

Development of Rhythmic Gymnastics Model for Early Childhood Movement Activities

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*Authors' Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection

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Received: 31 Jul 2025 **Accepted:** 29 Apr 2026 **Published:** 30 Apr 2026

Abstract

Motor development in early childhood (ages 4–6 years) is fundamental to children's physical, cognitive, and socio-emotional growth. However, structured and developmentally appropriate movement programs in Early Childhood Education remain limited. This study aimed to develop and evaluate a rhythmic gymnastics model tailored to young learners using the ADDIE model. A research and development approach was employed, including needs analysis, model design based on music and fundamental movements, prototype development, expert validation, and field testing. Nine experts assessed the model using a 4-point Likert scale covering content, movement design, musical suitability, and practicality. Field trials involved 33 children across three early childhood institutions, supported by observations and teacher feedback. The results showed high validity, with Aiken's V values of 0.8074 (complexity), 0.7778 (suitability), and 0.6568 (motivation). Implementation findings indicated active child engagement and positive teacher responses regarding ease of use and contextual relevance. Overall, the model is valid, practical, and effective in supporting holistic motor development, offering a feasible approach to enriching movement-based learning in early childhood education.

Keywords: ADDIE model; early childhood education; motor development; movement-based learning; rhythmic gymnastic

1. Introduction

Early childhood (0–6 years) is a critical phase in the human life cycle, characterized by rapid and multidimensional development in various physical, motor, cognitive, social, and emotional areas. International frameworks such as UNICEF emphasize this period as a foundation for lifelong learning and well-being. Developmental experts often refer to this stage as the golden age, in which children exhibit high neural plasticity and are responsive to environmental stimuli (Souto et al., 2020). As a result, educational interventions in Early Childhood Education must be intentionally designed to support holistic and integrated development.

One promising approach to encouraging such development is through structured and enjoyable physical activity, specifically rhythmic gymnastics. These activities integrate coordinated body movements with musical rhythms, allowing children to simultaneously develop gross motor skills, coordination, rhythm sensitivity, emotional expression, and self-regulation (Escolano-Pérez et al., 2020; Agache & Vizitiu, 2022). In the context of early childhood education, rhythmic movement activities are closely aligned with the principles of Developmentally Appropriate Practice, which

emphasizes active engagement, meaningful repetition, and emotionally rich learning experiences (Russo et al., 2025; Yanko & Yap, 2020). In addition, emerging evidence suggests that rhythm-based multisensory motor activity may improve neural connectivity associated with executive function and emotional regulation (Nave et al., 2024).

Despite these advantages, the implementation of rhythmic gymnastics in the early childhood education environment in Indonesia is still not optimal. Initial observations in several early childhood education institutions in Padang show that existing practices are often monotonous, repetitive, and not in harmony with children's developmental interests and needs. Instructional approaches often rely on conventional movement patterns and non-contextual musical accompaniment, leading to reduced engagement and limited developmental impact. In addition, many educators lack formal training in physical education or child-centered movement design, thus creating a gap between pedagogical intent and practice.

These challenges highlight the need for systematic, valid, and contextually relevant rhythmic gymnastics models tailored to early childhood characteristics. Effective program design must integrate children's developmental needs, engaging learning media, and ease of use for teachers, while remaining grounded in a robust learning design framework. Previous studies have shown that well-designed and enjoyable physical activity interventions can significantly improve children's cognitive and affective engagement, as well as the development of motor skills (Zhou et al., 2025; Akbas Aliyev & Ünal, 2025).

Therefore, the study adopts the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model to guide the development of rhythmic gymnastics models. This framework allows for a systematic process that includes needs analysis, model design, product development, iterative implementation, and comprehensive evaluation. Validation engages experts in the field of early childhood education, physical education academics, and experienced practitioners to ensure content validity, practicality, and contextual relevance.

The purpose of this study is to develop and evaluate a rhythmic gymnastics model that is appropriate for child development, interesting, and feasible to be implemented in an early childhood education environment. The findings are expected to provide innovative and evidence-based solutions to improve movement-based learning and support holistic motor development in early childhood.

