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# Development of a running speed game model for teaching short-distance running at telaga biru public elementary school 16

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**ABSTRACT**

This study is a Research and Development (R&D) study developed using the ADDIE model, comprising five stages: (1) Analysis, (2) Design, (3) Development, (4) Implementation, and (5) Evaluation. Direct-instruction teaching of short-distance running at SD Negeri 16 Telaga Biru has produced low student interest, limited active participation, and underdeveloped starting, acceleration, and coordination technique, representing a clear pedagogical gap that this study addresses by embedding sprint training within a competitive relay-game structure. This research aimed to develop and evaluate the feasibility and effectiveness of a Running Speed game model for teaching athletics to elementary school students. Data were collected through expert validation questionnaires (learning experts and game experts) and a pretest-posttest field trial involving fourth-grade students. Expert validation indicated that the product falls into the "feasible to highly feasible" category in terms of material suitability, movement-activity appropriateness, safety, and clarity of instructions. Field implementation produced a significant positive impact on students' cognitive, psychomotor, and affective learning outcomes. The novelty of this study lies in its systematic integration of relay-based competitive play with the technical demands of short-distance running (start, acceleration, and sprint) within a validated ADDIE development cycle evaluated across three learning domains simultaneously. These findings support confidence that the Running Speed model is a feasible and empirically effective alternative for athletics instruction in resource-limited elementary schools.

**Keywords:** Running speed; game development; educational games; short-distance running; physical education learning

**ABSTRAK**

Penelitian ini merupakan jenis penelitian dan pengembangan (R&D) yang dikembangkan menggunakan model ADDIE dengan 5 tahapan, yaitu: 1) Analysis, 2) Design, 3) Development, 4) Implementation, 5) Evaluation. Pembelajaran lari jarak pendek yang dilaksanakan secara konvensional di SD Negeri 16 Telaga Biru menyebabkan rendahnya minat belajar siswa, keterlibatan aktif yang terbatas, serta kemampuan start, akselerasi, dan koordinasi gerak yang belum optimal,

sehingga diperlukan model pembelajaran alternatif berbasis permainan estafet kompetitif. Penelitian ini bertujuan mengembangkan dan menguji kelayakan serta efektivitas model permainan Running Speed untuk pembelajaran atletik lari jarak pendek. Data dikumpulkan melalui angket validasi ahli (ahli pembelajaran dan ahli permainan) serta uji coba lapangan pretest-posttest pada siswa kelas IV. Hasil validasi ahli menunjukkan produk berada pada kategori "layak hingga sangat layak" dari aspek kelayakan materi, kesesuaian aktivitas gerak, keamanan, dan kejelasan instruksi. Implementasi di lapangan memberikan dampak positif yang signifikan terhadap kemampuan kognitif, psikomotor, dan afektif siswa. Kebaruan penelitian ini terletak pada integrasi sistematis antara permainan estafet kompetitif dengan tuntutan teknik lari jarak pendek (start, akselerasi, sprint) melalui siklus pengembangan ADDIE yang tervalidasi dan diuji pada tiga domain pembelajaran sekaligus. Temuan ini menegaskan bahwa model permainan Running Speed layak dan efektif secara empiris sebagai alternatif pembelajaran atletik di sekolah dasar dengan keterbatasan sarana dan prasarana.

**Kata Kunci:** Running speed; pengembangan permainan; permainan edukatif; lari jarak pendek; pembelajaran PJOK

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## INTRODUCTION

Physical Education, Health, and Sport (PJOK) is an inseparable part of Indonesian educational life. Beyond its role in improving physical health, sport also functions as a stress reliever, a source of livelihood, and an indicator of social status, among many other benefits (Arisqa, Ridwan, Prayudha, & Suyono, 2024). Within the PJOK curriculum, athletics—particularly short-distance running—occupies a central position because it develops the fundamental movement capacities that underlie the majority of other sport skills taught at the elementary level.

According to Ilmi and Lestari (2025), athletics is among the sport disciplines most dependent on running speed, coordination, reaction, and precise movement technique, while Pratama and Sitompul (2024) define short-distance running as an all-out effort covering a distance of 100 to 400 meters. Mastery of these elements at an early age has long been recognized as foundational to later athletic development, since children who fail to acquire efficient sprint mechanics tend to carry inefficient movement patterns into adolescence (Chaouachi et al., 2017).

Despite this importance, classroom-level implementation of short-distance running instruction in Indonesian elementary schools frequently remains conventional. Preliminary observation and needs analysis conducted at SD Negeri 16 Telaga Biru revealed that teachers rely predominantly on direct-instruction methods with little variation in the form of games, resulting in a monotonous learning atmosphere with limited active student involvement. This pattern is consistent with broader concerns raised in the physical education literature: Dyson (2019) argues that the quality of physical education depends heavily on pedagogical variety and meaningful student engagement, while Beni, Fletcher, and Ní Chróinín (2017) note that meaningful experiences in physical education are strongly associated with enjoyment, social interaction, and a sense of competence—elements that are frequently absent from instruction based solely on verbal command and repetitive drilling.

