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Puzzle Play and Fine Motor Development among Children Aged 4–5 Years

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ABSTRACT

Introduction: Preschool age is a critical period for child development, including fine motor skills. However, fine motor developmental delays are still found among preschool children. Puzzle play is considered one of the educational activities that may help stimulate fine motor development. Initial observations at YPP Generasi Bangsa Tangkahan Kindergarten, Medan Labuhan, showed that several children experienced difficulties in activities such as folding, drawing, and imitating writing.

Objective: This study aimed to determine the relationship between puzzle play and fine motor development among children aged 4–5 years at YPP Tangkahan Nation Generation Kindergarten, Medan Labuhan, in 2025.

Method: This study used a descriptive correlational design with a cross-sectional approach conducted at YPP Generasi Bangsa Tangkahan Kindergarten, Medan Labuhan, in 2025. The respondents were 33 children aged 4–5 years who met the inclusion criteria and were selected using a total sampling technique. Data were collected through direct observation using the Denver Developmental Screening Test II (DDST II) instrument. Fine motor assessment for children aged 4–5 years included activities such as drawing shapes, folding paper, arranging objects, and imitating writing according to the DDST II guidelines. Data were analyzed using the Chi-Square test.

Results: The results showed that 22 children (66.7%) were categorized as having normal fine motor development, while 11 children (33.3%) were categorized as suspect. Based on column percentages in the crosstab analysis, among children with appropriate puzzle-play activities, 20 children (83.3%) had normal fine motor development and 4 children (16.7%) were categorized as suspect. Meanwhile, among children with inappropriate puzzle-play activities, 2 children (22.2%) had normal fine motor development and 7 children (77.8%) were categorized as suspect. Statistical analysis using Fisher's Exact Test showed a significant relationship between puzzle play and fine motor development among children aged 4–5 years at YPP Generasi Bangsa Tangkahan Kindergarten, Medan Labuhan, in 2025 ($p < 0.001$).

Conclusion: Puzzle play was associated with fine motor development among children aged 4–5 years. Puzzle activities may be used as a practical form of stimulation to support children's fine motor skills development at home and in educational settings. Further studies with larger samples and different research designs are recommended to strengthen the findings.

Keywords: *Puzzle play; Fine motor development; Preschool children; Educational games; Child development.*

Permainan Puzzle dan Perkembangan Motorik Halus pada Anak Usia 4–5 Tahun

ABSTRAK

Pendahuluan: *Usia prasekolah merupakan periode kritis bagi perkembangan anak, termasuk keterampilan motorik halus. Namun, keterlambatan perkembangan motorik halus masih ditemukan pada anak prasekolah. Permainan puzzle dianggap sebagai salah satu kegiatan edukatif yang dapat membantu menstimulasi perkembangan motorik halus. Hasil observasi awal di TK YPP Generasi Bangsa Tangkahan, Medan Labuhan, menunjukkan bahwa beberapa anak mengalami kesulitan dalam kegiatan, seperti melipat, menggambar, dan meniru tulisan.*

Tujuan: *Penelitian ini bertujuan untuk mengetahui hubungan antara permainan puzzle dan perkembangan motorik halus pada anak usia 4–5 tahun di TK YPP Generasi Bangsa Tangkahan, Medan Labuhan, pada tahun 2025.*

