



Web-Based Educational Games for Teaching Basic Football Techniques in Secondary School Physical Education

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Abstract

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The development of a web-based educational game for the teaching of Physical Education, Sports, and Health (Penjasorkes) represents an innovative approach aimed at enhancing student engagement and comprehension of fundamental soccer techniques, including passing, dribbling, and shooting. However, traditional methods in Physical Education classes often rely heavily on verbal instructions and textbooks, leading to low student motivation and limited mastery of basic techniques. This research employs a Research and Development (R&D) methodology based on the Alessi & Trollip model, which encompasses stages of planning, design, and development. The research subjects include media experts, content specialists, Penjasorkes teachers from high schools and vocational schools, and students as end users. The research involved two media experts, two content experts, three Penjasorkes teachers, and 93 students from high schools and vocational schools in the Boyolali region of Central Java. Data collection was conducted through observations and questionnaires, followed by qualitative and quantitative analysis. The alpha test results indicated a "very good" validation from experts and practitioners, with an average score of 89%, while the beta test conducted with students yielded an average score of 90%, demonstrating the feasibility and appeal of this media. These findings affirm that the web-based educational game can significantly boost student motivation and engagement, serving as a practical solution to the limitations of conventional learning media. Consequently, this educational game is not only pertinent to Penjasorkes instruction in high schools and vocational schools but also has the potential to serve as a model for the development of similar media in other educational contexts.

Keywords:

Web-based educational games; Physical Education; Basic Football Techniques; Interactive Learning; Games

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INTRODUCTION

Contemporary pedagogical methods in Physical Education and Health instruction at the secondary school level have experienced a notable evolution. This transition underscores the significance of novel educational methodologies to facilitate students' motor skill development, character enhancement, and physical health advancement (Guío Gutiérrez, 2022). Moreover, contemporary physical education curricula prioritize the incorporation of technology to enhance the engagement and relevance of learning experiences for 21st-century students (Arufe-Giráldez et al., 2022; Fröberg & Lundvall, 2022). In the realm of Physical Education, Sports, and Health (*Penjasorkes*) at the high school and vocational



school levels, soccer is a fundamental subject of study. Soccer not only imparts fundamental techniques but also cultivates pupils' social and physical competencies. Fundamental tactics such as passing, dribbling, shooting, and ball control are crucial skills that pupils must acquire to perform effectively in the game. The implementation of learning models like Student Teams Achievement Division (STAD) has demonstrated enhancement in learning outcomes for fundamental methods, particularly in passing (Nugraha, 2022). Innovations like the utilization of plastic balls are effective in facilitating the comprehension of fundamental approaches (Panas et al., 2023; Wijaya et al., 2021). Utilizing a game-based methodology, students can acquire knowledge in a dynamic and enjoyable manner, hence enhancing their motivation and engagement (Atiq & Budiyanto, 2020). Systematic and repetitive drills, including passing and dribbling, can markedly enhance pupils' abilities (Amir Supriadi et al., 2023; Yudha et al., 2023). Consequently, including fundamental soccer methods into the Physical Education curriculum not only enhances athletic skills but also cultivates students' character and discipline (Vesisenaho et al., 2019).

At SMA N (State Senior High School) Banyudono, students face challenges in understanding and applying fundamental soccer techniques, such as dribbling, kicking, and passing the ball. A survey conducted with 57 students revealed that 63.2% attributed their difficulties primarily to the lack of engaging learning media. Furthermore, 73.4% of the students reported ongoing challenges in executing passing movements correctly. In a similar context at SMK N (State Vocational High School) Banyudono, a survey of 36 students indicated that 63.9% felt they had a limited understanding of physical education material due to monotonous teaching methods, which predominantly relied on textbook usage and verbal instructions. These preliminary findings highlight the urgent need for innovative and interactive learning media to address the deficiencies observed in the teaching of basic football techniques. Accordingly, this study serves as an initial effort to explore and develop web-based educational game solutions tailored to the context of physical education in secondary and vocational schools. Additionally, the scarcity of visual aids and supporting facilities diminished the effectiveness of the learning process, physical education teachers at both institutions acknowledged that a less interactive teaching approach hindered students' mastery of essential soccer movements, which are crucial for enhancing their performance (Li & Lu, 2020; Manzano-Sánchez et al., 2019).

