

THE EFFECT OF CONGKLAK GAMES ON THE COGNITIVE DEVELOPMENT OF EARLY CHILDHOOD

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Abstract

This study aims to evaluate the effectiveness of congklak as a learning medium for the cognitive development of children aged 5-6 years. Using a quantitative method with a One Group Pretest-Posttest pre-experimental design, the study involved eleven children at the Kota Ilmu Plus Kindergarten. The intervention was carried out for three weeks with a frequency of once per week, a duration of 30-45 minutes per session. Data were collected through structured observations measuring the ability to count, problem solving, logical thinking, focus, and memory. The results showed a decrease in the average score from 20.82 (Developing According to Expectations) in the pre-test to 15.82 (Starting to Develop) in the post-test, with an increase in variance from 11.76 to 84.76. A paired sample t-test showed a significant difference ($t=2.355$; $p=0.040 < 0.05$). The analysis identified internal factors (cognitive maturity, emotional state, motivation, learning style, concentration, physical condition, previous experience) and external factors (student grouping, time management, lesson planning, teacher competence) that influence learning outcomes. The study concluded that the effectiveness of the congklak game is highly dependent on the suitability of the application to the individual characteristics of the child and requires attention to supporting learning factors. A differentiated approach that considers the child's cognitive-emotional readiness, adequate time allocation, and responsive teaching strategies to individual needs is needed.

Keyword: Congklak Game, Cognitive Development, Early Childhood, Learning Media, Game-Based Learning

INTRODUCTION

The preoperational stage in Jean Piaget's theory of cognitive development is a crucial phase in early childhood development, particularly between the ages of 5 and 6. Piaget argued that kindergarten-aged children are in a transitional stage from the preoperational phase to the concrete phase. Children learn effectively through tangible objects, such as beads, seeds, candy, or other play tools that can be used to help them practice counting. Cognitive development plays a crucial role in determining the ability to think, solve problems, and process data. Appropriate stimulation is crucial for children's development to maximize cognitive function, including numeracy skills, logic, concentration, and the development of thinking strategies (Trisnadewi

et al., 2024).

Games are a very enjoyable activity for children and can lead to meaningful learning. Play can enhance children's cognitive development and thinking skills. Traditional games are games with deep meaning, fostering love from parents, love for the environment, and empathy for friends (Amelia & Istikomah, 2022). One such traditional game is congklak. Using congklak as a medium in engaging and interactive learning can support the development of basic numeracy skills. This game is an effective way to stimulate children's cognitive skills, particularly in understanding the concepts of numbers and addition.

In children aged 5-6 years, cognitive development begins to develop, and teachers often use a question-and-answer method in teaching arithmetic, rather than relying on concrete media. This can quickly cause children to become bored and fed up. A study revealed that 4 out of 10 early childhood children experience delays in their cognitive development (Safitri et al., 2020). One way to support early childhood progress is through play activities. Play activities are highly functional in enriching various aspects of child development, as revealed in research by (Pahrul and Amalia, 2020) who examined the use of circle-shaped games to stimulate children's cognitive development. One type of traditional game known in various regions of Indonesia and able to encourage children's cognitive development is congklak.

Previous research has shown that games involving strategy and calculation can improve children's cognitive abilities. Research by Fydarliani et al., 2021, shows that playing congklak can improve children's cognitive abilities, such as strategizing, counting, calculating, and adding, as well as sharpening analytical skills. Furthermore, research by Susilawati et al., 2021, found that changes in congklak game strategies can improve children's cognitive abilities. Other studies have shown that traditional games improve cognitive abilities. According to Apriyanda et al., 2024, traditional congklak games also have a positive effect on children's psychomotor and cognitive development.

Based on various expert opinions and previous research, it can be concluded that teachers still teach using only the question-and-answer method without using learning media or game activities, causing children to quickly become bored. This is because the learning methods applied are not appropriate for the developmental characteristics of early childhood and are too monotonous, which can lead to cognitive delays. Based on this problem, research has discussed the use of the traditional game congklak as a supporting learning medium. Previous research has shown that in addition to being a fun activity, congklak is effective in enhancing children's cognitive development (Fydarliani et al., 2021). Therefore, the traditional game of congklak can be used as an engaging and interactive learning medium to support children's cognitive development.

This study was conducted to measure the effectiveness of congklak as a learning medium for children's cognitive development, as well as to provide more in-depth scientific evidence regarding the benefits of traditional congklak as a fun learning medium for early childhood education in early childhood education (PAUD). This study was based on the limitations of previous research that specifically examined the influence of congklak on the cognitive development of Indonesian children.