The consequence of this conventional approach at SD Negeri 16 Telaga Biru is low student interest and motivation toward athletics instruction, characterized by reduced enthusiasm, rapid boredom, and minimal active participation. Observational data also indicated that students' technical running abilities—including starting position, acceleration, and movement coordination—had not developed optimally. Limited facilities and a narrow repertoire of instructional models were identified as contributing factors. These field findings are consistent with international evidence showing that structured, well-designed games can substantially improve fundamental movement skills (FMS) in children (Lubans, Morgan, Cliff, Barnett, & Okely, 2010; Holfelder & Schott, 2014), and that FMS deficits identified early in primary school tend to persist without targeted, play-based intervention (Zhang, Tang, Geng, Li, Liu, & Cai, 2025).

A growing body of research supports the use of game-based learning (GBL) as an effective strategy for addressing these problems. Adipat, Laksana, Busayanon, Ausawasowan, and Adipat (2021) argue that embedding learning content within game structures increases student engagement by activating intrinsic motivation and providing immediate, meaningful feedback. Consistent with this, Abad Robles, Collado-Mateo, Fernández-Espínola, Castillo Viera, and Giménez Fuentes-Guerra (2020), in a systematic review and meta-analysis, found that game-based teaching approaches produce measurable improvements in decision-making and skill execution among young learners, while Barba-Martín, Bores-García, Hortigüela-Alcalá, and González-Calvo (2020) reported similarly favorable outcomes for the Teaching Games for Understanding (TGfU) model across a six-year body of literature. In the Indonesian context specifically, Anggraini et al. (2025) demonstrated that the use of game-based learning media significantly enhanced elementary students' interest in physical education, and Yulianti, Siska, Andre, and Sari (2025) showed that modified relay-race games substantially improved balance, agility, and coordination in young children—findings that closely parallel the pedagogical logic underlying the present study.

From a theoretical standpoint, the design of the Running Speed model draws on principles of motor learning and experiential learning theory, which posit that motor skills are

most effectively acquired through repeated, contextually meaningful practice rather than isolated technical drilling (Casey & Goodyear, 2019). This aligns with constructivist views of physical education pedagogy, in which the teacher's role shifts from instructor to facilitator, and students construct movement competence through guided play. Within this framework, the competitive-cooperative structure of relay games is theorized to simultaneously stimulate the psychomotor domain (through repeated sprint bouts), the cognitive domain (through understanding of game rules and running technique), and the affective domain (through teamwork, discipline, and sportsmanship), consistent with evidence that structured relay and small-sided games elevate motivation and engagement in physical education settings (Simón-Chico, González-Peño, Hernández-Cuadrado, & Franco, 2023).

Observations at SD Negeri 16 Telaga Biru further indicate that fourth-grade students respond more enthusiastically to learning activities packaged as games than to conventional drills. A play-based approach is capable of creating an enjoyable learning atmosphere, increasing student activeness, and encouraging maximal movement without psychological pressure. Repeated short-duration sprint efforts embedded within play are also consistent with the anaerobic-alactic energy demands that dominate children's sprint performance, and such repeated-effort formats have been shown to be an effective and age-appropriate stimulus for developing acceleration and coordination in youth populations (Beyer et al., 2020; Aloui et al., 2021).

Although several previous studies have examined game-based models for developing fundamental movement skills or specific sports such as football and volleyball (Sulistiyono et al., 2021; Samsudin, Setiawan, Taufik, & Solahuddin, 2021), research that specifically develops a validated, ADDIE-based running-speed game model tailored to short-distance running instruction at the elementary level—and that is empirically tested across cognitive, psychomotor, and affective learning domains simultaneously—remains limited. This constitutes the research gap addressed by the present study. The novelty of this research lies in its integration of a competitive relay-based game structure specifically designed around the technical demands of short-distance running (start, acceleration, and sprint), combined with a systematic ADDIE development cycle and empirical evaluation across three learning domains at once.

Based on the results from the field, the Running Speed game model was designed as a solution to the problems identified above. The model was developed by transforming short-distance running activities into a relay-race game format, using simple equipment and adapted to the field conditions and characteristics of elementary school students. The game emphasizes speed, acceleration, reaction, and movement coordination through competitive yet enjoyable play activities. Accordingly, this study aims to (1) develop a Running Speed game model for teaching short-distance running that is feasible according to learning and game experts, and (2) examine the effectiveness of the developed model in improving the cognitive, psychomotor,

and affective learning outcomes of fourth-grade students at SD Negeri 16 Telaga Biru.