Digital media and web-based educational games are essential in contemporary education, especially in Physical Education, Sports, and Health (*Penjasorkes* or known as physical education) instruction at secondary and vocational schools. Digital media, through its interactive capabilities, can augment students' learning experiences by offering interactivity, cooperation, and avenues for autonomous learning (Ishak et al., 2023). In sports education, the incorporation of digital media enhances the presentation of creative content, including essential football techniques (passing, dribbling, shooting), exceeding traditional methods. The use of various media enhances student engagement, motivates learning, and facilitates the attainment of physical education curriculum objectives (Mohammed & Baysen, 2022; Wijaya et al., 2021). Moreover, web-based educational games can establish a transparent and accessible learning environment, providing effective

solutions for schools with constrained technology infrastructure (Chugh & Turnbull, 2023; Qian & Clark, 2016). This method renders physical education more entertaining while fostering students' motor skills, collaboration, and 21st-century competences.

The concept of incorporating digital media and online educational games in Physical Education and Health instruction is to enhance the quality of the teaching and learning experience through innovative technologies (Zhang, 2018). Web-based instructional games facilitate an interactive and individualized learning experience, promoting lifelong mastery of athletic skills. The evolution of digital technology has transformed conventional learning methods, facilitating the conversion of fundamental soccer techniques, including passing, dribbling, and shooting, into an engaging and readily accessible digital format through computers or smartphones (Bang et al., 2023; Picerno et al., 2019). The collaboration across disciplines in the creation of this educational game, incorporating interactive design, digital technology, and pedagogy, presents new prospects for developing more engaging and effective learning experiences (Senjam et al., 2021; Kim & Park, 2019). By implementing this strategy, Physical Education and Health educators can leverage technology to enhance student engagement, facilitate conceptual comprehension, and promote motor skill development more effectively (Ahmad et al., 2024).

Numerous studies have demonstrated the positive impact of web-based educational games on learning across various contexts. Camacho-Sánchez et al. (2023) emphasize that educational games can significantly enhance students' motivation, engagement, and learning outcomes in Physical Education. Furthermore, Yan et al. (2023) reveal that game-based approaches can improve fundamental motor skills and students' performance in physical activities. In the realm of technology-enhanced learning, Li et al. (2024) indicate that interactive elements in educational games, such as simulations and quizzes, can actively engage students and enhance their conceptual understanding. Additionally, Kaya & Ercag (2023) found that digital educational games provide an engaging learning experience, motivate students, and support academic success. These findings underscore the relevance of developing web-based educational games as innovative and effective learning media, particularly for teaching fundamental soccer techniques in Physical Education at high schools and vocational schools. In alignment with this, other research indicates that integrating web-based educational games with inquiry-based strategies can foster a more dynamic and interactive learning environment, promoting student engagement and critical thinking skills (Yan et al., 2023; Wijaya et al., 2021). By incorporating multimedia features such as animations, interactive modules, and movement recognition elements, educators can create a more immersive and cost-effective learning experience that meets the needs of 21st-century students. These web-based games not only accommodate various learning styles but also provide greater motivation for students to actively participate in the learning process (Hui & Mahmud, 2023; Dabbous et al., 2022). Consequently, this research reinforces the importance of integrating technology in education to enhance student engagement, material comprehension, and overall learning outcomes.

Prior study indicates that the use of technology-based educational games effectively enhances student involvement in the learning process (Zeng et al., 2020; Rahardja et al., 2019). Web-based educational games offer advantages in terms of accessibility via smartphones or laptops, as well as interactive features encompassing learning instructions, implementation steps, technique explanation videos, and practice questions presented in a game format (Idris et al., 2020; Hartt et al., 2020). Such media not only captivate students' interest but also augment their comprehension of learning materials through a more engaging and interactive approach. Therefore, one strategy to address the limitations of learning media in Physical Education, Sports, and Health subjects, particularly regarding basic football techniques in senior high schools and vocational schools, is the development of a web-based educational game. This game is designed to assist students in understanding and practising fundamental techniques such as passing, dribbling, and shooting, while simultaneously increasing their learning motivation. Consequently, this research aims to develop a web-based educational game that is suitable for use as an innovative learning medium in physical education subjects at the senior high school and vocational education levels.

