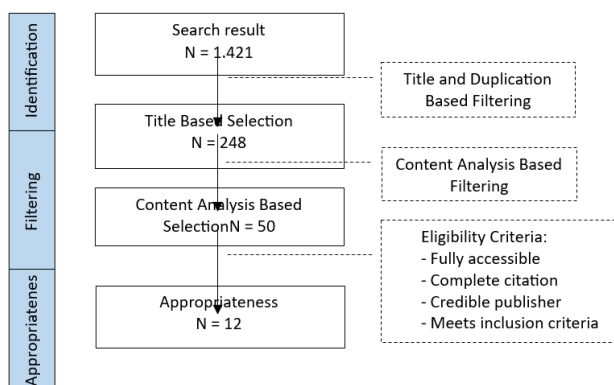


Figure 1. Prisma for chart

Results

The five categories (excluding Author and Year) listed in Table 1 are described and discussed in 1 article. The results of this study examined 12 article manuscripts in the form of research methods and types, contents, research objectives, and research results. The results can be seen in Table 2.

Table 2. Summary of physical literacy articles on esports

Author and Year	Title	Research Methods and Types	Research Objectives	Research Results
(Pu, Kim, & Daprano, 2021)	Can esports substitute traditional sports? The convergence of sports and video gaming during the pandemic and beyond	604 US-based respondents, 509 met the qualifications (sports fans and over 18 years old). The survey used a revised version of the MSSC scale for sports consumption. Six motives were assessed: escapism, social, achievement, drama, knowledge, gambling, and sports substitute. The Point of Attachment Index (PAI) is used to assess attachment to players, teams, and sports.	This study aims to examine the various ways video games, esports in particular, have been utilized for content production and fan engagement (i.e., gamification) in traditional sports during the COVID-19 pandemic, as well as the reactions of sports fans with respect to their motives, attachment points, and other consumer behaviors.	The survey results further revealed that gamification content is not consumed simply as a “substitute” for traditional sports, but rather a complementary yet unique product. It's important to recognize the difference between video game fans and traditional sports fans.
(Bubna, Trotter, Watson, & Polman, 2023)	Coaching and talent development in esports: a theoretical framework and suggestions for future research	Analysis and evaluation of documents in the form of research results	The aim of this perspective paper is to conceptualize the application of ecological and constraint-based approaches in a new context such as esports.	By paying attention to concepts such as skill acquisition, deliberate practice, ecological dynamics, affordances, and constraints, this research provides a strong foundation for understanding how esports athletes can improve their performance through targeted practice and an effective gaming environment.
(Franks, King, Bodine, Chisari, Heller, Jamal, Luksch, Quinn, Singh, Solomon, 2022)	AOASM Position Statement on Esports, Active Video Gaming, and the Role of the Sports Medicine Physician	Analysis and evaluation of documents in the form of research results	The aimed of this study is to provide an in-depth understanding of evaluation, common conditions, diagnosis, treatment, prevention, and the future in esports medicine.	Common injuries in esports athletes include upper extremity overuse syndrome, muscle pain, and acute muscle strains. Unergonomic body posture causes neck, shoulder and back pain. Additionally, excessive use of moving devices and dance boards can also cause injuries to the lower extremities. Psychological problems such as anxiety, mood, and sleep disorders should also be considered.
(Giakoni-Ramírez, Merellano-Navarro, Duclos-Bastías, 2022)	Professional Esports Players: Motivation and Physical Activity Levels	A total of 260 male professional esports players from 7 countries, namely Chile, Argentina, Brazil, Mexico, Spain, Germany, and Sweden, were considered for the sample of the present study, exceeding in number several researches. The age range of the participants was 18–30 years (M =	This study aims to explain the relationship between physical activity levels and motivational orientation in a number of international professional esports players.	Key results highlight that more than 90% of esports athletes have high and/or moderate levels of physical activity. Professional esports players with low levels of physical activity also show positive scores in the motivation dimension.

