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Strengthening Early Childhood Motor Development through Structured Educational Play and Outdoor Learning

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Abstract

Background: Motor development is a fundamental aspect of early childhood growth, influencing physical coordination, cognitive processes, and social interaction. However, in many early childhood education settings, particularly in geographically constrained areas, motor stimulation activities are often limited, less structured, and lack variation in instructional strategies.

Aims: This community service initiative aims to strengthen early childhood motor development through structured educational play and outdoor learning activities.

Methods: This program employed a participatory educational approach through direct engagement with teachers and children in an early childhood education institution. The implementation was carried out in three stages: initial observation and needs identification, structured intervention through educational play and outdoor activities, and reflective evaluation. The activities included movement-based exercises, fine motor skill stimulation, coordination games, and outdoor learning tasks. Data were collected through observation, documentation, and informal interviews, and analyzed using descriptive qualitative techniques.

Results: The results indicate a significant improvement in children's participation and motor engagement during learning activities. Children demonstrated better coordination, balance, and fine motor control through activities such as bead stringing, geometric jumping, and coordinated movement exercises. The integration of outdoor learning also enhanced children's enthusiasm, interaction, and active involvement in the learning process.

Conclusion: Structured educational play combined with outdoor learning effectively strengthens early childhood motor development. The implementation of this community service initiative provides a practical and applicable model for enhancing motor stimulation in early childhood education settings, particularly in areas with limited learning resources.

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INTRODUCTION

Early childhood education represents a critical phase that significantly shapes children's cognitive, social, and physical development trajectories (Shonkoff et al., 2021; Yoshikawa et al., 2022). Within this developmental stage, motor development plays a central role in enabling children to explore their environment and engage in meaningful learning experiences (Adolph & Hoch, 2022; Robinson et al., 2022). The development of motor competence has been associated with improved executive function, self-regulation, and early academic readiness (McClelland et al., 2022; Cameron et al., 2023). Contemporary educational perspectives emphasize the integration of movement-based activities into early learning to support holistic development (OECD, 2023; UNESCO, 2022). Motor skills are broadly categorized into fine and gross motor domains, both of which contribute to coordinated movement and task performance (Logan et al., 2022; Barnett et al., 2022). Insufficient stimulation of motor skills may lead to developmental delays and reduced classroom engagement (Hulteen et al., 2022; Lubans et al., 2023). These considerations highlight the importance of structured motor development interventions in early childhood education.

Motor development is influenced by the interaction of biological maturation, environmental factors, and learning experiences within educational settings (Clark & Metcalfe, 2021; Haywood & Getchell, 2022). Fine motor skills support precision tasks such as writing and object manipulation, while gross motor skills facilitate locomotion, balance, and spatial awareness (Goodway et al., 2022; Robinson et al., 2023). The integration of these motor domains supports children's autonomy and participation in structured learning activities (Cameron et al., 2023; McClelland et al., 2022). Learning environments that provide varied and active movement opportunities tend to produce more optimal developmental outcomes (Barnett et al., 2022; Logan et al., 2022). However, the effectiveness of motor development is strongly influenced by the quality of instructional design and the availability of appropriate learning media (OECD, 2023; UNESCO, 2022). Limited variation in teaching strategies may restrict children's opportunities to develop motor competence effectively (Desimone & Garet, 2021; Egert et al., 2022). These conditions indicate the need for innovative and adaptive learning approaches.

Recent developments in early childhood pedagogy emphasize the importance of active and experiential learning approaches in supporting motor development (Kolb & Kolb, 2021; Zosh et al., 2022). Experiential learning allows children to directly engage in physical activities that enhance coordination and movement control (Gibson et al., 2022; Mygind et al., 2022). The integration of movement into learning processes has been shown to improve attention, motivation, and participation (Diamond & Ling, 2021; Engel et al., 2022). Active learning approaches also promote social interaction through collaborative and interactive activities (Hirsh-Pasek et al., 2022; Weisberg et al., 2022). The relationship between physical activity and cognitive development further strengthens the relevance of movement-based

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learning strategies (Tomporowski et al., 2021; Vazou et al., 2022). Learning environments that integrate experiential and movement-based approaches provide more meaningful and engaging learning experiences (Becker et al., 2023; Marchant et al., 2022). These findings suggest that structured and engaging learning designs are essential in early childhood education.

