

The Influence of the Design of an E-Book-Based Basic Locomotor Movement Learning Model on Elementary School Students' Learning Outcomes

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Abstract. This study examined the effect of an e-book-based learning model on elementary school students' basic locomotor movement skills. Basic locomotor skills are essential for motor development, yet their instruction in physical education is often limited to conventional methods. A quantitative quasi-experimental design with a pretest–posttest control group was employed. The participants were 30 fourth-grade students divided into an experimental group and a control group. The experimental group received instruction using an e-book-based learning model, while the control group was taught using conventional methods. Data were collected through a locomotor skills test and observation sheets and analyzed using descriptive statistics and an independent samples t-test. The results revealed a significant difference in posttest scores between the two groups ($p < 0.05$), with higher learning gains observed in the experimental group. These findings indicate that e-book-based learning is an effective and innovative approach for improving basic locomotor skills in elementary physical education.

Keywords: Basic Locomotor Skills, E-Book, Learning Model, Physical Education, Elementary School

1 Introduction

Physical education has a vital role in fostering the comprehensive development of elementary school students, including physical, cognitive, social, and emotional aspects. At the primary school level, physical education is not solely intended to improve physical fitness but also to cultivate fundamental movement skills that serve as the foundation for lifelong participation in physical activity. Among these skills, basic locomotor movements such as walking, running, jumping, hopping, skipping, and galloping are particularly essential, as they underpin the acquisition of more advanced motor skills and sport-specific techniques [1], [2].

Studies in motor development suggest that children who achieve sufficient proficiency in basic locomotor skills are more likely to engage in physical activities and demonstrate better motor coordination as they grow older. In contrast, inadequate mastery of these skills during early childhood may limit students' involvement in physical activities and negatively affect their

confidence in movement performance. Consequently, the effective instruction of basic locomotor movements represents a fundamental responsibility for elementary physical education teachers [3], [4].

Despite their importance, the teaching of basic locomotor skills in elementary schools continues to face several challenges. Instruction is often dominated by traditional approaches, including verbal explanations and teacher-centered demonstrations, with limited use of supportive learning media. Such practices may reduce student engagement, hinder the visualization of correct movement execution, and restrict opportunities for independent learning. Furthermore, large class sizes and limited instructional time frequently constrain teachers' ability to provide repeated demonstrations and individualized feedback [5], [6].

Advancements in digital technology and the widespread availability of mobile devices have opened new possibilities for innovation in educational practice, including physical education. Digital learning media, particularly e-books, have gained attention due to their flexibility, ease of access, and ability to present content in a structured and visually engaging manner [7], [8]. E-books can incorporate illustrations, diagrams, sequential movement instructions, and practice guidelines that support students' comprehension of movement concepts. When designed appropriately, e-books function not only as learning materials but also as instructional tools that encourage self-paced and independent practice [9], [10].

In physical education settings, e-book-based learning media offer potential solutions to several limitations of conventional instruction. Visual depictions of movement techniques allow students to repeatedly observe correct forms, which is crucial for effective motor learning. In addition, the accessibility of e-books both inside and outside the classroom enables students to revisit learning content beyond scheduled lessons, thereby supporting continuity of learning and accommodating individual differences in learning pace.

Previous research has reported positive effects of digital and multimedia-based learning environments on student motivation, engagement, and learning outcomes [11]. Presenting information through a combination of text and visual elements has been shown to enhance understanding and retention. However, empirical studies specifically examining the use of e-book-based learning models in elementary physical education particularly for developing basic locomotor movement skills remain limited. Much of the existing literature focuses on cognitive subjects or sport-specific skills, leaving a gap in research related to digital media applications for fundamental movement learning at the elementary level.

Moreover, many available digital learning resources are not specifically tailored to the developmental characteristics and learning needs of elementary school students. Without appropriate instructional design, the potential advantages of e-books may not be fully realized. Therefore, there is a need to design and evaluate an instructional model that systematically integrates e-book-based media into physical education learning, ensuring alignment between learning objectives, content delivery, practice activities, and students' stages of motor development [12], [13].

Based on these considerations, this study aims to examine the effect of an e-book-based learning model on elementary school students' learning outcomes in basic locomotor movement skills [14], [15]. By evaluating the effectiveness of this approach, the study seeks to provide empirical evidence supporting the integration of digital learning media in elementary physical education and to offer practical insights for teachers in developing innovative and effective instructional practices.

2 Methods

2.1 Research Design

This study employed a quantitative research approach using a quasi-experimental method. A quasi-experimental design was selected because random assignment of participants to groups was not feasible in the natural school setting [16]. The specific design applied in this study was the pretest posttest control group design, which allows comparison of learning outcomes before and after the intervention between an experimental group and a control group. This design was chosen to identify causal relationships between the e-book-based learning model and students' basic locomotor movement learning outcomes.