Metode: *Penelitian ini menggunakan desain deskriptif korelasional dengan pendekatan cross-sectional yang dilaksanakan di TK YPP Generasi Bangsa Tangkahan, Medan Labuhan, pada tahun 2025. Responden penelitian berjumlah 33 anak usia 4–5 tahun yang memenuhi kriteria inklusi dan dipilih menggunakan teknik total sampling. Data dikumpulkan melalui observasi langsung menggunakan instrumen Denver Developmental Screening Test II (DDST II). Penilaian motorik halus pada anak usia 4–5 tahun meliputi kegiatan menggambar bentuk, melipat kertas, menyusun benda, dan meniru tulisan sesuai dengan pedoman DDST II. Data dianalisis menggunakan uji Chi-Square.*
Hasil: *Hasil penelitian menunjukkan bahwa 22 anak (66,7%) dikategorikan memiliki perkembangan motorik halus normal, sedangkan 11 anak (33,3%) dikategorikan suspek. Berdasarkan persentase kolom dalam analisis tabulasi silang, pada kelompok anak dengan aktivitas permainan puzzle yang sesuai, sebanyak 20 anak (83,3%) memiliki perkembangan motorik halus normal dan 4 anak (16,7%) dikategorikan suspek. Sementara itu, pada kelompok anak dengan aktivitas permainan puzzle yang tidak sesuai, sebanyak 2 anak (22,2%) memiliki perkembangan motorik halus normal dan 7 anak (77,8%) dikategorikan suspek. Analisis statistik menggunakan Fisher's Exact Test menunjukkan adanya hubungan yang signifikan antara permainan puzzle dan perkembangan motorik halus pada anak usia 4–5 tahun di TK YPP Generasi Bangsa Tangkahan, Medan Labuhan, pada tahun 2025 ($p < 0,001$).*
Kesimpulan: *Permainan puzzle berhubungan dengan perkembangan motorik halus pada anak usia 4–5 tahun. Aktivitas permainan puzzle dapat digunakan sebagai bentuk stimulasi praktis untuk mendukung perkembangan keterampilan motorik halus anak di rumah dan lingkungan pendidikan. Penelitian lebih lanjut dengan jumlah sampel yang lebih besar dan desain penelitian yang berbeda direkomendasikan untuk memperkuat temuan ini.*

Kata kunci: *permainan puzzle; perkembangan motorik halus; anak prasekolah; permainan edukatif; perkembangan anak.*

INTRODUCTION

Child development involves changes in physical, cognitive, social, and motor abilities that occur throughout childhood. One important aspect of preschool development is fine motor skill development, which supports children's ability to perform activities such as drawing, folding, arranging objects, and writing (1). Delays in fine motor development are still found among preschool children and may affect their readiness for learning activities. Appropriate stimulation through play activities is considered important during the preschool period, as children at this stage are highly responsive to environmental stimulation. Educational games such as puzzles may help stimulate hand-eye coordination and fine motor skills in preschool children (2).

Preschoolers are children aged 3–6 years who are in an important stage of growth and development, often referred to as the golden age (2)(3). During this period, children actively develop various abilities, including motor, social, emotional, and cognitive skills. However, developmental delays may still occur, particularly in fine motor development, which can affect children's readiness for learning activities (4).

Fine motor development is one aspect of child development that is easily observed, although it often receives less attention than other aspects of development. Fine motor skills refer to the coordination between the small muscles in the hands and eyes. Fine motor development is crucial because it supports a child's ability to perform basic daily tasks, such as eating, writing, and other activities that require the us e of small muscles in the hands (5). Fine motor development in children requires parental attention. If a child experiences delays in development, further development will be hampered. Therefore, parents need to be sensitive in

assessing the extent to which their child's developmental abilities are being met (6).

According to UNICEF, approximately 93 million children aged 14 years and younger worldwide experience moderate or severe developmental delays or disabilities that may affect motor, cognitive, and social development. Early identification and appropriate stimulation are important to support optimal child development (7)(8).

Based on the results of the 2018 Basic Health Research (Riskesdas) conducted by the Indonesian Ministry of Health, child growth and development remains a major concern in efforts to improve the quality of child health in Indonesia. In addition to nutritional issues such as stunting, delayed child development is also a challenge, especially in developing and middle-income countries, as it can impact a child's ability to reach their optimal developmental potential. Globally, it is estimated that more than 250 million children under five are at risk of not achieving optimal development due to nutritional factors and lack of developmental stimulation (9). Research by Paninsari D et al. also explains that stimulation through educational play tools can help improve children's fine motor development (10).