21.30; SD = 2.26).

(Hong, 2023)	eSports: the need for a structured support system for players	Semi-structured interviews are conducted with 51 individuals from 18 nationalities including professional, semiprofessional, amateur and retired players, a coach, game publishers, national eSports associations, a sponsor, a tournament organiser, and federations. Deductive analysis is applied to the data.	This study discusses how various parties have roles and responsibilities in supporting the health and well-being of esports players.	Result: The responsibility for ensuring eSports players' health and wellbeing should be shared by all stakeholders. Stakeholders are aware of criticisms of eSports and understand this; such criticisms may be deflected with a growing appreciation of eSports' value. The need for young players to balance training and commitment to eSports with broader educational requirements is highlighted.
(Jeong, Kudo, Kaneko, Nakazawa, 2024)	Esports experts have a wide gaze distribution and short gaze fixation duration: A focus on League of Legends players	20 participants (11 expert and 9 low skill) were analyzed. The average age of expert players was 22.6 years and low skill players 20.2 years. The average playing experience of low skill players is 2 years and that of expert players is 8.6 years. The expert group averaged 2 other games besides LoL, while the low skill group averaged 1.3 other games. During the task, participants sat in front of a monitor and wore a Pupil Labs eye-tracking device. The distance between the participant and the monitor was 100 cm. Easy and medium tasks are performed for 12 minutes each. Eye movements were recorded using Pupil-Capture software (version 3.5).	This study aimed to compare eye gaze movement strategies between expert LoL (League of Legends) players and low-skill players during specific tasks. The task is carried out using a computer artificial intelligence system and LoL.	The collected eye gaze movement data showed no significant differences between expert and low-skill players, fixation duration, and number of fixations. However, eye gaze movement data from expert players and low-skill players collected during the moderate task differed significantly. Additionally, there was no significant difference in the distance between the center of the monitor and the center of the heatmap between expert players and low-skill players.
(Ketelhut, Martin-Niedeken, Zimmermann, Nigg, 2021)	Physical Activity and Health Promotion in Esports and Gaming—Discussing Unique Opportunities for an Unprecedented Cultural Phenomenon	Analysis and evaluation of documents in the form of research results	This study discusses the importance of physical activity in improving performance in the world of esports.	Research shows that physical exercise can positively influence brain anatomy, physiology and function and improve cognitive performance. Related executive abilities such as attention, memory, information processing, and task switching ability, are affected by physical exercise. Especially aerobic exercise has been proven to be effective in increasing attention ability, improving mood, reducing anxiety and stress
(Kulecka, Fraczek, Balabas, Czarnowski, Zeber-Lubecka, Zapala, Baginska, Glowienka, Szot, Skorko, Kluska, Piatkowska, Mikula, Ostrowski, 2023)	Characteristics of the gut microbiome in esports players compared with those in physical education students and professional athletes	Investigated the composition and function of the gut microbiota, as well as short chain fatty acids (SCFAs), and amino acids, in a group of 109 well-characterized Polish male esports players. The results were compared with two reference groups: 25 endurance athletes and 36 healthy students of physical education. DNA and metabolites isolated from fecal samples were analyzed using shotgun metagenomic sequencing and mass spectrometry, respectively. Physical activity and nutritional measures were evaluated by questionnaire.	This study investigated the relationship between physical activity levels and eating habits with the composition and function of gut microbiota in esports players, physical education students, and professional athletes.	There were significant differences between esports players and students with respect to nine bacterial species and nine amino acids. By contrast, all of the above-mentioned measures differentiated professional athletes from esports players and students, with 45 bacteria differentiating professional athletes from the former and 31 from the latter.
(Onishi, Yamasaki, Hara, Hirotoomi, Miyazaki, 2022)	Esports for Seniors: Acute Effects of Esports Gaming in the Community on the Emotional State and Heart Rate among Japanese Older Adults	Twenty-five older men and women participating in health promotion activities in community centers (75 ± 8 years old) played a two-player racing game (Gran Turismo Sport, Sony) for 8–10 min. Their heart rates (HRs) were measured while the subjects played the games. The blood pressure (BP) and Profile of Mood States (POMS) were measured before and after gaming.	This study aims to describe mood responses and physiological indicators during esports play among community-dwelling older men and women in a community-based setting.	Hasil penelitian ini adalah The blood pressure (BP) and Profile of Mood States (POMS) were measured before and after gaming. The average HR during games (98 ± 17 bpm) was significantly higher than at pre-gaming (76 ± 11 bpm, p < 0.001). The BP before and after the games did not significantly change. Interestingly, the vigor scores

