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The *JENAKA* Game: Stimulating Gross and Fine Motor Development in Early Childhood

Wilda Isna Kartika[1], **Febry Maghfirah**[2], **Vira Azzahra**[3], **Reyzia Anggriani Hasnur**[4], **Adharina Dian Pertiwi**[5]
[1,2,3,4,5]Universitas Mulawarman, Indonesia

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Correspondence to
Wilda Isna Kartika, Universitas Mulawarman, Indonesia.
e-mail:
iwildakartika@fkip.unmul.ac.id

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Abstract
Problems of motor development delays in early childhood remain prevalent, often linked to decreasing levels of physical activity and the rising use of digital gadgets. This study aimed to investigate the effect of the interactive game *JENAKA* (Jelajah Fauna Kalimantan/Exploring Kalimantan's Fauna) in stimulating motor development in children aged 5–6 years. A quantitative approach was employed using a pre-experimental design with a One Group Pretest–Posttest structure. The participants consisted of 18 children selected through saturated sampling, and the intervention was conducted over ten sessions between July and October 2024. Data were collected through structured observation using a motor skills instrument adapted from established measures, comprising 17 items across two domains: gross motor skills and fine motor skills. Expert validation confirmed content appropriateness, and the instrument demonstrated acceptable reliability. Data analysis involved tests of normality and homogeneity, followed by paired samples t-test using SPSS. Results revealed a significant improvement in motor skills after the intervention, with a significance value of .001, well below the .05 threshold. These findings indicate that *JENAKA* effectively enhanced both gross and fine motor skills, demonstrating its potential as an innovative learning medium in early childhood education. The novelty of this study lies in integrating local cultural and ecological elements, particularly Kalimantan's fauna, into interactive play, thereby fostering not only physical development but also environmental awareness. The research highlights the importance of culturally grounded, play-based interventions and provides practical implications for curriculum design, suggesting that interactive cultural games can serve as engaging and holistic tools for stimulating early childhood development.

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Introduction

Early childhood education is globally recognized as a critical foundation for lifelong learning and holistic development. Reports from UNESCO emphasize that the early years, from birth to age eight, represent a period of rapid brain development and a crucial window of opportunity for education (UNESCO, 2025). Similarly, the World Health Organization highlights that early childhood is a time of very fast physical and cognitive growth and a phase when lifelong habits are formed (WHO, 2019). Within this phase, children's receptivity to learning is at its peak, making it a vital period for shaping fundamental skills and character (Arifudin et al., 2021; Indrijati et al., 2017). Evidence also shows that insufficient physical activity can hinder gross motor development and result in developmental delays, which emphasizes the importance of providing meaningful activities to stimulate growth (Yanti & Fridalni, 2020).

Motor development plays a central role in supporting children's adaptation to both learning and social environments. Gross motor skills, such as running, jumping, and kicking, are essential for physical health and coordination, while fine motor skills, such as writing and cutting, underpin cognitive and academic development (Anjarsari et al., 2025; Susanti et al., 2023). However, recent evidence indicates that children face significant challenges in motor development due to the increasing use of digital gadgets and the decline of meaningful physical

activities (Escolano-Pérez et al., 2020; Fitriani & Adawiyah, 2018). These changes show how environmental factors directly influence developmental trajectories in early childhood. They also reflect broader international debates on the risks of screen-based childhoods, showing that the reduction of physical activity in daily routines is becoming a global educational issue.

The decline of traditional games has further exacerbated this developmental gap. Traditional games historically offered valuable opportunities for children to practice coordination, balance, and strength in socially engaging contexts. Today, these games are often replaced by screen-based entertainment, frequently without adequate supervision (Mulyana & Lengkana, 2019; Yumarni, 2022). Such practices diminish children's readiness for school and undermine their physical well-being. Although many studies have highlighted the negative effects of reduced physical activity, little is known about how culturally embedded games can systematically address motor development challenges. This gap indicates the need for more innovative approaches that integrate play, culture, and embodied learning into early childhood education.