Based on 2019 health data from North Sumatra Province, monitoring child growth and development is a crucial indicator in efforts to improve early childhood health. The North Sumatra Provincial Government, through its maternal and child health program, continues to promote early detection of toddler growth and development to prevent developmental disorders in preschool-aged children (11).

Delays in fine motor development can have a significant impact on a child's development, hindering age-appropriate achievement (12). Children who experience fine motor delays often face learning difficulties, which can lead to behaviors such as reluctance to write and a decreased interest in learning (13) (14). Furthermore, these delays can impact a child's personality, such as feelings of inferiority, doubt, and anxiety when interacting with their environment. In preschool children, fine motor delays can also hinder a child's ability to socialize with peers, especially in play and writing activities (15). The impact of delayed fine motor development in children arises due to several contributing factors. Therefore, children who experience fine motor delays often have difficulty coordinating their hand and finger movements flexibly, which can affect their independence and social interactions (16).

Fine motor development in preschool children is influenced by several factors, including nutritional status, health conditions, environmental stimulation, parental education, and opportunities to participate in activities that train hand-eye coordination and finger movements (15). Delays in fine motor development may affect children’s ability to perform activities such as drawing, folding paper, arranging objects, and imitating writing. Therefore, early detection of developmental problems is important to identify children who may require additional stimulation or intervention. One commonly used screening instrument is the Denver Developmental Screening Test II (DDST II), which assesses children’s developmental abilities, including fine motor skills (14). In this study, puzzle play was examined as a form of educational stimulation that may support fine motor development in preschool children. Data on parental education were collected using a questionnaire completed by the parents.

The Denver Developmental Screening Test (DDST) is a method for examining developmental problems in children. This method assesses a child's development in four areas: personal social skills, fine motor skills, language skills, and gross motor skills. In terms of fine motor skills, the

DDST assesses a child's ability to perform movements involving specific body parts, such as following the midline, holding small objects, or examining beads, among other activities. The DDST is a test often used to monitor the development of children aged 0-6 years (17). This test is quite quick, easy to administer, and has a high level of accuracy. However, it should be noted that the DDST is not a test for diagnosing disease or measuring a child's intelligence. In addition, by providing appropriate stimulation to children, we can help prevent disorders in their development and ensure optimal growth and development (18).

Puzzles are educational toys that involve assembling picture pieces into a whole. Puzzles may serve as an educational activity that supports fine motor stimulation in children (19). Through this game, children can train their finger muscles by shuffling and rearranging the puzzle pieces to form a complete picture. As Muzamil explained, puzzles play a crucial role in developing children's fine motor skills. By assembling the corresponding picture, children actively engage their fingers, which may contribute to the development of fine motor skills (20).

Research on puzzle games and fine motor development has previously been conducted among children aged 24–36 months in Jaddih Village, Bangkalan, involving 32 children. The study found that 71.9% of children were able to achieve puzzle game indicators, and most children demonstrated good fine motor development (59.4%). Statistical analysis using logistic regression showed a significant association between puzzle play and fine motor development ($p = 0.004$)(21).

However, previous studies have primarily focused on younger children and different community settings. Limited research has specifically examined the relationship between puzzle play and fine motor development among preschool children aged 4–5 years in kindergarten settings, particularly in Medan Labuhan. Therefore, this study aims to provide additional evidence regarding the association between puzzle play activities and fine motor development in preschool children within the local educational context.

Based on an initial survey conducted through interviews with the person in charge at YPP Generasi Bangsa Tangkahan Kindergarten, Medan Labuhan, a preliminary observation involving 25 students was carried out. The findings showed that 15 children demonstrated indications of fine motor developmental delays, including difficulties in folding paper, drawing, and imitating writing. Specifically, 4 children were unable to fold paper properly, 5 children had difficulty drawing, and 6 children were unable to imitate writing. Teachers also reported that these difficulties were observed during the teaching and learning process, particularly in activities requiring fine motor coordination. These preliminary observation findings became the basis for conducting the main study. In the main study, the total population and sample consisted of 33 children aged 4–5 years who met the inclusion criteria and were selected using a total sampling technique.