				(positive mood affect) in POMS increased after the games ($p < 0.05$) in females, but not in males.
(Parry & Giesbrecht, 2023)	Esports, real sports and the Olympic Virtual Series	Analysis and evaluation of documents in the form of research results	This research discusses the concepts of virtualization and simulation in the context of sports, especially in computer games and virtual sports simulations.	The results of this research reveal that the experience of virtuality can affect individuals in a real way, such as feeling tense when playing games, but this experience cannot be equated with physical reality.
(Poulus, Coulter, Trotter, Polman, 2020)	Stress and Coping in Esports and the Influence of Mental Toughness	Participants were 316 esports athletes, ranked in the top 40% of one of five major esports: Defense of the Ancients 2, League of Legends (LoL), Counter Strike: Global Offensive, Overwatch and Rainbow Six: Siege. Participants completed the MTI, Mental Toughness Questionnaire 6 (MTQ6), Stress Appraisal Measure, and Brief COPE inventory.	This study explored stress and coping in electronic sports (esports) athletes and the influence of mental toughness (MT), as defined by two prominent conceptualizations: the 4/6Cs and Mental Toughness Index (MTI) frameworks.	Results showed that MT (via both MT frameworks) was associated with perceived control, and MTQ6 subscales were associated with stress intensity. Mental toughness (both frameworks) was associated with the selection of more problem-focused and emotion-focused coping strategies and less avoidance coping strategies. The results indicate there is some overlap between the MT and stress-coping process in high-performing traditional sports and competitive esports athletes.
(Rossoni, Vecchiato, Brugin, Tranchita, Adami, Bartesaghi, Carveretta, Palermi, 2023)	The eSports Medicine: Pre-Participation Screening and Injuries Management—An Update	Analisis dan evaluasi dokumen berupa hasil penelitian	This paper aims to explore the different injuries that can occur in a professional Athlete, suggesting how every high-level gamer could benefit from a pre-participation evaluation and a correct injury prevention strategy.	The results of this research, First, the research proposes two main criteria that need to be considered before esports can be classified as a professional sport. The first criterion is about physical performance and skillful use of body skills. The second criterion concerns institutional stability, with the existence of rules for regulation and governance. Various health problems such as eye fatigue, neck and back pain, as well as hand and wrist problems, are often reported by Athletes. This is caused by repetitive movements using gamepads, mice, and keyboards as well as sitting for long periods of time with sub-optimal posture.

Based on the category review in Research Methods and Types, there are five articles using document analysis and evaluation methods and literature review based on the results of previous research (Ketelhut et al., 2021; Franks et al., 2022; Bubna et al., 2023; Parry & Giesbrecht, 2023; Rossoni et al., 2023). The method aims to reveal and highlight the relationship between the research objectives studied and the facts that occur among e-sports. Three articles use the method by testing the effect of the independent variable on the dependent variable (Giakoni-Ramírez et al., 2022; Onishi et al., 2022; Kulecka et al., 2023). The method aims to test how strong the factors that can affect the skills of esports athletes are based on the problems in the study. Four articles use the method of exploration, as well as surveys using questionnaires and interviews (Poulus et al., 2020; Pu et al., 2021; Hong, 2023; Jeong et al., 2024). The method aims to analyze a topic in the variable more deeply or compare the skills of athletes based on ability, gender, and type of game.

