

Research Article

# Development of Learning Technology in Physical Education, Sports, and Health at Elementary School (Study On Third Graders)

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**Abstract:** This study aims to develop a contextual and adaptive PJOK (Physical Education, Sports, and Health) learning technology to improve student learning outcomes, particularly in basic motor skills. The research addresses the ineffectiveness of conventional teaching methods in meeting the needs of the digital-native generation. The study used a Research and Development (R&D) approach, based on a modified Borg & Gall model comprising five main stages. The research subjects were third-grade students at SD Negeri Gondangrejo 1, selected through purposive sampling. Data collection methods included classroom observations, structured interviews with PJOK teachers, expert validation questionnaires, and performance tests assessing motor skills such as coordination, balance, agility, speed, and comprehension of instructions. The study revealed a significant improvement in students' posttest scores compared to pretest results in all assessed aspects of motor skills. Expert validation showed that the developed PJOK learning technology had high levels of feasibility, validity, and reliability. This study presents an innovative approach to PJOK instruction by integrating contextual and adaptive technology tailored to the digital-native generation. It offers a practical and effective solution to modernize physical education in elementary schools and enhance students' motor skill development.

**Keywords:** Elementary School; Learning Technology; Media Development; Motor Skills; Physical Education.

## 1. Introduction

The development of information and communication technology today has penetrated various fields, including education. 21st-century learning demands the integration of technology in the teaching and learning process to be able to meet the challenges of the digital generation. As explained by in the 21st century era, digital transformation in education has presented new opportunities for students to access quality learning materials and engage in learning processes tailored to their individual needs.

At the elementary school level, Physical Education, Sports, and Health (PJOK) play a strategic role in shaping students' character, motor skills, and physical health. According to, physical education has significant benefits for child development, especially in motor, cognitive, social, and emotional aspects. Furthermore, according to, physical education is a field of knowledge that focuses on learning physical movements, sports activities, and maintaining physical fitness.

However, the PJOK learning process in elementary schools is still dominated by conventional approaches that are demonstrative and instructional, thus less able to facilitate students' needs in understanding the material visually and interactively.

Several previous studies have examined the benefits of integrating technology in PJOK learning. A study by showed that the use of animation media can create an engaging and interactive learning environment, ultimately increasing students' active participation in learning activities. Another study by found that the development of Android-based interactive learning media significantly increased students' interest and understanding of the material.

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Similarly, research by in a SINTA-accredited journal stated that the development of this interactive learning media successfully produced efficient and attractive PJOK learning aids and offered a new approach in delivering PJOK material in the digital era.

Nevertheless, most studies still focus on measuring learning outcomes or motivation without addressing the development of learning technology models suitable for the characteristics of elementary school students. Additionally, there are few studies that explore the local development context of PJOK technology in semi-urban areas like Gondangrejo, which face unique challenges in terms of infrastructure and teacher resources. This gap forms the basis for the necessity of this research.

This study contributes novelty by developing a contextual PJOK learning technology prototype based on the needs of elementary school students and easy for teachers to operate in daily learning activities. This innovation not only aims to enrich PJOK learning media but also supports the digital transformation in basic education that is adaptive to technological developments.

The purpose of this study is to develop a PJOK learning technology model that can be effectively implemented for third-grade students at SD Gondangrejo 1. It is hoped that this development can improve the quality of learning interaction, enhance student learning outcomes, and serve as a replicable learning model for other elementary schools. The scientific benefit of this study is expected to enrich the literature on PJOK learning technology and serve as a reference for curriculum developers and education practitioners in designing relevant and sustainable physical education learning.

## 2. Proposed Method

This study applies the Research and Development (R&D) method using the Borg & Gall development model, which has been adapted into several main stages, namely: (1) conducting an initial study and gathering information; (2) planning and developing a prototype product; (3) conducting limited-scale trials; (4) revising the product based on feedback from experts and initial field test results; and (5) conducting operational trials. The Research and Development method is a research approach aimed at creating a specific product. This model was chosen because it can address the need for an adaptive, contextual learning product that can be tested for feasibility gradually within the context of elementary schools.

The research population refers to all objects or individuals who have similar or relevant characteristics to the problem being studied. Meanwhile, according to, in research activities, understanding the population is crucial because the sample taken must represent that population. The sample, as part of the population, needs to be selected appropriately and adjusted to the research approach applied, whether qualitative or quantitative. The population in this study consists of all third-grade students at SD Negeri Gondangrejo 1, Karanganyar Regency. Sampling is a systematic approach applied by researchers to select a small portion of elements or individuals chosen from a predetermined population, which will be used as the data source in the observation or experimental process according to the research objectives (Delice, 2010). Furthermore, purposive sampling is a method of selecting research subjects based on specific criteria or characteristics determined by the researcher. The research sample was purposively determined by considering the suitability of subject characteristics, namely classes that have never used technology in PJOK learning. The sample consisted of 24 students as limited trial subjects, and another 24 students as operational trial subjects.

Data was collected through several techniques: (1) Observation of the physical education learning process to map the needs of students and teachers. (2) Structured interviews with physical education teachers as input for the instructional technology design planning. (3) Expert validation questionnaires to assess the feasibility aspects of the material, design, and media usage. (4) Performance tests to measure the improvement of students' skills after using the developed technology.

The instrument was validated through expert judgment by content experts and educational media experts. The validity test results showed that all indicators fell into the valid category ( $V \text{ Aiken} > 0.75$ ). Reliability testing using Cronbach's Alpha produced a reliability coefficient of 0.86, indicating that the instrument is highly reliable.

