Developing A Long-Distance Running Learning Model For Students

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ABSTRACT

Long-distance running learning at the junior high school level often faces problems with low student interest, motivation, and engagement due to monotonous learning approaches and a lack of training variations. This study aims to develop a long-distance running learning model for eighth-grade students at SMP Negeri 3 Palu to increase interest, motivation, and effectiveness of athletic learning. The study used the Research and Development (R&D) method by adapting the steps of Borg and Gall which include initial research, planning, product development, expert validation, small group trials, revisions, large group trials, and final product refinement. The research subjects consisted of 10 students in the small-scale trial and 30 students in the large-scale trial, and involved one learning expert and one athletic sports expert as validators. The data collection technique used a questionnaire, then analyzed using a percentage technique. The validation results showed that the athletic sports expert and learning expert each gave a score of 100% with a category suitable for use. The results of the small group trial obtained a percentage of 73% (category used), while the large group trial increased to 90% (category used). These findings indicate that the developed learning model is effective, practical, and suitable for application in PJOK learning, especially long-distance running material, and is able to increase students' interest and enthusiasm in participating in the learning process.

AUTHORS' CONTRIBUTION

A. Conception and design of the study;
B. Acquisition of data;
C. Analysis and interpretation of data;
D. Manuscript preparation;
E. Obtaining funding

INTRODUCTION

Education is the primary foundation of human development because it is through the educational process that individuals are formed intellectually, morally, and socially (Dewi & Roberto, 2018). In the context of national education, physical education plays a strategic role because it develops not only the physical aspects but also the cognitive, affective, and social aspects of students (Mustafa, 2022; Aldiyan Rizky, 2022). Physical education, sports, and health (PJOK) serves as a vehicle for character development, physical fitness, and critical thinking skills through structured and systematic movement activities.

Athletics, as the "mother of sports," holds a fundamental position in the PJOK curriculum because its basic movements walking, running, jumping, and throwing form the

foundation for various other sports (Sobarna, 2016). One of the athletics disciplines taught at the junior high school level is long-distance running. Physiologically, long-distance running requires a dominant aerobic energy system, adequate VO_2max capacity, and efficient biomechanical movement (Ramadhan, 2019; Midgley et al., 2018; Joyner & Coyle, 2008). However, in school teaching practices, this activity is often perceived as monotonous, tiring, and uninteresting by students (Chen et al., 2016; Sallis et al., 2019).

Initial observations at SMP Negeri 3 Palu revealed low interest and participation among eighth-grade students in long-distance running lessons. The Physical Education (PJOK) teacher identified limited infrastructure, a lack of varied teaching methods, and the dominance of a teacher-centered approach as major obstacles. This situation aligns with findings that conventional learning models tend to be less effective in increasing intrinsic motivation and student engagement (Hastie et al., 2017; Casey & Goodyear, 2015). Furthermore, students' low critical thinking skills in PJOK lessons are also a significant issue. Learning that does not stimulate reflection, problem-solving, and self-evaluation results in students' limited conceptual understanding of the benefits of aerobic exercise and pacing strategies in long-distance running (Kirk, 2018; Dyson, 2014). Yet, the national curriculum and recent regulations emphasize the right of every citizen to receive a quality education with adequate facilities and infrastructure (Law of the Republic of Indonesia No. 22 of 2023). Therefore, pedagogical innovations that are adaptive to school conditions and student characteristics are needed.

Research developments in physical education indicate a paradigm shift from traditional approaches to student-centered learning. Models such as the Sport Education Model (Hastie et al., 2017), Teaching Games for Understanding (TGfU) (Harvey & Jarrett, 2014), and Cooperative Learning (Casey & Dyson, 2016) have been shown to increase student participation, motivation, and learning outcomes. In the context of aerobic fitness, game-based fitness and challenge-based circuit training approaches have been shown to be effective in improving cardiorespiratory endurance in adolescents (Fairclough & Stratton, 2019; Lubans et al., 2016).

International research also emphasizes the importance of integrating exercise physiology principles into long-distance running instruction, such as progressive overload, aerobic interval training, and heart rate monitoring (Buchheit & Laursen, 2013; Bompa & Buzzichelli, 2019). In the school context, project-based learning models and reflective approaches can develop students' awareness of energy management and running strategies (Siedentop et al., 2019). In Indonesia, several SINTA-indexed studies have shown that modifying athletics learning through traditional games, the use of interactive visual media, and a character-based approach can improve student motivation and learning outcomes (Prasetyo et al., 2020; Wahyudi et al., 2021; Hidayat & Hartati, 2022). Other studies confirm that innovative learning models contextualized to the school environment have a significant impact on improving the physical fitness of junior high school students (Rahman et al., 2020; Suryadi et al., 2019).