2.2 Research Setting and Participants

The study was conducted at an elementary school during the regular physical education learning schedule. The participants consisted of 30 fourth-grade students, aged between 9 and 10 years. The participants were selected using purposive sampling based on the similarity of learning characteristics and physical education curriculum implementation. The students were divided into two groups: an experimental group ($n = 15$) and a control group ($n = 15$). Both groups were comparable in terms of age, gender distribution, and initial motor skill ability, as indicated by pretest results.

2.3 Learning Model and Intervention Procedure

The learning intervention was conducted over four instructional sessions, each lasting approximately 40 minutes. The experimental group was taught using an e-book-based learning model designed to support the development of basic locomotor movement skills, incorporating learning objectives, movement explanations, illustrated step-by-step instructions, and guided practice activities. Instruction was delivered through a combination of e-book-assisted explanations, teacher demonstrations, and supervised practice. The e-book functioned as both an instructional and reinforcement tool, enabling students to review movement content during and after lessons. In contrast, the control group received conventional instruction based on verbal explanations and direct demonstrations without the use of digital learning media.

2.4 Research Instruments

Two primary instruments were used to collect data in this study:

1. **Basic Locomotor Movement Skills Test** This test was designed to assess students' performance in fundamental locomotor movements, including walking, running, jumping, and hopping. Each movement was evaluated based on predefined performance criteria, such as body posture, coordination, balance, and movement accuracy. Scores were assigned using a standardized scoring rubric.
2. **Observation Sheet** An observation sheet was used to assess students' participation and engagement during learning activities. The observation focused on indicators such as active involvement, responsiveness to instructions, and consistency in performing movement tasks.

2.5 Validity and Reliability of Instruments

Content validity of the instruments was established through expert judgment involving physical education experts and elementary education practitioners. The instruments were reviewed to ensure alignment with learning objectives and developmental characteristics of elementary school students. Reliability testing was conducted using inter-rater reliability, with two observers independently assessing student performance. The reliability coefficient indicated a high level of agreement between raters, confirming the consistency of the measurement results.

2.6 Data Collection Procedure

Data collection was carried out in three stages. First, a pretest was administered to both the experimental and control groups to measure students' initial basic locomotor movement skills. Second, the learning intervention was implemented according to the assigned instructional methods for each group. Third, a posttest was administered after the completion of the intervention to measure students' learning outcomes. Observation data were collected concurrently during each learning session.

2.7 Data Analysis Techniques

Data analysis involved both descriptive and inferential statistical techniques. Descriptive statistics were used to calculate mean scores, standard deviations, and gain scores for each group. Inferential analysis was conducted using an independent samples t-test to compare posttest results between the experimental and control groups. Prior to hypothesis testing, assumptions of normality and homogeneity were examined using the Kolmogorov Smirnov test and Levene's test, respectively. All statistical analyses were conducted at a significance level of 0.05.

3 Results and Discussion

This section presents the results of data analysis obtained from the pretest and posttest measurements of students' basic locomotor movement skills in both experimental and control groups. The results are organized into descriptive statistics, assumption testing, inferential analysis, and learning gain analysis to comprehensively describe the effectiveness of the e-book-based learning model.

3.1. Descriptive Analysis of Learning Outcomes

Descriptive statistical analysis was conducted to determine the initial and final learning outcomes of students in both groups. The pretest results indicate that the experimental and control groups had relatively similar baseline abilities in basic locomotor movement skills prior to the intervention.

Table 1. Descriptive Statistics Of-Pretest and Posttest Scores

Group	Test	Mean	SD	Min	Max
Experimental	Pretest	62.40	6.12	52	72
	Posttest	82.67	5.48	74	92
Control	Pretest	61.87	5.94	50	70
	Posttest	72.13	6.01	62	84

Table 1 shows a substantial increase in posttest scores for both groups. However, the experimental group demonstrated a noticeably higher mean score compared to the control group after the learning intervention. The narrower standard deviation in the experimental group also indicates more consistent learning outcomes among students.

3.2. Learning Gain Analysis

To further examine the magnitude of learning improvement, gain scores were calculated by subtracting pretest scores from posttest scores.

Table 2. Gain Score Comparison Between Groups

Group	Mean Gain	SD Gain	Gain Category
Experimental	20.27	4.86	High
Control	10.26	4.21	Moderate

The gain score analysis indicates that the experimental group achieved a high level of improvement, while the control group showed only moderate improvement. This finding suggests that the e-book-based learning model contributed substantially to students' mastery of basic locomotor movement skills.