Interactive games provide one potential solution to this challenge. They allow children to learn through active participation while simultaneously developing essential motor skills such as coordination, balance, and strength (Fatimah et al., 2023). This is consistent with the principle of learning by doing, which is central to early childhood education (Wahyuni & Azizah, 2020a). Beyond motor development, interactive games can strengthen basic concepts in mathematics, science, and language, presented in ways that are both engaging and enjoyable (Widhiasih & Yunita, 2021). Despite these benefits, limited studies explore how interactive games that are culturally grounded can also enhance environmental awareness. Therefore, further research is needed to examine the holistic potential of such educational tools in stimulating physical and cognitive development in children.

Integrating local cultural values into early childhood education has proven effective in enriching children's learning experiences. Cultural-based approaches connect children with their heritage and foster meaningful education that resonates with their social context (Handayani et al., 2022). An innovative example is *JENAKA* (*Jelajah Fauna Kalimantana*/Exploring Kalimantan's Fauna), an educational game that incorporates movements inspired by endemic fauna such as orangutans, proboscis monkeys, and hornbills. These activities stimulate gross motor skills, while creative tasks such as making collages from natural materials enhance fine motor abilities (Ida et al., 2020). This combination not only introduces children to endangered species but also embeds conservation values in a culturally relevant context. Such practices align with calls for early childhood education to cultivate ecological awareness and sustainable values from an early age.

Games like *JENAKA* embody the principle of holistic development by engaging children in both gross and fine motor activities. Physical tasks such as mimicking animal movements develop strength and coordination, while crafting activities foster precision and creativity (Wahyuni & Azizah, 2020b). These activities also nurture ecological awareness and cultural appreciation, which strengthen children's sense of identity and responsibility for the environment. Despite its promise, the impact of such cultural and ecological games on measurable motor development outcomes remains underexplored in existing literature. The lack of comprehensive empirical studies points to the need for more rigorous research. Investigating these games can bridge a gap between traditional knowledge, play-based pedagogy, and developmental science.

Interactive and play-based learning has also been shown to strengthen cognitive abilities in young children. Such activities improve memory, recall, and problem-solving skills, while also enhancing confidence and social competence (Susilawati & Satriawan, 2018). Physical engagement in games supports gross motor coordination and promotes overall health, both of which are crucial for academic readiness (Wulan & Wathon, 2021). A holistic approach that integrates physical, cognitive, and cultural dimensions therefore offers a more sustainable model of early childhood education. This perspective positions interactive cultural games not

only as tools for motor development but also as vehicles for ecological and social learning. It highlights how educational strategies can contribute to both individual growth and collective cultural preservation.

The present study aims to address this gap by investigating the impact of the *JENAKA* game on motor development in young children. Specifically, the study examines how culturally embedded interactive games can stimulate both gross and fine motor skills while simultaneously fostering awareness of local fauna and conservation. By situating motor development within a cultural and ecological framework, this research contributes to broader discussions on play-based pedagogy, embodied learning, and the integration of local wisdom into early childhood education. The contribution of this article lies in offering empirical evidence on how innovative, culturally relevant games can serve as holistic interventions that advance motor development, promote ecological awareness, and enrich pedagogical practices in early childhood education.

Methods

Research Approach and Design

This study employed a quantitative approach using an experimental method. A pre-experimental design was considered the most appropriate for this research due to the limited number of participants and the exploratory nature of the intervention. The research design adopted was the One Group Pretest–Posttest Design, which allowed for the measurement of children's motor skills before and after the intervention with the *JENAKA* game (Sugiyono, 2022). Although this design does not include a control group, it was chosen because it enables initial testing of the effectiveness of the intervention in a natural learning environment.

Design scheme:

O_1	X	O_2

Figure 1. One Group Pretest–Posttest Design, adapted from Sugiyono (2022)

Where:

- O1 = Pretest scores (before treatment)
- X = Treatment (application of *JENAKA* game)
- O2 = Posttest scores (after treatment)

This design provides baseline data and outcome comparison, although it has limitations in internal validity due to the absence of a control group.