METHODS

This research employs the Research and Development (R&D) methodology, adopting the Alessi and Trollip development model. This model was selected due to its systematic and structured approach, specifically designed for the development of multimedia-based products frequently utilised in learning processes (Alessi & Trollip, 2001). The model comprises three primary stages: planning, designing, and development, which facilitate product feasibility testing through beta trials during the development phase. An illustration of the research stages in this study can be observed in Figure 1 below.

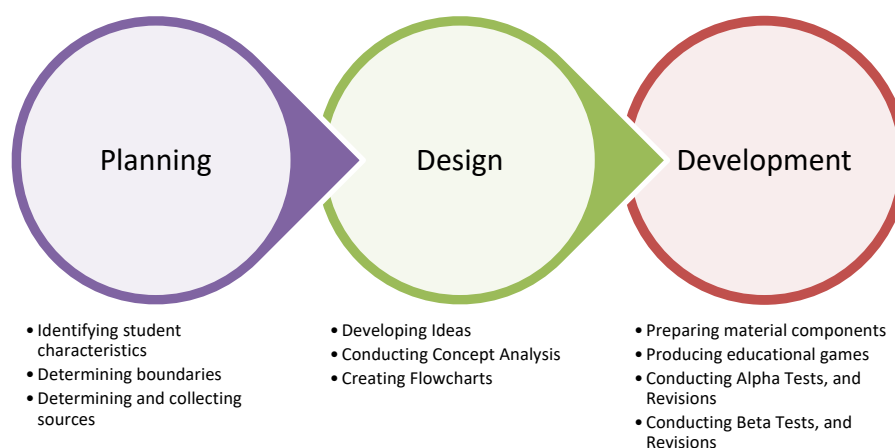


Figure 1. Research design

This study involved two media specialists, two content specialists, three educational practitioners (physical education instructors at the high school and vocational high school levels), and a cluster of 93 students from high schools and vocational high schools in the Boyolali region of Central Java. Media experts evaluated the technical aspects, interface design, and navigation of web-based games, while content experts assessed the alignment of game content with the physical education curriculum for high schools and vocational high schools, particularly regarding fundamental soccer techniques. Educators offered feedback on the feasibility of incorporating the game into classroom instruction, while high school and vocational students, as end users, contributed perspectives on the content, structure, and general quality of the program (Khoiri et al., 2023). This study employed a non-test data gathering technique, incorporating observation and questionnaires (Nisiotis, 2021;Khoiri et al., 2023). Observations were conducted during the design phase to assess physical education learning activities, particularly fundamental soccer tactics, utilizing observation sheets to document instructional approaches, student engagement, and obstacles encountered in the learning process. During the planning, development, and evaluation phases, questionnaires were employed to gather data on needs analysis and identification, subsequently obtaining feedback from experts, educators, and students. A Likert scale was utilized to evaluate the technical features, content, practicality, and appeal of the educational game product. This multifaceted data gathering strategy seeks to guarantee an exhaustive media assessment, encompassing all pertinent elements in the creation of this online educational resource.

In this research, questionnaire items pertaining to the suitability of the interactive game-based website learning media product with an inquiry approach were utilised as instruments. The questionnaire was adapted from a tiered format with a 4-level Likert scale, ranging from 1 (highly unsuitable) to 4 (highly suitable) (Syahril et al., 2022). The questionnaire was designed to collect data regarding media suitability from four subject groups: content experts, instructional media experts, practitioners (Physical Education teachers at senior high school and vocational high school levels), and students. Each group had specific assessment criteria to evaluate particular aspects. The assessment criteria for content experts, instructional media experts, practitioners, and students are delineated in the following table 1, 2, 3, and 4.

