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The Effect of Using the Number Maze Educational Game on Developing Mathematical Logic Intelligence in 5-6 Year Old Children

Pengaruh Penggunaan Permainan Edukatif Maze Angka Terhadap Mengembangkan Kecerdasan Logika Matematika Anak Usia 5-6 Tahun

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Abstract
This study aims to analyze the effect of using the number maze educational game tool (APE) on the development of mathematical logic intelligence in children aged 5-6 years at TK IT Nurul Ilmi. The main problem underlying this research is the low ability of children to recognize number symbols and solve simple numerical problems due to unvaried learning methods. The research method used is quantitative with a quasi-experimental design of the One-Group Pretes-Postes type. The research sample consisted of 15 children selected using a purposive sampling technique. Data were collected through structured observation sheets and analyzed using paired sample t-test. The results showed that the application of the number maze game had a significant effect on improving children's mathematical logic intelligence. This can be seen from the drastic increase in the average score of children's abilities after being given the intervention. This study recommends the use of number maze media as an effective alternative learning media to stimulate logical-mathematical thinking skills in early childhood education institutions.
Keywords: educational games; number maze; mathematical logic; early childhood; experimental method

Abstrak
Penelitian ini bertujuan untuk menganalisis pengaruh penggunaan Alat Permainan Edukatif (APE) maze angka terhadap pengembangan kecerdasan logika matematika anak usia 5-6 tahun di TK IT Nurul Ilmi. Masalah utama yaitu masih rendahnya kemampuan anak dalam mengenali lambang bilangan dan memecahkan masalah numerik sederhana akibat metode pembelajaran yang kurang variatif. Metode penelitian yang digunakan adalah kuantitatif dengan desain eksperimen semu tipe One-Group Pretes-Postes. Sampel berjumlah 15 orang yang dipilih menggunakan teknik purposive sampling. Data dikumpulkan melalui instrumen lembar observasi terstruktur dan dianalisis menggunakan rumus paired sample t-test. Hasil penelitian menunjukkan bahwa penerapan permainan maze angka memberikan pengaruh yang signifikan terhadap peningkatan kecerdasan logika matematika anak. Hal ini terlihat dari kenaikan nilai rata-rata kemampuan anak yang sangat drastis setelah diberikan perlakuan. Penelitian ini merekomendasikan penggunaan media maze angka sebagai salah satu alternatif media pembelajaran yang efektif untuk menstimulasi kemampuan berpikir logis-matematis di lembaga pendidikan anak usia dini.
Kata kunci: *permainan edukatif; maze angka; logika matematika; anak usia dini; metode eksperimen*

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A. INTRODUCTION

Early childhood education is a crucial phase in stimulating all aspects of a child's development, one of which is cognitive abilities (Suryana, 2016). Within the cognitive aspect, logical-mathematical intelligence plays a crucial role as the foundation for logical, critical, and problem-solving skills from an early age (Talango, 2020). However, in reality, the development of logical-mathematical intelligence often faces obstacles in practice due to the limited use of innovative and interactive learning media (Rosita et al., 2018). The learning process tends to be monotonous and teacher-centered, such as the use of student worksheets (LKS) or abstract lecture methods. This makes children feel bored and makes it difficult to understand the numerical concepts being taught (Sit, Amallia, et al., 2021).

This problem was clearly discovered through initial observations (pre-research) conducted on the logical-mathematical intelligence of children aged 5-6 years at TK IT Nurul Ilmi. Based on initial data, the majority of children were still in the Not Yet Developing (BB) and Beginning to Develop (MB) criteria in mathematical logic achievement. Of the total children observed, as many as 65% of children were unable to recognize number symbols correctly and often mixed up when mentioning the numbers 6, 9, 7, and 8. In addition, around 70% of children experienced difficulty in sequencing number patterns and solving simple numerical problems, such as counting the number of objects randomly. Children tended to be passive and less enthusiastic when faced with activities related to the concept of numbers and counting logic. This initial data indicates the urgency of problem solving through the application of concrete media that can transform abstract mathematical concepts into concrete and fun.