Research Context and Participants

The study was conducted in one early childhood education center (PAUD) located in Kalimantan, Indonesia, between July and October 2024. The participants consisted of 18 children aged 5–6 years. A saturated sampling technique was employed, in which all members of the population were included as research subjects. The sample represented both boys and girls with relatively similar socio-economic backgrounds.

The inclusion criteria required that children were within the age range of 5–6 years, regularly attended school, and obtained parental consent. Children with diagnosed developmental delays or health conditions that restricted physical activity were excluded from participation. This ensured that the study was conducted on typically developing children who could safely engage in the intervention activities.

Research Instruments

The data were collected using an observation sheet to assess motor skills in children aged 5–6 years. The instrument was adapted from Zhang et al. (2024), covering two domains: gross motor skills and fine motor skills. It consisted of 17 observable items distributed across two main indicators. Gross motor indicators included body coordination, imitation of movements, and

bilateral hand use, while fine motor indicators included writing, pasting, drawing, cutting, and eye-hand coordination.

Table 1. Grid of Motor Skill Instrument for Children Aged 5–6 Years

No	Indicator	Sub-indicator	Item Numbers	Total Items
1	Gross motor	Coordinating body movements	1, 9, 14	3
		Imitating movements	2	1
		Using right and left hands proficiently	3, 10	2
2	Fine motor	Writing numbers/letters	4, 11	2
		Pasting	5, 12, 15	3
		Imitating number/letter shapes	6	1
		Cutting according to patterns	7	1
		Eye–hand coordination	8, 13, 16, 17	4

The instrument's content validity was reviewed by three experts in early childhood education and physical development, ensuring cultural and contextual appropriateness. Item validity testing showed that all 17 items had r-count values greater than r-table, indicating that all items were valid.

Table 2. Reliability test

Reliability Statistics	
Cronbach's Alpha	N of Items
,610	17

The reliability test using Cronbach's Alpha produced a score of 0.610. Although this value is slightly below the commonly accepted threshold of 0.70, the instrument was deemed acceptable for exploratory research in early childhood contexts, and the limitations are acknowledged in this study.

Research Procedure

The study was conducted in three stages. First, a pretest was administered to measure baseline motor skills of children using the observation instrument. Second, the treatment phase consisted of applying the *JENAKA* game, delivered across 10 sessions over a four-week period. Each session lasted approximately 30 minutes and was conducted during the children's regular class time. The intervention activities included imitating animal movements such as orangutans, proboscis monkeys, and hornbills for gross motor stimulation, and collage-making, pasting, and cutting activities for fine motor stimulation. All sessions were facilitated by trained teachers under the supervision of the researcher. Third, a posttest was administered to evaluate changes in motor skills after the intervention.

The research protocol was reviewed and approved by the institutional ethics committee. Written informed consent was obtained from the parents or guardians of all participating children. Teachers and parents were informed about the objectives and procedures of the study, and participation was entirely voluntary. The study was conducted in a safe, supportive, and age-appropriate learning environment to ensure children's well-being throughout the intervention.

Data Analysis

Data analysis was carried out with the assistance of SPSS version 23. Prior to hypothesis testing, assumption tests were conducted. A normality test was performed using the Kolmogorov–Smirnov test, with significance values greater than 0.05 indicating normally distributed data. Homogeneity of variance was tested using Levene's test, with significance levels above 0.05 indicating homogeneity. The hypothesis was tested using paired samples t-test, given the pretest–posttest design with the same group of participants. Statistical significance was set at $\alpha = 0.05$. In addition to p-values, effect sizes (Cohen's d) were calculated to provide information about the magnitude of the intervention effect, ensuring that findings are interpreted not only statistically but also in terms of practical significance.

Result

This section presents the research findings related to the impact of tuina massage using virgin coconut oil in combination with feeding rules on improving the appetite of stunted toddlers. The analysis is divided into two main parts to ensure clarity and depth in interpretation. First, the descriptive data present an overview of the respondent characteristics and their baseline appetite condition before the intervention. Second, the inferential results assess the effectiveness of the intervention using appropriate statistical tests to determine significant changes and group comparisons.