Table 1. Material Expert Instrument Grid

No	Indicator
1.	Suitability of basic football technique material with curriculum
2.	Clarity of material delivery in the game
3.	Suitability of material difficulty level with students' abilities
4.	Completeness of basic football technique material (passing, kicking, dribbling, etc.)
5.	Use of terms that are easy for students to understand
6.	Suitability of game material with physical education and health learning objectives
7.	Strength of material explanation based on football theory
8.	Attractiveness of material for students

Adaptation from research Fesol & Salehuddin (2022) and Gusril et al. (2022)

Table 2. Media Expert Instrument Grid

No	Indicator
1.	Attractive and easy-to-understand interface
2.	Easy-to-use in-game navigation
3.	Consistency of visual design across games
4.	Graphic and animation quality that supports learning
5.	Game responsiveness across devices (computers, tablets, smartphones)
6.	Speed and stability of access to the game platform
7.	Use of sound or audio that supports learning
8.	Use of interactivity that helps students understand the material

Adaptation from research Hanifah et al. (2022) and Andrea & Nurhuda (2020)

Table 3. Students Instrument Grid

No	Indicator
1.	Suitability of the game with the learning objectives of Physical Education and Health
2.	Ease of navigation and use of the game
3.	Integration of basic soccer technique materials in the game
4.	Student interest and motivation in using the game

Adaptation from research Fesol & Salehuddin (2022)

Table 4. Learning Practitioner Instrument Grid

No	Indicator
1.	Ease of use of the Game
2.	The attractiveness and accuracy of the Game display
3.	The attractiveness of the images, animations, and music in the Game
4.	The Game contains elements that motivate learning
5.	Availability of evaluation of practice questions
6.	Learning Process and Effectiveness

Adaptation from research Saputra et al. (2021)

The instruments in this study were validated by the research supervisor, who served as the expert (Sugiyono, 2018). Data collected from the designed interactive multimedia product were evaluated through descriptive analysis, which expressed the results as a percentage average of the total validation score. The questionnaires used for product evaluation were analysed to assess the level of feasibility based on the percentage score. According to previous research, interactive multimedia is considered feasible as a learning medium if it obtains at least 63% of the total percentage score (Syahrial et al., 2022).

Furthermore, to promote consistency and objectivity in the feasibility evaluation, the percentage score conversion criteria for the feasibility category were derived from prior research (Saputri et al., 2020). The evaluation encompasses the criteria of highly feasible, practicable, somewhat feasible, and not feasible, which serve as the foundation for determining if the generated learning media meets the

minimum implementation standards in the educational process, as stated in table 5.

Table 5. Instructional Media product eligibility criteria

Percentage	Qualification	Decision
82 – 100%	Very good	Very Eligible
63 – 81%	Good	Eligible
44 – 62%	Enough	Less Eligible
25 – 43%	Deficient	Not Eligible

RESULTS

The planning phase serves as the initial step in the development of a web-based educational game. During this stage, data were gathered through observations and interviews, including recent findings from physical education classes in high schools and vocational schools. The results, analyzed using descriptive statistical methods, indicated that the teaching methods employed were limited in the variety of learning media utilized. Most of the fundamental soccer techniques were conveyed through conventional means, primarily verbal explanations, with YouTube videos serving as the sole source of supplementary information. Notably, nearly all students in the classes possessed smartphones and were accustomed to using technology in their daily lives. The potential for leveraging interactive media technology for teaching basic soccer techniques thus remains largely untapped. For instance, the implementation of a web-based educational game specifically designed to practice concepts such as passing, dribbling, and shooting could serve as an effective alternative to enhance student engagement and understanding. The current limitations in media usage restrict students' ability to receive instructional content, interact with the material, and apply the techniques taught. Consequently, students often lack motivation and do not experience deep learning. Therefore, the development of a web-based educational game aims to address these issues by providing an interactive, engaging, and relevant learning medium tailored to the needs of high school and vocational school students.

Furthermore, the results of the needs analysis survey were processed using percentage analysis to present the students' responses quantitatively. Out of 93 students surveyed, 85% reported understanding the basic concept of passing in soccer, 88% understood dribbling properly, 82% understood basic shooting techniques, and 90% comprehended the basic rules of the game. Additionally, 92% felt capable of passing well, and 87% reported the ability to maintain ball control during play. In terms of interest and motivation, 95% of students expressed enthusiasm for using web-based educational games to master football techniques, and 93% stated that such media would motivate them to study. These results, detailed in Table 6, affirm the strong potential of website-based media to enhance students' fundamental football skills and motivation.