RESEARCH METHODS

This study used a quantitative method with a pre-experimental One Group Pretest-Posttest Design. In this design, one group of research subjects was given a treatment in the form of a congklak game, with measurements taken before (pretest) and after (posttest) the treatment to determine the effect of the intervention on children's cognitive development. The research design can be described as follows: $O_1 \rightarrow X \rightarrow O_2$, where O_1 is the pretest (measurement of cognitive ability before treatment), X is the treatment (administration of the congklak game), and O_2 is the posttest (measurement of cognitive ability after treatment).

The independent variable in this study was the traditional congklak game, which was given for three weeks, once a week, for 30-45 minutes per session. The dependent variable was the cognitive development of children aged 5-6 years, including numeracy skills (counting, addition, and subtraction), problem-solving skills, logical thinking skills, concentration and focus, and memory.

ANALYSIS

The data in this study were obtained through direct observation during the learning process. The observation instrument used for this purpose had been previously developed and validated. This instrument was used to determine the cognitive abilities of early childhood children at Kota Ilmu Plus Kindergarten. All observations were structured, with the researcher recording the children's actions, responses, and abilities based on indicators listed on the observation sheet.

The observations were conducted in a classroom with 11 students, consisting of 4 girls and 7 boys. The learning activities observed used the game of congklak as a medium to develop children's cognitive abilities. This observation aimed to obtain accurate and comprehensive data on the development of children's cognitive abilities during the learning process. The results of the observation activities regarding children's cognitive abilities using congklak as a medium in Kota Ilmu Plus Kindergarten are presented in Table 1:

Table 1. Observation Results of Cognitive Abilities in Class B

No	Pre-test	Post-test
A01.	24	24
A02.	20	18
A03.	20	20
A04.	16	0
A05.	23	7
A06.	24	23
A07.	20	16
A08.	14	0
A09.	24	23
A10.	24	19
A11.	20	24
Amount	229	174
Average	20,82	15,82
Mode	20 dan 24	23 dan 24

Based on Table 1, it is known that the results of observations of congklak playing activities during the pre-test in class B showed an average score of 20.82, with the lowest score being 14 and the highest score being 24. The most frequently appearing scores, namely the mode, were 20 and 24, while the median score was 20. In the post-test activity, the observation results showed that the average score decreased to 15.82. The lowest score was 0, while the highest score was 24. The modes in the post-test were 23 and 24, and the median score was 19.

Comparison of Pre-test and Post-test Scores of Cognitive Abilities of 5-6 Year Old Children in Class B of Kindergarten Plus Kota Ilmu

Table 2. Pre-test and Post-test Statistical Results

Statistics				
		Subjek	Pre	Post
N	Valid	11	11	11
	Missing	0	0	0
Mean			20.8182	15.8182
Median			20.0000	19.0000
Mode			20.00 ^a	.00 ^a
Std. Deviation			3.42982	9.20672
Variance			11.764	84.764
Range			10.00	24.00
Minimum			14.00	.00
Maximum			24.00	24.00
Sum			229.00	174.00

Table 2 shows that the average pre-test score was 20.82, which falls into the Developing as Expected (BSH) category. Meanwhile, the average post-test score was 15.82, which falls into the Starting to Develop (MB) category. Thus, there was a 5.00 difference between the two tests. The standard deviation for the pre-test was recorded at 3.43, while for the post-test, it increased significantly to 9.21. This indicates that the results of the post-test were more varied or had a wider range than those of the pre-test.

The variance value for the pre-test was 11.76, while the post-test score shot up to 84.76. This means the distribution of scores on the post-test was significantly larger than on the pre-test. This difference in variance indicates inconsistency in the children's performance on the post-test, as evidenced by the lowest score of 0 and the highest score of 24. Furthermore, the lowest score on the pre-test was 14, which is higher than the lowest score on the post-test, which was 0. Meanwhile, the highest score on both tests was also 24. This indicates that while some students achieved the highest scores on both tests, some others experienced a significant decline in performance on the post-test.

The median score for the pre-test was 20.00, while on the post-test it decreased to 19.00. This decrease in the median indicates a general shift in the distribution of scores toward lower scores. The mode on the pre-test was 20.00, indicating that this score was the most frequently obtained by the children. However, in the post-test, the mode changed to 0.00, which indicates that there was more than one student who obtained a score of 0. This change in mode is an important indicator that there is a serious problem in the learning process or the child's condition at the time the post-test was conducted.

