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THE INFLUENCE OF EDUCATIONAL GAME MEDIA ON THE MATHEMATICAL ABILITY OF CHILDREN

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Abstract

This study was motivated by the low mathematical ability of children aged 5–6 years, which is mostly caused by learning methods that are less interesting and tend to be monotonous. Learning at the ECE level generally still focuses on the use of worksheets and teacher-dominated approaches, so that children are less actively involved in the learning process. The purpose of this study was to determine the extent to which educational game media, especially the modified monopoly board game, can improve children's mathematical understanding. This study used a quantitative approach with a quasi-experimental design (non-equivalent control group design). The sample consisted of 18 children selected through purposive sampling techniques. Data collected through structured observation and analyzed using the N-Gain formula and the Mann-Whitney U test. The results showed that the N-Gain value of 0.84 was classified as high, and the Mann-Whitney test showed a significance of $0.000 < 0.05$. This means that there is a significant difference between the experimental and control groups, so that the alternative hypothesis is accepted. Thus, the monopoly game is proven to be effective in improving the mathematical abilities of early childhood children.

Keywords: Mathematical Ability; Educational Games; Monopoly Board; Early Childhood

Abstrak

Penelitian ini dilatarbelakangi oleh rendahnya kemampuan matematika pada anak usia 5–6 tahun, yang sebagian besar disebabkan oleh metode pembelajaran yang kurang menarik dan cenderung monoton. Pembelajaran di tingkat PAUD umumnya masih fokus pada penggunaan lembar kerja dan pendekatan yang didominasi oleh guru, sehingga anak kurang terlibat secara aktif dalam proses belajar. Tujuan dari penelitian ini adalah untuk mengetahui sejauh mana media permainan edukatif, khususnya permainan papan monopoli yang telah dimodifikasi, dapat meningkatkan pemahaman matematika anak. Penelitian ini menggunakan pendekatan kuantitatif dengan desain quasi eksperimen (non-equivalent control group design). Sampel terdiri dari 18 anak yang dipilih melalui teknik purposive sampling. Data yang dikumpulkan melalui observasi terstruktur dan dianalisis menggunakan rumus N-Gain serta uji Mann-Whitney U. Hasil menunjukkan bahwa nilai N-Gain sebesar 0,84 tergolong tinggi, dan uji Mann-Whitney menunjukkan signifikansi $0,000 < 0,05$. Artinya, terdapat perbedaan yang signifikan antara kelompok eksperimen dan kontrol, sehingga hipotesis alternatif diterima. Dengan demikian, permainan monopoli terbukti efektif dalam meningkatkan kemampuan matematika anak usia dini.

Kata kunci: Kemampuan Matematika; Permainan Edukatif; Papan Monopoli; Anak Usia Dini

Introduction

Early childhood is in a very important phase of development and is often referred to as the golden age, which is a crucial period in growth that lasts until the age of six. During this period, children experience rapid development in various aspects such as religious and moral values, socio-emotional, cognitive, physical-motor, language, and art. Among all these aspects, the cognitive aspect has a central role in forming the foundation of children's thinking abilities, especially in solving problems and logical thinking which will later become the foundation of their academic abilities. Ramadhina et al., stated that cognitive development, especially in children aged 5-6 years, is closely related to the ability to think symbolically, solve problems, and think logically (Hariyani et al., 2024; Ramadhina et al., 2024). These abilities are not only relevant in an academic context, but also in children's daily lives as part of their efforts to overcome the challenges they face.

The ability to think logically and solve problems developed at an early age has a long-term influence on children's academic success later in life, especially in mathematics. According to Jackman, the acquisition of mathematical concepts in early childhood begins with their direct interaction with the surrounding environment (Jackman, 2012). This learning process occurs through concrete experiences such as counting objects, recognizing patterns, or comparing sizes and quantities. Therefore, the learning experiences given to children should be active, contextual, and enjoyable in order to encourage children to be more involved in the learning process.

The constructivism theory developed by Jean Piaget is one of the important foundations in understanding children's learning processes. According to Piaget, children aged 5-6 years are in the pre-operational stage, where they begin to be able to think logically but are still very dependent on concrete experiences (Ibda, 2019). In this context, children learn not only through memorization, but through active interaction with the environment and exploration of real objects. For example, when children are given the opportunity to count fruit or toys, they not only learn to recognize numbers, but also understand the concept of quantity and simple mathematical operations. This proves that early childhood mathematics learning must involve direct experience and not be based solely on an abstract approach.