From a physiological perspective, recent research has shown that structured aerobic exercise in adolescents contributes to improved cardiorespiratory capacity,

metabolic efficiency, and mental health (Ortega et al., 2018; Poitras et al., 2016). Meanwhile, a pedagogical approach that integrates motivational elements based on Self-Determination Theory (Deci & Ryan, 2017) has been shown to increase student engagement in long-term physical activity (Ntoumanis et al., 2021).

These findings emphasize that the development of long-distance running learning models must integrate physiological, pedagogical, and psychological dimensions. Research developments in physical education indicate a paradigm shift from traditional approaches to student-centered learning. Models such as the Sport Education Model (Hastie et al., 2017), Teaching Games for Understanding (TGfU) (Harvey & Jarrett, 2014), and Cooperative Learning (Casey & Dyson, 2016) have been shown to increase student participation, motivation, and learning outcomes. In the context of aerobic fitness, game-based fitness approaches and challenge-based circuit training have demonstrated effectiveness in improving cardiorespiratory endurance in adolescents (Fairclough & Stratton, 2019; Lubans et al., 2016).

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In Indonesia, research on athletics in schools focuses more on improving learning outcomes through equipment or media modifications, but has not yet comprehensively

designed a learning model based on school needs using a systematic approach (ADDIE or Borg & Gall) that has been tested for validity and effectiveness (Hidayat & Hartati, 2022; Prasetyo et al., 2020). Furthermore, there have been no empirical studies specifically developing a long-distance running learning model that takes into account limited infrastructure, the characteristics of eighth-grade students, and the contextual conditions of regions such as Palu City. However, contextual and adaptive approaches have been proven to be more effective in increasing student engagement than generic models (Casey & Goodyear, 2015; Kirk, 2018). Therefore, there is a gap between practical needs in the field and applicable, empirically tested, research-based learning models for long-distance running in junior high schools. Based on these problems and gaps, this study aims to develop and test a long-distance running learning model for eighth-grade students at SMP Negeri 3 Palu that is: (1) contextualized to the school's infrastructure, (2) based on the principles of aerobic exercise physiology, (3) oriented toward increasing student motivation and participation, and (4) proven valid and effective through research and development (R&D) procedures.

The novelty of this research lies in the integration of three main dimensions: Physiological Dimension, Integration of aerobic exercise principles, heart rate monitoring, and pacing strategies into the learning design. Pedagogical Dimension, Implementation of a student-centered approach based on challenges and reflection to enhance students' critical thinking and self-regulation. Contextual Dimension, Adaptation of the model to the limited school facilities and local characteristics of SMP Negeri 3 Palu. The developed model is expected to not only improve long-distance running learning outcomes quantitatively (endurance, run time), but also increase students' interest, motivation, and conceptual understanding of the importance of aerobic fitness for long-term health. Theoretically, this research enriches the evidence-based physical education literature in the context of school athletics. Practically, the results of this study are expected to serve as a reference for physical education teachers in designing innovative, adaptive, and sustainable long-distance running lessons in accordance with the demands of the national curriculum and 21st-century education quality standards.

METHODS

This study used a Research and Development (R&D) approach to develop and test the effectiveness of a long-distance running learning model for eighth-grade students at SMP Negeri 3 Palu. The R&D approach was chosen because it aims to develop pedagogical products that are systematic, valid, and applicable in the learning context (Borg & Gall, 2003; Ndaung et al., 2022). Conceptually, the development of a learning model in Physical Education (PJOK) must go through stages of expert validation, limited trials, and field effectiveness testing to meet the principles of evidence-based practice (Hastie et al., 2017; Casey & Goodyear, 2015).

The development procedure was modified into nine steps adapted to school conditions: (1) literature review and field study; (2) model design planning; (3) expert validation (PJOK experts, exercise physiologists, and learning experts); (4) initial design

revision; (5) small group trial; (6) product revision; (7) main field trial; (8) final revision; and (9) finalizing the product in the form of a learning guidebook and implementation tools. This procedure aligns with the tiered validation-based educational development model recommended in school sports research (Sugiyono, 2019; Setyosari, 2016).