METHODS

The study used a descriptive correlational design with a cross-sectional approach to examine the relationship between puzzle play and fine motor development among children aged 4–5 years at YPP Generasi Bangsa Tangkahan Kindergarten, Medan Labuhan. The study was conducted from February to May 2025. The population consisted of all children aged 4–5 years enrolled at YPP Generasi Bangsa Tangkahan Kindergarten, Medan Labuhan, in 2025, totaling 33 children. The sample was selected using a total sampling technique, in which all eligible children were included as research respondents.

The inclusion criteria were children aged 4–5 years who were actively enrolled in school, able to participate in puzzle-playing activities, and whose parents or guardians provided informed consent. The exclusion criteria included children who were absent during data collection, had neurological disorders, severe visual impairments, or limitations in hand movement that could interfere with participation in puzzle activities and fine motor assessments.

The independent variable in this study was puzzle play, defined as children's participation in educational puzzle activities involving the arrangement of shapes and pictures according to appropriate patterns. Puzzle play was categorized as "appropriate" if children were able to match shapes or pictures correctly, follow instructions, and complete the puzzle according to the expected pattern and developmental stage. Puzzle play was categorized as "not appropriate" if children were unable to complete these indicators properly. Observations were conducted directly by the researcher during learning activities using a structured observation sheet developed based on indicators of preschool fine motor stimulation activities. The observation sheet included indicators related to puzzle completion, hand-eye coordination, accuracy, and ability to follow instructions. Assessment scores were categorized according to predetermined criteria. However, inter-rater reliability testing was not conducted.

The dependent variable was fine motor development, which was assessed using the Denver Developmental Screening Test II (DDST II) instrument. Fine motor development was evaluated through age-appropriate tasks, such as drawing, folding paper, and imitating writing. The assessment results were categorized according to DDST II interpretation guidelines.

This study was conducted after obtaining approval from the school and informed consent from parents or guardians.

Data were analyzed using the Chi-Square test or Fisher's Exact Test when the expected cell counts were less than five, with a significance level of $p < 0.05$.

RESULT

Univariate Analysis

After conducting research on 33 respondents, namely kindergarten children aged 4–5 years at YPP Generasi Bangsa Tangkahan Kindergarten, Medan Labuhan District, from February to May 2025, the following data on the distribution of respondent characteristics were obtained:

Table 1. Frequency Distribution of Respondent Characteristics

No	Characteristics	n	%
	Age		
1	4 years	14	42.4
2	5 years	19	57.6
	Gender		
1	Male	15	45.5
2	Female	18	54.5
	Parental Education		
1	Primary School	5	15.2
2	Secondary School	18	54.5
3	Higher Education	10	30.3
	Total	**33**	**100**

Based on Table 1, among the total of 33 respondents at YPP Generasi Bangsa Tangkahan Kindergarten, Medan Labuhan, in 2025, the majority of children were aged 5 years (19 children; 57.6%), while 14 children (42.4%) were aged 4 years. Based on sex, 18 children (54.5%) were Female and 15 children (45.5%) were Male. In terms of parental education, most parents had secondary school education (18 respondents; 54.5%), followed by higher education (10 respondents; 30.3%) and primary school education (5 respondents; 15.2%).