Theoretical studies state that early childhood is in the pre-operational stage of cognitive development (Jean Piaget) in the journal (Marinda, 2020), where they build understanding through the manipulation of physical objects and play activities. Play for children is the most effective learning tool. One medium that can be used to stimulate this ability is an Educational Game Tool (APE) in the form of a number maze (Artamevia et al., 2024). The number maze game is designed to train concentration, eye-hand coordination, and problem-solving skills as children move the number pieces to the right

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place (Apriani et al., 2025). Several previous relevant studies have tested the effectiveness of maze media or similar educational games. Research by (Sit, Arlina, et al., 2021) shows that the use of visual and motor-based game tools can significantly improve children's logical-mathematical intelligence. In addition, (Tasliyah et al., 2020) also emphasized that mathematics learning integrated with manipulative APE successfully increased the enthusiasm and numerical understanding of early childhood (Nurlaili, 2022).

Although extensive research has been conducted on maze media and mathematical intelligence, there are gaps that distinguish this study from previous research (Lubis & Ardilla, 2023). Most previous studies focused on conventional path mazes or the use of mazes solely for fine motor development. The novelty of this study lies in the modification of the number maze game that integrates three indicators of mathematical intelligence simultaneously in a single gameplay: number symbol recognition, number pattern sequencing, and independent mechanical-spatial problem solving through a quasi-experimental method (*Quasi-Experiment) type One-Group Pretes-Postes.*The urgency of solving the problems in this research is very pressing. If these obstacles to logical-mathematical intelligence are not immediately addressed through appropriate media such as number mazes, children will experience more complex difficulties learning mathematics at subsequent levels of elementary education.*(learning gap)*, as well as reducing their interest in science and technology (Zakiyah & Abdul, 2021).

Based on the background and urgency that has been explained, the formulation of the problem in this study is: Is there a significant influence of the use of educational number maze games on the development of mathematical logic intelligence of children aged 5-6 years at TK IT Nurul Ilmi? This study aims to analyze and determine the significant influence of the use of educational number maze games on the development of mathematical logic intelligence of children aged 5-6 years at TK IT Nurul Ilmi.

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B. RESEARCH METHODS

This research uses a quantitative approach with this type of research.*pre-experimental design*. The design used is*One Group Pretes-Postes Design*, a study conducted on a single group without a control group, with a pretest administered before treatment and a posttest after treatment. This design was used to determine the effect of the educational number maze game on the logical-mathematical intelligence of children aged 5–6 years. According to Sugiyono (2022), the research design can be described as follows:

$$O_1 \; X \; O_2$$

Information:

X = Treatment given through educational number maze game activities

O_1 = Logical mathematical intelligence before being given treatment

O_2 = Mathematical logic intelligence is given treatment

The research was conducted at TKIT Nurul Ilmi in April–May 2026. The research subjects were 15 children aged 5–6 years, consisting of 8 boys and 7 girls. The sampling technique used*total sampling*, because all children in group B were used as research subjects. The number of samples used was adjusted to the number of active children in the research class. The data collection techniques used in this study included structured observation, testing, and documentation (Inanna, 2024). Observations were conducted periodically using scaled observation sheets to directly monitor the development of children's indicators during play. The testing technique was implemented through a pretest before the intervention to measure initial abilities, and a posttest at the end of the learning period to evaluate the children's final achievement of logical-mathematical intelligence (Munawaroh, 2017).

The instrument for assessing logical-mathematical intelligence in children aged 5–6 years was developed comprehensively based on the Child Development Achievement Level Standards (STPPA), which are broken down into several tactical indicators. These achievement indicators are presented in a matrix of instrument grids to ensure content validity in measuring children's cognitive abilities, as presented in Table 1 below (Pendidikan et al., 2020):

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Table 1. Research Variable Indicators

No	Variables	Indicator
1. .	Children's Logical Mathematical Intelligence	1. Children are able to search for and find the number symbols 1-20 on the maze path (number maze) 2. Children are able to sequence numbers sequentially based on the concept of logical sequence. 3. Children are able to match the number of pictures with number cards (one-to-one correspondence) 4. Children are able to solve simple problems (*problem solving*) in determining the toll-free lane
2.	Motor Skills and Thinking Attitudes	5. Able to recognize number and color patterns on the maze board structure 6. Able to coordinate eye and hand movements when shifting number pawns 7. Demonstrate concentration, accuracy, and perseverance in completing tasks

Source: PAUD Implementation Plan (Education et al., 2020)

Each observation indicator sheet was assessed using a modified Likert scale for early childhood development with a range of four standard achievement levels. These achievement levels consist of Not Yet Developing (BB), Starting to Develop (MB), Developing According to Expectations (BSH), and Developing Very Well (BSB). The data analysis technique integrated descriptive and inferential statistical calculations using SPSS version 25 software. Descriptive statistics were used to analyze the average value (*mean*), standard deviation, and variance of the test results. The prerequisite analysis tests performed included a data normality test using the Shapiro-Wilk method, given the small sample size (less than 50 children). Data were categorized as normally distributed if the significance coefficient p-value showed a number greater than 0.05.