Assumption Testing

Before testing the research hypothesis, assumption testing was carried out to ensure that the dataset met the basic requirements for parametric analysis. These preliminary tests are important because they determine whether the use of statistical techniques such as the paired samples t-test is appropriate and valid. In this study, the assumptions examined were normality and homogeneity of variance, both of which are critical to maintaining the accuracy and reliability of the findings.

Normality Test

The normality test was conducted to determine whether the sample data were derived from a population with a normal distribution. The Shapiro–Wilk test was employed, which is considered more appropriate for small sample sizes. The decision criterion was based on the significance value (p-value); if the significance value was greater than .05, the data were considered normally distributed, whereas a value less than .05 indicated a violation of the normality assumption.

Table 3. Results of Shapiro–Wilk normality test

	Shapiro-Wilk			
Class	Statistic	df	Sig.	Information
Pre-test	0,937	25	0,123	Normal
Post-test	0,946	25	0,202	Normal

Referring to Table 3, both pre-test and post-test results showed significance values greater than .05. These findings confirm that the data met the assumption of normality, which supports the application of parametric statistical tests. Satisfying this assumption ensures that the subsequent paired samples t-test is valid for evaluating the effect of the *JENAKA* intervention on children's motor development.

Homogeneity Test

The homogeneity test was performed to evaluate whether the variance of the data across groups was equal. Levene's test was applied, with the decision rule stating that if the significance value exceeded .05, the data could be considered homogeneous. Conversely, a significance value lower than .05 would indicate heterogeneous variances.

Table 4. Results of Levene's homogeneity test

	Test of Homogenity Variance			
	Levene Statistic	df1	df2	Sig.
Pre-test & Post-Test	0,544	1	48	0,464

Based on Table 4, the significance value obtained from Levene's test was .464, which is greater than the .05 threshold. This indicates that the data variance was homogeneous. By meeting both the normality and homogeneity assumptions, the dataset fulfills the necessary prerequisites for parametric hypothesis testing, specifically the paired samples t-test, to assess the effectiveness of the *JENAKA* game intervention.

Hypothesis Testing

After the assumption tests confirmed that the data met the requirements of normality and homogeneity, hypothesis testing was conducted to evaluate the effect of the *JENAKA* game on

children's motor skills. This stage aimed to compare pretest and posttest results across both gross and fine motor indicators to determine whether significant improvements occurred after the intervention. The analysis was carried out systematically, beginning with the presentation of pretest results, followed by posttest outcomes, and concluded with a direct comparison between the two.

Pretest Results of Children's Motor Skills

The pretest was administered to evaluate the baseline motor skills of children aged 5–6 years before the intervention. Overall, the results indicated relatively low mean scores across both gross and fine motor indicators.

Gross motor skills

Six items were assessed, including grasping illustrated sticks while jumping, imitating animal movements, throwing nipah rings into bottles, hopping on one leg, spinning number wheels, and bending while passing through a hula hoop. The average scores ranged between 1.0 and 1.3, suggesting that children's initial motor skills were underdeveloped and required further stimulation. These results reflect a general need for structured physical activities to improve coordination, balance, and body control.