3.3. Assumption Testing

Prior to conducting inferential statistical tests, assumption testing was performed to ensure the validity of the analysis.

1. Normality Test the Kolmogorov Smirnov test showed that the pretest and posttest data for both groups were normally distributed ($p > 0.05$).
2. Homogeneity Test Levene's test indicated that the variances of posttest scores between the experimental and control groups were homogeneous ($p > 0.05$).

These results confirm that the data met the assumptions required for parametric testing.

3.4. Inferential Statistical Analysis

An independent samples t-test was conducted to compare posttest scores between the experimental and control groups.

Table 3. Independent Samples T-Test Results

Variable	T-Value	Df	Sig. (p)
Learning Outcomes	3.42	28	0.002

The results indicate a statistically significant difference between the posttest scores of the experimental and control groups ($p = 0.002 < 0.05$). This finding confirms that the e-book-based learning model had a significant effect on improving students' basic locomotor movement skills

3.5. Effect Size Analysis

To determine the magnitude of the treatment effect, Cohen's d was calculated.

Table 4. Effect Size (Cohen's D)

Group Comparison	Cohen's d	Effect Category
Experimental vs. Control	1.25	Large

The effect size value of 1.25 indicates a large effect, demonstrating that the e-book-based learning model had a strong practical impact on students' learning outcomes.

3.6. Graphical Representation of Results

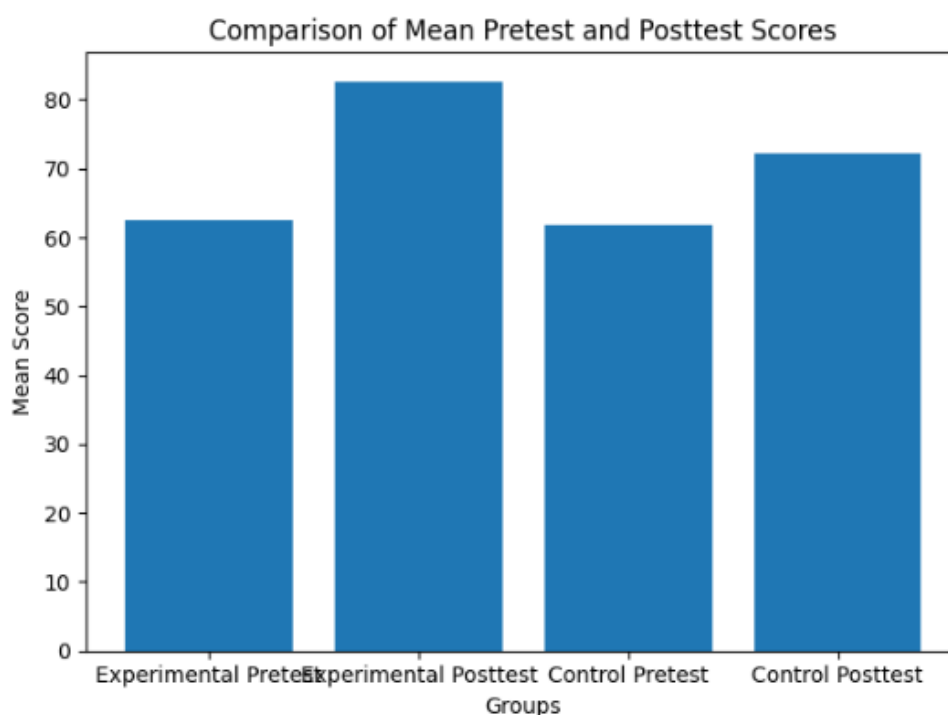


Fig. 1. Comparison of Mean Pretest and Posttest Scores

The graphical representation illustrates that both groups experienced improvements in learning outcomes. However, the experimental group showed a steeper increase from pretest to posttest compared to the control group. This visual trend supports the statistical findings and highlights

the effectiveness of the e-book-based learning model in enhancing basic locomotor movement learning.

3.7. Summary of Research Findings

Based on the results obtained, several key findings can be summarized as follows:

1. Both experimental and control groups demonstrated improved basic locomotor movement skills after instruction.
2. The experimental group showed significantly higher posttest scores than the control group.
3. Gain score and effect size analyses revealed that the e-book-based learning model produced a high and meaningful improvement in learning outcomes.
4. The results provide strong empirical evidence supporting the integration of e-book based instructional media in elementary physical education learning.