Despite these theoretical advancements, the implementation of motor development activities in early childhood institutions often remains limited in practice (Nilsen et al., 2021; Palmer et al., 2022). Learning activities are frequently dominated by sedentary routines that reduce opportunities for active engagement (Webster et al., 2022; True et al., 2023). This condition is more pronounced in institutions with limited access to learning resources and pedagogical innovation (Slot et al., 2023; Sheridan et al., 2022). The absence of structured activities contributes to inconsistencies in children's motor development (Darling-Hammond et al., 2022; Avalos, 2021). Environmental constraints also limit the utilization of outdoor spaces as learning environments (Fjørtoft, 2022; Ernst, 2021). These challenges highlight the importance of adaptive and context-sensitive educational interventions. The development of practical and applicable learning strategies becomes increasingly necessary.

Educational play has been widely recognized as an effective approach for enhancing learning outcomes in early childhood (Zosh et al., 2022; Hirsh-Pasek et al., 2022). Play-based learning encourages exploration, creativity, and interaction within meaningful learning contexts (Weisberg et al., 2022; Engel et al., 2022). Structured play activities provide opportunities for children to develop both fine and gross motor skills in an integrated manner (Gibson et al., 2022; Becker et al., 2023). Educational play also supports intrinsic motivation, which is essential for sustained engagement in learning (Ryan & Deci, 2021; Diamond & Ling, 2021). The integration of play into formal learning environments enhances the overall quality of educational experiences (Marchant et al., 2022; Tomporowski et al., 2021). However, the effectiveness of play-based learning depends on its design and implementation (Vazou et al., 2022; Mygind et al., 2022). These considerations emphasize the importance of structured educational play.

Outdoor learning provides additional opportunities for children to engage in physical activity and environmental exploration (Fjørtoft, 2022; Ernst, 2021). Outdoor environments allow children to experience diverse movement patterns that cannot be replicated in indoor settings (Mygind et al., 2022; Gibson et al., 2022). Exposure to natural environments has been associated with improved physical health and psychological well-being (Chawla, 2021; Gray et al., 2022). Outdoor activities also promote social interaction and collaborative learning (Marchant et al., 2022; Becker et al., 2023). The flexibility of outdoor settings supports creativity and exploratory learning processes (Dankiw et al., 2021; Brussoni et al., 2022). Despite these advantages, outdoor learning remains underutilized in many early childhood

institutions (Ernst, 2021; Fjørtoft, 2022). This condition highlights the need for structured integration of outdoor learning.

The combination of educational play and outdoor learning offers a comprehensive approach to supporting motor development (Zosh et al., 2022; Gibson et al., 2022). This integration enables both structured and exploratory learning experiences (Mygind et al., 2022; Becker et al., 2023). Children are provided with opportunities to develop motor skills through engaging and meaningful activities (Gray et al., 2022; Chawla, 2021). Structured activities ensure that learning objectives are achieved effectively (Kolb & Kolb, 2021; Marchant et al., 2022). At the same time, outdoor environments enhance authenticity in learning experiences (Dankiw et al., 2021; Brussoni et al., 2022). This approach aligns with holistic educational paradigms (OECD, 2023; UNESCO, 2022). Such integration reflects a responsive and innovative strategy in early childhood education.

Field observations conducted on 19 November 2024 at Raudhatul Athfal (RA) Trikora, Bitung City revealed limitations in the implementation of motor development activities . Learning activities were predominantly conducted indoors with minimal variation in instructional strategies . The availability of educational media supporting motor stimulation was limited . Children's engagement in movement-based activities was relatively low due to limited structured opportunities . These conditions indicate a discrepancy between expected practices and actual implementation. The need for structured and engaging interventions becomes increasingly evident. Contextual adaptation is essential in designing effective learning strategies.

The implementation of structured activities integrating educational play and outdoor learning reflects an adaptive response to these conditions. This approach emphasizes direct engagement and experiential learning processes. The use of simple and accessible learning media supports feasibility in resource-limited settings. Active participation enhances learning effectiveness and engagement. The integration of multiple strategies creates dynamic learning environments. Teacher involvement also plays a critical role in facilitating implementation. These elements contribute to improved learning outcomes.

