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Enhancing Logical Thinking in Preschoolers: The Educational Block Media Approach

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Abstract

The capacity for logical thinking is crucial in early childhood development, facilitating the ability to reason and analyze from multiple perspectives to form concrete conclusions. This study investigates the effect of educational block media on enhancing logical thinking abilities among preschool children aged 4-5 years. Employing a quasi-experimental design with a pretest-posttest control group format, the research aims to evaluate the effectiveness of these tools in an educational setting. Forty children from a kindergarten class were chosen through purposive sampling as the study's participants. The data collection involved administering performance tests, both before and after the introduction of the educational blocks, to assess the children's logical thinking skills quantitatively. Statistical analysis was performed using SPSS 21, which included tests for Normality, Homogeneity, and the Independent Sample t-test to compare the experimental and control groups' scores. The results showed that the experimental group, which used the educational block media, significantly outperformed the control group in the posttest, with mean scores of 15.65 and 9.90, respectively. The statistical analysis supported these results with a t-test yielding a significance level of 0.000, confirming the positive impact of the educational blocks on the development of logical thinking skills. The findings highlight the effectiveness of using tangible educational tools like blocks in stimulating cognitive processes among young children. This study provides valuable implications for early childhood education practices, recommending integrating educational block media into teaching strategies to enhance cognitive development. It also suggests areas for further research, particularly in the longitudinal impact of such educational interventions on child development over time.

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Introduction

Preschool education, also known as early childhood education, is an effort to nurture and stimulate children from birth up to the age of six years. This nurturing aids in the physical and spiritual growth and development of children. Often referred to as the "Golden Age," this period is when children are particularly receptive to learning processes and receiving various stimuli to support their growth and development. To successfully foster early childhood development, six fundamental aspects must be nurtured. These include, but are not limited to, the instillation of moral and religious values, enhancement of cognitive abilities, refinement of language skills, development of motor skills, improvement of socio-emotional abilities, and encouragement of artistic expression (Kusumawati & Mashudah, 2020; Uce, 2017).

A critical area for development is cognitive growth. The cognitive ability process centers on enhancing an individual's capacity to think, acquire knowledge, and address challenges faced by children (Aisyah, 2020). This development enhances children's intellectual abilities (Amalia & Khoiriyati, 2018; Aprianti & Nafiqoh, 2020). Logical thinking ability is one aspect of cognitive development that requires stimulation (Nur et al., 2020). According to Purnama (2019) and Pattisina, logical thinking involves coherent and rational thought processes based on available information. In the context of early childhood, logical thinking is understood as a child's ability to draw logical conclusions and provide supporting evidence. Logical thinking

skills include integrating, differentiating, classifying, calculating, measuring, and recognizing patterns (Bahfen, 2018). Logical thinking also encompasses various aspects, such as distinguishing magnitudes of difference (more significant than, less than, and the largest or smallest), demonstrating proactive decision-making in selecting game concepts, organizing task strategies, understanding essential cause-and-effect relationships in the environment, grouping objects according to color, shape, and size, and arranging objects by size from most miniature to largest or vice versa (Sumarmo et al., 2012).

Initial studies in several research projects have identified gaps in the cognitive development of early childhood. A study by Hidayat and Nur (2018) noted that children's cognitive abilities in kindergartens have not been effectively enhanced through the learning process. This is due to a lack of teachers' understanding of varied teaching methods and the diverse characteristics of individual students. Meanwhile, a study by Hafina et al. (2019) mentioned that teachers often become trapped in conventional teaching methods in educational practice. As a result, the learning cycle becomes a repetitive routine, such as lining up, singing, and entering the classroom. Upon closer examination, it is evident that learning activities can be very tedious. This is because the use of media in learning still lacks variety and innovation.

Based on initial observations of learning activities at Al-Khodijah Kedungsoko Tulungagung Kindergarten for children aged 4-5 years, it was found that some children still have low logical thinking abilities. Several characteristics some children display include not understanding various geometric shapes and the inability to classify similarities in color, shape, and size. It is apparent that children still do not understand concepts of cause and effect, equivalence, and difference and are not accustomed to learning involving sequential or contrasting patterns. The cause is that the variety and process of learning provided by educators in the classroom are less varied, thus reducing the involvement and enthusiasm of children during learning, making it uninteresting. Although the school has implemented media intended to enhance early childhood development, its application remains limited.

