

The Effect of “Jejak Huruf Pintar” Educational Game Tool on Gross and Fine Motor Skills of Children Aged 5–6 Years

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ABSTRACT

Motor development in early childhood is a fundamental aspect that supports coordination, physical readiness, and independence in daily activities. However, motor stimulation in early childhood education settings is often delivered through monotonous activities that limit active participation. This study aims to analyze the effect of the Educational Game Tool (APE) “Jejak Huruf Pintar” on gross and fine motor skills of children aged 5–6 years. The novelty of this study lies in the integration of locomotor and fine motor stimulation within a single circuit-based learning media using letter-pattern spatial navigation. This study employed a quantitative approach with a quasi-experimental one-group pretest–posttest design involving 18 children in Group B at Harapan Ceria Kindergarten selected through purposive sampling. Data were collected using structured observation based on PAUD motor development indicators and analyzed using paired sample t-test, normality test, and effect size (Cohen’s *d*). The results showed a significant improvement in motor skills after the intervention ($p < 0.001$; $d = 1.21$). The mean score of gross motor skills increased from 58.4 to 82.1, while fine motor skills increased from 55.7 to 79.6. The findings indicate that “Jejak Huruf Pintar” is effective in enhancing integrated motor development through active and meaningful play experiences.

ABSTRAK

Perkembangan motorik pada anak usia dini merupakan aspek fundamental yang mendukung koordinasi, kesiapan fisik, dan kemandirian dalam aktivitas sehari-hari. Namun, stimulasi motorik di lembaga pendidikan anak usia dini masih sering dilakukan melalui aktivitas yang monoton sehingga membatasi keterlibatan aktif anak. Penelitian ini bertujuan untuk menganalisis pengaruh penggunaan Alat Permainan Edukatif (APE) “Jejak Huruf Pintar” terhadap kemampuan motorik kasar dan halus anak usia 5–6 tahun. Kebaruan penelitian ini terletak pada integrasi stimulasi motorik kasar dan halus dalam satu media pembelajaran berbasis sirkuit dengan navigasi spasial berbentuk pola huruf. Penelitian ini menggunakan pendekatan kuantitatif dengan metode quasi-eksperimen desain one-group pretest–posttest yang melibatkan 18 anak kelompok B di TK Harapan Ceria yang dipilih menggunakan teknik purposive sampling. Data dikumpulkan melalui observasi terstruktur berdasarkan indikator perkembangan motorik PAUD dan dianalisis menggunakan uji paired sample t-test, uji normalitas, serta effect size (Cohen’s *d*). Hasil penelitian menunjukkan adanya peningkatan signifikan pada kemampuan motorik anak setelah intervensi ($p < 0,001$; $d = 1,21$). Rata-rata skor motorik kasar meningkat dari 58,4 menjadi 82,1, sedangkan motorik halus meningkat dari 55,7 menjadi 79,6. Temuan ini menunjukkan bahwa “Jejak Huruf Pintar” efektif dalam meningkatkan perkembangan motorik yang terintegrasi melalui pengalaman bermain yang aktif dan bermakna.

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Introduction

Early childhood is widely recognized as the golden age, a critical period in which physical, cognitive, social, and motor development progresses rapidly and forms the foundation for later stages of growth. During this phase, the nervous system and neuromuscular functions develop intensively, requiring appropriate stimulation to ensure optimal motor development. Gross motor skills such as walking, running, jumping, and maintaining balance play a vital role in children’s daily physical activities, while fine motor skills such as grasping, writing, and finger coordination are essential for early academic tasks (Sujiono, 2019; Sumantri, 2020). These two domains are interrelated and collectively contribute to the development of overall body coordination and functional independence in children. Gross physical responses must be systematically paired with targeted hand manipulation to assure comprehensive physiological readiness in early education.

However, in early childhood education settings, motor stimulation is often delivered in a

limited and less varied manner. Learning activities tend to emphasize sedentary tasks such as sitting, listening to instructions, and completing worksheets, which reduce opportunities for children to engage in active physical exploration. This condition is further exacerbated by the increasing use of digital devices, leading to higher levels of sedentary behavior and reduced involvement in physical activities that support sensorimotor development (Latif et al., 2021). As a result, some children experience delays in coordination, balance control, and fine motor precision, which are essential for writing and other manipulative activities.

Previous studies have shown that play-based learning media can positively influence children's motor development (Astini et al., 2021; Wahyuningsih et al., 2023). Traditional apparatus layouts and guided circuit movements effectively enhance muscle endurance and directional reaction speeds. Structured tactile engagements also amplify basic eye-to-hand synchronization during preschool tasks. However, most of these interventions tend to focus separately on either gross motor skills through physical outdoor activities or fine motor skills through desk-based tasks such as coloring and writing exercises. Integrated approaches that simultaneously stimulate both motor domains within a single structured activity remain relatively limited. Therefore, there is a need for innovative learning media that can combine gross and fine motor stimulation in a unified, meaningful, and engaging learning experience.