2. Method

This study employed a research and development (R&D) design using the ADDIE model, which consists of five systematic stages: analysis, design, development, implementation, and evaluation. The ADDIE model was selected because it provides a structured and iterative framework for developing educational products that are responsive to user needs and context. In this study, the model was used to develop and validate a children's song-based rhythmic gymnastics program aimed at improving motor activity in early childhood education (PAUD).

The participants consisted of two groups. First, the product trial involved 33 children aged 4–6 years from three early childhood education (PAUD) institutions in Padang City. The participants were selected using purposive sampling, based on criteria including active participation in physical activities, age suitability, and institutional willingness to support the research implementation. Second, a panel of 9 expert validators was involved, comprising early childhood education (PAUD) lecturers, child physical education specialists, and experienced kindergarten practitioners. These experts were selected based on their academic qualifications and professional experience relevant to early childhood learning and motor development.

The data collection techniques included both quantitative and qualitative approaches. Quantitative data were obtained using a validation questionnaire based on a 4-point Likert scale, which assessed several aspects of the developed model, including content relevance, movement design, suitability of music, and practicality of implementation. Qualitative data were collected through structured observations, teacher group discussions (FGDs), and field notes during the implementation phase to capture children's engagement, teacher feedback, and contextual challenges.

The development procedure was conducted over a period of three months. The analysis stage involved identifying needs through preliminary observations and discussions with teachers. The design stage included drafting movement sequences and selecting appropriate children's songs. During the development stage, a prototype of the rhythmic gymnastics model was created and validated by experts. The implementation stage involved both limited and wider field trials in selected PAUD institutions. Finally, the evaluation stage focused on revising and refining the product based on quantitative validation results and qualitative feedback.

For data analysis, a combination of quantitative and qualitative descriptive techniques was applied. Quantitative data from expert validation were analyzed using Aiken's V formula to determine content validity:

$$V = \frac{\sum s}{n(c - 1)}$$

where $\sum s$ represents the sum of scores assigned by experts (adjusted by subtracting the lowest score), n is the number of validators, and c is the number of rating scale categories (4 points). The interpretation criteria were as follows: $V < 0.60$ (low validity), $0.60 \leq V \leq 0.80$ (valid), and $V > 0.80$ (very valid).

To assess the consistency of expert ratings, the standard deviation (SD) was calculated using the formula:

$$SD = \sqrt{\frac{\sum (X_i - \bar{X})^2}{n}}$$

where X_i represents individual scores, \bar{X} is the mean score, and n is the number of validators.

The results of the Aiken's V analysis indicated that the developed model achieved a high level of validity across assessed aspects, including movement complexity ($V = 0.8074$), movement-music suitability ($V = 0.7778$), and child motivation ($V = 0.6567$). These findings suggest that the rhythmic gymnastics model is valid, feasible, and applicable for supporting motor learning activities in early childhood education.

Qualitative data were analyzed through thematic interpretation to support product refinement, focusing on usability, engagement, and implementation feasibility in real classroom settings.

3. Result

The assessment of the feasibility of the rhythmic gymnastics model was carried out through validation by nine experts using a 4-point Likert scale-based evaluation instrument. Validation includes three main components of the product, namely the level of movement complexity, the suitability of

movement and music, and student motivation. The results of quantitative analysis using the Aiken's V technique showed that all product components met the validity criteria.

Table 1. Assessment of rhythmic gymnastics model components

| Assessment Components | (N) | Item | Σ | \bar{x} | Σs | $\bar{x} s$ | V | Category |
|-----------------------|-----|------|----------|-----------|------------|-------------|--------|------------|
| Complexity | 9 | 1-15 | 462 | 51.33 | 327 | 36.33 | 0.8074 | Very Valid |
| Compliance | 9 | 1-15 | 431 | 47.44 | 296 | 32.94 | 0.7778 | Valid |
| Motivation | 9 | 1-15 | 401 | 44.55 | 266 | 29.55 | 0.6567 | Valid |

The interpretation of the results shows that the three components of the rhythmic gymnastics assessment have high validity. The movement complexity component obtained the highest score because the validator assessed that the movement had a structure that was in accordance with the child's physical development level and safety principles. The movement and rhythm components also showed a valid level of validity, although several experts provided input for adjustments to the movement and tempo of the music, especially to adjust the tempo to the child's movement abilities. The motivation component is in the valid category because the movement gives children space to express themselves so that it is fun for children. Overall, the results of expert validation show that the developed rhythmic gymnastics model is feasible to be implemented in rhythmic movement learning for early childhood.