Participatory and practice-based approaches have been recognized as effective strategies in educational interventions (Banks et al., 2022; Greenwood & Levin, 2022). Direct involvement of participants enhances engagement and ownership of learning processes (Minkler, 2021; Ledwith, 2021). Experiential learning supports knowledge retention and skill development (Kolb & Kolb, 2021; Zosh et al., 2022). Collaborative learning environments promote interaction and social development (Weisberg et al., 2022; Hirsh-Pasek et al., 2022). These approaches align with contemporary educational theories. The integration of theory and practice strengthens learning effectiveness. Such approaches are particularly relevant in early childhood contexts.

The application of structured and integrated learning strategies reflects a context-sensitive educational model. This model emphasizes practical

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implementation rather than theoretical instruction. Learning activities are designed to adapt to local conditions and available resources. Participatory approaches enhance sustainability and relevance. Alignment between objectives and implementation strengthens outcomes. This model supports continuous improvement in educational practices. Such approaches contribute to meaningful learning experiences.

This community service initiative aims to strengthen early childhood motor development through structured educational play and outdoor learning activities implemented at Raudhatul Athfal (RA) Trikora, Bitung City. The implementation focuses on enhancing children's motor skills through movement-based and interactive activities. The program also aims to increase engagement and participation in learning processes. The use of structured strategies supports effective motor stimulation. The integration of outdoor learning enhances learning experiences. This initiative provides a practical model for early childhood education. The implementation is particularly relevant for resource-limited contexts.

METHODS

Community Service Program Design

This community service initiative employed a participatory educational intervention approach, emphasizing direct engagement with participants through structured and experiential learning activities. This approach was selected to ensure that the intervention was contextually relevant, practice-oriented, and responsive to the actual conditions of the educational setting. The design integrates elements of experiential learning and participatory involvement, enabling children and teachers to actively engage in motor skill development activities. The intervention focuses on the application of structured educational play combined with outdoor learning to enhance motor development outcomes.

Setting, Participants, and Stakeholders

The program was implemented on 19 November 2024 at Raudhatul Athfal (RA) Trikora, an Islamic early childhood education institution located in Lembeh Island, Bitung City, Indonesia. The participants consisted of early childhood students, teachers, and a team of 15 university students who acted as facilitators during the implementation process. The selection of this institution was based on initial observations indicating the need for structured motor development stimulation and variation in learning strategies. The involvement of multiple stakeholders aimed to ensure collaborative implementation and effective facilitation of learning activities.

Implementation Stages

The implementation was structured into sequential stages consisting of preparation, execution, and evaluation. Each activity was designed to target specific

motor skills and learning outcomes. The detailed implementation framework is presented in Table 1.

Table 1. Structured Program Implementation of Educational Play and Outdoor Learning

Stage	Activity	Description	Targeted Motor Skills	Indicators of Achievement
Preparation	Initial Observation	Identification of learning conditions and motor activity patterns	—	Identification of needs and baseline conditions
Preparation	Coordination with Teachers	Discussion on activity design and scheduling	—	Agreement on implementation plan
Implementation	Introduction & Social Interaction	Ice-breaking, self-introduction, and engagement activities	Social-motor interaction	Children show responsiveness and participation
Implementation	Group Exercise (Gymnastics)	Guided physical movement activities	Gross motor (balance, coordination)	Children follow movements with improved coordination
Implementation	Singing and Movement	Rhythm-based activities integrating body movement	Gross motor & coordination	Synchronization of movement and rhythm
Implementation	Bead Stringing	Threading beads into strings	Fine motor (hand-eye coordination)	Increased precision and control of hand movement
Implementation	Paper Rolling with Feet	Rolling objects using feet	Gross motor (lower limb coordination)	Improved foot coordination and control
Implementation	Geometric Jumping	Jumping based on geometric patterns	Gross motor (balance and agility)	Accuracy in jumping patterns
Implementation	Balance Game	Maintaining balance using simple tools	Gross motor (stability)	Ability to maintain posture and balance
Implementation	Number Bowling Game	Throwing balls to knock numbered targets	Coordination & motor control	Improved targeting and movement control
Implementation	Outdoor Learning Activities	Exploration-based learning outside classroom	Integrated motor skills	Increased engagement and active movement

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Evaluation	Observation	Monitoring children's participation and motor performance	—	Observable improvement in activity engagement
Evaluation	Reflection with Teachers	Discussion on outcomes and feedback	—	Identification of strengths and improvements

The effectiveness of the program was assessed based on measurable qualitative indicators, including increased participation in learning activities, improved coordination of fine and gross motor skills, enhanced responsiveness to structured instructions, and positive feedback from teachers regarding the implementation process. These indicators reflect both behavioral changes in children and perceived improvements in learning quality.