This is in accordance with Piaget's constructivism principle which emphasizes the importance of concrete experiences in learning. Therefore, through direct experience, children learn about numbers, how to count, and basic mathematical operations that will support the development of their logistical thinking skills in the future (Kaizar & Alordiah, 2023). In this context, playing becomes an effective approach to improve children's logical thinking skills and mathematical abilities. Playing is not just a recreational activity, but a learning tool that can develop children's cognitive, social, and emotional aspects in a balanced way. Utoyo explains that basic mathematical skills in early childhood include recognizing numbers, counting objects, and understanding basic operations such as addition and subtraction (Suryadi et al., 2021; Utoyo, 2018). Playing activities can provide a fun and effective experience to develop these skills.

However, the reality in the field shows that many young children have difficulty

in understanding basic mathematical concepts. Based on observations at Sumberjaya State Kindergarten, West Lampung Regency, most children aged 5-6 years have not been able to group objects based on shape and size and still have difficulty in understanding simple mathematical operations. For example, when asked to group objects based on shapes such as triangles, circles, and squares, they are confused because the shapes have different colors or sizes. This shows that children's understanding of mathematical concepts is still limited.

One of the causes of children's low math skills is a learning approach that is less appropriate to the characteristics of early childhood. Many teachers still use conventional methods such as reading, writing, and arithmetic (*calistung*) which are carried out in one direction. This method tends to be boring and does not actively involve children. In fact, children learn most effectively through play activities. Piaget emphasized that children build knowledge through direct exploration (Masgumelar & Mustafa, 2021). Therefore, mathematics learning should be packaged in a form that is fun and appropriate to the world of children.

As an alternative, a learning strategy is needed that integrates mathematical concepts into interesting play activities. One potential solution is the use of educational game media. This media allows children to learn actively in a fun atmosphere. Humaida & Suyadi explained that educational games such as puzzles, blocks, role-playing games, and board games help children understand the concepts of rules, strategies, and decision-making (Hasanah et al., 2020; Humaida & Suyadi, 2021). These games also train social and problem-solving skills.

One of the educational games that can be used in learning mathematics is the monopoly game. Although generally known as an entertainment game, monopoly can be modified into a learning medium. Sihotang stated that through this game children can learn to count steps based on dice numbers, recognize numbers, and understand the concepts of "more" and "less" (Sihotang, 2022). In this study, researchers used a modified monopoly to suit the cognitive development stage of early childhood. Modifications include child-friendly visual design, the use of small numbers, and challenges that are appropriate to children's abilities. This game provides a concrete, active, and fun learning experience. Children can count steps when moving pieces, compare numbers, and make decisions based on situations in the game. In addition, children also learn to wait for their turn, follow rules, and interact with their peers. All of these aspects are important in supporting children's cognitive and social-emotional development simultaneously.

The selection of this research topic is based on the results of observations at Sumberjaya State Kindergarten, which shows that educational game media is still rarely used. Mathematics learning is more often done through worksheets and teacher-centered lecture methods. This condition has an impact on children's low interest and understanding of mathematics material. Therefore, a new approach is needed that is more in accordance with children's characteristics, one of which is through a modified monopoly game. This study aims to determine the extent to which the modified monopoly game influences the mathematical abilities of children aged 5-6 years. It is hoped that through this game, children can better understand the concept of numbers,

count objects, and recognize basic mathematical operations more easily and enjoyably. The use of game-based learning strategies such as modified monopoly encourages active participation, collaboration, and critical thinking, all of which are important for developing problem-solving skills in early childhood.

By integrating modified games into the curriculum, a more engaging and effective learning environment can be created. This approach not only makes learning fun, but also provides valuable opportunities for children to develop key cognitive skills that will support their future academic success. Therefore, it is important to adopt strategies that are aligned with children's developmental stages, by creating environments where they can actively explore, experiment, and apply mathematical concepts in real-world contexts. By creating such environments, early childhood education can lay the foundation for lifelong learning and cognitive development.

In conclusion, integrating game-based learning strategies, such as modified games like Monopoly, into early childhood education can significantly improve children's mathematical abilities and cognitive skills. By providing opportunities for active, hands-on learning, children can develop a deeper understanding of abstract concepts and become more engaged in the learning process. This approach is not only in line with Piaget's constructivist theory but also supports children's social-emotional development, preparing them for future academic and life challenges. Given the positive impacts of educational play, it is important for educators to incorporate these types of learning experiences into their teaching methods to better support the cognitive growth of young children.