Hypothesis testing to test the differences in influence between variables is carried out using analysis.*Paired Sample t-Test*with a significance level > 0.05 (Waruwu, 2024). Hypothesis testing using*Paired Sample t-Test*to determine the effect of the educational number maze game on children's mathematical logic intelligence before and after treatment was given (Nurlaili, 2019). The research hypothesis is formulated as follows:

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H_0: There is no influence of the educational number maze game on intelligence mathematical logic for children aged 5–6 years.

H_a: There is an influence of the educational number maze game on logical intelligence. mathematics for children aged 5–6 years

Meanwhile, the mathematical formula used to calculate the t-value is as follows (Oktaviani & Setiyono, 2022):

$$t = \frac{\mathrm{Md}}{\sqrt{\frac{\Sigma(xd)^2}{N(N-1)}}}$$

Information:

Md = mean of the difference between pre-test and post-test

Xd = deviation of each subject (d-Md)

$\sum x\ 2d$= sum of squares of deviations

N = number of samples 47 db = determined N-

C. FINDINGS AND DISCUSSION

This research was conducted for four weeks, from April 1 to May 1, 2026, at Nurul Ilmi Kindergarten. The study involved a group of 15 children aged 5–6 years. The treatment consisted of a number maze educational game to develop children's logical and mathematical intelligence. The media used were:

Figure 1. Number Maze Media

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A pretest was then administered before treatment to determine the children's initial logical-mathematical intelligence. After treatment using the educational number maze game, a posttest was administered to assess the children's development.

Table 2. Frequency Distribution of Pretest Scores

No	Interval (Shoes)	Frequencies (f)	Percentage (%)	Category
1	8-9	2	13,3%	BB
2	10-11	9	60,0%	MB
3	12-13	3	20,0%	MB
4	14-15	1	6,7%	BSH
Total		**15**	**100%**	

Based on Table 2, it can be seen that before being given treatment, the majority of children's logical mathematical intelligence was still in the Starting to Develop (MB) and Not Yet Developed (BB) categories with an accumulative percentage reaching**93,3%**(14 children). Only 1 child (6.7%) was in the Developing According to Expectations (BSH) category. This reinforces the initial condition that children's ability to recognize number symbols and solve simple numerical problems is still low.

Table 3. Frequency Distribution of Posttest Scores

No	Interval (Shoes)	Frequencies (f)	Percentage (%)	Category
1	16-17	1	6,7%	MB
2	18-19	5	33,3%	BSH
3	20-21	6	40,0%	BSH
4	22-23	2	13,3%	BSB
5	24-25	1	6,7%	BSB
Total		**15**	**100%**	

Based on Table 3, there was a very significant change or shift in the child's ability curve after the intervention was given.**73,3%**children (11 children) successfully achieved the Developing According to Expectations (BSH) category and**20%**Children (3 children) were able to achieve the highest criteria, namely Very Well Developed (BSB). There were no

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longer any children in the Not Yet Developed (BB) category.

Table 4. Comparison of Average Values and Development Categories

Measurement	Shoes Minimum	Maximum Score	Mean Value	Category
Pretest	8	14	10.8	MB
Positions	16	25	20,5	BSH

In descriptive statistics, there was a spike in the average value (*mean*) which is very drastic, namely from**10,8**rise to**20,5**. Supported by inferential test results*Paired Sample T-Test*with a Sig. value (2-tailed) = 0.000 < 0.05, then H is conclusively$_0$rejected and H$_a$accepted.

Discussion

The results of the study showed that the educational number maze game significantly influenced the logical-mathematical intelligence of children aged 5–6 years. This was evident in the increase in the children's average score from 10.8 in the pretest to 20.5 in the posttest after being given treatment using the number maze game.*Paired Sample t-Test*also shows a significance value of 0.000 < 0.05 so that H$_0$rejected and H$_a$accepted. In addition, the value*effect size*of 3.65 shows that the educational number maze game has a very large influence on the development of children's mathematical logic intelligence (Apriani & Ilhami, 2025).