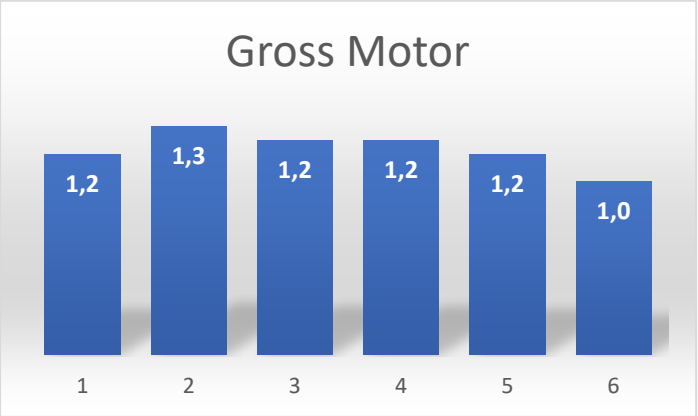

Figure 2. Mean pretest scores of gross motor indicators

Fine motor skills

Eleven items were observed, including writing words, pasting numbers, copying digits, cutting shapes, inserting illustrated sticks into holes, writing numbers, matching pictures, assembling puzzles, making collages, rolling balls into cups, and threading geometric shapes. The average scores ranged between 1.1 and 1.4, again showing limited initial ability. These findings indicate that children's hand–eye coordination, precision, and creative fine motor skills required additional support.

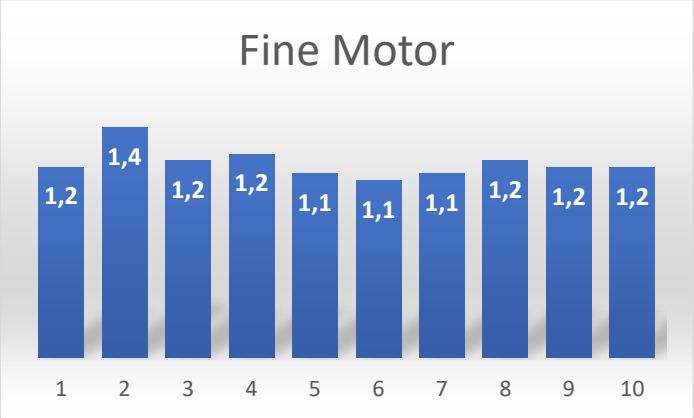

Figure 3. Mean pretest scores of fine motor indicators

Posttest Results of Children's Motor Skills

After ten sessions of the *JENAKA* game intervention, a substantial increase was recorded across both gross and fine motor indicators.

Gross motor skills

All six items showed significant improvement, with mean scores increasing to the range of 3.1–3.4. The largest gain was observed in bending while passing through a hula hoop, with a posttest mean of 3.44. These results suggest that imitative play involving animal movements and active body coordination contributed effectively to the enhancement of gross motor skills.

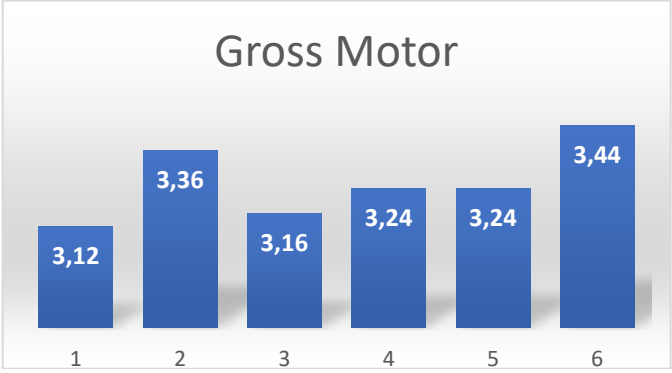

Figure 4. Mean posttest scores of gross motor indicators

Fine motor skills

Eleven items also demonstrated clear improvement, with posttest mean scores ranging between 3.1 and 3.5. The most notable gain was in threading geometric shapes, which reached an average of 3.48. Activities such as collage-making, puzzle assembly, and writing practice provided children with opportunities to refine precision, creativity, and hand–eye coordination.