Method

This study uses a quantitative approach with a quasi-experimental method. This approach was chosen because it is appropriate for measuring the effect of certain treatments on the observed variables, in this case the effect of the monopoly board game on the mathematical abilities of children aged 5–6 years. The effect is measured by applying a certain treatment to a group that is given educational game media treatment and applying it to another group called the control group, then determining the final results of the two groups (Creswell & J. David, 2018; Sugiyono, 2016). The research design used is Nonequivalent Control Group Design, which is a design involving two groups that are not selected randomly, but each group is still given a pretest and posttest. The experimental group will receive treatment in the form of a monopoly board game, while the control group will not receive special treatment.

This research was conducted at Sumberjaya State Kindergarten, West Lampung Regency. The research implementation time lasted for two weeks in March 2025. In this study, the population used was all children aged 5–6 years who were at Sumberjaya State Kindergarten, which consisted of two class groups, namely group A and group B. The sample determination was carried out using a purposive sampling technique, namely the selection of samples based on certain considerations, such as a balanced number of children and relatively equal abilities. Group A was designated as the experimental group, and group B as the control group. Each group consisted of 10 children, so the total

sample used in this study was 20 children.

This study consists of two variables, namely the independent variable and the dependent variable. The independent variable is the monopoly board game given as a treatment to the experimental group, while the dependent variable is the mathematical ability of children aged 5–6 years, which will be measured before and after the treatment. The data collection techniques used in this study were observation, testing, and documentation. Observation was used to record the process of implementing activities and the development of children's abilities directly during the activity. Tests were used to measure children's mathematical abilities through questions that were adjusted to indicators of early childhood mathematical abilities, such as recognizing numbers, counting, and completing simple addition or subtraction operations. Tests were given to both groups before and after treatment. Documentation was used to obtain supporting data, such as the number of children, child identity data, and documentation of activities during the research process.

Data analysis techniques in research are one of the important steps, because by using techniques, the results of the research conducted will be visible. This data analysis technique is carried out after all the data that has been obtained from the observation results have been collected. Abdul said that the data analysis technique used aims to answer the hypothesis that has been formulated (Abdul, 2020). In research, a hypothesis is an assumption or guess that must be tested for truth through data analysis. The method used in this study is the Mann-Whitney Test. Before testing using the Mann-Whitney Test, the data results are first calculated using N-Gain. The Mann-Whitney test is a non-parametric test used to analyze data. According to Sriwidadi, the Mann-Whitney test is used to determine whether there is a difference in the average (means) of two unpaired or independent samples (Sriwidadi, 2011). In this test, the number of samples used does not have to be the same, and there is no provision that the research data must be normally distributed.

The research instruments used consisted of math test questions and observation sheets. The test questions were arranged based on indicators of early childhood mathematical abilities, while the observation sheets were used to record children's activities while playing and their involvement in the learning process. The data obtained were analyzed quantitatively. Data analysis was conducted in two stages, namely descriptive analysis and inferential analysis. Descriptive analysis was used to determine the average value, standard deviation, and minimum and maximum values of the test results. Meanwhile, inferential analysis was conducted using a t-test to determine whether there was a significant difference between the test results of the experimental group and the control group after the treatment was given.

Results and Discussion

Monopoly game is a modified learning media to teach mathematical concepts to children aged 5-6 years. This game is adjusted to the needs and development level of children, and is carried out in groups in the Sumberjaya State Kindergarten hall. Each session is filled with mastery of basic mathematical skills such as grouping, matching,

comparing, and sorting. Monopoly Market Education is an educational version of the monopoly game is an educational version of the monopoly game designed for children to learn while playing. Children answer challenges based on color, shape, or size according to the card instructions. The game board depicts various shops and market activities, such as cake shops, vegetable carts, and ice cream stalls, which are visualized in an attractive way to support fun and effective learning.