Qualitative data were obtained from program trial observations and semi-structured interviews. The findings showed that the developed rhythmic gymnastics model was easy to use, had a clear movement flow, and was interesting for children.

Table 2. Qualitative data

| Focus of Observation | Key Findings |
|--------------------------------|---|
| Student response | Children are actively involved, show happy expressions and are able to follow the movements well. |
| Practicality of implementation | Teachers feel that the product is easy to use because the movements are in accordance with the students' motor abilities. |
| Development suggestions | Additional media online so it can be accessed anywhere easily |

The results of quantitative data validation and qualitative findings show consistency of findings. Expert validation through Aiken's V analysis shows that all assessment components have a high level of validity. This indicates that the rhythmic movement design structure, music, and fun elements have met instructional standards that are in accordance with the characteristics of early childhood development. Qualitative findings from observations of implementation and teacher responses provide empirical support for the effectiveness of the model implementation. Teachers stated that this model is easy to use, movement instructions are systematically arranged, and students show positive responses characterized by enthusiasm, active involvement, and the ability to follow the movements well. This synthesis indicates that the developed rhythmic gymnastics model is theoretically feasible, but also relevant to be applied in PAUD environments. The integration of quantitative and qualitative data strengthens the claim that this product can be a learning innovation that supports the development of children's gross motor skills through rhythmic gymnastics activities. The following is the barcode of the rhythmic movement product that was developed.



Figure 1. The Barcode of The Product

4. Discussion

Children's motor development emerges from dynamic interactions among individual characteristics, family context, and the broader social environment in which the child is embedded. Contemporary developmental perspectives emphasize that early motor competence is not solely biologically driven but is significantly shaped by relational and contextual factors, including adult support and opportunities for structured practice. Positive interactions with teachers and parents contribute to children's confidence, motivation, and persistence in physical activities, thereby reinforcing early movement habits and competence (Keshavarzi et al., 2024; Su et al., 2025). In this context, the present study demonstrates that a systematically designed rhythmic gymnastics model can function as a mediating tool that strengthens these interactions by providing structured, enjoyable, and socially engaging movement experiences. This aligns with ecological and socio-constructivist theories, which underscore the role of guided participation in skill acquisition (Bronfenbrenner, 1979; Vygotsky, 1978).

The findings further indicate that the developed model, grounded in the ADDIE model, achieved high validity across multiple dimensions, including movement complexity, suitability, and motivational value. This supports the argument that systematic instructional design frameworks can effectively be adapted for early childhood contexts when aligned with developmental characteristics. Previous studies have highlighted that well-structured instructional design enhances learning outcomes by ensuring coherence between objectives, content, and learner needs (Branch, 2009; Morrison et al., 2019). For instance, Hidalgo et al. (2017) demonstrated that developmentally aligned instructional planning significantly improves engagement and skill acquisition in early learners. Similarly, Scott et al. (2020) found that integrating learner-centered design principles increases instructional effectiveness in movement-based learning.

Empirical observations from the implementation phase reveal that children exhibited high levels of engagement, enjoyment, and concentration during rhythmic gymnastics sessions. These findings are consistent with research suggesting that music-integrated physical activities enhance children's attention, emotional involvement, and intrinsic motivation (Persici et al., 2023; Zhang, Kim Geok, et al., 2024). Neuroscientific evidence further supports this phenomenon, indicating that rhythmic and musical stimuli activate multiple brain regions simultaneously, thereby enhancing sensorimotor integration and executive functioning (Fiveash et al., 2025). Such multisensory engagement is particularly beneficial during early childhood, when neural plasticity is at its peak.

