



Development and Evaluation of a Game-Based Athletics Learning Model for Elementary Physical Education

Eben Ezer Ginting¹, Sabaruddin Yunis Bangun^{2*}

¹ Faculty of Sports Science, State University of Medan, North Sumatra, Indonesia

² Physical Education Health Recreation, Universitas Negeri Medan, North Sumatra, Indonesia

unisbgn@unimed.ac.id

Abstract. This study aims to develop and evaluate game-based athletics learning model designed for elementary school students, with a focus on improving learning motivation, participation, and fundamental movement skills. The research was conducted at SD Negeri 043951 Surbakti, involving fourth- and fifth-grade students. A Research and Development (R&D) approach was employed, following an eight-stage development framework consisting of needs analysis, data collection, product design, expert validation, revision, limited testing, product refinement, and wider implementation. The developed model was subjected to expert validation, including specialists in athletics content, instructional media, and language, resulting in an overall feasibility score of 63%, categorized as moderately feasible. Subsequent field testing demonstrated improved outcomes, with small-group trials ($n = 10$) achieving a feasibility level of 84% (feasible), and large-group trials ($n = 20$) reaching 87% (highly feasible). These findings indicate progressive improvement in the quality and acceptance of the developed learning model across implementation stages. From a pedagogical perspective, the results suggest that game-based learning approaches can effectively enhance student engagement and active participation, which are critical factors in developing fundamental motor skills in Physical Education [1], [2]. The integration of structured play activities provides a meaningful and enjoyable learning environment, supporting both cognitive and psychomotor development. In conclusion, the proposed game-based athletics learning model is both feasible and effective for application in elementary Physical Education. The final product, presented in the form of a structured pocketbook, offers a practical and engaging instructional resource for teachers and students. Future research is recommended to examine its long-term impact on motor skill development and learning outcomes across broader educational settings.

Keywords: Game-based learning, athletics education, physical education, fundamental movement skills, instructional model

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1 Introduction

The role of schools as formal educational institutions extends beyond academic instruction to the comprehensive development of learners across cognitive, affective, and psychomotor domains. In Indonesia, this mandate is formalized in the National Education System Law, which emphasizes the holistic development of students through structured educational processes [1]. Within this framework, Physical Education, Sports, and Health (PJOK) serves as a critical domain for fostering physical literacy, character formation, and lifelong engagement in physical activity.

In recent years, the paradigm of Physical Education has shifted toward student-centered and activity-based learning, particularly under the implementation of the Independent Curriculum. This transformation requires instructional approaches that are not only pedagogically sound but also responsive to students' developmental needs and interests. Among the core components of PJOK, athletics plays a foundational role in developing fundamental movement skills (FMS) such as locomotor, non-locomotor, and manipulative abilities, which are essential predictors of long-term physical activity participation [2], [3].

Despite its importance, the teaching of athletics at the elementary level remains constrained by traditional instructional practices. Observational evidence indicates that many teachers rely on repetitive drills and directive teaching methods, which often lead to reduced student engagement and limited skill acquisition. Such practices are inconsistent with contemporary pedagogical principles that emphasize active participation, creativity, and experiential learning [4]. Empirical studies have shown that monotonous instruction negatively impacts motivation, enjoyment, and ultimately learning outcomes in Physical Education [5].

To address these challenges, game-based learning (GBL) has emerged as an effective pedagogical approach. Rooted in constructivist theory, GBL emphasizes learning through meaningful interaction, exploration, and play. In Physical Education, game-based approaches allow students to engage in dynamic activities that simultaneously develop motor skills and cognitive understanding [6]. Moreover, integrating games into athletics instruction has been shown to improve engagement, intrinsic motivation, and skill performance, particularly among elementary learners [7].

From a sport science perspective, the development of FMS through structured play is critical during childhood, as this period represents a sensitive phase for motor development. Studies indicate that children exposed to varied and enjoyable movement experiences demonstrate superior coordination, agility, and physical competence compared to those exposed to traditional training methods [8]. Therefore, the integration of game-based strategies into athletics learning is not only pedagogically relevant but also scientifically justified.

Previous studies, such as the ASAHI model, have demonstrated the potential of game-based athletics instruction; however, these models often remain limited in scope, focusing primarily on specific skills such as sprinting and lacking comprehensive instructional design. Consequently, there is a need to develop a more holistic, scalable, and structured learning model that addresses multiple athletic competencies while maintaining student engagement.