Instructional and engaging learning materials are needed to support the development of children's logical reasoning abilities. The learning presented to children must provide a pleasant atmosphere. One such medium is wooden blocks of various shapes, colors, and sizes (El Fiah, 2017). Wooden blocks greatly benefit children's learning as they can enhance logical thinking abilities. Children can solve various problems using educational blocks, such as arranging objects in order from smallest to largest by size. During the initial phase, children may try to group similar shapes and sizes, moving on to collecting blocks of identical shapes without prior instruction (Purwanti Nasution, 2015). The benefits of playing with blocks span various areas, such as physical development, emotional growth, creative expression, and sensory development. Additionally, playing with blocks helps children learn important concepts such as shape, size, and numerical value. Children's visual-spatial skills can be stimulated using block play by depicting and detailing various objects around them and shaping them according to the objects found (Rahmatia et al., 2021).

Previous research by Nurul Maulida et al. (2020) stated that learning media stimulate the logical abilities of children aged 5-6 years, with positive effects noted in the study. Sholihah (2019) also reported in her research that numerical puzzle media is better applied to stimulating children's logical thinking abilities than conventional learning. This aligns with the view of Ernitasari & Rakimahwati (2022) that by utilizing media in children's learning, it is possible to train children in recognizing numbers, shapes, sizes, and arrangements of objects, as well as to train and enhance logical thinking, problem-solving, social-emotional skills, and discipline.

Several previous studies have emphasized the critical role of learning media in enhancing children's cognitive abilities. However, the use of educational wooden blocks has not yet been fully implemented optimally and has not been adapted to the characteristics of early childhood. This results in the limited use of wooden block media for assembling and creating constructive buildings. Additionally, research on using educational wooden blocks focused on children's

logical thinking abilities is rare. Thus, the researcher was interested in focusing this study on using educational wooden blocks adapted to the characteristics of children aged 4-5 years and focusing on developing children's logical thinking abilities.

Based on the background presented, the researcher is motivated to conduct this study to examine the influence of using educational wooden blocks to develop logical thinking abilities in children aged 4-5 years at TK Al Khodijah Kedungsoko Tulungagung. The educational wooden blocks used in this study are adapted for children aged 4-5 years, including blocks shaped as rectangles, triangles, and cylinders in three various colors (yellow, blue, and green). The use of educational wooden blocks in this study is expected to provide benefits and contribute to early childhood education as a solution to stimulating children's logical thinking abilities at this age.

Methods

This study employed a quantitative research methodology, specifically utilizing a quasi-experimental design (pretest-posttest control group design) to explore the cognitive impacts of educational toys on preschool children. The experiment was conducted at TK Al-Khodijah Kedungsoko, Tulungagung, involving 40 children aged 4-5 years. These participants were selected through purposive sampling based on their age and developmental stage, which is crucial for ensuring homogeneity in cognitive abilities. The experimental procedure comprised two primary phases: administering pretests to establish baseline cognitive capabilities, followed by the intervention. In the experimental group, children were engaged in play activities using educational blocks varying in shape (triangle, circle, square) and color (green, blue, yellow), with sizes ranging from large to small. Conversely, the control group continued conventional learning activities without using educational blocks (Creswell & Creswell, 2018).

Observational techniques were employed to collect data on the children's logical thinking abilities, supplemented by performance tests to assess the practical application of cognitive skills learned using the educational blocks. The reliability and validity of the study were ensured through rigorous testing protocols and the calibration of observational instruments. The educational blocks used as the primary tool in this study were systematically chosen to challenge various cognitive skills, including size differentiation, color recognition, and shape identification, which are pertinent to logical thinking in early childhood education. Data were analyzed using quantitative methods, with the t-test employed to determine the significant differences between the pretest and posttest results of the experimental and control groups. This statistical approach provided a robust framework for assessing the effectiveness of using educational blocks to enhance young children's logical thinking abilities (Creswell & Guetterman, 2019).