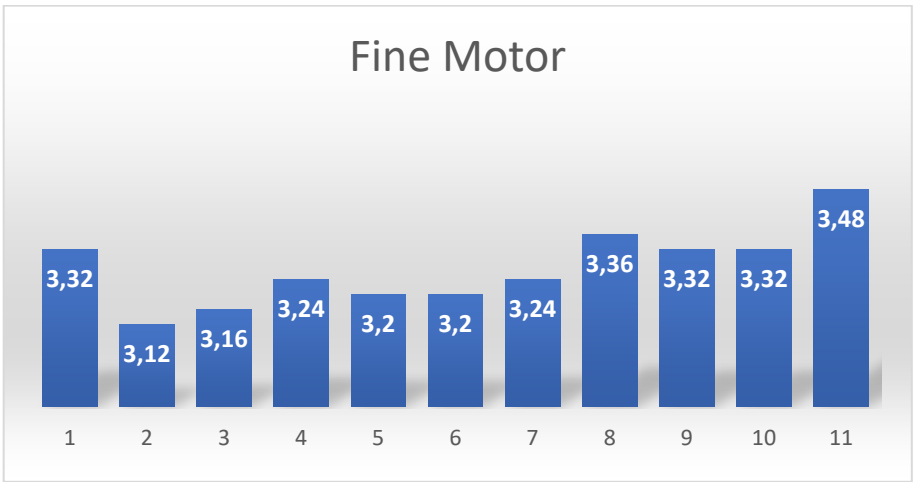

Figure 5. Mean posttest scores of fine motor indicators

Comparison of Pretest and Posttest Scores

A direct comparison between pretest and posttest scores revealed consistent and substantial gains across all observed items. Increases ranged from 1.7 to 2.4 points, with the highest improvement observed in bending through a hula hoop and threading geometric shapes. These results highlight the overall effectiveness of the intervention in enhancing both gross and fine motor development.

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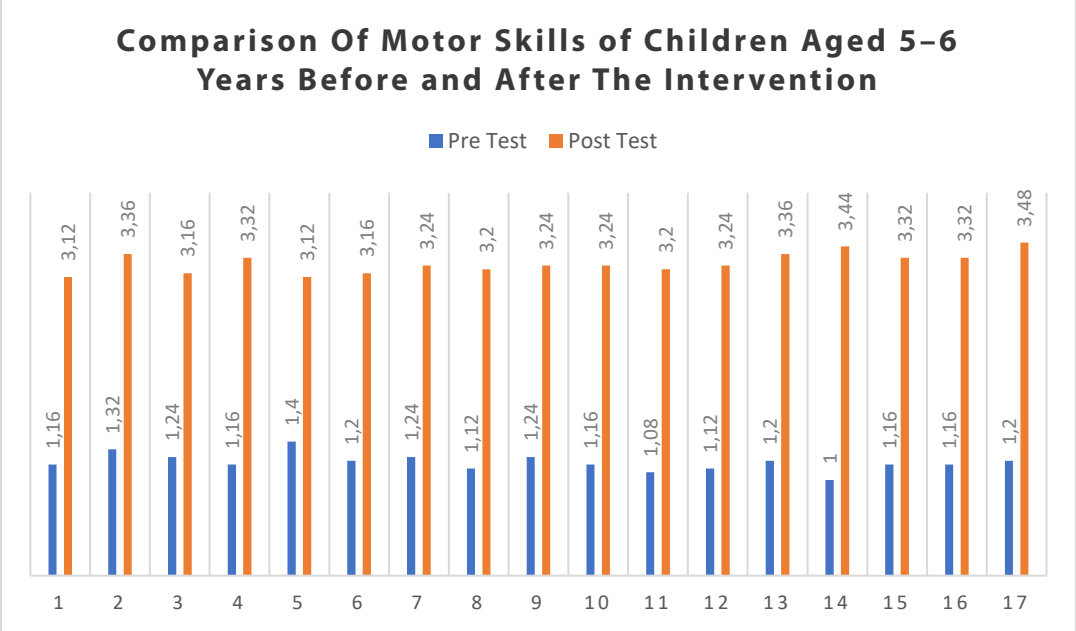

Figure 6. Comparison of mean pretest and posttest scores of motor skills

The comparative figure clearly illustrates the substantial gains between pretest and posttest conditions. All indicators demonstrated improvement of at least 1.7 points, with the largest increases observed in complex coordination tasks. This consistent growth across both gross and fine motor domains confirms that the *JENAKA* intervention functioned as a holistic learning tool, successfully combining cultural relevance with developmental benefits.