Discussion

The results of the first study show that gamification content in esports is not only a substitute for traditional sports but a unique complement. Fans of video games and traditional sports have different market segments, so it is important to recognize these differences in developing appropriate physical literacy for esports athletes. Thus, the results of this study provide an important foundation for the development of a more holistic form of physical literacy for esports athletes involving physical, mental, and technological aspects. It can help esports athletes optimize their performance, improve their overall well-being, and strengthen esports' position as a legitimate and meaningful form of sport. Physical literacy programs should include strategies to improve athletes' mental well-being, such as relaxation techniques, stress management, and psychological support (Cheng et al., 2023). The second study provides in-depth insights into skill development and expertise acquisition in

esports. Concepts such as skill acquisition, deliberate practice, and ecological dynamics are important to improve athlete performance. Directed physical literacy can help esports athletes optimize their practice and gaming environment. Physical literacy not only includes an understanding of movement and physical skills, but also involves an understanding of how the environment and context influence behavior and decision making in the context of physical activity and sport (Paramitha et al., 2021). In the context of esports, physical literacy will include an understanding of how physical skills, such as reaction and coordination, play a role in-game performance, as well as an understanding of how the game environment affects the strategies and tactics used (Luu et al., 2021). Then, the need for recommendations for collaboration between various disciplines, including sports science, psychology, and information technology. For example, biomechanicians can work with coaches to understand how physical skills contribute to game performance (Molavian et al., 2023).

The third study identified various physical injuries common to esports athletes, such as overuse syndrome and muscle pain. Non-ergonomic posture during play can also lead to health problems such as neck, shoulder, and back pain. In addition, psychological problems such as anxiety and sleep disorders also often arise. Physical literacy can provide knowledge to prevent injuries and manage mental health. Concrete proposals for developing physical literacy for esports athletes include, firstly, holding regular education and training sessions for esports athletes about injury risks, ergonomics and the importance of physical exercise (Hulme et al., 2019). Secondly, developing an exercise program specifically designed for esports athletes, including cardiovascular exercises, core strengthening, and postural stretching (Monteiro Pereira et al., 2023). The third is encouraging esports athletes to adopt healthy habits such as proper eye care, adequate sleep, and adequate rest between play sessions. The fourth is to build partnerships with health professionals such as physiotherapists, sports doctors, and psychologists to provide comprehensive health services for esports athletes (Ketelhut et al., 2021). The fourth study shows that most esports athletes have moderate to high levels of physical activity. Intrinsic and extrinsic motivation correlate with energy expenditure, suggesting that good physical literacy can improve motivation and physical performance. In response to these findings, alternative concrete proposals can be made to develop physical literacy for esports athletes, such as the integration of physical activity into daily routines. It is then important to increase the understanding and awareness of esports athletes about the importance of physical activity in their health and performance. It can be done through educational sessions, seminars, or individual consultations with health specialists (DiFrancisco-Donoghue et al., 2022; Tang et al., 2023).

The fifth study emphasizes the collective responsibility of stakeholders in ensuring the health and well-being of esports athletes. Education and the balance between esports