Table 2. Frequency Distribution of Puzzle Play Activities

No	Puzzle Play Category	Frequency (f)	%
1	Appropriate	24	72.7
2	Inappropriate	9	27.3
	Total	**33**	**100**

Based on Table 2, among the 33 respondents, the majority of children were categorized as having appropriate puzzle play activities, totaling 24 children (72.7%), while 9 children (27.3%) were categorized as having inappropriate puzzle play activities. The appropriate and inappropriate puzzle play categories were determined based on structured observation criteria used during the study.
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Table 3. Frequency Distribution of Respondents' Fine Motor Development Based on DDST II

No	Fine Motor Development Category	n	%
1	Normal	22	66.7
2	Suspect	11	33.3
3	Untestable	0	0
	Total	**33**	**100**

Based on Table 3, among the 33 respondents at YPP Generasi Bangsa Tangkahan Kindergarten, Medan Labuhan, in 2025, most children were categorized as having normal fine motor development (22 children; 66.7%), while 11 children (33.3%) were categorized as suspect. No children were included in the untestable category.

Bivariate Analysis

Table 4. Relationship Between Puzzle Play and Fine Motor Development Among Children Aged 4–5 Years

No	Fine Motor Development	Playing *Puzzles*				Total		P *Value*
		Appropriate Puzzle Play		Inappropriate Puzzle Play				
		n	%	n	%	n	%	
1	Normal	20	83.3	2	22.2	22	66.7	0.000
2	Suspect	4	16.7	7	77.8	11	33.3	
Total		**24**	**100**	**9**	**100**	**33**	**100**	

Based on Table 4, most children with normal fine motor development were categorized as having appropriate puzzle play activities (20 children; 83.3%). In contrast, most children categorized as suspect in fine motor development were

included in the inappropriate puzzle play category (7 children; 77.8%). The Fisher's Exact Test showed a statistically significant association between puzzle play and fine motor development among children aged 4–5 years ($p < 0.001$). children were able to achieve the puzzle game indicators, and 59.4% demonstrated good fine motor development. The statistical test results indicated a significant association between puzzle play and fine motor development ($p = 0.004$). These findings suggest that puzzles may be used as an educational activity to support children's fine motor stimulation. The researchers concluded that parents and health workers should consistently provide stimulation through educational games such as puzzles in children's daily activities (21).

DISCUSSION

The Relationship Between Playing *Puzzles* and the Development of Fine Motor Skills in Children 4-5 Years

The results of the statistical analysis using the Chi-Square test showed a p-value of < 0.001 ($\alpha = 0.05$). This indicates a statistically significant relationship between puzzle play and the fine motor development of children aged 4–5 years at YPP Generasi Bangsa Tangkahan Kindergarten, Medan Labuhan, in 2025.

The results of this study are supported by research conducted by Inayatur Rosyidah (2025), which showed that puzzle games had an effect on the fine motor development of preschool children. The study found that before the intervention, children's fine motor development was categorized as normal in 16 children (36.4%), suspected in 21 children (47.7%), and untestable in 7 children (15.9%). After the puzzle game intervention, the number of children with normal fine motor development increased to 34 children (77.3%), while 10 children (22.7%) were categorized as suspected and none were untestable. The Wilcoxon test results showed $p = 0.000$ ($p < 0.05$), indicating a significant effect of puzzle games on fine motor development in preschool children at Muslimat 6 Kindergarten Tarbiyatul Athfal Sambong Hamlet, Jombang. However, unlike the previous interventional study, the present study used a cross-sectional design and therefore only assessed the association between puzzle play and fine motor development, not a causal effect (22) .

Research by Nikmah, Qomari, and Zainiyah (2023) showed a significant relationship between puzzle games and the fine motor development of children aged 24–36 months. As many as 71.9% of

Motor development plays a vital role in shaping a child's overall personality. Fine motor skills are essential for everyday activities such as writing, cutting, scribbling, and stacking blocks. These skills provide the foundation for optimal growth and learning. Fine motor skills develop as the nervous and muscular systems mature, and every movement a child makes is the result of the body's systems working together, controlled by the brain (23). Fine motor development also helps children adapt to learning environments, such as drawing, coloring, painting, and preparing to write. Kindergarten instruction should stimulate these skills through repeated and consistent practice. If properly honed, children will become more skilled in activities such as drawing, cutting paper, assembling *puzzles* , weaving, and sharpening pencils. One effective activity for stimulating fine motor skills is playing *puzzles* (24).