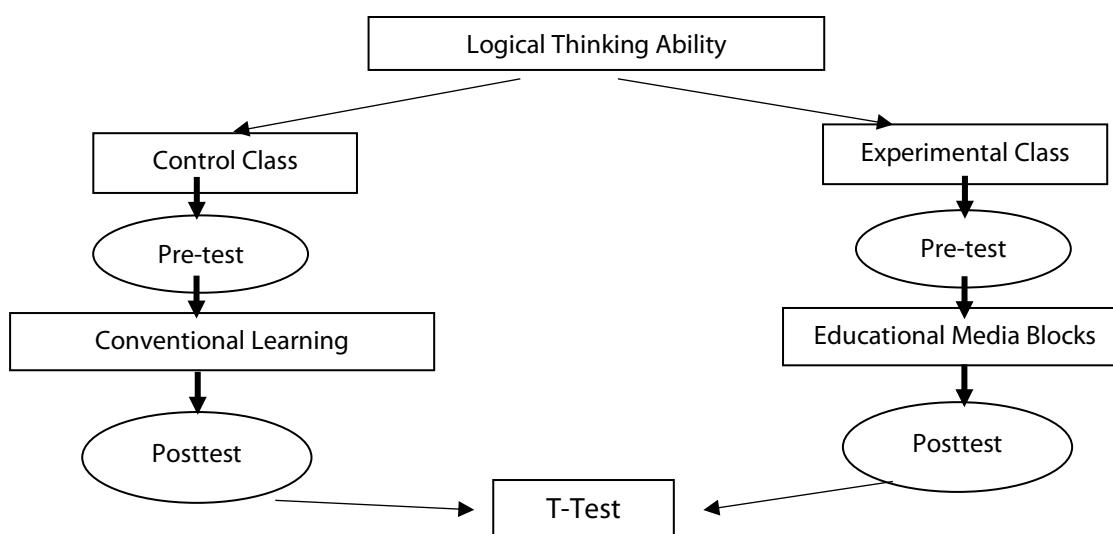


Figure 1. Research Flowchart

Result

3.1. Description of Data Analysis

The study results indicate the calculation outcomes on pretest and posttest data, subsequently processed using the independent sample t-test analysis with IBM SPSS 21, as presented below.

Table 1. Statistical Test Result Data

Statistics	Experimental Pre-test	Control Pre-test	Experimental Post-test	Control Post-test
Number of Children	20	20	20	20
Lowest Score	27	22	41	30
Highest Score	34	28	53	42
Mean Test Score	30.15	25.35	45.80	35.15
Standard Deviation	1.9	1.9	3.8	3.1

From the test results in Table 1, it can be concluded that the pretest scores of the experimental class in cognitive development of logical thinking show a minimum score of 27, a maximum score of 34, with an average of 30.15 and a standard deviation of 1.9. Meanwhile, for the pretest data of the control class, the minimum score is 22, and the maximum score is 28, with an average of 25.35 and a standard deviation of 1.9. These results indicate no significant difference in pretest scores between the two classes.

Posttest data of the experimental class on cognitive development of logical thinking shows a minimum score of 41, a maximum score of 53, and an average of 45.80. On the other hand, the posttest data of the control class has a minimum score of 30 and a maximum score of 42, with an average of 35.15 and a standard deviation of 3.1. It can be concluded that there is a significant difference in test scores between the two classes. A significant improvement in scores was observed in the experimental class after using educational blocks as a medium. This indicates that using educational blocks positively impacts children's cognitive development of logical thinking.

3.2. Normality Test

Further analysis of the test data in Table 1 is necessary to draw more definite conclusions about the impact of using educational blocks on children's cognitive development of logical thinking. A normality test of the sample data must be conducted to determine whether the data are typically distributed. The normality test is carried out using SPSS version 21 based on the Shapiro-Wilk normality test, shown in the following table.

Table 2. Shapiro-Wilk Normality Test Data

Shapiro-Wilk	Experimental Pre-test	Control Pre-test	Experimental Post-test	Control Post-test
Statistic	0.953	0.918	0.918	0.973
df	20	20	20	20
Significance Value	0.409	0.104	0.089	0.816

The normality test results in the above table indicate that all data have a significance value greater than 0.05, suggesting that the data are typically distributed.

