DEVELOPMENT AND VALIDATION OF TACTICAL GAMES LEARNING MODELS BASED ON DIGITAL TECHNOLOGY

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Abstract

This study developed an Android-based Tactical Games learning model application to enhance tactical understanding, decision-making, and engagement in physical education. The application was validated by experts in material, media, and informatics, receiving scores of about 80%, confirming its validity and feasibility because expert evaluation ensures that learning tools meet pedagogical and technical standards. User testing, involving 53 elementary school students, showed a system usability scale (SUS) score of 76.75, categorizing the application as "good." This score is important because usability impacts student interaction and learning outcomes. Additionally, effectiveness surveys recorded an average score of 7.79, demonstrating the application's ability to support tactical learning and game-based instruction because structured digital tools enhance student engagement and comprehension. These findings indicate that integrating digital technology into tactical games learning provides an interactive and structured approach to physical education. However, future research should expand testing with different learning models and enhance teacher training, because successful technology adoption depends on educators' ability to integrate it effectively into instruction.

Keywords: Android, Digital technology, Learning, Physical education, Tactical games.

1. Introduction

The tactical learning model in physical education engages students in structured games to develop tactical skills, cognitive learning, and game performance [1]. Many reports regarding game for education have been well-documented (Table 1).

Table 1. Previous studies regarding game in education.

No.	Title	Ref.
1	Improving students' critical thinking through blended learning media learning game word wall	[2]
2	Students' attitude towards gamification-based teaching in mathematics in basic schools	[3]
3	Influence of gamification elements on students' academic performance	[4]
4	Enhancing philosophy comprehension through what am I? Word guessing game	[5]
5	Game-based activity method: A case of grade 5 students	[6]
6	Designing English education game application for early childhood	[7]
7	Designing a notation card game media to improve the ability to read rhythmic music of 7th grade junior high school	[8]

The tactical games model (TGM) enhances students' ability to analyse and respond to various game situations, fostering critical thinking and decision-making [9]. To ensure effective implementation, TGM follows structured stages: understanding the game structure, recognizing objectives, fostering tactical awareness, and applying technical skills [10]. This structured approach improves physical, cognitive, and emotional skills, enhancing problem-solving ability and teamwork. Modern pedagogical strategies emphasize student-centred learning, requiring adaptable teaching methods in sports education [11]. The tactical approach promotes active learning, structured play analysis, and strategic decision-making [12, 13]. However, traditional TGMs lack personalized learning tools, real-time feedback, and structured assessments, limiting effectiveness in diverse student populations [13]. With advancements in technology, integrating digital tools into tactical learning has become essential [14, 15]. Teaching sports games in elementary schools requires inclusive, engaging approaches to address student diversity [16]. To enhance critical thinking and participation, it is essential to improve game concept understanding and structured digital learning experiences [17].

Previous studies showed that game-based learning increases student activity levels more than traditional methods [18]. Research highlights flipped learning and digital media as effective for cognitive development and motivation [19, 20]. However, game-based models do not always enhance enjoyment or competence [21]. Digital tools such as interactive videos and online assessments may bridge this gap [22]. This study developed a Digital Technology-Based Tactical Games Learning Model, integrating tactical understanding, practical videos, and evaluation tools into a single platform. The novelty lies in using digital technology for tactical learning, tailored video materials, and digital-printed learner evaluations [23, 24]. This research innovates sports education by providing an engaging, structured, and accessible learning model.

2. Method

This study employed a design-based research (DBR) approach, which is adaptive and iterative, making it suitable for educational technology development. Detailed information regarding this method is explained elsewhere [25]. The research focused on developing the Tactical Games learning model via an Android application, expert validation, and user validation. The study involved two participant groups. The first group consisted of three experts evaluating design and feasibility based on experience, professional background, and expertise in physical education, learning media, or informatics engineering. The second group included 53 fifth-grade students from elementary schools in Tasikmalaya, Indonesia, assessing user validity and effectiveness. Research instruments included validation tools for material and media experts [26] and the System Usability Scale (SUS), a 10-statement usability test on a 5-point Likert scale [27]. The SUS Score categories are shown in Fig. 1 [28]. Data were analysed using descriptive percentage techniques to interpret expert and user feedback, ensuring the application's feasibility and usability.
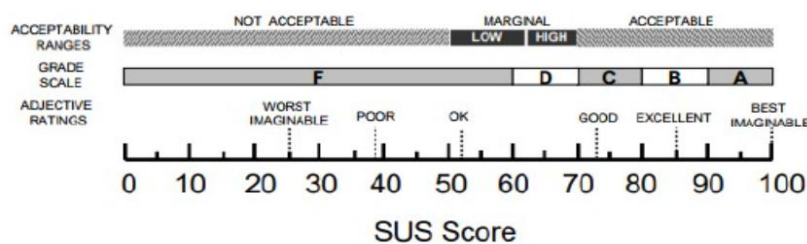

Fig. 1. SUS score category.