Puzzles are a fun and beneficial form of stimulation that may supports children's development, particularly fine motor skills. Through the activity of holding, moving, and arranging small pieces, children actively practice hand-eye coordination, improve accuracy, and cultivate patience. This process also involves the brain, especially the cerebellum and parietal lobe,

which may plays an important role in regulating fine movements, motor coordination, and concentration (25). When assembling *a puzzle* , children not only practice manual skills but also logical thinking skills simultaneously. Thus, playing *with puzzles* may provide comprehensive stimulation, both cognitively and motorically (26). Therefore, the involvement of parents and teachers in introducing and accompanying children to play with *puzzles* is very important, because it may help create a conducive environment to support the growth and development of children aged 4–5 years according to their developmental stage (27).

The findings showed that most children who engaged appropriately in puzzle play demonstrated normal fine motor development. These results indicate that puzzle activities may support the stimulation of children's fine motor skills through activities requiring hand-eye coordination, finger movement control, and concentration. The findings are consistent with previous studies reporting that educational games such as puzzles are associated with improved fine motor development in preschool children. However, this study was limited by its cross-sectional design and relatively small sample size, so causal relationships could not be established. Future studies are recommended to involve larger samples and longitudinal or experimental designs to further explore the association between puzzle play and fine motor development.

Data analysis showed that among the 33 children aged 4–5 years, 22 children (66.7%) were categorized as having normal fine motor development, while 11 children (33.3%) were categorized as suspect. Among the children with normal fine motor development, 2 children were categorized as having inappropriate puzzle play activities. This finding suggests that factors other than puzzle play, such as parental stimulation at home, participation in other fine motor activities, and individual developmental readiness, may also contribute to fine motor development. Meanwhile, among children categorized as suspect, 4 children demonstrated appropriate puzzle play activities. This may indicate that fine motor development is also influenced by other factors, including nutritional status, health conditions, and environmental stimulation. Therefore, puzzle play may support fine motor stimulation, but children's development is likely influenced by multiple interacting factors.

STUDY LIMITATIONS

This study had several limitations. First, the sample size was relatively small and involved only one kindergarten, which may limit the generalizability of the findings. Second, the cross-sectional design only identified relationships between variables and could not determine causal associations. Third, potential confounding factors such as nutritional status, parenting patterns, socioeconomic conditions, and stimulation at home were not fully controlled. In addition, the use of observational assessments may have introduced observer bias during data collection and interpretation. Furthermore, inter-rater reliability testing was not conducted, so differences in observer assessments may have affected the consistency and reliability of the measurement results.

CONCLUSION

Based on the results of this cross-sectional study conducted at YPP Generasi Bangsa Tangkahan Kindergarten, Medan Labuhan, most children demonstrated appropriate puzzle-playing activities and normal fine motor development. Statistical analysis showed a significant association between puzzle play and fine motor development among children aged 4–5 years ($p < 0.001$). Children who played puzzles appropriately tended to have better fine motor development compared to those who

did not. However, because this study used a cross-sectional design, the findings only indicate an association and cannot confirm a causal relationship between puzzle play and fine motor development.

AUTHOR'S CONTRIBUTION STATEMENT

The author was responsible for study conception and design, data collection, data analysis, manuscript preparation, and final approval of the manuscript.

CONFLICTS OF INTEREST

The author declares no conflicts of interest related to this study.

DECLARATION OF GENERATIVE AI AND AI-ASSISTED TECHNOLOGIES

The author used ChatGPT by OpenAI to assist in language improvement and grammar checking during manuscript preparation. The author reviewed and edited the content and takes full responsibility for the final manuscript.

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