3.3. Homogeneity Test

The subsequent test is the homogeneity test, aimed at determining whether the samples from the experimental and control classes originate from the same or homogeneous population. The results of the normality test are presented in Table 3.

Table 3. Homogeneity Test Results

Levene Statistic	df1	df2	Sig.
0.064	1	38	0.801

The calculations from the homogeneity test in Table 3 show a significance value (α) Sig = 0.801, with a significance of $0.801 > 0.05$. Therefore, it can be concluded that both research subject groups are homogeneous in characteristics after undergoing the normality and homogeneity tests.

3.4. Hypothesis Testing

Further data analysis will involve hypothesis testing using the t-test on the prepared data. The hypothesis testing aims to determine whether there is an effect from the use of educational block media in both groups, the experimental class and the control class. The technique used is the independent sample t-test.

Table 4. Independent Sample T-test Descriptive Data

	Class	N	Mean	Std. Deviation	Std. Error Mean
Gain	Experimental	20	15.65	3.16	0.70813
	Control	20	9.90	2.57	0.57537

The results from the independent sample t-test output using SPSS reveal a significant difference between the learning outcomes of the experimental and control classes. The experimental class has a mean difference of 15.65 with a standard deviation of 3.16, while the control class has a mean of 9.90 with a standard deviation of 2.57. The mean score difference reaches 5.75, with a confidence level of 95%. Therefore, it can be concluded that the average score in the experimental class is higher compared to the control class.

Table 5. Independent Sample T-test Results

	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Gain	Equal variances assumed	0.222	0.640	6.302	38	0.000	5.75000
	Equal variances are not assumed.			6.302	36.472	0.000	5.75000

The results of the independent sample T-test indicate a t-value of 6.302 and a significance (2-tailed) of 0.000. This significance value (Sig.) $0.000 < 0.005$ indicates that using educational block media significantly impacts the cognitive abilities of logical thinking in children aged 4-5 years at TK Al Khodijah Kedungsoko Tulungagung.

Discussion

This research focuses on the influence of implementing educational media blocks on the logical thinking abilities of children aged 4-5 years. Through an experimental quantitative research approach, this study produced new insights reflecting previous research on using learning media to enhance children's developmental aspects. The results show a significant improvement in the logical thinking abilities of children aged 4-5 years. These findings confirm the positive impact of optimizing the use of educational media blocks on the logical thinking abilities of young children.

The research data analysis indicates a significant influence of using educational media blocks to enhance the logical thinking abilities of children aged 4-5 years at TK Al-Khodijah Kedungsoko Tulungagung. The statistical data testing results show that the null hypothesis is rejected, and the alternative hypothesis is accepted. This data acquisition makes children more active and highly interested in learning during the educational process. This is in line with the opinion of Rohimah (Ristyadewi & Fitria, 2023) that cognitive ability involves a person's capacity to form opinions about known topics or information. There are three aspects of cognition, namely those related to thinking logically. The logical thinking process recognizes variances, regularities, origins, and consequences associated with basic abilities (Babullah, 2023; Mellisa et al., 2021).

Previous findings suggest that conveyed knowledge needs to be understood effectively, and it is essential to consider many factors (Ristyadewi & Fitria, 2023; Wijayanti & Lestarinigrum, 2022). Children can learn to differentiate and evaluate events in their daily lives. They can critically question whether these events make sense and correspond with their acquired knowledge. Moreover, in education, students are also encouraged to think critically, where they can observe phenomena or events they experience through their senses and then pose various relevant questions to find answers (Sholihah, 2019; Sumarmo et al., 2012).

According to research by Aisyah (2020), Simoncini et al. (2020), and Sofia & Taib (2019), playing with blocks has several advantages. First, children learn to engage in activities involving procedures and work stages by playing with blocks. This allows children to develop systematic thinking skills about shapes and spaces more quickly and effectively; second, children can learn how to organize plans and plan activities through playing with blocks. This helps children develop essential planning skills; third, playing with blocks encourages children to work in a structured environment. This can positively motivate them to work collaboratively and interact with others in a structured setting; fourth, children's ability to perform mapping while playing with blocks also contributes to the development of symbolic thinking abilities. This can impact the enhancement of language abilities and children's thought structures.