## RESEARCH METHOD

This study employed a Research and Development (R&D) approach based on the ADDIE model, comprising five sequential stages: Analysis, Design, Development, Implementation, and Evaluation (Branch, 2009). ADDIE was selected because of its systematic, iterative structure, which allows continuous expert feedback and revision throughout the development process, consistent with prior R&D studies that used the same framework to build validated game-based physical education models (Sulistiyono et al., 2021; Samsudin et al., 2021).

In the Analysis stage, the researchers conducted classroom observation, informal interviews with the physical education teacher, and a review of student learning outcomes at SD Negeri 16 Telaga Biru to identify the instructional problems described in the Introduction. In the Design stage, the game concept, rules, safety procedures, and required equipment were drafted with reference to the technical components of short-distance running (start, acceleration, and sprint) and to the developmental characteristics of upper-grade elementary students. In the Development stage, a prototype of the Running Speed game was produced and submitted to a learning expert and a game expert for validation using structured expert-judgment questionnaires covering material feasibility, movement-activity suitability, safety, and instructional clarity; the product was revised iteratively based on their qualitative and quantitative feedback until it reached a feasible category.

In the Implementation stage, the revised model was trialed in the field with fourth-grade students of SD Negeri 16 Telaga Biru, located at Jl. Yan Lamatenggo, Desa Pentadio Barat, Kecamatan Telaga Biru, Kabupaten Gorontalo, Gorontalo Province. Data collection proceeded from initial observation through to product try-out, following standard R&D procedure. In the Evaluation stage, student learning outcomes were assessed using a pretest-posttest design across three learning domains: cognitive (understanding of running concepts, rules, and technique), psychomotor (running speed, starting technique, acceleration, and movement coordination), and affective (motivation, self-confidence, cooperation, discipline, and enthusiasm).

Data were analyzed descriptively. Expert validation results were interpreted using a feasibility-category scale (ranging from not feasible to highly feasible) to determine whether the product met the established criteria for field use. Pretest–posttest results across the three learning domains were compared descriptively to evaluate the direction and consistency of improvement following implementation of the Running Speed model. Researchers recommend that future replications of this design report full instrument validity/reliability coefficients and inferential statistics (e.g., paired-sample t-test results) alongside the descriptive comparison, to strengthen the empirical claims made in the Results section.

## RESULTS

The results of this research and development study are presented according to the ADDIE stages, followed by the empirical evaluation of the implemented model across the cognitive, psychomotor, and affective learning domains.

At the Analysis stage, the needs assessment confirmed that short-distance running instruction at SD Negeri 16 Telaga Biru had been conducted using direct instruction with minimal variation, producing low student interest and underdeveloped starting, acceleration, and coordination technique. These findings formed the empirical basis for the Design and Development stages.

At the Design and Development stages, the Running Speed game model was constructed around a relay-race format that integrates the start, acceleration, and sprint phases of short-distance running into a series of competitive team-based tasks using simple, low-cost equipment (cones, batons, and marked lanes) suitable for schools with limited sport facilities. The model was designed with attention to motor-learning principles, physical development theory, and the specific instructional needs of athletics education.

Validation by the learning expert and the game expert indicated that the product met the required feasibility standards, falling into the "feasible to highly feasible" category across all four evaluated aspects: material feasibility, movement-activity suitability, safety, and clarity of instructions (Table 1). Revisions were made based on expert input, resulting in a final product with a simpler game structure, clearer instructions, and more efficient, safer equipment use for students.

**Table 1. Expert Validation Results by Aspect.**

| Aspect Evaluated | Expert Feasibility Category |
|---|---|
| Material feasibility | Feasible – Highly Feasible |
| Movement-activity suitability | Feasible – Highly Feasible |
| Safety | Feasible – Highly Feasible |
| Instructional clarity | Feasible – Highly Feasible |

At the Implementation and Evaluation stages, the pretest-posttest comparison indicated a consistent positive shift across all three learning domains. In the cognitive domain, students demonstrated improved understanding of the basic concepts of sprinting, the rules of the Running Speed game, and the technical execution of short-distance running from pretest to posttest. Because the game format allowed students to learn through direct, hands-on experience (experiential learning), conceptual understanding appeared easier for students to internalize and retain compared with instruction delivered through verbal explanation alone.

In the psychomotor domain, the game proved effective in improving running speed, movement coordination, starting technique, acceleration, and sprint execution. The repeated short-distance efforts embedded in the relay format are consistent with the anaerobic-alactic

energy pathway that dominates children's sprint performance, and align with prior evidence that modified games can strengthen fundamental movement skills through simple, structured, and enjoyable movement patterns. Posttest psychomotor results showed a marked improvement in students' fundamental motor competence relative to the pretest condition.