Tabel 6. Needs Analysis Results

Statement/Question	Response (N=93)	
	Yes (%)	No (%)
Do you understand the basic concept of passing in soccer?	85%	15%
Do you understand how to dribble properly?	88%	12%
Do you understand the basic techniques of shooting?	82%	18%
Do you understand the basic rules of the game of soccer?	90%	10%
Do you feel capable of passing well?	92%	8%
Are you able to keep the ball during the game?	87%	13%
Are you interested in using website-based educational games to learn?	95%	5%
Does website-based media motivate you to learn soccer techniques?	93%	7%

The design phase follows planning, during which the insights from the prior stage are manifested as a flowchart illustrating the progression of the website-based instructional game. This flowchart delineates the primary components of the game, including navigation, interactive activities, and the presentation of fundamental soccer techniques, such as passing, dribbling, and shooting. The flowchart serves as a framework for developing visually appealing media that enhances student comprehension and motivation. This method guarantees that web-based educational games effectively address the challenges of studying Physical Education and Health in high school and vocational school settings through a systematic and inquiry-driven approach. This is a flowchart of the produced instructional game.

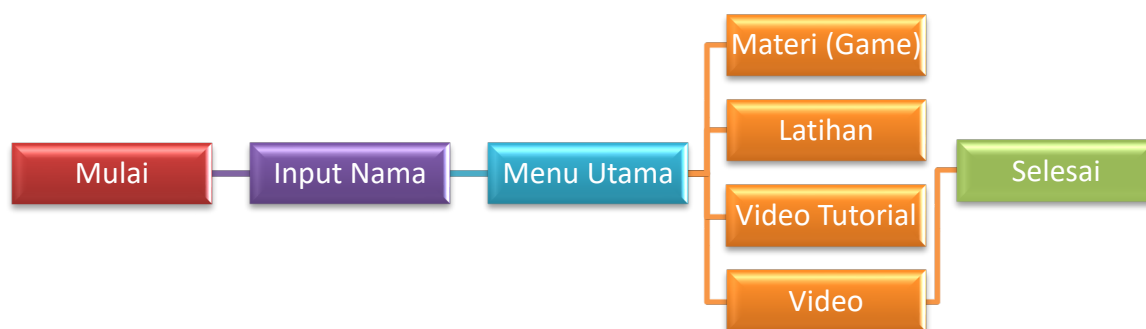


Figure 2. Flowchart of Educational Games for Physical Education

After developing the concept and flowchart, the development step proceeded with the creation of a web-based instructional game focusing on basic soccer skills, including passing, dribbling, and shooting. The game content was composed of narrative text, demonstration videos, illustrative images, and interactive exercises, all systematically organized to enhance student comprehension and engagement. Upon completing the development of the web-based educational game, alpha testing was conducted by media experts, content specialists, and practitioners (physical education teachers at the high school and vocational school levels). The alpha testing assessed the game's technical quality, practicality, and alignment with

the curriculum. Table 7 presents the results of the expert validation, including feasibility assessments and refinement suggestions prior to student trials. This stage ensured that the developed educational media met quality standards and was ready for implementation.

Tabel 7. Alpha Test Results

No	Validator	Average Validation Score (%)	Qualification	Decision
1.	Media Expert I	88%	Very good	Eligible
2.	Media Expert II	89%	Very good	
3.	Material Expert I	84%	Very good	Eligible
4.	Materials Expert II	83%	Very good	
5.	Practitioner I	94%	Very good	Eligible
6.	Practitioner II	94%	Very good	
7.	Practitioner III	88%	Very good	
Average Total Alpha Test Results		89%	Very good	Eligible

This alpha test thoroughly evaluates media and resources to prevent student errors in future trials. The alpha test shows that validators rate website-based learning media as excellent, scoring 89%. Media experts gave the game an average rating of 88% and 89%, indicating that its technology and visual design meet standards for excellence and viability. The learning resource meets Physical Education curriculum and educational objectives, as material specialists gave it an average rating of 84% and 83%, indicating extremely good quality. Physical education teachers gave the highest rating, 94%, showing students' engagement and motivation with the game. Validation shows that the website-based educational game is an engaging learning medium. To test the web-based instructional game, kids engaged in beta testing. Media effectiveness, appeal, and eligibility in teaching soccer basics are assessed. Student response from the beta test shows that the game is high-quality and acceptable for instructional use.