Qualitative research collects data through interviews, observations, and focus group discussions to gain an in-depth understanding of respondents' views and experiences. Meanwhile, quantitative research uses questionnaires, structured observations, and experiments to gather numerical data that are analyzed statistically. Quantitative data are analyzed using t-tests (both independent and paired sample t-tests) to evaluate differences in learning outcomes before and after the use of learning media, as well as between different experimental groups. Meanwhile, qualitative descriptive analysis is applied to interpret the results of interviews and observations. Data processing is conducted with the help of the latest version of SPSS software. Statistical calculations refer to the procedures described (Sudjana, 2015).

The research model illustrates the relationship between the independent and dependent variables as follows:

$$X \rightarrow Y$$

Symbol description:

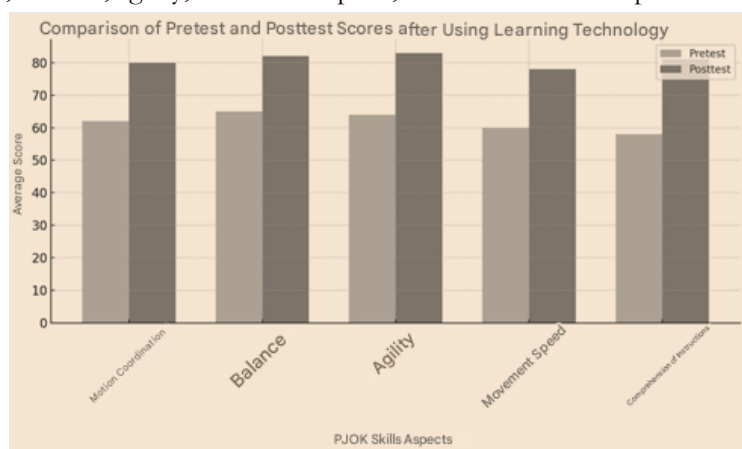
X: Developed Physical Education learning technology

Y: Learning outcomes of students' motor skills

This model illustrates that the development of learning technology (X) is expected to have a positive impact on the improvement of physical education learning outcomes (Y) in elementary school students.

### 3. Results and Discussion

This research was conducted at SD Negeri Gondangrejo 1, Karanganyar, from February to April 2025. The data collection process involved initial observation to map the learning needs, interviews with the PJOK teacher to explore obstacles and opportunities, as well as limited and operational trials of PJOK learning technology media. Learning outcomes were assessed through pretests and posttests on five aspects of motor skills, namely movement coordination, balance, agility, movement speed, and instruction comprehension.



**Figure 1.** Comparison of Pretest and Posttest Scores after the Use of Learning Technology.

The analysis results show a significant improvement in all aspects of motor skills after using technology-based learning media. The average posttest scores were higher compared to the pretest scores across all aspects. Figure 1 presents the data comparing pretest and posttest scores.

The highest increase occurred in the aspect of instruction comprehension, from an average score of 58 to 81, indicating that visual media helps students understand movement instructions more clearly and consistently. The agility aspect recorded the highest posttest score (83), suggesting that movements demonstrated through digital media are easier for students to imitate.

## Discussion

These research findings align with those by Rosyidi., et all, who found that the development of Android-based interactive learning media significantly increased students' interest and understanding of the material. The study by Matos, etc all, 2025 showed that the use of animation media can create an engaging and interactive learning environment, which in turn encourages students to participate more actively in learning activities. Furthermore, (Nugraha, 1974) explained that learning technology allows students to observe and imitate movements repeatedly without limitations of time and space.

Theoretically, these findings support multimodal and constructivist learning approaches, where simultaneous engagement of visual and auditory senses enhances the effectiveness of skill transfer (Arsyad, 2020). Technology is not only a tool but also an integral part of an adaptive learning strategy that is relevant to the needs of the digital generation.

This study reinforces the understanding that integrating learning technology in physical education can improve the quality of basic motor skills learning in elementary schools. The practical implication of these results is the availability of an effective and user-friendly learning media model for teachers, even with limited resources. These findings can also serve as a reference for education policymakers in expanding the digitalization of non-academic learning.

## 4. Conclusions

Based on the results of the conducted research, it can be concluded that the development of learning technology in the PJOK (Physical Education, Sports, and Health) subject has a positive impact on improving the learning outcomes of elementary school students, particularly in the aspect of basic motor skills. The implementation of technology-based media has been proven to help students better understand instructions and significantly enhance agility, balance, and movement coordination. This media is also considered effective and feasible for use based on expert validation and field trials. These findings address the research objective that the developed learning technology can be practically applied in PJOK lessons and contributes to the efficiency of the teaching and learning process, especially in schools with limited practical learning facilities.

Although the results show a significant effect, this study has limitations in terms of population scope, involving only one elementary school in a semi-urban area, and has not tested the sustainability of media use in the long term. Therefore, further research with a broader scope and longer implementation period is needed to determine the long-term effectiveness of the developed media. Future studies are also recommended to explore the development of media based on augmented reality or more adaptive interactive mobile applications to better meet personalized learning needs in the future.

As a practical recommendation, PJOK teachers are advised to gradually start integrating digital learning media into the teaching and learning process, especially for basic movement skills material. Educational policymakers at the school and regional government levels are also expected to support the development and provision of learning technology facilities in elementary schools as part of an inclusive and sustainable digital transformation strategy for physical education.

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