training and other educational commitments are also important concerns. Several points support the relevance of the study to the development of physical literacy for esports athletes, such as recruiting staff such as esports psychologists to help players overcome the psychological challenges of an esports career and organizing tournaments in support of the health and well-being of esports players. They can provide educational support and dual career support to help players manage the transition from an esports career to a post-career life (Said et al., 2023). Then parental support and the gaming community are also important in supporting the ambitions of esports players (Svensson et al., 2024). Parents can help manage the physical health aspects of players. Thus, the gaming community can provide positive social support. The sixth study shows significant differences in eyesight movements between skilled and low-skilled players during moderate tasks. It suggests that proper physical exercise can affect visual and cognitive performance. Some concrete proposals for the development of physical literacy for esports athletes are as follows. First, exercises that target effective eye movements, such as eye scanning exercises to recognize important information in the game (Kurniawan et al., 2022). Second, involves exercises that emphasize quick reactions to changes in the game, such as situation simulation exercises that require quick decision-making (Djaba et al., 2024). Third, designs exercises that blend visual stimulation with precise motor actions, such as exercises that simulate in-game situations and encourage players to respond quickly (Cumming & Quinton, 2023). Fourth, technologies such as eye-tracking devices should be utilized to monitor and analyze players' eye movements during the game so as to provide useful feedback for the development of physical literacy (Dahl et al., 2021).

The seventh study reveals that physical exercise can improve cognitive function and executive abilities, which are important for success in e-sports. Aerobic exercise, in particular, has been shown to be effective in increasing attention and reducing anxiety and stress. The concrete proposal for the development of physical literacy for esports athletes based on the results of the study is to develop a physical exercise program that is integrated into the training routine of esports athletes. It should include aerobic exercise to improve concentration and strength training to prevent injury. Research shows that physical exercise can positively affect anatomy, physiology, and brain function and improve cognitive performance (Saggar et al., 2015). Executive abilities associated with success in gaming, such as attention, memory, information processing, and task-switching abilities, are affected by physical exercise. Especially aerobic exercise has been shown to be effective in improving attention ability (Liu & Wang, 2022). In addition, physical exercise also has a mood-enhancing effect and can help reduce anxiety and stress, which can also positively affect gaming performance (Jannah et al., 2023; Sridana et al., 2024). The eighth study showed significant differences in gut microbes among esports players,

professional athletes, and students. It suggests that physical activity and a healthy diet also affect gut and overall health. Concrete proposals for the development of physical literacy for esports athletes based on the results of this study can include counseling on the importance of a balanced diet, knowledge of the types of gut microbes that play a role in physical health and performance, and the impact of various eating habits and levels of physical activity. Then, it emphasizes the importance of maintaining a balance between time spent in front of the screen and time for physical activity by promoting regular rest and proper physical exercise between play sessions (Saotome & Culos-Reed, 2018; Beasley et al., 2021).

The ninth study shows that playing games can increase heart rate and positive mood, especially in women. However, blood pressure did not change significantly. Physical literacy also needs to pay attention to aspects of cardiovascular health. The research is significant in the efforts to develop forms of physical literacy for esports athletes, although the focus is not directly on esports athletes. Some of the ways in which the research is relevant to the development of physical literacy for esports athletes include routinely monitoring physiological responses, such as increased heart rate (HR) while playing esports using wearable devices or health and fitness applications (Welsh et al., 2023). It is important because an understanding of how esports activities affect the body, especially in older populations, can help the development of better training programs for esports athletes. Providing education to esports athletes on how playing esports can affect heart rate, mood, and general physical health (Watanabe et al., 2021). It can be done through seminars, online educational materials, or special training sessions, and provide support and resources to help athletes manage stress, maintain mental health, and improve overall well-being. It could include counseling sessions or mental health training. The tenth study highlights that virtual experiences in e-sports are different from physical reality, although they can tangibly affect individuals. Physical literacy should include an understanding of how virtual experiences can affect physical and mental health. Concrete proposals for developing physical literacy for esports athletes based on the results of this research include providing education about the importance of physical health, including the ergonomics of good body posture when playing games, the importance of regular rest, and regular physical exercise to prevent injuries related to the use of controllers or VR devices (Ross-Stewart & Lee, 2023). Then, put together a special physical training program designed to improve the motor skills, endurance, and general fitness of esports athletes. This training can include balance, coordination, and quick response exercises that are specific to specific gaming needs (Bonny, 2022; Santoso et al., 2024).