Data Collection Techniques

Data collection in this program was conducted through a combination of observation, documentation, and informal interviews to capture both process and outcome dimensions of the intervention. Observations were carried out systematically during the implementation of each activity to assess children's participation, motor coordination, and responsiveness to structured learning tasks. The observational process focused on identifying changes in children's engagement levels, movement accuracy, and ability to follow instructions during motor-based activities.

Documentation was used to record the overall implementation process, including activity sequences, learning interactions, and visual evidence of children's participation. This documentation served as supporting data to validate observational findings and to provide a comprehensive overview of the program implementation.

In addition, informal interviews were conducted with teachers to gather reflective insights regarding the relevance, effectiveness, and applicability of the implemented activities. These interviews provided contextual understanding of how the intervention influenced teaching practices and children's learning experiences. The combination of these data collection techniques ensured a holistic understanding of both the implementation process and its outcomes.

Data Analysis

The collected data were analyzed using a descriptive qualitative approach**,** involving systematic processes of data reduction, categorization, and interpretation. Observational data were organized based on activity types and corresponding motor skill indicators, allowing for the identification of patterns in children's engagement

and performance. Documentation data were used to support and triangulate observational findings, while interview data provided contextual insights into the effectiveness of the intervention. The analysis aimed to evaluate the extent to which structured educational play and outdoor learning contributed to improvements in early childhood motor development.

Ethical Considerations

The implementation of this program adhered to ethical standards in early childhood education. Participation was conducted with institutional approval, and all activities prioritized children's safety and well-being. Documentation involving children was carried out with respect for privacy and without exposing identifiable personal information.

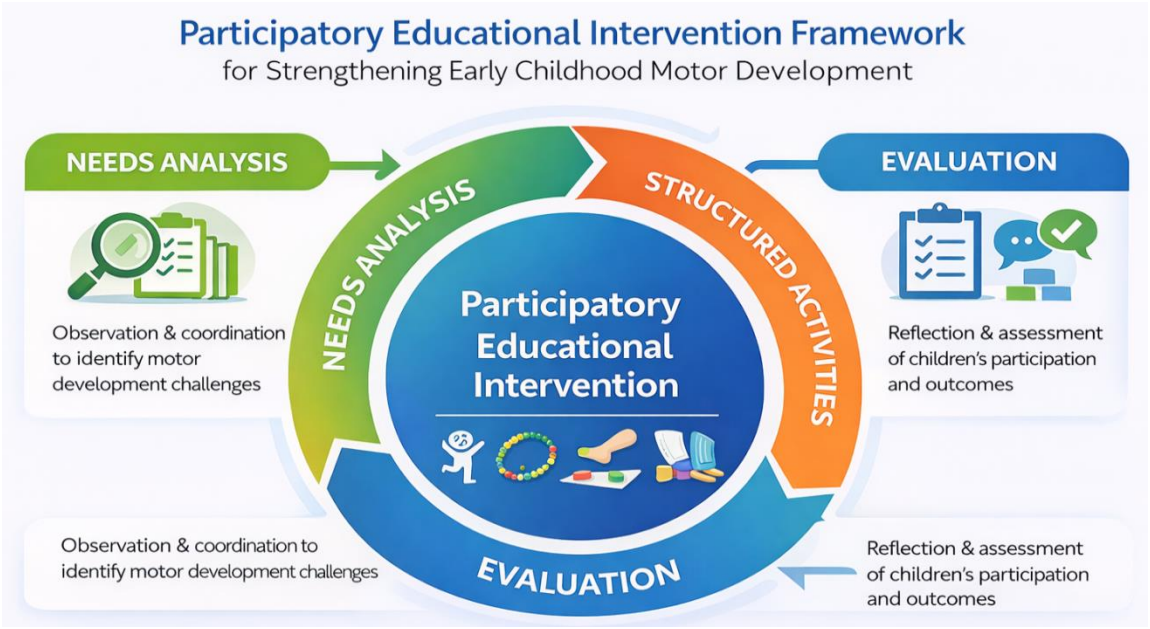

Figure 1. Participatory Educational Intervention Framework in Early Childhood Motor Development Program

RESULTS AND DISCUSSION

Results

Results

This section presents the results of the community service initiative conducted at Raudhatul Athfal (RA) Trikora, Bitung City. The findings are systematically organized based on the three stages of implementation: preparation, implementation, and evaluation, to clearly describe both the process and the outcomes of the intervention.