Tabel 8. Beta Test Results

No	Test Type	Average Validation Score (%)	Qualification	Decision
1.	Individual Test (4 Students)	91%	Very good	Eligible
2.	Small Group Test (15 Students)	90%	Very good	
3.	Large Group Test (62 Students)	89%	Very good	Eligible
Average Total Beta Test Results		90%	Very good	Eligible

The results presented in Table 8, it indicated that the web-based educational game demonstrates an excellent level of eligibility, achieving an average validation score of 90%. In an individual assessment involving four students, the media received an average score of 91%, suggesting that the web-based educational game

is personally engaging. A small group test with 15 students yielded an average score of 90%, reflecting the consistent quality of the media in a collaborative setting. Furthermore, a large group assessment involving 62 students resulted in an average score of 89%, which still falls within the very good category and confirms its eligible for use. Overall, these findings affirm that the developed learning media is appropriate for enhancing students' understanding of fundamental soccer techniques. Consequently, the final decision indicates that the web-based educational game is classified as "eligible" for implementation in classroom learning activities.

Discussion

The development of web-based learning media for physical education in high schools and vocational schools is crucial in addressing the challenges of 21st-century education. Despite the integration of technology into students' lives, conventional methods that utilize minimal technology continue to prevail (Apostolou, 2020), resulting in limited student engagement in understanding fundamental football techniques such as passing, dribbling, and shooting. Previous research has indicated that technology-based interactive media, such as web-based educational games, can enhance students' motivation, comprehension, and involvement in the learning process (Adam, 2020). However, most studies have not concentrated on specific solutions for physical education. This research aims to bridge that gap by developing a web-based educational game tailored to meet the needs of both students and teachers while supporting the physical education curriculum, thereby providing a practical solution that can significantly improve the quality of learning.

The alpha and beta tests showed that the website-based instructional game for learning basic soccer fundamentals was practical, with an average validation score of 89% and 90%, respectively. Media experts noted technological benefits such as an appealing interface, easy navigation, and good visual and audio quality that aids learning. Material specialists assessed the Instructional Content, including basic soccer techniques (passing, dribbling, shooting), against the Physical Education curriculum and student comprehension. According to beta test comments, students found the game entertaining and motivated them to study more. Educational practitioners praised its effectiveness.

Recent research found out the significance of innovative educational approaches in secondary and vocational school learning, with gamification and game-based learning demonstrating efficacy in enhancing academic performance, motivation, and student engagement (Dahalan et al., 2024). Mobile-based games, for instance, have been shown to improve self-directed learning skills (Nurdin et al., 2023), while level-based RPG games can enhance students' mathematical comprehension (Zi-Xuan Ding, Ting-Sheng Weng, 2023). Learning tools such as virtual laboratories and augmented reality have also aided in addressing resource limitations for subjects like electro-pneumatics and gasification in vocational schools (Sukardjo et al., 2023; Khoirunnisa et al., 2023). In alignment with these findings, the web-based educational game developed in this study integrates features such as intuitive navigation, engaging visual design, supportive audio, and

interactive elements. The simplified navigation facilitates students' exploration of the material, visual and audio components create a more engaging learning experience, while interactivity in the form of quizzes and simulations enables students to comprehend basic football technique theory while practising it virtually. These findings corroborate the literature asserting that technology-based learning media can enhance students' understanding, motivation, and learning outcomes (Huraj et al., 2022; Budiarto et al., 2024), rendering this game an innovative and relevant solution for Physical Education learning in secondary and vocational schools.

Web-based instructional game content teaches soccer basics including passing, dribbling, and shooting, corresponding with high school and vocational school Physical Education curriculum learning objectives. Expert validation shows that this content is relevant to the curriculum and improves students' cognitive, affective, and psychomotor learning outcomes, with average validation scores of 84% and 83% in alpha testing, indicating a clear, systematic presentation of material appropriate for students' comprehension levels. Game-based learning in physical education (PE) improves student motivation, academic achievement, and health (Camacho-Sánchez et al., 2023). Games that improve motor, tactical, and social abilities have been proven to work (Darmawansah, 2020)(Shen & Shao, 2022). Educational movies in PE classrooms boost health literacy and promote good views of PE (Elvani Hertati, 2022; Hrg et al., 2023; Merino-Campos et al., 2023). Game performance, fundamental movement skills, and physical activity outcomes improve using a game-based strategy in primary school PE (Yan et al., 2023). PE interventions have a small to moderate impact on learning outcomes, with psychomotor skills showing the most significant effects (Dudley et al., 2022), but sustainable development is underrepresented in PE teacher education curricula. This shows that web-based educational games are an innovative Physical Education learning tool.