3. Results and Discussion

An Android-based Tactical Games Learning Model Application has been successfully developed (Fig. 2). The application includes learning materials, model syntax, implementation strategies, evaluation tools, e-LKPD for assessment, and the game performance assessment instrument (GPAI) for gameplay analysis. These features were designed to enhance tactical learning and improve students' engagement in sports education [16].

Fig. 2. Initial display and content overview of the developed application.

To ensure its quality and feasibility, the application underwent expert validation (Tables 2 and 3). The Material Expert rated the app at 79%, suggesting that an LKPD (student's worksheet) feature should be added because authentic assessment helps measure student understanding more effectively [16]. The Informatics Expert provided a 75% rating, noting that some icons required multiple attempts to respond and advising further testing to determine whether this issue is caused by weak signal strength or a programming flaw. This concern is crucial because usability issues can hinder user interaction and reduce learning efficiency [16]. The Media Expert, who rated the app 81%, praised the media display but recommended incorporating interactive elements (e.g., sliding images for matching activities) to make evaluation tools more engaging. This is important because interactive learning features enhance student motivation and knowledge retention [16].

Table 2. Summary of experts' findings and recommendations.

Validators	Assessment Percentage	Recommendations
Material Expert	79%	Add the LKPD (student's worksheet) feature because authentic assessment provides concrete evidence of student learning [16]. If possible, make it online so that students can immediately access their results.
Informatics Expert	75%	The existing features are well-designed, but some icons are unresponsive or require multiple clicks. It is important to determine whether this issue is due to signal strength limitations or a programming flaw because usability problems can hinder engagement [16].
Media Expert	81%	The media display is excellent, but online evaluation tools could be more interactive. Adding elements such as sliding images for matching activities would make the learning process more engaging because interactive tools increase student motivation and retention [16].

Table 3. Summary of user validation results and average SUS score.

	Statement Number										Effect
	1	2	3	4	5	6	7	8	9	10	
Average	4.32	1.89	3.96	1.94	3.92	1.98	4.09	1.92	4.02	1.89	7.79
Standard Deviation	0.61	0.32	0.59	0.46	0.62	0.64	0.63	0.73	0.54	0.58	0.88
Average SUS Score	76.75										

These findings reinforce previous research, which highlights that integrating Android-based applications into Tactical Games learning enhances student engagement, cognitive skills, and sports performance [16]. Furthermore, prior studies have demonstrated that digital media encourages active participation in physical education [29, 30]. Research has shown that mobile applications improve fitness knowledge [31], enhance training efficiency [32], and boost student motivation in sports lessons [26]. Similarly, video tagging in a TGfU-based soccer unit was found to improve students' perception of digital tools in sports learning [33-36]. These findings align with this study because the Tactical Games Learning Application was effective in increasing cognitive engagement and physical activity [16].

However, challenges remain, including teacher training and school infrastructure limitations. These challenges must be addressed because the success of digital integration depends on teachers' ability to balance technology with hands-on learning experiences [16]. In elementary school physical education, the role of digital media should be considered not just in improving movement experiences, but also in reshaping social interactions [16]. Digital tools must support, not replace, traditional physical activities because self-expression through play remains a core component of sports education [16]. By combining game-centred teaching methods (e.g., Tactical Games Approach) with digital applications, educators can create engaging and productive learning experiences [16]. This approach helps students not only develop technical and tactical sports skills but also fosters self-assessment and conflict resolution abilities. However, successful integration depends on ensuring that digital tools complement rather than dominate physical activities because excessive reliance on technology could reduce essential movement-based learning [16]. This adds new information regarding sports science education as reported elsewhere [37-41].

4. Conclusion

This study successfully developed an Android-based Tactical Games learning model application, validated for feasibility and usability. Expert validation scores of about 80% confirmed its validity and feasibility, while the SUS score of 76.75 placed it in the "good" usability category. User surveys showed an effectiveness score of 7.79, indicating its usefulness in physical education learning. The study demonstrates the potential of digital technology in game-based learning, but further research should expand testing on different models and enhance teacher training to improve technology integration in physical education and ensure long-term effectiveness in learning.

Acknowledgments

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