Tabel 3. Paired Sample Statistic

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Sebelum diberikan perlakuan	20.8182	11	3.42982	1.03413
	Setelah diberikan perlakuan	15.8182	11	9.20672	2.77593

In the pre-test (before treatment), the mean score was 20.8182 with a sample size (N) of 11 children. The standard deviation for the pre-test was 3.42982, indicating a relatively small or homogeneous distribution of the data. The standard error of the mean for the pre-test was 1.03413, indicating a relatively low level of error in estimating the population mean from the sample.

Meanwhile, in the post-test (after treatment), the mean score decreased to 15.8182 with the same sample size of 11 children. The standard deviation for the post-test increased dramatically to 9.20672, indicating a much greater distribution of post-test data compared to the pre-test. The standard error of the mean for the post-test also increased to 2.77593, indicating a greater degree of estimation uncertainty.

The increase in standard deviation from 3.43 to 9.21 indicates that after treatment, children's cognitive abilities varied greatly. Some children maintained a high score (24), while others experienced a drastic decline, reaching a score of 0. This indicates that the treatment was inconsistent in its effect on all children, or that other factors significantly influenced the post-test results.

Tabel 4. Paired Sample Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pair 1 Sebelum diberikan perlakuan - Setelah diberikan perlakuan	5.00000	7.04273	2.12346	.26863	9.73137	2.355	10	.040

The mean difference between the pre-test and post-test was 5.00000, meaning there was an average decrease of 5 points from pre-test to post-test. The standard deviation of this difference was 7.04273, indicating considerable variation in the pattern of decline or increase among individual children. The standard error of the mean for the difference was 2.12346, which was used in calculating the confidence interval and t-value.

The 95% confidence interval for the mean difference ranged from a lower limit of 0.26863 to an upper limit of 9.73137. Because this confidence interval excludes the value 0 and is entirely positive, it confirms that the difference between the pre-test and post-test is statistically significant. In other words, the decrease was not due to chance or sampling error but was a real difference.

The calculated t-value obtained was 2.355 with a degree of freedom (df) of 10 ($n-1 = 11-1 = 10$). The significance value (2-tailed) was 0.040, which is smaller than the significance level of $\alpha = 0.05$. These results indicate that the null hypothesis (H0) which states there is no difference between the pre-test and post-test is rejected, and the alternative hypothesis (H1) which states there is a significant difference between the pre-test and post-test is accepted.

DISCUSSION

Analysis of Factors Influencing Learning Outcomes

According to information obtained from this study, there was a decrease in the average score from the pre-test (20.82) to the post-test (15.82) and a significant increase in variance from 11.76 to 84.76. These findings reflect differences in children's performance during the learning process. The decline in learning outcomes and the increasing variation in children's performance require a deeper understanding of the various elements that influence these results. In early childhood learning environments, there are two main categories of factors that must be considered: internal factors originating from the child and external factors related to learning management.

Internal Factors of Children

Internal factors refer to the personal characteristics and circumstances inherent in each child, such as cognitive readiness, emotional state, motivation, learning style, concentration span, physical health, and previous learning experiences. These factors significantly influence how they react to and understand the learning material being taught. In this study, it was clear that each child exhibited differences and uniqueness related to learning readiness, interests, and various learning profiles. The results of this study showed significant variation in children's learning achievement, with emphasis on two children (A04 and A08) who experienced a drastic decline to a score of 0 on the post-test, as well as several other children (A02, A05, A07, A10) who also experienced significant declines in their scores. This drastic decline indicates a serious mismatch between the cognitive demands and procedures of the congklak game applied and the children's level of cognitive maturity, emotional stability, intrinsic motivation, and previous experiences.

Based on Piaget's theory of cognitive development, children aged 5-6 years are in a transitional phase from the preoperational stage to the concrete operational stage. In this phase, not all children have the same cognitive maturity in understanding abstract concepts such as game strategies and complex calculations in congklak. Research by (Juariah et al., 2025) confirms that the rate of cognitive development in early childhood varies greatly, where some children are able to grasp concepts more quickly, while others require a longer period of intensive repetition and an in-depth approach to reach the same level of understanding.

Internal factors include desire and motivation. One obstacle to implementing the traditional congklak game is the child's emotional state and desire. When a child feels sad, this can hinder the implementation of congklak, so the sad child will be forced to participate in the game. Factors that support congklak instilling character values in children are the availability of facilities and infrastructure. Meanwhile, factors that hinder the implementation of congklak in instilling character values in children include their moods, such as feelings of sadness, lack of enthusiasm, and other things. Not all children aged 5 to 6 years are ready to master these skills optimally without a sufficient adaptation phase. The emotional aspect plays a significant role in the learning process of early childhood and cannot be separated from cognition.