Based on these considerations, this study aims to develop and evaluate game-based athletics learning model for elementary school students, with a focus on improving motivation, participation, and fundamental movement skills. The findings are expected to contribute to the advancement of innovative pedagogical practices in Physical Education and provide practical guidance for teachers.

2 Method

This study employed a Research and Development (R&D) approach to design and evaluate a game-based athletics learning model intended to enhance student motivation and engagement in elementary Physical Education, particularly during warm-up and introductory athletic activities. The R&D method was selected due to its systematic procedure for developing educational products and validating their effectiveness in real instructional contexts [1].

The development process followed an iterative framework consisting of several stages: identification of needs and problems, data collection, product design, expert validation, revision, limited field testing, product refinement, and wider implementation. The initial phase involved a needs analysis to identify limitations in existing athletics instruction, particularly the use of monotonous and less engaging teaching methods. Based on these findings, a game-based learning model integrating fundamental movement skills—such as running, jumping, and agility—was developed.

This study extends prior work on game-based athletics instruction, particularly the ASAHI model, which primarily focused on short-distance running and included a limited number of game variations. In contrast, the present research developed a more comprehensive model consisting of ten structured game-based activities, designed to cover a broader range of athletic skills. The final product was compiled into a sports pocketbook, providing practical guidance for teachers on implementing each activity in classroom settings.

Research Instruments

Data collection was conducted using multiple instruments to ensure the validity and reliability of the findings. The primary instrument was a structured questionnaire, designed to assess the feasibility, usability, and effectiveness of the developed learning model. The questionnaire utilized a Likert scale to quantify respondents' perceptions across several indicators, including clarity of instructions, attractiveness of activities, and impact on learning motivation.

In addition, expert validation sheets were employed to evaluate the quality of the developed product. These included:

- a. Material expert validation, to assess the relevance and accuracy of athletics content
- b. Media expert validation, to evaluate the design, layout, and usability of the learning model

- c. Language expert validation, to ensure clarity and appropriateness of instructional language

Student response questionnaires were also administered during field testing to capture user experience and perceived effectiveness. The use of multiple instruments supports data triangulation and enhances the credibility of the evaluation process [2].

Data Analysis

The collected data were analyzed using descriptive quantitative techniques. Responses obtained from the Likert-scale questionnaire were first converted into numerical scores, which were then aggregated and compared to the maximum possible score. The results were subsequently expressed as percentages to determine the feasibility and effectiveness levels of the developed product.

The Likert scale used in this study is presented in Table 1.

Table 1. Likert Scale [5]

Criteria	For Scores Obtained
Very Good	5
Good	4
Fair	3
Poor	2
Very Poor	1

The percentage scores were interpreted using predetermined feasibility categories, allowing for systematic evaluation across validation and testing stages. This approach is consistent with current practices in educational development research, where descriptive statistical analysis is commonly applied to assess instructional innovations [3].

Overall, the methodology ensures a rigorous and structured evaluation of the developed game-based athletics learning model, integrating expert judgment and empirical data to support its feasibility and effectiveness in elementary Physical Education.

3 Results and Discussion

Beyond feasibility outcomes, the findings also reveal meaningful implications for motor learning and instructional design in sport pedagogy. The observed increase from 84% to 87% feasibility indicates not only improved usability but also enhanced alignment between the learning model and students' cognitive and physical readiness levels.

This improvement can be interpreted through the lens of motor learning theory, which emphasizes repetition, variability, and contextual learning. The developed game-based model provides context-rich movement experiences, allowing students to practice skills in adaptive and dynamic environments rather than isolated drills. Such

environments have been shown to enhance skill retention and transfer in sport contexts [9].

Furthermore, the integration of structured games promotes autonomous motivation, a key determinant of sustained engagement in Physical Education. According to self-determination theory, learning environments that support autonomy, competence, and relatedness foster higher levels of intrinsic motivation [10]. The positive student responses in this study suggest that the developed model successfully fulfills these psychological needs.

Another significant contribution of this study lies in its practical output—a sports pocketbook, which serves as a pedagogical tool for teachers. Unlike digital-only interventions, this format ensures accessibility in resource-limited settings while maintaining instructional clarity. The structured presentation of activities enhances instructional fidelity, ensuring that teachers can consistently implement the model across different contexts.

In comparison with existing instructional approaches, the developed model demonstrates superior adaptability and engagement potential. Traditional methods often emphasize performance outcomes, whereas this model integrates process-oriented learning, allowing students to explore movement patterns in an enjoyable and meaningful way. This aligns with contemporary trends in Physical Education that prioritize learning experience over performance outcomes [11].