4 Discussion

The findings of this study indicate that the e-book-based learning model design had a significant and positive impact on elementary school students' basic locomotor movement skills. Students in the experimental group demonstrated markedly greater improvements in posttest scores than those in the control group, as shown in Fig. 1. This result confirms that the incorporation of e-book-based instructional media into physical education effectively enhances students' mastery of fundamental locomotor skills.

The effectiveness of the learning model can be attributed to the clear, systematic, and visually supported presentation of movement content within the e-book. Mastery of basic locomotor movements requires an understanding of correct posture, coordination, and movement sequences. Through detailed illustrations and structured step-by-step explanations, the e-book enabled students to repeatedly observe and internalize proper movement execution. Such repeated visual exposure is particularly beneficial during the cognitive and associative stages of motor learning, where visual guidance plays a crucial role in shaping accurate movement patterns.

This interpretation is further supported by the gain score analysis. The experimental group achieved a high gain category, whereas the control group showed only moderate improvement. These results suggest that conventional instructional approaches alone may not sufficiently facilitate optimal motor skill development. In contrast, the e-book-based model promoted more consistent practice and deeper conceptual understanding, leading to superior learning outcomes. Moreover, the large effect size observed in this study indicates that the differences between groups were not only statistically significant but also educationally meaningful.

Student engagement also emerged as a key contributing factor. Observational findings revealed higher levels of active participation among students in the experimental group. The digital format of the e-book increased students' interest and motivation, as it aligned well with their familiarity with technology-based learning. Enhanced engagement is closely associated with improved outcomes in physical education, where active involvement and repeated practice are essential for skill acquisition.

These results are in line with multimedia learning theory, which posits that learning is more effective when information is delivered through a combination of visual and verbal modalities. By integrating textual explanations with movement illustrations, the e-book helped reduce cognitive load and directed students' attention toward essential movement elements. This multimodal approach supported better comprehension, retention, and practical performance of locomotor skills.

From an instructional standpoint, the e-book-based learning model also provided pedagogical benefits for teachers. The e-book served as a supportive instructional resource that complemented teacher demonstrations and minimized the need for repeated verbal instruction. Consequently, teachers were able to devote more time to monitoring student performance and delivering individualized feedback, which likely contributed to the improved consistency of skill execution observed in the experimental group.

Despite these encouraging results, several limitations should be acknowledged. The study involved a relatively small sample from a single elementary school, which may limit the generalizability of the findings. In addition, the duration of the intervention was relatively short, and long-term retention of locomotor skills was not assessed. Future research should include larger and more diverse samples, extended intervention periods, and follow up evaluations to examine the sustainability of learning effects.

In conclusion, this study provides strong empirical support for the integration of e-book-based learning models in elementary physical education. The results demonstrate that structured digital learning media can significantly enhance student engagement, understanding, and motor skill development. Therefore, e-book-based instructional models represent a promising and innovative approach for supporting fundamental movement learning in elementary school settings.

5 Conclusion

This study concludes that the e-book-based learning model design has a significant positive effect on improving elementary school students' basic locomotor movement skills. The quasi-experimental results demonstrate that students who learned through the e-book-based model achieved higher posttest scores than those taught using conventional instructional methods. These findings indicate that integrating digital learning media into physical education enhances learning effectiveness and supports motor skill development. Therefore, e-book-based learning models can be considered a viable and innovative instructional approach for improving basic locomotor skills in elementary physical education settings.

References.

- [1] N. Nasrullah, I. Irfan, And A. Ardiansyah, "Project Based Learning Based On Basic Locomotor Movement Skills In Physical Education Learning," *Indonesian Journal Of Physical Education And Sport Science*, Vol. 5, No. 4, Dec. 2025, Doi: 10.52188/Ijpe. V5i4.1458.
- [2] F. Sidik Siregar, A. Siregar, R. Sahputera Sagala, A. N. Abady, E. Faridah, And F. S. Siregar, "Developing Interactive Multimedia-Based Locomotor Basic Motion Teaching