Based on this gap, the Educational Game Tool (APE) "Jejak Huruf Pintar" was developed as a circuit-based learning media that integrates locomotor activities, such as jumping along letter-shaped pathways, with fine motor tasks, such as tracing letter patterns. Utilizing modular step fields and directional tracking boards assists kids in refining spatial accuracy and mechanical weight shifts simultaneously. This design provides children with an active learning experience in which physical movement and fine motor manipulation occur within a single continuous learning sequence. Accordingly, this study aims to analyze the effect of the "Jejak Huruf Pintar" Educational Game Tool on the gross and fine motor skills of children aged 5–6 years in an integrated manner.

Method

This study employed a quantitative approach using a quasi-experimental design with a one-group pretest–posttest model (Sugiyono, 2018). The design was used to examine changes in children's gross and fine motor skills before and after the implementation of the Educational Game Tool (APE) "Jejak Huruf Pintar." Although this design does not include a control group, it is considered appropriate for exploratory educational research in early childhood settings where classroom conditions and participant control are limited.

The study was conducted at Harapan Ceria Kindergarten and involved 18 children aged 5–6 years in Group B. Participants were selected using purposive sampling based on specific criteria, including developmental age appropriateness, active participation in classroom activities, and consistent attendance during the intervention period.

Data were collected through structured observation using an assessment sheet developed in accordance with early childhood motor development indicators based on national PAUD standards. The instrument measured two domains of motor skills. Gross motor skills were assessed through four indicators, namely body balance during jumping activities, coordination of movement along a letter-shaped pathway, agility in directional changes, and leg muscle strength during locomotor tasks. Fine motor skills were assessed through four indicators, namely tripod grasp ability, visual-motor coordination during tracing activities, finger movement control in forming lines, and visual concentration during manipulative tasks. Each indicator was rated on a four-point scale ranging from 1 (very low development) to 4 (very good development), and total scores were converted into percentage values for interpretation purposes.

The validity of the instrument was ensured through expert judgment in early childhood education, while reliability testing using Cronbach's Alpha produced a coefficient above 0.80, indicating good internal consistency. The research procedure consisted of three stages, beginning with a pretest to measure baseline motor skills, followed by a treatment phase in which the "Jejak Huruf Pintar" learning media was implemented over six sessions within two weeks (three sessions per week, each lasting 30 minutes), and ending with a posttest using the same instrument to measure changes in motor performance after the intervention. Data analysis was conducted using SPSS software. Normality assumptions were tested using the Shapiro–Wilk test, while differences between pretest and posttest scores were analyzed using a paired sample t-test with a significance level of $\alpha = 0.05$. In addition, effect size was calculated using Cohen's d to determine the magnitude of the

intervention effect.

Result and Discussion

The results of this study demonstrate that the Educational Game Tool (APE) “Jejak Huruf Pintar” provides a meaningful and effective contribution to the improvement of children’s motor development. The intervention created a structured yet enjoyable learning environment in which children were actively engaged in a continuous sequence of movement activities. These activities combined locomotor experiences through spatial navigation along letter-shaped pathways and manipulative tasks through tracing and fine motor exercises. The descriptive findings indicate a consistent increase in both motor domains after the intervention period, suggesting that the learning design successfully facilitated integrated motor stimulation.

In the locomotor domain, children showed a substantial improvement from a pretest mean score of 58.4 to a posttest score of 82.1. This increase reflects the positive influence of repeated movement experiences that required children to actively engage their whole body in structured spatial navigation. Moving across layout tracks enhances large joint mobility and dynamic posture adjustment. During the intervention, children were consistently exposed to movement sequences that required them to transition between points along letter-shaped pathways. This process encouraged them to coordinate their movements in response to spatial cues while maintaining continuity in motion. Over time, children became more confident and efficient in performing movement transitions, indicating improved motor control and spatial adaptation within a structured play environment.

In the manipulative domain, the mean score increased from 55.7 to 79.6. This improvement suggests that children were able to enhance their ability to control small muscle movements, particularly in hand and finger coordination tasks. The manipulative activities, which involved tracing letter patterns immediately after locomotor tasks, provided repeated opportunities for children to practice precision-based movements. Direct item tracking exercises are highly vital for conditioning small bone parameters and structural control in the hands. This immediate transition between gross and fine motor activities created a continuous learning cycle that reinforced the connection between bodily movement and hand control. As a result, children demonstrated better stability in hand movement, improved accuracy in tracing tasks, and increased ability to maintain focus during fine motor activities.