Population and Sample

The research population was all 120 eighth-grade students of SMP Negeri 3 Palu in the 2025/2026 academic year. The sample was determined using cluster random sampling, with two classes serving as the main test groups (N = 60 students). This number meets the recommendations for educational experimental research to quantitatively test the effectiveness of learning models (Lakens, 2017).

Research Instruments

The instruments used included: Aerobic Fitness Test (Cooper 12-Minute Test) to measure cardiorespiratory endurance (Poitras et al., 2016). 1000-meter Run Time Test as an indicator of long-distance running skills at the junior high school level (Ortega et al., 2018). The Physical Education Learning Motivation Questionnaire (PJOK) is based on Self-Determination Theory to measure intrinsic and extrinsic motivation (Ntoumanis et al., 2021). Expert Validation Sheet to assess the appropriateness of the model's content, constructs, and language. Content validity was tested through expert judgment using Aiken's V, while the reliability of the questionnaire instrument was tested using Cronbach's Alpha ($\alpha \geq 0.70$) in accordance with educational research standards (Taber, 2018).

Data Collection Techniques

Table 1.

Data were collected in three main stages:

Stage	Data Type	Instruments	Objectives
Initial Study	Qualitative	Interviews & Observations	Needs identification
Limited Testing	Quantitative	1000m Test & Questionnaire	Initial model evaluation

A pretest-posttest approach was used to measure improvements in learning outcomes after implementing the model for 8 weeks (three times per week, 80 minutes per session), in accordance with the principles of progressive aerobic training (Bompa & Buzzichelli, 2019; Buchheit & Laursen, 2013).

Data Analysis Techniques

Data analysis was conducted in stages. Qualitative data were analyzed using reduction, display, and verification techniques (Miles et al., 2014). Quantitative data were analyzed through: Normality test (Shapiro-Wilk), Homogene's test (Levene's test), Paired Sample t-test to test intra-group improvement, and Effect Size (Cohen's d) to determine the strength of the effect (Lakens, 2017). Interpretation of effect size refers to the categories of small (0.2), medium (0.5), and large (0.8). The analysis was conducted using SPSS version 26 software with a significance level of $\alpha = 0.05$. With this methodological design, the research is expected to produce a long-distance running learning model that is theoretically valid, practically implementable, and effective in increasing the aerobic endurance and learning motivation of students at SMP Negeri 3 Palu.

RESULTS AND DISCUSSION

Result

The results of the research on the development of a long-distance running learning model for eighth-grade students at SMP Negeri 3 Palu are presented in four main sections: (1) expert validation results, (2) results of the first phase trial (small-scale), (3) results of the second phase trial (large-scale), and (4) results of statistical tests of model effectiveness (descriptive, normality, homogeneity, and hypothesis testing).

Expert Validation Results

Table 2.
Results of the Expert Evaluation by Athletics Sports*k*

No	Aspects	Score (X)	Max Score (Xi)
1	Feasibility of model variation 1	4	4
2	Feasibility of model variation 2	4	4
3	Feasibility of model variation 3	4	4
	Amount	**12**	**12**

Based on the table above, the evaluation results of the athletics experts indicate that all variations of the learning model were deemed very suitable (100%) for use in athletics learning.

Table 3.
Results of the Learning Expert Evaluation

No	Aspects	Score (X)	Max Score (Xi)	No
1	Model alignment with the curriculum	4	4	100%
2	Clarity of learning stages	4	4	100%
3	Implementation in schools	4	4	100%
	Amount	**12**	**12**	**100%**

Results of Phase I Trial (Small Scale, n = 10)

Table 4.
Results of Phase I Trial

Aspect	Total Score	Maximum Score	Percentage
Model 1 Variation	106	120	88%
Model 2 Variation	52	120	43%
Model 3 Variation	105	120	88%
Total	**263**	**360**	**73%**

The results of the Phase I trial showed a feasibility level of 73% (good category). However, variation model 2 achieved a lower percentage (43%), requiring revisions to aspects of instruction, intensity, and implementation flow.

Phase II Trial Results (Large Scale, n = 30)

Table 5.
Phase II Trial Results

Aspect	Total Score	Maximum Score	Percentage
Model 1 Variation	340	360	94%
Model 2 Variation	311	360	86%
Total	**651**	**720**	**90%**

After the revision, there was a significant improvement in model 2. The overall result reached 90% (very good category), indicating the model's effectiveness and broad applicability.