A comfortable and distraction-free play environment significantly supports the development of concentration skills in early childhood. A comfortable, noise-free, and well-lit space can improve a child's ability to maintain concentration for longer. Conversely, an

uncomfortable or overly noisy environment tends to quickly distract a child. (Arumdapta & Safitri, 2024) showed that children who study in a comfortable space have higher concentration levels than those who study in an environment full of distractions.

Emotional instability in children can interfere with their thinking skills and learning process. Therefore, even if a child has good cognitive potential, an unfavorable emotional state can lead to decreased performance. The significant decline in some children, particularly A04 and A08, is likely influenced by emotional factors such as anxiety during evaluations, competitive pressure with peers, or low self-confidence.

A child's past experiences also influence their cognitive development and emotional management. (Nur Faudillah et al., 2023) state that a child's development can be influenced by the brain's response to past experiences, both good and bad, in their environment. Children who have experienced failure or stress can develop emotional difficulties, which then impacts their cognitive performance in evaluative situations.

Intrinsic motivation also plays a vital role in the learning process and is closely related to a child's emotional state. Research by (Susilawati et al., 2021) revealed that a child's interest in learning media significantly influences the effectiveness of cognitive stimulation, where children who are disinterested typically do not perform optimally in learning activities.

One of the principles of early childhood education is learning through play, which focuses on child development, is child-centered, implements active learning, and utilizes learning media, various learning resources, and resource persons. When children experience stress or discomfort due to difficulties in a game, their enthusiasm for active participation will diminish, ultimately impacting their evaluation results. Therefore, during the activity process, teachers can group children based on similar ability levels when implementing congklak games. For example, when playing congklak, a child who is not yet proficient can be paired with another child who is also not proficient.

Variations in each child's learning style are also a crucial element influencing learning success. According to (Maufiroh et al., 2025), some children tend to learn visually, auditorily, or kinesthetically when processing information. In the context of congklak games, children with a kinesthetic learning style may grasp concepts more quickly because they are directly involved in the activity of manipulating the seeds, while children with visual or auditory learning styles may require additional explanations.

Rosenzweig and Bennett (2024, as cited in Romlah, 2025), state that children's cognitive development is greatly influenced by their environment and the type of stimulation they receive. An environment filled with various stimuli, such as the availability of a variety of educational games, can accelerate cognitive development. Educational games not only stimulate children's curiosity but also encourage them to think actively and creatively. Educational games like congklak can help children develop various cognitive skills, including logical thinking, problem solving, and understanding basic mathematical concepts.

A child's concentration and memory are important internal factors influencing the success of the learning process. Early childhood children generally have a short attention span, typically between 10 and 15 minutes for children aged 5-6 years. Congklak games, which require continuous concentration and remembering strategies from previous sessions, may be very difficult for some children. Research by Trisnadewi et al., 2024, shows that appropriate stimulation is crucial for optimizing children's cognitive functions, including arithmetic, logic,

concentration, and the development of thinking strategies.

A child's physical health and nutritional status are crucial factors in academic performance. Children who feel tired, sleep deprived, or have health problems during the post-test tend to show a significant decline in focus and cognitive abilities. Furthermore, a child's experiences and background prior to the learning process also significantly influence the results achieved. (Rohmah, 2025) explains that a child's cognitive development at an early age is influenced by various factors, such as environment, interests, talents, and heredity. All of these factors play a role in a child's ability to process information. Family aspects, stimulation at home, and previous play opportunities form the cognitive foundation that children bring to the learning process. Differences in numeracy ability are often rooted in previous play experiences and learning environments. Consistent with this, children who are accustomed to playing congklak demonstrate faster mastery of the game than those who play new games. This aligns with the results of a study (Muthia Humairo & Amelia, 2021), which concluded that exploratory traditional games encourage the development of numeracy skills because learning is fun and without coercion.

External Factors: Learning Management

External factors related to learning management play an equally important role in determining the success of the educational process. Successful learning management requires sound planning, implementation, and evaluation in accordance with early childhood education criteria (Safitri et al., 2020). In this study, various aspects of learning management require further investigation to understand the decline in outcomes.

One of the main obstacles in implementing differentiated learning is the challenge of grouping students according to their learning interests, profiles, and readiness. According to Ngaisah et al. (2023), their research explains that implementing differentiated learning presents challenges, especially when educators must group students based on their individual characteristics. This process of identifying and grouping requires time and a deep understanding of each child, as well as sufficient teaching skills from educators. When grouping is not implemented optimally, there can be a mismatch between teaching methods and student needs, ultimately impacting unsatisfactory learning outcomes.