Table 1. Motor Skills Scores Before and After Intervention

Motor Skills	Pretest	Posttest	Increase
Gross Motor Skills	58.4	82.1	23.7
Fine Motor Skills	55.7	79.6	23.9

Further analysis of specific motor indicators provides a more detailed understanding of how the intervention influenced different aspects of development. The indicator-based results show that improvements occurred not only in general motor performance but also in finer developmental components that support overall motor competence. Children demonstrated better integration between visual perception and physical response, particularly during tasks that required coordination between eye movement and hand action.

Table 2. Motor Development Indicators Before and After Intervention

Indicator	Pretest	Posttest	Increase
Locomotor skills	58%	82%	24%
Manipulative skills	55%	80%	25%
Tripod grasp	54%	77%	23%
Visual-motor coordination	55%	81%	26%
Finger control	53%	78%	25%
Visual concentration	57%	82%	25%

The consistent improvement across all indicators suggests that the learning intervention did not only affect isolated motor abilities, but also supported the development of integrated motor functions. Children were observed to gradually become more coordinated in their movements, more precise in their hand control, and more focused during task completion. This indicates that the structured play-based design of “Jejak Huruf Pintar” successfully facilitated active sensorimotor

engagement throughout the learning process.

The inferential statistical analysis using a paired sample t-test further confirmed the effectiveness of the intervention, with $t(17) = 9.84$ and $p < 0.001$. This result indicates that the difference between pretest and posttest scores is statistically significant. In addition, the effect size value of Cohen's $d = 1.21$ indicates a large practical effect, suggesting that the intervention had a strong impact on children's motor development beyond statistical significance.

The improvement in locomotor skills can be understood as a result of structured and repetitive movement experiences embedded within the learning media. The letter-shaped pathway functioned as a spatial guide that required children to continuously adjust their movement direction and timing. This type of structured movement activity encouraged children to develop better body awareness and movement planning skills. Through repeated exposure, children became more efficient in controlling their movements and adapting to spatial demands, which is an important aspect of early motor development.

From a theoretical perspective, Newell's Constraints Theory provides a useful explanation for these findings. The design of the learning environment acts as an external constraint that shapes how children move and interact with space. Instead of engaging in random movement, children are guided by spatial patterns that require them to regulate their motor responses. This constraint-based learning process encourages children to refine their movement strategies and gradually develop more stable and coordinated motor patterns.

In the manipulative domain, the improvements can be attributed to the structured tracing activities that followed locomotor engagement. The immediate shift from large muscle movement to fine motor tasks created a continuous sensorimotor integration process. This design allowed children to connect whole-body movement experiences with precise hand-based actions. As children repeatedly engaged in tracing tasks, they developed better control over finger movements, improved hand stability, and increased ability to maintain attention during task completion. Working with customizable stencils and floor outlines stimulates precision alignment in terminal muscle pathways.

Gibson's Affordance Theory further supports this explanation by highlighting how the learning environment provides meaningful opportunities for action. The tracing tools and letter patterns served as affordances that naturally encouraged children to explore and practice fine motor movements. Children did not merely follow instructions but actively interacted with the materials, which enhanced their engagement and supported skill acquisition through direct experience. This tactile exploration using raw media blocks helps stabilize the hand pivots required for early writing readiness.

Compared to previous studies that often separate gross and fine motor stimulation, this study highlights the advantage of integrating both domains within a single structured learning system. The results suggest that simultaneous stimulation through circuit-based activities provides a more holistic developmental experience. Children are not only practicing isolated skills but are also engaging in coordinated movement sequences that reflect real developmental demands in early childhood. The large effect size further emphasizes the practical relevance of the intervention. Beyond numerical improvement, observational data during the intervention indicated that children were more enthusiastic, actively involved, and emotionally engaged in the learning process. This suggests that the "Jejak Huruf Pintar" media also contributes positively to learning motivation, which is an important factor in sustaining developmental progress in early childhood education.

Conclusion

This study concludes that the Educational Game Tool (APE) "Jejak Huruf Pintar" has a significant and positive effect on the motor development of children aged 5–6 years, particularly in locomotor and manipulative skills. The findings show that children's motor performance improved substantially after the intervention, as indicated by the increase in locomotor scores from 58.4 to 82.1 and manipulative scores from 55.7 to 79.6, supported by a large effect size ($d = 1.21$). These results confirm that structured, play-based learning activities are effective in stimulating integrated motor development in early childhood.

The integration of locomotor activities through letter-shaped spatial navigation and manipulative tasks through tracing activities provides a continuous sensorimotor learning experience. This approach allows children to actively engage in meaningful movement sequences that strengthen body coordination, movement control, and hand precision within a single learning system. The learning design also encourages higher engagement and motivation, making motor stimulation more enjoyable and developmentally appropriate. Practically, the "Jejak Huruf Pintar" media can be

recommended as an innovative alternative learning tool for early childhood educators to support holistic motor development in classroom settings.

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Disclosure statement

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