The eleventh study shows that mental toughness and effective stress management strategies are associated with better performance. Sports psychology interventions designed for traditional sports athletes can also benefit esports

athletes. In the context of developing physical literacy for esports athletes, several concrete proposals can be considered based on the results of the study, among others. The first is to include mental training components such as relaxation exercises, visualization, and emotional regulation (Smith et al., 2022). It can help athletes to develop the mental strength and stress-handling abilities required in competition. The second is the development of adaptability to stress; by strengthening Mental Toughness, athletes can learn to deal with stressors better and still perform optimally in challenging situations (Bányai et al., 2019). The twelfth study highlights two main criteria for classifying esports as professional sports: physical performance and institutional stability. Common health problems such as eye-strain and neck pain were also identified, suggesting the need for good physical literacy to address these problems. Some concrete proposals for the development of physical literacy for esports athletes based on the results of the study include esports athletes' need to understand the importance of good posture and correct ergonomics when playing games. They should be trained to sit with proper posture, adjust the height of chairs and tables properly, and take regular breaks to improve their posture (Difranco-Donoghue et al., 2021). Then, esports athletes need to be equipped with an appropriate physical exercise program to improve their physical fitness. The program should be designed to improve muscle strength, balance, flexibility, and good posture. The next proposal is that esports athletes need to understand the importance of balanced Nutrition to support their physical and mental health (Ribeiro et al., 2021). They should be trained to make healthy and nutritious food choices and understand the negative impact of energy drinks and fast food consumption.

The results of examining various reference sources show that several forms of physical literacy exist in the context of esports. These include directed physical training programs, health education and training, promotion of physical activity, use of technology for health monitoring, and professional mentoring. However, not all athletes have sufficient access to or understanding of all forms of literacy. This research also resulted in a new understanding of the forms of physical literacy that can be further developed. For example, a new physical exercise formula based on in-depth reference analysis. In addition, packaging physical literacy with appropriate media, such as video tutorials or technology-based applications, can also be an important part of this development. The limitation of this study is the need for more emphasis on specific physical aspects. Many journals provide general advice on the importance of physical exercise and health for esports athletes but need concrete suggestions that are directly related to the development of specific physical literacy. It includes a need for more emphasis on relevant types of physical exercise, structured training strategies, and the integration of physical exercise in existing esports training programs. With a better understanding of the physical and literacy needs required in esports, this study provides a solid

foundation to improve the health, performance, and well-being of esports athletes in the future.

Conclusion

From the results of the research that has been studied, it is clear that physical literacy is very important for esports athletes. Physical literacy not only helps prevent injuries and improve performance but also supports mental health and overall well-being. Therefore, education about physical literacy must be an integral part of e-sports training to ensure athletes can play healthy and sustainably. Esports athletes can take advantage of these findings to improve their performance and physical health. By understanding effective patterns and principles in designing physical exercise programs, athletes can adapt exercises to suit their individual needs. They can also set clear goals and conduct periodic evaluations to ensure that they stay on track toward optimal health and performance.

Fitness trainers and consultants can use the results of this study as a guide to design a training program that is more effective and tailored to the needs of esports athletes. By understanding the proven principles of successful adjustment to individual needs, clear goal setting, and periodic measurement, they can provide athletes with better guidance in achieving their optimal physical and performance potential. Esports organizations and the fitness industry can leverage these findings to develop better training and education programs for esports athletes. By understanding the importance of tailoring to individual needs and setting clear goals, they can provide the necessary resources to support the health and performance of athletes holistically.

Researchers and academics can use these findings as a basis for further research on the health and performance of esports athletes. They can continue to research effective patterns and principles in designing specific physical exercise programs for esports athletes and identify unexplored research areas. The media and public can become more aware of the importance of physical health in the world of esports. With an emphasis on tailoring to individual needs and clear goal setting, perceptions of the health and performance of esports athletes can evolve to become more positive and seen as an integral part of success in the game.

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Conflict of Interest

This study contains no material that could be considered a conflict of interest by the authors.

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