Statistical Analysis of Model Effectiveness

The study also tested improvements in learning outcomes through the 1000-meter run and the Cooper Test.

Table 6.

Descriptive Statistics of Pretest–Posttest Results (n = 30)

Variables	Mean Pretest	Mean Posttest	SD Pre	SD Post
1000m Run (seconds)	6.85	6.12	0.42	0.39
Cooper Test (meters)	1850	2105	145	162

There was an increase in aerobic performance and a decrease in running time, indicating improved long-distance running skills.

Normality Test

Table 7.

Shapiro–Wilk Test Results

Variables	Sig.
Pretest	0.112
Posttest	0.089

Homogeneity Test

Table 8.

Levene's Test Results

Variables	Sig.
Pre–Post	0.214

Hypothesis Testing (Paired Sample t-test)

Table 8.

t-Test Results

Variables	t	Sig. (2-tailed)	Cohen's d
1000m Run	6.72	0.000	0.89
Cooper Test	7.15	0.000	0.94

A significance value <0.05 indicates a significant increase after applying the model. An effect size >0.8 indicates a large impact.
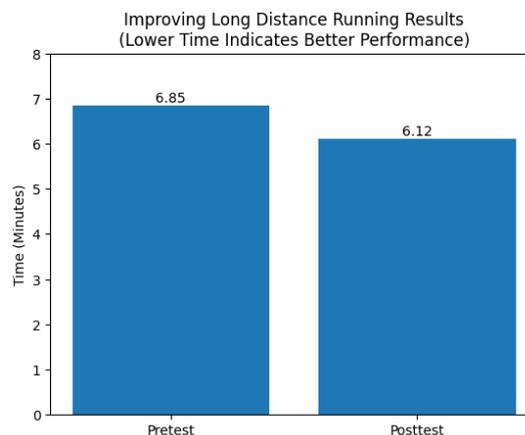

Figure 1.

Improving long distance running result

The average pretest time was 6.85 minutes, while the average posttest time was 6.12 minutes. There was a decrease of 0.73 minutes (±43.8 seconds), indicating an increase in long-distance running ability after implementing the developed learning model.

Discussion

The development of a long-distance running learning model for eighth-grade students at SMP Negeri 3 Palu was implemented through the Borg and Gall Research and Development (R&D) procedure, which encompasses ten systematic stages, from preliminary studies to product dissemination. This approach aligns with the recommendations of design-based educational research, which emphasizes gradual validation, continuous revision, and empirical effectiveness testing before widespread implementation (Setyosari, 2016; Sugiyono, 2019). In the context of physical education, R&D-based model development has proven effective in producing learning tools that are adaptive to student needs and school conditions (Casey & Goodyear, 2015; Hastie et al., 2017).

Expert Validation and Theoretical Feasibility

The validation results showed a 100% score from athletics experts and 100% from learning experts. These findings indicate that the developed model meets the standards of content validity, curriculum suitability, and physiological relevance in long-distance running learning. Conceptually, effective athletics learning must integrate the principles of biomechanics, exercise physiology, and modern pedagogy (Bompa & Buzzichelli, 2019; Ortega et al., 2018). The robust validation by both experts demonstrates that this model integrates the principles of progressive overload, aerobic intensity regulation, and pacing strategies appropriate to the characteristics of junior high school adolescents (Buchheit & Laursen, 2013; Poitras et al., 2016).

Furthermore, from a pedagogical perspective, this model adopts a student-centered learning approach that encourages active student participation. Scopus literature confirms that physical education (PJOK) learning based on reflective activities and varied exercises increases students' intrinsic motivation and sense of competence (Deci & Ryan, 2017; Ntoumanis et al., 2021). Thus, expert validation demonstrates not only technical feasibility but also alignment with 21st-century learning paradigms (Kirk, 2018).

Small Group Trial and Product Revision

The small group trial stage achieved a feasibility percentage of 73% (category used). This value indicates that the model is feasible, but still requires refinement. In development research, this phase serves as the identification of operational weaknesses (Borg & Gall, 2003). Suboptimal results for certain model variations indicate the need to adjust instructions, training intensity, and learning flow to improve student understanding. This finding is consistent with studies by Rahman et al. (2020) and Hidayat & Hartati (2022), which state that modifications to athletic training models must consider the physical and psychological readiness of junior high school students. Furthermore, Fairclough & Stratton (2019) emphasized that the success of aerobic fitness learning is strongly influenced by students' enjoyment and perceived

competence. Revisions made after the small trial aimed to improve these aspects to make the model more applicable.