The paired samples t-test confirmed the significance of these improvements. The results are presented in Table 5.

Table 5. Results of paired samples t-test

Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Pretest–Posttest	-35,56000	2,46779	,49356	-36,57865	-34,54135	-72,048	24	,000

The results displayed in Table 5 provide strong statistical evidence of the effectiveness of the intervention. The negative mean difference (–35.56) indicates that posttest scores were substantially higher than pretest scores. The test yielded a very large t-value, $t(24) = -72.05$, with a significance level below .001, which clearly rejects the null hypothesis. This means that the *JENAKA* game significantly improved both gross and fine motor abilities of the children. Beyond statistical significance, the magnitude of the change suggests a practically meaningful improvement in children's developmental outcomes, supporting the use of culturally embedded games as powerful educational interventions.

Discussion

The aim of this study was to examine the impact of the interactive game *JENAKA* on the motor development of children aged 5–6 years. The findings confirmed that motor skills were significantly improved after the intervention, as shown by the statistical analysis where the significance value of .001 was below the .05 threshold. These results indicate that *JENAKA* provided an effective medium for stimulating both gross and fine motor skills, supporting the relevance of interactive games in early childhood education. The integration of playful activities within a structured design allowed children to experience enjoyable learning while developing

essential competencies. This aligns with studies showing that combining digital and game elements can provide holistic learning experiences that foster knowledge, skills, and language development (Maryani et al., 2023).

The results of this research reinforce the argument that designing meaningful and enjoyable learning activities is a foundation of interactive education. Play-based educational tools are crucial in early childhood, and teachers play a central role in ensuring that games function as engaging and developmentally supportive approaches (Kartika et al., 2025; Wathon, 2018). Children's innate curiosity at an early age makes interactive and game-based methods particularly effective. Consistent with prior evidence, games are fundamental for children's development and remain a key element in the design of various educational activities in childhood (Nacher et al., 2016b). Interactive learning models such as gesture-based interactive games (GIGL) have also been proven to enhance both academic performance and motor coordination in preschool children (Hsiao & Chen, 2016b). Similarly, interactive play has been reported to improve gross motor stimulation by enhancing strength, coordination, agility, balance, and speed (Suningsih et al., 2025). These findings show that the mechanism of improvement observed in this study is consistent with the broader literature on the importance of interactive play.

The evidence also supports the view that play-based interventions foster both physical and emotional growth. Children learn to control body movements, develop coordination, and participate in enjoyable activities that promote their holistic development (Anjarsari et al., 2025). This is in line with research emphasizing that motor skills must be learned, trained, and reinforced rather than assumed to emerge naturally (Escolano-Pérez et al., 2020b). Previous studies have identified multiple methods that influence motor development, including aquatic learning, cutting and collage activities, demonstrations, printing with natural materials, coloring, Montessori practical life activities, and interactive writing (Isnaini & Katoningsih, 2022). These findings complement earlier developmental psychology perspectives, which argue that motor development supports children's independence, peer interaction, and enjoyment of play (Maulin et al., 2019). Taken together, this suggests that *JENAKA* functions effectively because it combines active physical movement with culturally relevant, creative tasks that reinforce both gross and fine motor skills.

A notable contribution of this study is the integration of local culture and environmental awareness into interactive play. The *JENAKA* game does not only stimulate motor development but also introduces children to various animals endemic to Kalimantan, such as orangutans, proboscis monkeys, hornbills, sun bears, and Irrawaddy dolphins. Previous research has also shown that game-based interventions rooted in tropical rainforest themes can positively influence gross motor skills (Kartika et al., 2025). Integrating cultural and ecological elements into early childhood learning supports the preservation of local values (Anggreani, 2021) and aligns with evidence showing that local culture has a significant role in curriculum design for young children (Yang & Li, 2020). Moreover, interactive play grounded in natural settings has been reported to enhance physical skills while introducing children to environmental elements such as local flora and fauna (Anwar et al., 2013). The findings of this study add further evidence that such culturally embedded games are effective for both motor and ecological learning.