In the affective domain, students exhibited increased motivation, self-confidence, cooperation, discipline, and enthusiasm for learning. The competitive-yet-collaborative nature of the relay format appeared to foster a positive learning climate and healthy social interaction among students, consistent with physical education theory emphasizing the role of play-based activity in cultivating character, sportsmanship, and a sense of responsibility.

Overall, the results indicate that the Running Speed game model is not only theoretically feasible, as confirmed by expert validation, but also empirically effective, given the consistent improvement observed across all three domains of student learning. The model addresses a longstanding gap in athletics instruction at the elementary level, where learning has traditionally been perceived as repetitive and insufficiently varied.

## DISCUSSION

The improvements observed across the cognitive, psychomotor, and affective domains support the central premise of this study: that transforming short-distance running instruction into a structured, competitive game increases both the feasibility and the effectiveness of athletics learning at the elementary level. This finding is consistent with Abad Robles et al. (2020) and Barba-Martín et al. (2020), whose systematic reviews concluded that game-based and understanding-oriented teaching approaches in physical education reliably improve decision-making, skill execution, and student engagement relative to conventional, drill-based instruction.

The psychomotor gains observed in this study—particularly in starting technique, acceleration, and coordination—align closely with sprint-development literature showing that repeated short-duration efforts are an effective and age-appropriate stimulus for improving acceleration mechanics and coordination in children (Chaouachi et al., 2017; Beyer et al., 2020; Aloui et al., 2021). The relay-based structure used in this study appears to operationalize these training principles within a format that is enjoyable rather than repetitive, which may explain why student engagement remained high throughout implementation. This is further corroborated by Yulianti et al. (2025), who found that a modified relay-race game substantially improved balance, agility, and coordination among young children, mirroring the psychomotor improvements documented here.

The affective improvements—particularly in motivation, cooperation, and discipline—are consistent with Simón-Chico et al. (2023), who reported that challenge-based, game-oriented physical education experiences significantly increase student motivation and engagement, and with Dyson (2019), who argues that pedagogical variety is a defining feature

of quality physical education. These findings also resonate with Beni et al. (2017), who emphasize that meaningful experiences in physical education—characterized by fun, social connection, and a sense of competence—are central to sustained student engagement, elements that a purely instructional, non-game-based approach struggles to provide.

From a theoretical perspective, the results support the applicability of experiential and motor-learning theory (Casey & Goodyear, 2019) to elementary athletics instruction: students appear to construct both conceptual understanding and technical competence more effectively through direct, contextualized play than through verbal instruction alone. Practically, these findings suggest that the Running Speed model offers elementary schools—particularly those with limited sport facilities—a low-cost, readily implementable alternative to conventional athletics instruction that simultaneously addresses cognitive, psychomotor, and affective learning objectives.

## CONCLUSION AND IMPLICATIONS

The Running Speed game model developed through this study is a feasible and effective learning product for teaching short-distance running to fourth-grade students at SD Negeri 16 Telaga Biru. Expert validation from learning and game experts categorized the product as feasible to highly feasible in terms of material feasibility, movement-activity suitability, and instructional clarity, while field implementation produced a positive and consistent impact on students' cognitive, psychomotor, and affective learning outcomes. These findings answer the research objectives by confirming both the developmental feasibility and the practical effectiveness of the model, and they support its use as an innovative, inclusive, and applicable instructional strategy for short-distance running education, particularly in elementary schools with limited sport facilities. Theoretically, the study reinforces the relevance of experiential, play-based approaches to motor-skill acquisition in children.

## RESEARCH LIMITATIONS

This study is limited by its single-site design, involving only fourth-grade students at one elementary school, which restricts the generalizability of the findings to other schools, grade levels, or regional contexts. The evaluation of learning outcomes relied on descriptive pretest-posttest comparisons rather than inferential statistical testing, and detailed psychometric properties (validity and reliability) of the cognitive, psychomotor, and affective instruments were not reported in full. Future research should employ larger and more diverse samples, inferential statistical analysis, and fully reported instrumentation to strengthen the empirical evidence base for the Running Speed model.

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development stage, and to Universitas Negeri Gorontalo for institutional support in the completion of this study.

## ETHICAL STATEMENT

This article has complied with the applicable research ethics standards involving human subjects as participants. All research procedures have obtained ethical approval from the Research Ethics Committee of [Insert Institution/University Name] with ethical approval certificate number: [Insert Ethical Approval Number]. The researchers ensured the confidentiality of all participants' identities and obtained written informed consent from each participant's parent or legal guardian prior to data collection, in compliance with the moral principles of scientific research involving children.

## CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in the conduct of this research or in the preparation of this article, whether financial from any specific sponsor or non-financial with any party. All data presented in the research results are objective findings obtained in the field without external intervention that could affect the integrity and transparency of this study. The authors take full responsibility for the authenticity and validity of the information provided in this manuscript

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