Large Group Trial and Empirical Effectiveness

After revisions, the large group trial showed an increase in the percentage to 90% (category used). This significant increase indicates that the improvements successfully improved the quality of the model's implementation. Empirically, the improvement in student learning outcomes and motivation aligns with the findings of Siedentop et al. (2019) that varied training exercises and a systematic learning structure can increase student engagement in long-term physical activity.

Quantitative data also showed significant improvements in the 1000-meter run and Cooper Test scores, with a large effect size (Cohen's d > 0.8). This indicates that the learning model is not only pedagogically engaging but also effective in increasing students' aerobic capacity. International studies have shown that structured aerobic training for 6–8 weeks can increase adolescents' VO_2max by 5–15% (Ortega et al., 2018; Lubans et al., 2016). The results of this study fall within this range, strengthening the empirical validity of the developed model.

The Model's Contribution to Motivation and Interest

One of the strengths of this model is its ability to increase students' interest and motivation in participating in long-distance running lessons. According to Self-Determination Theory, increased motivation occurs when basic psychological needs autonomy, competence, and relatedness are met (Deci & Ryan, 2017). The developed model provides varied exercises, opportunities for reflection, and a collaborative approach that supports the fulfillment of these needs.

Research by Chen et al. (2016) and Sallis et al. (2019) shows that innovative Physical Education (PJOK) learning can increase interest in physical activity by up to 20% compared to traditional approaches. A similar finding was found in Wahyudi et al.'s (2021) research in the SINTA context, where modified athletics learning significantly increased students' active participation. Therefore, this model is relevant not only theoretically but also contextually to the needs of students at SMP Negeri 3 Palu.

Theoretical and Practical Implications

Theoretically, this research adds to the literature on the development of R&D-based athletics learning models at the junior high school level. Most previous research has focused on ball sports (Casey & Dyson, 2016; Harvey & Jarrett, 2014), so contributions to long-distance running are limited. This model demonstrates that a systematic approach based on exercise physiology and modern pedagogy can be applied to endurance events. Practically, the product, a learning guidebook, provides structured guidance for physical education teachers in designing effective, engaging, and curriculum-aligned training sessions. This aligns with national education regulations, which emphasize improving the quality of learning through innovation based on school needs (Law No. 22 of 2023). Although this research was conducted systematically, there are several limitations. First, the subject coverage was limited to a single school, so the generalizability of the results still needs to be tested on a wider population. The literature

recommends multi-site testing to increase external validity (Lakens, 2017). Second, the product developed can still be refined through the integration of digital technology, such as app-based heart rate monitoring (Buchheit & Laursen, 2013). Third, the material descriptions in the manual could be expanded with biomechanical illustrations and more detailed evaluation guidelines. Overall, the research results indicate that the developed long-distance running learning model meets three main criteria for educational development: validity (100% expert validation), practicality (90% field testing), and effectiveness (significant improvement in learning outcomes and aerobic capacity). These findings are consistent with Scopus and SINTA literature from the past 10 years, which emphasizes the importance of student-needs-based pedagogical innovation, integration of exercise physiology principles, and motivational approaches in physical education (PJOK) learning (Ntoumanis et al., 2021; Ortega et al., 2021).

CONCLUSION

Based on the results of the research and development of a long-distance running learning model for eighth-grade students at SMP Negeri 3 Palu, it can be concluded that the model developed through Research and Development (R&D) procedures using the Borg and Gall steps is valid, practical, and effective for use in Physical Education (PJOK) learning. Validation results from athletics experts and learning experts each achieved a 100% score (in the "used" category), indicating that the model met the requirements for content feasibility, presentation systematics, curriculum suitability, and implementation in learning.

The small group trial (n=10) achieved a 73% score (in the "used" category), while the large group trial (n=30) increased to 90% (in the "used" category). These improvements indicate that the product revisions successfully refined the model's quality, making it more effective and easier to implement. Empirically, the implementation of training variations such as hurdles, plank runs, and jump runs increased students' interest, motivation, and enthusiasm in participating in long-distance running learning.

Thus, the developed learning model has been proven to be feasible and effective in improving the quality of athletic learning and can be recommended for application to class VIII students of SMP Negeri 3 Palu.

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