Block media can significantly impact children's cognitive abilities, such as identifying concepts, shapes, colors, sizes, number and letter symbols, and displaying logical and symbolic thinking. In addition, children can develop skills to solve simple problems in their daily lives, perform counting operations, and categorize objects based on color, shape, and size in three different variations (Astuti & Hipziah, 2020; Atiasih, 2020; Fasiska et al., 2022; Novita Sari & Oktamarina, 2022; Putri et al., 2023; Wika Mala & Permata Sari, 2022). Block media can also influence children's creativity as children can effectively convey their thoughts and concepts. They have the potential to express creativity and realize their ideas. In addition, children can foster their imaginative abilities and enhance cognitive development through various media (Anisa et al., 2018; Husniyati, 2022; Veronica, 2018).

Block building plays a vital role in the development of young children. It aids children in developing imagination, manipulation skills, creative experiences, and dramatic abilities (Dyah Purwani et al., 2023; Masnipal, 2020). Moreover, playing with blocks can also enhance numeric abilities (Bojorque et al., 2018; Schmitt et al., 2018) and improve mathematical abilities such as counting, recognizing shapes, and understanding mathematical language (Pirrone et al., 2018; Simoncini et al., 2020). This also aligns with research by Hidayat & Nur (2018) and Shunhaji & Fadiyah (2020) that block teaching aids can enhance cognitive abilities in constructing various field constructions. Bullock Masnipal (2020) states that the teacher's ability to understand scenarios, game stages, and how to use block play equipment, assessing students is a requirement to create compelling games, thus impacting the development of physical (fine motor), social, emotional, and cognitive skills including creativity. Blocks are helpful for emotions, creative expression, and intellectual development and are suitable for solo or group play (Kewalramani et al., 2020; Manning, 2018).

Block building helps babies arrange their world, learn from others, and develop organizing skills (Ariyanti et al., 2023; Juvrud et al., 2022). Lex Gray stated, 'No other play medium contains more potential value for human growth than fractional blocks,' Gwen Somerset wrote, 'Unit blocks are often referred to as the "all-purpose game." They meet children's needs over the years and present ongoing challenges as they develop the ability to make plans' Denico (2019). Rahmatunisa and Rachmat (2022) revealed that planning and implementing learning with block play can enhance children's cognitive abilities. Therefore, integrating block media into learning can enhance children's cognitive abilities.

Thus, this study provides a valuable contribution to early childhood education practices, emphasizing the importance of integrating educational block learning media in developing logical thinking abilities in children aged 4-5. The implications of this research include improving and adding insights related to using educational block media more appropriately so that educators can implement it in the learning process at school to develop children's cognitive abilities. These findings emphasize the importance of further research on evaluating the learning approach using educational block media on the cognitive abilities of young children.

Conclusion

This study aimed to explore the effectiveness of educational block media in enhancing the logical thinking abilities of 4-5-year-old children. The findings demonstrate that this educational

tool significantly boosts logical thinking skills, as evidenced by the substantial score improvements in the experimental group compared to the control group employing traditional teaching methods. The data analysis results indicate that educational block media significantly influences the logical thinking abilities of children aged 4-5 years at TK Al Khodijah Kedungsoko Tulungagung. This is evident from the research findings, which show a significant difference in the score outcomes between the experimental class, with an average score of 15.65 using educational block media, and the control class, which scored 9.90 using conventional learning methods. The analysis using an independent sample t-test yielded a significance level 0.000, indicating that this value is smaller than 0.005. The implications of this study are profound, suggesting that educational block media can be an essential resource in preschool education to foster critical cognitive skills. The evidence that children exposed to this method outperform their peers in logical thinking tasks underscores its potential to enhance early educational curricula. Despite these promising results, the study acknowledges certain limitations. The focus was narrowly on logical thinking skills, excluding other cognitive domains. Additionally, the sample was restricted to a single educational setting, which may affect the generalizability of the findings. Given these constraints, further research is recommended to validate these results across different settings and with a broader demographic. Future studies should also explore the impact of educational block media on other critical cognitive and developmental areas, employing innovative media formats to enrich our understanding and application of educational tools in child development.

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