Learning time management is also an important element that needs to be considered. In this study, the limited duration of congklak learning, which was 30-45 minutes per session, once a week for three weeks, may not have been optimal enough to ensure all children fully understood the game's rules and strategies. Children need time to process their experiences and understand their surroundings. Breaks and playtime provide opportunities for children to integrate what they have learned, and this is crucial for their growth and development. Therefore, the time allocated in this study, which ranged from 90 to 135 minutes over three weeks, needs to be reviewed to assess whether it is sufficient to lead to meaningful cognitive changes.

Proper planning of the learning process also requires extra attention in managing early childhood education. An effective plan must consider the availability of learning facilities and infrastructure, as well as the abilities of teachers and students (Safitri et al., 2020). In the context of congklak, it is important for teachers to design activities that not only focus on cognitive elements such as counting, but also consider the social-emotional aspects and motor

development of children. Limited planning can result in ineffective learning and can lead to children losing interest in the activities.

Furthermore, teachers' skills in creating and managing classrooms are also crucial factors for a successful learning process. Several studies have shown that teachers sometimes struggle to control children's behavior when their emotions are unstable. A teacher's ability to differentiate instruction, create a pleasant environment, and provide individualized support to each child significantly impacts learning outcomes. (Maufiroh et al., 2025) emphasize that a personalized learning approach is crucial for optimal child development. However, challenges lie in teachers' limited knowledge and access to learning resources. Learning aids also need to be reviewed for their appeal and suitability to the child's characteristics. Learning media that are uninteresting or monotonous can quickly cause children to become bored and lose focus while learning. In the context of congklak, teachers need to create a variety of activities and modify the game to maintain relevance and engage children's attention throughout the learning session.

CONCLUSION

This study aimed to assess the effectiveness of the congklak game as a learning tool that supports the cognitive development of 5- to 6-year-old children at the Kota Ilmu Kindergarten Plus. Based on the analysis of pre-test and post-test data, this study yielded several important findings that addressed the stated objectives.

First, the results revealed a statistically significant difference between pre-test and post-test scores ($t=2.355$; $df=10$; $p=0.040<0.05$), although this difference indicated a decline in cognitive ability. The average score decreased from 20.82 (Developing as Expected) in the pre-test to 15.82 (Beginning to Develop) in the post-test, a difference of 5.00 points. This finding indicates that under the conditions of this study, the congklak game has not been proven effective in promoting the cognitive development of 5- to 6-year-old children and may even lead to a decline in overall performance.

Furthermore, variation in children's learning outcomes increased significantly from pre-test to post-test, as seen in the increase in variance from 11.76 to 84.76 and standard deviation from 3.43 to 9.21. This increase in variability indicates that children's reactions to learning using the congklak game media were highly varied and inconsistent. Some children were able to maintain their performance (a score remained at 24), while others experienced a drastic decline to a score of 0. This finding suggests that the effectiveness of the congklak game is highly dependent on the characteristics of individual children and has not succeeded in creating equality or increasing collective abilities.

Finally, although there was a strong positive correlation between pre-test and post-test scores ($r=0.743$; $p=0.009$), indicating relative consistency in the order of abilities across children, this does not indicate the success of the intervention, but rather indicates that children's cognitive ability patterns tend to be stable despite a general decline in scores. Children with high pre-test abilities tended to maintain relatively higher abilities in the post-test.

Fourth, in-depth studies show that educational outcomes are influenced by a complex interaction between internal and external factors. Internal factors include variations in children's cognitive maturity, fluctuating emotional and motivational states, individual differences in

learning styles, limitations in attention span and working memory capacity, physical conditions, and variations in children's experiences and backgrounds. External factors, on the other hand, involve challenges in grouping students according to their individual characteristics, limited learning time (only 90-135 minutes over three weeks), the need for improvements in the quality of lesson planning, and teachers' ability to use varied and responsive learning approaches to individual children's needs.

Based on the results obtained, it cannot be concluded that congklak is an effective medium for supporting the cognitive development of early childhood. This game still has potential, but requires significant modifications and a more comprehensive approach. This approach must consider the child's cognitive and emotional readiness, appropriate duration and frequency of learning, and varied teaching strategies according to each child's needs, learning style, and developmental level. This study emphasizes the importance of conducting a comprehensive evaluation of the factors that support learning before applying traditional game-based learning media in the context of early childhood education.

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