This improvement occurs because the number maze game provides a concrete, interactive, and enjoyable learning experience for young children. In this game, children not only learn number symbols but also engage in logical thinking activities to determine the correct path to reach the game's goal. This activity helps children develop systematic thinking and simple problem-solving skills through play and learning (Zakiyah et al. 2021).

The results of this study align with Jean Piaget's theory of cognitive development, which states that children aged 5–6 years are in the preoperational stage. At this stage, children more easily understand concepts through concrete objects, visual symbols, and play activities (Paul, 2021). The use of number maze games provides children with opportunities for hands-on learning through path exploration, pattern observation, and simple decision-

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making, making basic mathematical concepts easier for them to grasp (Wati et al., 2023).

Furthermore, the play-while-learning approach in the number maze game aligns with the characteristics of early childhood education, which emphasizes active and enjoyable activities (Hijriati, 2021). Children learn without pressure because learning takes place through engaging games that increase motivation. This allows children to be more focused, active, and enthusiastic during the learning process.

The results of this study are also supported by research (Apriani & Ilhami, 2025), which states that number maze games can improve early childhood number symbol recognition skills. Research (Zakiyah et al., 2021) also shows that maze games are effective in improving number recognition skills in early childhood. However, this study is novel because it focuses not only on number recognition skills but also on developing pattern recognition, logical thinking, and simple problem-solving skills as part of the logical-mathematical intelligence of children aged 5–6 years.

The educational number maze game helps children develop cognitive skills that are included in early childhood development indicators in the STPPA aspect. The game activities carried out during the research train the ability to classify, seriate, one-to-one correspondence, and solve simple problems (Latif, 2020).

Classification skills are evident when children group numbers and match number symbols to the corresponding number of objects. Seriation skills develop when children order numbers from smallest to largest in a maze. Furthermore, children also learn one-to-one correspondence when connecting the number of objects with the correct number symbol. These activities demonstrate that number maze games can stimulate logical mathematical thinking skills gradually according to the child's age (Widiastuti et al., 2023).

During the game, children are also trained to solve simple problems by finding the correct path to the final maze goal. They must choose a path, pay attention to number patterns, and avoid dead ends. This activity fosters critical thinking, concentration, precision, and simple decision-making skills in young children (Nurhayati & Putro, 2021).

The use of concrete manipulative media such as number mazes is crucial in early childhood education because young children are still in the concrete thinking stage. Through visual media and hands-on activities, children more easily grasp mathematical concepts than

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learning that only uses worksheets or verbal explanations. Therefore, number maze games can be an effective alternative learning medium for developing logical-mathematical intelligence in early childhood (Susanti & Affrida, 2018).

In addition to developing cognitive skills, number maze games also create a fun and interactive learning environment (Khadijah and Armanila, 2017). Children appear more active during learning activities because they are directly involved in exploring the game. This suggests that the use of educational games can increase children's engagement in learning and help teachers create more innovative learning that aligns with the developmental characteristics of early childhood (Khadijah et al., 2022). Thus, the educational number maze game can be used as an effective learning medium in developing the mathematical logic intelligence of children aged 5-6 years through concrete, active, and fun play activities.

D. CONCLUSIONS AND SUGGESTIONS

The results of this study obtained several conclusions, namely: (1) the use of educational games*maze*Numbers have been proven to have a significant influence on the development of logical mathematical intelligence in children aged 5-6 years at TK IT Nurul Ilmi, which is shown by the jump in the average value from 10.8 to 20.5 as well as the value*effect size*of 3.65; (2) media*maze*Effective numbers stimulate children's ability to recognize number symbols 1-20, sort numbers logically, carry out one-to-one correspondence, and solve simple spatial-mechanical problems independently through concrete and fun play activities. Thus, the following suggestions are made: (1) for PAUD teachers, it is recommended to integrate media*maze*these numbers into play-based learning and modify the circuit innovatively according to the child's development level; (2) for schools, it is hoped that they will facilitate the provision of varied manipulative educational play tools (APE) to support the implementation of an interactive PAUD curriculum; (3) for parents, it is recommended to continue stimulating the introduction of the concept of numbers and patterns through continuous harmonious play activities while accompanying children at home.

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