- Materials In The Physical Education Course,” *Jurnal Pendidikan*, Vol. 15, No. 4, Pp. 6416–6424, 2023, Doi: 10.35445/Alishlah.V15i4.3842.
- [3] H. Hartati, N. W. Kusnanik, B. Hardiyono, And Y. Yardinal, “Basic Locomotor Learning Model: New Approach Using Small Games Competition In Elementary School,” *Physical Education Theory And Methodology*, Vol. 22, No. 4, Pp. 537–543, Dec. 2022, Doi: 10.17309/Tmfv.2022.4.12.
 - [4] C. Yuwono, T. Rahayu, S. Sulaiman, And T. Rustiadi, “Increasing Students’ Gymnastic And Rhythmic Activities Through Locomotor, Non-Locomotor, And Manipulative Movement Patterns,” *International Journal Of Education In Mathematics, Science And Technology*, Vol. 10, No. 1, Pp. 57–73, 2021, Doi: 10.46328/Ijemst.2164.
 - [5] T. Ramadhani, M. Arif, M. Nuryansah Nugraha, K. Kunci, M. Pembelajaran, And G. Dasar Lokomotor, “Learning Model Development Locomotor For Student Elementary School,” *Informatics Media Journal [Jumin]*, Vol. 5, No. 2, Pp. 126–32, Jun. 2024, Accessed: Jan. 08, 2026. [Online]. Available: [Http://Ejournal.Sisfokomtek.Org/Index.Php/Jumin](http://Ejournal.Sisfokomtek.Org/Index.Php/Jumin)
 - [6] I. Verawati, R. Dewi, B. S. Pane, And N. Nurkadri, “The Effect Of Locomotor Games On Gross Motor Ability Of Elementary School Students,” *Kinestetik : Jurnal Ilmiah Pendidikan Jasmani*, Vol. 6, No. 2, Pp. 262–270, Jun. 2022, Doi: 10.33369/Jk.V6i2.21632.
 - [7] H. Alhim Dos Santos, M. Herlinda Dos Santos, N. Anggara, E. Pratiwi, And I. Kalimantan Mab, “Optimizing Learning Through Gamification In Digital Learning To Improve Physical Education Learning Outcomes”, Doi: 10.31851/Hon.V7i1.18280.
 - [8] Ferawati, “Digital Pedagogical Needs In Physical Education: Mapping Teacher And Student Perspectives On Multimedia Gymnastics Learning,” *International Seminar On Humanity, Education And Language*, Vol. 1, No. 1, Pp. 1–9, Jun. 2025, Doi: 10.21009/Ishel.V1i1.56721.
 - [9] Y. Sumitro Purba And O. Unju Subandi, “Basic Motion Learning Model Locomotor Based On The Iv Elementary School Student Play Approach,” *Jupe : Jurnal Pendidikan Mandala*, Vol. 10, No. 3, Pp. 1060–1075, Sep. 2025, [Online]. Available: [Http://Ejournal.Mandalanursa.Org/Index.Php/Jupe/Index](http://Ejournal.Mandalanursa.Org/Index.Php/Jupe/Index)
 - [10] D. Endriani, I. Akhmad, And B. Daulay, “Development Of E-Book Based Volleyball Learning Model,” *Kinestetik : Jurnal Ilmiah Pendidikan Jasmani*, Vol. 6, No. 2, Pp. 363–370, Jun. 2022, Doi: 10.33369/Jk.V6i2.21915.
 - [11] L. T. H. Wiguno, A. W. Kurniawan, H. Wahyudi, And A. H. Aqsha, “Development Of Interactive Multimedia-Based Physical Fitness Learning Media In Junior High School,” *Jossae (Journal Of Sport Science And Education)*, Vol. 8, No. 1, Pp. 54–68, Jun. 2023, Doi: 10.26740/Jossae.V8n1.P54-68.
 - [12] I. A. Budiman *Et Al.*, “Motor Learning Development In Children: A Bibliometric Analysis,” *International Journal Of Human Movement And Sports Sciences*, Vol. 13, No. 2, Pp. 479–489, Apr. 2025, Doi: 10.13189/Saj.2025.130226.
 - [13] A. G. Lemos, E. L. Avigo, And J. A. Barela, “Physical Education In Kindergarten Promotes Fundamental Motor Skill Development,” *Advances In Physical Education*, Vol. 02, No. 01, Pp. 17–21, 2012, Doi: 10.4236/Ape.2012.21003.
 - [14] N. Zeng, M. Ayyub, H. Sun, X. Wen, P. Xiang, And Z. Gao, “Effects Of Physical Activity On Motor Skills And Cognitive Development In Early Childhood: A Systematic Review,” 2017, *Hindawi Limited*. Doi: 10.1155/2017/2760716.

- [15] B. Abdullah, S. Amri, K. L. Yee, And B. A. Samah, "The Impact Of Traditional Gaines On The Gross Motor Skill Development Of An Early Childhood," *Social Sciences (Pakistan)*, Vol. 8, No. 6, 2013, Doi: 10.3923/Sscience.2013.590.595.
- [16] Lily Alamanda, "Enhancing Student Activity Through Learninggamification: A Quantitative Analysis," *Indonesian Journal Of Islamic Studies*, Vol. 12, No. 2, Pp. 6–15, 2024, [Online]. Available: <https://ijis.umsida.ac.id>,