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Preparation Stage

The preparation stage focused on identifying the initial conditions and educational needs related to children's motor development. Preliminary observations indicated that motor learning activities were not yet systematically structured and were predominantly conducted through routine classroom practices. Learning activities were largely implemented indoors, limiting opportunities for children to engage in active movement and physical exploration. In addition, the availability of learning media to support motor development was found to be limited, resulting in less varied and less stimulating learning experiences. Instructional strategies were generally conventional and did not fully integrate educational play or outdoor learning approaches. These conditions reflect a gap between expected early childhood learning practices and their implementation in the field Based on these findings, coordination with teachers was carried out to design structured and contextually relevant learning activities. The planning process involved aligning activities with children's developmental characteristics, available resources, and learning objectives. This stage ensured that the intervention was feasible, adaptive, and responsive to the identified needs.

Figure 2. Flyer of Community Service Program

Implementation Stage

The implementation stage involved a series of structured and participatory activities designed to stimulate both fine and gross motor skills. The activities were conducted in a sequential and integrated manner, beginning with introductory sessions aimed at building engagement and creating a positive learning atmosphere. Children showed initial responsiveness and willingness to participate in social interaction activities. The intervention continued with group exercise activities that focused on improving gross motor skills, particularly balance and coordination. Children demonstrated the ability to follow guided movements and showed gradual improvement in synchronizing body movements. This was followed by singing and movement-based activities, which combined rhythm and physical coordination, further enhancing children's participation and responsiveness.

Fine motor development was stimulated through bead stringing activities, where children practiced hand-eye coordination and precision. Observations indicated noticeable improvements in children's ability to control hand movements and complete tasks with increased accuracy. Additional activities such as paper rolling using feet and geometric jumping were implemented to strengthen lower limb coordination, balance, and agility. Children showed improved control of body movements and greater accuracy in performing structured tasks. Balance games and number-based bowling activities further supported the development of coordination and motor control. Children demonstrated improved ability to maintain stability and accurately direct movement toward specific targets. The integration of outdoor learning activities provided a more dynamic learning environment, allowing children to explore, interact, and engage more actively in physical activities. This resulted in increased enthusiasm, active participation, and enhanced social interaction among peers.

Figure 3. Presents The Implementation of Structured Educational Play And Outdoor Learning Activities

Evaluation Stage

The evaluation stage focused on assessing changes in children's participation, motor skills, and overall engagement throughout the intervention. Observational findings indicated a significant increase in children's active involvement in learning activities. Children appeared more confident, less hesitant, and more willing to participate in movement-based tasks.

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Improvements were observed in both fine and gross motor domains. Children demonstrated better coordination, balance, and control of body movements, as well as increased ability to follow structured instructions. These changes indicate that the implemented activities provided effective and meaningful stimulation for motor development. In addition, children showed enhanced responsiveness during learning activities, including improved ability to follow directions, cooperate with peers, and engage in group tasks. These behavioral changes reflect not only motor development but also improvements in social interaction and learning engagement.

Feedback obtained from teachers during reflection sessions indicated that the intervention was effective, practical, and relevant to classroom needs. Teachers reported increased understanding of how to implement structured educational play and outdoor learning as part of daily teaching practices. Furthermore, teachers expressed positive perceptions regarding children's progress and engagement during the program.

Figure 4. Illustrates The Evaluation Process through Observation and Reflection With Teachers, Highlighting The Outcomes of The Implemented Activities.

The results indicate that the participatory educational intervention contributed positively to children's motor development and learning engagement. The structured integration of educational play and outdoor learning provided opportunities for children to actively participate in meaningful learning experiences. Improvements were observed in participation, motor coordination, responsiveness to instructions, and teacher perceptions of learning effectiveness.