Tabel.1 Recapitulation of Pre-test and Post-test Values for Ekserimen Class

Category	Interval	Pre-test		Interval	Post-test	
		f	%		f	%
BB	27 - 31	14	77,78%	51 - 55	1	5,56%
MB	32 - 36	2	11,11%	56 - 60	2	11,1%
BSH	37 - 41	0	0%	61 - 66	5	27,78%
BSB	> 42	2	11,1%	> 67	10	55,56%
Amount		18	100,00		18	100,00

Tabel.2 Recapitulation of Pre-test and Post-test Values for Control Class

Category	Interval	Pre-test		Interval	Post-test	
		f	%		f	%
BB	25 - 29	12	66,67%	29 - 33	9	50%
MB	30 - 34	2	11,11%	34 - 37	5	27,78%
BSH	35 - 39	0	0,00%	38 - 41	0	0,00%
BSB	> 40	3	16,67%	> 41	4	22,22%
Amount		18	100,00		18	100,00

Pretest and posttest data from the experimental and control classes were analyzed using N-Gain, then tested with Mann-Whitney via SPSS v26. The N-Gain results showed an average of 0.84 (high category) in the experimental class and 0.09 (low category) in the control class. This shows that the educational monopoly board game media has a significant effect on improving children's math skills compared to worksheets. The results of the Mann-Whitney test show an Asymp. signature value. (2-tailed) of 0.000 (<0.05), which means there is a significant difference between the experimental and control classes. Thus, the H_a hypothesis is accepted, indicating that the educational monopoly board game media has a positive effect on the mathematical abilities of children aged 5–6 years.

The results of the study showed a significant difference between the experimental class and the control class in improving the mathematical abilities of children aged 5–6 years. The experimental class using the monopoly game showed a high average N-Gain score (0.84), while the control class only reached the low category (0.09). The monopoly game facilitates children to learn through concrete activities such as counting steps, answering number challenges, and devising strategies, so that mathematical concepts are easier to understand. In addition, this game also develops children's social skills such as cooperation and communication.

This finding is supported by research by Junaria et al. which shows that educational game media is effective in stimulating children's mathematical logic abilities

and interest in learning (Junariah et al., 2015). This positive change shows that, the learning method using games provides a learning experience that makes it easier for children to understand mathematical concepts. The results of this study are in line with the findings of previous studies that discussed the effectiveness of learning methods using games in helping children understand mathematical concepts. For example, research conducted by Rahmawati, shows that educational games can significantly stimulate logical thinking skills in children (Rahmawati, 2015).

The monopoly game in this study has been modified according to the child's age, from simple tasks such as grouping colors to basic arithmetic operations, so that it can be applied flexibly according to the child's ability level. The findings of Amelia & Rahmadani also strengthen the results of this study. They stated that educational game media, especially board games, can stimulate children's interest in learning (Amelia & Rahmadani, 2022). In the context of this study, the monopoly game that has been modified to adjust the material and rules of the game – such as the use of simple numbers and grouping challenges or arithmetic operations – has been shown to have a positive impact on the mathematical abilities of early childhood because it is in accordance with their cognitive development stage.

Although the control class also experienced an increase, the results were not as large as the experimental class. This shows that real-life experiential learning is more effective than conventional methods. According to Piaget, children aged 5–6 years are in the pre-operational stage, where optimal learning is obtained through play and concrete activities (Nopiana & Suryadi, 2018). Other factors such as teaching style and classroom atmosphere also affect the results. In the experimental class, the teacher was more interactive and learning took place in a fun atmosphere without pressure, making children more enthusiastic. Conducive environmental support and sufficient playtime also strengthened the success of learning. This is in line with Zaini's opinion which states that children who learn through games understand the material faster (Zaini, 2019). Thus, the modified monopoly game as an educational medium has been proven effective in improving the mathematical abilities of early childhood.

Conclusion

Based on the research that has been conducted, it can be concluded that the use of educational games, especially modified Monopoly, is an effective learning medium in stimulating the mathematical abilities of early childhood students. This study found that compared to conventional passive learning methods, educational games provide a more interesting and interactive experience for children. This game encourages active participation and improves understanding of basic mathematical concepts, thus answering the research question regarding the effectiveness of educational games in improving mathematical abilities in children aged 5-6 years at Sumberjaya State Kindergarten, West Lampung. The implications of this study indicate that educational games, such as modified Monopoly, make a significant contribution to the development of cognitive and mathematical skills in early childhood education. The interactive nature of this game not only attracts children's attention but also encourages active learning,

which can result in better retention of mathematical concepts.

Based on these findings, it is recommended that teachers incorporate educational games such as modified Monopoly into their teaching strategies to enhance the learning experience. This method offers a more innovative and effective approach to teaching mathematics to early childhood children. Future research can explore the impact of other types of educational games across subjects and age groups to further strengthen the role of play in early childhood education.

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