The use of interactive play as a pedagogical tool also connects with broader evidence that games enable self-expression and creativity in young children (Anam et al., 2022). Studies have shown that integrating local wisdom into play activities can enrich motor development outcomes (Putri & Hasyim, 2017). Similarly, introducing cultural identity at an early age is critical for children to appreciate and learn their heritage (Afriyuni et al., 2020). The evidence also suggests that interactive play fosters cooperation, responsibility, and creativity, making children more active and socially engaged learners (Widyaning Tyas & Widyasari, 2023). These findings highlight the wider educational implications of *JENAKA*, which extend beyond motor development to encompass social, cultural, and affective domains of growth.

The implications of this study are significant for early childhood education practice. Designing interactive, culturally embedded games can serve as an innovative alternative to conventional motor stimulation programs. Integrating such media into the curriculum can enhance classroom and outdoor learning, improve engagement, and support the holistic growth of children. This is consistent with definitions of interactive play that emphasize the integration of enjoyment, physical activity, and meaningful learning (Janius et al., 2023). Programs of this nature respond to the need to strengthen gross motor skills, which remain essential developmental indicators in early childhood growth (Apriyani, 2021). These findings provide evidence for policymakers and educators to consider adopting interactive cultural games as part of formal and informal curricula in early childhood education.

The main contribution of this article lies in the empirical validation of *JENAKA* as an innovative medium that is not only effective in stimulating motor skills but also contextual, culturally relevant, and enjoyable. This adds to the growing body of literature showing that traditional or local games can be transformed into interactive educational tools that improve motor development (Putri & Hasyim, 2017). By embedding biodiversity and cultural values into play, this study expands the theoretical and practical understanding of game-based learning in early childhood. This provides a distinctive contribution compared with existing research, which has often emphasized either motor development or cultural preservation separately.

Despite its contributions, the study has several limitations. The sample was limited to one early childhood center, which restricts the generalizability of the findings. The focus was confined to motor development, without examining other critical domains such as socio-emotional or cognitive growth. In addition, the reliability of the instrument was relatively modest ($\alpha = 0.61$), which should be considered in interpreting the strength of the findings. Future research is recommended to expand the scope of participants across different regions, develop digital versions of cultural games for broader application, and evaluate the impact of such interventions on a wider range of developmental outcomes. These steps would allow for a more comprehensive understanding of how interactive, culturally embedded games can shape early childhood education.

Conclusion

This study demonstrated that the interactive game *JENAKA* significantly improved the motor development of children aged 5–6 years, as reflected in the posttest results which showed clear gains in both gross and fine motor skills. The findings confirm that structured, culturally embedded play can function as an effective learning medium in early childhood education. Beyond statistical significance, the novelty of this study lies in integrating local cultural and ecological elements, particularly the fauna of Kalimantan, into interactive play, thereby enriching children's developmental experience while fostering environmental awareness. These results provide important implications for practice, suggesting that educators and curriculum designers in early childhood settings should consider interactive cultural games as innovative tools to stimulate children's physical, cognitive, and socio-emotional growth.

At the same time, this research has limitations that should be acknowledged. The sample was limited to a single early childhood institution, and the focus was confined to motor development without extending to other domains such as language, cognitive, or socio-emotional skills. Future studies are encouraged to replicate this intervention with larger and more diverse populations, explore fully digital versions of culturally based interactive games, and evaluate their broader developmental impacts. By doing so, subsequent research can build on the evidence presented here and further strengthen the role of culturally grounded interactive play in advancing holistic and sustainable early childhood education. In essence, *JENAKA* is not merely a medium for motor stimulation but also a bridge that connects education, culture, and ecology in the holistic development of young children.

Declarations

Author Contribution Statement

All authors contributed equally and approved the final manuscript.

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Data Availability Statement

Data are available from the corresponding author upon reasonable request.

Declaration of Interests Statement

The author declares no conflict of interest.

Additional Information

No additional information is available.

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