Discussion

The findings of this study demonstrate that the implementation of structured educational play combined with outdoor learning significantly enhances early childhood motor development and learning engagement. Increased participation reflects the effectiveness of activity-based and participatory approaches, where children are more engaged in interactive, movement-oriented, and contextually

relevant learning (Pellegrini, 2021; Gibson et al., 2021; Mygind et al., 2021). These findings align with previous studies indicating that structured play and community-based interventions improve motivation, active involvement, and the overall quality of learning experiences (Gray et al., 2021; Becker et al., 2022; Marchant et al., 2021). Moreover, participatory approaches involving facilitators, teachers, and children strengthen learning interactions and promote active engagement, confirming the relevance of practice-based interventions in early childhood education

The improvement in children's motor coordination highlights the effectiveness of integrating fine and gross motor activities within structured learning designs. Activities such as bead stringing, geometric jumping, and balance exercises support the development of coordination, control, and body awareness in an integrated manner. Previous research confirms that varied and repetitive movement experiences within guided environments significantly enhance motor skills (Robinson et al., 2021; Hulteen et al., 2020; Logan et al., 2021). In addition, movement-based learning contributes not only to motor competence but also to cognitive development and physical confidence (Duncan et al., 2022; Cameron et al., 2021; Lubans et al., 2022). These findings reinforce the importance of designing engaging learning activities that intentionally target motor development while maintaining children's interest and enjoyment .

The integration of outdoor learning and positive teacher feedback further strengthens the effectiveness and sustainability of the intervention. Outdoor environments provide dynamic opportunities for movement, social interaction, and collaborative learning, which support physical and social-emotional development (Chawla, 2020; Gray et al., 2021; Mygind et al., 2021). Teachers reported that the activities were practical, engaging, and aligned with children's developmental needs, highlighting their applicability in real classroom contexts. This aligns with previous studies emphasizing the importance of teacher involvement and reflective practice in sustaining educational innovations (Desimone & Garet, 2020; OECD, 2022; UNESCO, 2021). Overall, the combination of structured play, outdoor learning, and participatory approaches offers a holistic and sustainable model for improving early childhood education practices.

Community Service Contribution

This program contributes to strengthening the quality of early childhood education practices through the implementation of structured educational play and outdoor learning activities. The intervention enhances children's motor development, including both fine and gross motor skills, as well as their participation and responsiveness during learning activities. At the institutional level, the program supports teachers in adopting more interactive, movement-based, and contextually relevant learning strategies. The implementation also provides practical experience for educators in designing and facilitating structured motor stimulation activities using simple and accessible learning media. The integration of participatory

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approaches with experiential learning represents an innovative community service model that can be adapted in similar early childhood education settings. Furthermore, the program strengthens collaboration between higher education institutions and early childhood education providers, contributing to the development of sustainable and practice-oriented educational improvements.

Limitations and Suggestions

The implementation of this program was conducted within a limited timeframe, which may affect the depth of observed outcomes and long-term impact on children's motor development. The number of participants was also limited to a single institution, which may influence the generalizability of the findings to broader contexts. Variations in children's initial motor abilities and learning responsiveness also contributed to differences in outcomes during the implementation. In addition, constraints related to learning facilities and environmental conditions influenced the scope of outdoor learning activities. Future programs are recommended to extend the duration of implementation, incorporate continuous mentoring for teachers, and involve a larger number of institutions to enhance scalability. The integration of more structured assessment tools is also suggested to provide more measurable and longitudinal evaluation of motor development outcomes.

CONCLUSION

This community service program demonstrates that structured educational play combined with outdoor learning is effective in strengthening early childhood motor development and learning engagement. The implementation enhances children's participation, coordination, and responsiveness to structured learning activities. The participatory educational intervention approach provides meaningful and practical learning experiences for both children and teachers, supporting the development of more interactive and dynamic learning environments. These findings indicate that practice-based and context-sensitive interventions can serve as effective strategies to improve the quality of early childhood education. Future programs are expected to adopt more sustainable and structured approaches to maximize long-term impact.

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AUTHOR CONTRIBUTION STATEMENT

I.K. served as the principal contributor responsible for conceptual design, supervision, and overall coordination of the program and manuscript preparation. A.R. contributed to the development of the intervention design and implementation strategy. F. contributed to the development of learning media and activity design. D.A.G were responsible for field implementation, data collection, and documentation during the program. S. contributed to data analysis, critical review, and refinement of the manuscript, particularly in language editing and academic writing quality.

AI DISCLOSURE STATEMENT

During the preparation of this manuscript, the authors utilized ChatGPT as a supporting tool to assist in structuring and refining the academic writing. All outputs were critically reviewed, revised, and validated by the authors to ensure accuracy, originality, and academic integrity. The authors take full responsibility for the content of this publication.

CONFLICTS OF INTERES

The authors declare that there are no conflicts of interest, either financial, institutional, or personal, that could have influenced the implementation of this program or the preparation of this manuscript.

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