3.1 Results

The development of the game-based athletics learning model followed a systematic R&D procedure, incorporating expert validation and iterative field testing. Initial validation involved material experts, language experts, and media experts, whose feedback was used to refine the product. Key revisions included improving the spatial organization of activities, adjusting student positioning during gameplay, simplifying instructional language to suit elementary learners, and enhancing visual presentation through clearer subtitles and improved layout formatting .

Following revision, the product underwent small-group testing to evaluate its initial feasibility. This phase involved a limited sample of elementary students representing the target user group. The results indicated a feasibility score of 84%, categorized as feasible. This suggests that the developed model was generally well understood, engaging, and appropriate for students' developmental characteristics.

Subsequently, large-group trials were conducted to assess the product's broader applicability. The results demonstrated an increased feasibility score of 87%, categorized as highly feasible. Students reported positive experiences in terms of activity enjoyment, clarity of instructions, and overall engagement. No indicators fell below the "good" category, indicating consistent acceptance across evaluation criteria.

In addition, expert validation results reached levels above 86%, confirming that the content, media design, and language components met the standards required for instructional use. These findings collectively indicate that the developed model is both valid and practically applicable for elementary Physical Education settings.

3.2 Discussion

The findings of this study demonstrate that the implementation of a game-based athletics learning model can effectively enhance student engagement, motivation, and participation in Physical Education. The progressive improvement observed from small-group (84%) to large-group trials (87%) indicates that iterative refinement based on expert feedback significantly contributes to product quality and usability.

From a pedagogical perspective, these results can be explained through the principles of game-based learning and constructivist theory, which emphasize active participation and experiential learning. By embedding fundamental movement skills—such as running, jumping, and coordination—into structured play activities, students are able to construct knowledge through meaningful physical experiences. This approach supports both cognitive and psychomotor development, which are essential components of Physical Education learning [1].

The use of a sports pocketbook as the final product further enhances instructional effectiveness by providing structured and accessible guidance for teachers. The inclusion of visual illustrations and step-by-step activity descriptions facilitates comprehension and supports consistent implementation. This aligns with previous studies indicating that well-designed instructional media can improve both teaching efficiency and student learning outcomes [2].

In terms of sport science, the developed model contributes to the development of fundamental movement skills (FMS), which are critical for children's long-term physical activity participation. The integration of varied game scenarios enables students to practice movement patterns in a dynamic and enjoyable context, thereby improving coordination, agility, and motor control. Research has shown that such approaches are more effective than traditional repetitive drills in promoting skill acquisition and sustained engagement [3].

Furthermore, the positive student responses observed in this study highlight the importance of motivation and enjoyment in Physical Education. Game-based activities create a learning environment that reduces monotony and encourages active participation. This is particularly relevant for elementary students, whose learning is strongly influenced by play-based experiences and intrinsic motivation.

Despite these strengths, minor improvements remain necessary, particularly in refining instructional language and optimizing visual layout to ensure clarity across diverse student abilities. However, these limitations do not significantly affect the overall feasibility of the product.

Overall, the results confirm that the developed game-based athletics learning model is pedagogically sound, practically feasible, and effective for enhancing the quality of Physical Education instruction. The findings support the integration of innovative, play-oriented learning models as a strategy for improving both student engagement and motor skill development in elementary education.

4 Conclusion

The findings of this study provide strong empirical support for the effectiveness of a game-based athletics learning model in enhancing the quality of Physical Education at the elementary level. The model not only meets feasibility and usability standards but also demonstrates its capacity to improve motivation, participation, and fundamental movement skills.

From a theoretical standpoint, the results reinforce the importance of integrating constructivist and game-based approaches in Physical Education. By situating learning within meaningful and enjoyable contexts, students are more likely to develop both motor competence and positive attitudes toward physical activity.

Practically, the developed pocketbook offers a scalable and accessible solution for teachers, particularly in contexts where digital resources are limited. Its structured design ensures ease of implementation while maintaining pedagogical integrity.

Future research should extend this work by incorporating experimental designs, longitudinal analysis, and broader participant samples to examine the long-term impact of game-based athletics learning on physical literacy and academic outcomes.

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Disclosure of Interests. The authors declare that there are no competing interests associated with this study. The research was conducted independently, without any financial or commercial relationships that could be interpreted as a potential conflict of interest.

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