The beta test results indicated that students reacted favorably to web-based instructional games, achieving an average validation of 90%. This reaction indicates a substantial enhancement in student motivation relative to traditional learning approaches, which are often less engaging and restricted in interactivity. The majority of students indicated that this interactive medium was not only engaging but also facilitated their comprehension and practice of fundamental soccer techniques, including passing, dribbling, and shooting. The beta test findings indicate that students in big groups achieved a validation score of 89%, demonstrating the media's effectiveness in a collaborative setting. This aligns with the literature indicating that digital game-based learning (DGBL) markedly enhances motivation, engagement, and academic achievement across multiple courses, particularly in STEM disciplines (Wang et al., 2022; Bakhsh et al., 2022). Moreover, other research indicates that DGBL enhances cognitive areas, such as mathematical knowledge and skills, as well as affective domains, including student attitudes, interests, and accomplishments (Hui & Mahmud, 2023). In higher education, digital game-based learning correlates with enhanced motivation, flow experiences, and academic achievement (Kaya & Ercag, 2023; Dabbous et al., 2022). Moreover, digital attributes including intuitive navigation, appealing visual design, and interactive aspects significantly enhance student engagement and

motivation (Li et al., 2024;Ishak et al., 2023). This web-based educational game has demonstrated its capacity to foster a more engaging learning environment, enhance student participation, and facilitate improved learning results relative to traditional techniques.

Educational games and gamification in physical education (PE) enhance learning by merging interactivity, engagement, and skill development. Research shows that this method improves academic achievement, motivation, and 21st-century competencies like critical thinking, teamwork, and flexibility (Guío Gutiérrez, 2022;Chugh & Turnbull, 2023). Technology in game-based learning environments improves subject knowledge, executive function, and health and physical performance (Kolovelonis & Goudas, 2023;Arufe-Giráldez et al., 2022). Flipped learning and gamification can provide immersive educational experiences that match students' daily technology use, bridging the gap between theoretical knowledge and practical application (Ferriz-Valero et al., 2022). As mentioned in previous studies, addressing students' different needs and obstacles is essential to realizing these approaches' potential. These findings demonstrate the power of educational games to improve learning outcomes in PE and beyond and provide the framework for future educational technology advances.

The development and implementation of web-based educational games for physical education (PE or *Penjasorkes*) learning faces various challenges, such as the integration of interactive features, validation of basic soccer technique materials, and technical limitations, especially in cross-device testing (Zen et al., 2022;Al Fatta et al., 2018). In schools with inadequate equipment, these issues can be addressed by creating media compatible with basic devices, offering teacher training, and engaging in collaboration with external entities, such as universities or technology groups. This study significantly contributes to the advancement of technology-based learning media for physical education (PE) by introducing educational games tailored to the needs of students and teachers, along with a practical framework for replication in sports education; however, several limitations exist. The restricted sample coverage of high schools and vocational schools in the research area renders the results not entirely representative of institutions with varying characteristics. This constraint emphasizes the necessity for expanded research and comprehensive assessment to evaluate the influence of web-based educational games on student learning outcomes across diverse educational settings, particularly in enhancing learning quality in schools with inadequate technological resources.

CONCLUSION

This development research has effectively met its aims by establishing a web-based instructional game for Physical Education in high schools and vocational schools, as evidenced by the findings and challenges addressed. The viability of this product is due to the contributions of several factors in the creation of the educational game, such as engaging design, expert validation, and constructive input from both practitioners and students. This game is expected to substantially improve students' comprehension and proficiency in fundamental football

principles, while also increasing their motivation to learn. Moreover, it is advisable that subsequent studies employ this medium to comprehensively evaluate its efficacy in enhancing students' learning outcomes and competencies in the subject matter under investigation. The significance of this research lies in its contribution to the advancement of innovative digital learning solutions in Physical Education, providing an effective model that integrates technology with motor skills training, thereby addressing the gap in interactive learning media for secondary and vocational education contexts.

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