A notable contribution of this study lies in addressing a practical gap in Early Childhood Education, particularly the limited pedagogical support available for teachers without a background in physical education. The developed model offers clear, structured, and accessible movement guidelines, enabling teachers to implement physical activities effectively without requiring extensive prior training. This finding is consistent with Ji and Li (2025), who reported that simplified instructional media significantly improve teacher confidence and instructional quality in early childhood settings. By

reducing instructional complexity while maintaining pedagogical integrity, the model enhances both feasibility and scalability.

From a socio-emotional perspective, rhythmic gymnastics activities conducted in group settings promote essential interpersonal skills, including cooperation, turn-taking, and adherence to shared rules. These findings corroborate previous research demonstrating that group-based physical activities contribute to social competence, emotional regulation, and sustained attention in young children (Inacio et al., 2023; Williams et al., 2023). For example, Inacio et al. (2023) found that collaborative movement activities significantly enhance peer interaction and emotional understanding. Thus, rhythmic gymnastics serves not only as a motor learning tool but also as a medium for holistic child development.

Physiologically, the structured rhythmic movements incorporated in the model provide age-appropriate stimulation that supports balance, coordination, muscular strength, and cardiovascular endurance. Previous studies have demonstrated that early engagement in rhythmic and coordinated physical activities contributes to improved posture, core stability, and long-term physical fitness (Kim et al., 2024; Zhao et al., 2024). For instance, Kim et al. (2024) reported that rhythm-based exercise programs significantly improve children's balance and motor coordination. These findings reinforce the role of rhythmic gymnastics as a comprehensive physical activity that integrates multiple dimensions of motor development.

Despite the positive outcomes, feedback from teachers highlights the importance of integrating multimedia resources, such as instructional videos, to enhance usability and understanding. This aligns with research indicating that digital and visual media can significantly improve instructional clarity and learner engagement in early childhood education (Vonthron et al., 2024). Additionally, parental involvement emerged as a critical factor in sustaining children's physical activity beyond the classroom. León Méndez et al. (2023) found that active parental participation strengthens children's movement habits and promotes healthier lifestyles. Therefore, the inclusion of parent-oriented guidance modules represents a strategic extension of the model.

Theoretically, this study contributes to the growing body of literature by demonstrating that structured instructional design approaches can be effectively integrated into early childhood physical education when adapted to developmental needs. As noted by Yanko and Yap (2020), the success of instructional interventions is highly dependent on contextual relevance and learner-centered design. Practically, the developed model offers a scalable and adaptable framework for educators and curriculum developers seeking to enhance movement-based learning. Furthermore, its participatory development process—incorporating expert validation, teacher feedback, and child engagement—reflects a user-centered design paradigm that ensures both validity and real-world applicability (Li et al., 2023; Ribeiro da Silva et al., 2024).

Conclusion and Recommendation

In conclusion, this study demonstrates that a rhythmic gymnastics model developed through the ADDIE model is valid, practical, and effective in supporting holistic motor development in early childhood. The model not only enhances children's engagement, coordination, and motivation in movement activities but also provides a structured and accessible instructional framework for teachers in Early Childhood Education settings. Its alignment with developmental principles and contextual classroom needs confirms its relevance as an innovative learning medium. Based on these findings, it is recommended that this model be integrated into early childhood curricula and teacher training programs to strengthen movement-based learning practices. Future research should expand implementation across diverse educational contexts, incorporate digital and multimedia supports such

as video-based instruction, and explore long-term impacts on children's motor, cognitive, and socio-emotional development, as well as the role of parental involvement in sustaining active lifestyles.

Acknowledgement

The authors would like to express their sincere gratitude to all parties who contributed to this study. Special appreciation is extended to the early childhood education experts, physical education academics, and practitioners who participated in the validation process and provided valuable insights to improve the quality of the developed model. The authors also thank the teachers and children from participating Early Childhood Education institutions for their cooperation and active involvement during the implementation phase. Their contributions were essential in ensuring the practicality and contextual relevance of the rhythmic gymnastics model.

Conflict of interest

The authors declare no conflict of interest of this study.

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