The Effect of Animated Video Traditional Games Learning Media on Kindergarten Children's Mathematical Abilities: An Experimental Study

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Abstract

Keywords:
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This study aims to analyze the influence of traditional game animation video learning media on the mathematical abilities of children aged 5–6 years at Oswald Siahaan Kindergarten. This study uses a quantitative approach with an experimental method. The experimental design used is quasi-experimental with a one-group pretest–posttest model. The population in this study consists of all children in Group B at Oswald Siahaan Kindergarten, totaling 20 children, with the sampling technique being a saturated sample. Data collection was carried out thru structured observation methods to measure children's mathematical abilities, including understanding number concepts, simple arithmetic operations, recognition of geometric shapes, and concepts of measurement. Data analysis was conducted by comparing pretest and posttest results using the paired sample t-test. The research results using the paired sample t-test obtained an Asympsig (2-tailed) value of 0.000 < 0.05. this means there is an improvement in children's mathematical abilities after using traditional game animation video media. These findings indicate that traditional game animation videos have a positive and effective impact on improving early childhood mathematical abilities.

Abstrak

Kata Kunci:
Video Animasi;

Penelitian ini bertujuan untuk menganalisis pengaruh media pembelajaran video animasi permainan tradisional terhadap kemampuan matematika anak usia 5–6 tahun di Taman

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Kemampuan Matematika; Anak Usia Dini;	*Kanak-kanak Oswald Siahaan. Penelitian ini menggunakan pendekatan kuantitatif dengan metode eksperimen. Desain eksperimen yang digunakan adalah quasi-eksperimental dengan model one-group pretest–posttest. Populasi dalam penelitian ini adalah seluruh anak kelompok B di Taman Kanak-kanak Oswald Siahaan yang berjumlah 20 anak, dengan teknik pengambilan sampel berupa sampel jenuh. Pengumpulan data dilakukan melalui metode observasi terstruktur untuk mengukur kemampuan matematika anak, meliputi pemahaman konsep bilangan, operasi hitung sederhana, pengenalan bentuk geometri, dan konsep ukuran. Analisis data dilakukan dengan membandingkan hasil pretest dan posttest menggunakan uji paired sample t-test. Hasil penelitian menggunakan uji paired sample t-test memperoleh nilai Asympsig (2-tailed) sebesar 0.000 < 0.05. ini berarti adanya peningkatan kemampuan matematika anak setelah penggunaan media video animasi permainan tradisional. Temuan ini menunjukkan bahwa media video animasi permainan tradisional berpengaruh positif dan efektif dalam meningkatkan kemampuan matematika anak usia dini.*

1. Introduction

Education plays a strategic role in developing individual potential to advance the nation and to shape future generations equipped with knowledge, attitudes, and skills relevant to the demands of the times. Through education, individuals are guided to develop critical thinking skills, problem-solving abilities, and adaptability to continuously evolving social and technological changes. Various levels of education, from basic to higher education, contribute significantly to preparing high quality and competitive human resources (Kurniawan et al., 2023). One of the fundamental foundations of this educational system is Early Childhood Education (ECE), which serves as an initial and crucial stage in building a comprehensive developmental foundation for children.

Early Childhood Education is intended for children from birth to six years old, a period known as the golden age. During this stage, children experience rapid development across various domains, including physical motor, cognitive, language, social emotional, creativity, as well as moral and religious values. Optimal development during this period significantly determines children's success in subsequent educational levels (Riani & Maryani, 2022). Therefore, providing appropriate, meaningful, and developmentally suitable stimulation is essential and must be carefully considered by educators and parents.

One important developmental aspect in early childhood education is cognitive development. Cognitive development is closely related to children's abilities to think, understand concepts, remember, reason, and solve simple problems. This aspect also forms the basis for future academic abilities, including literacy and numeracy skills (N. K. Dewi et al., 2025; Fauziyah & Hasibuan, 2020). Cognitive abilities in early childhood need to be stimulated through concrete, contextual, and enjoyable learning activities to enable children to understand concepts meaningfully.

Previous research on mathematical ability titled "Play Method: Efforts to Stimulate the Development of Early Childhood Mathematics" by Fitri Febri Handayani et al. (2022) states that mathematics is still considered one of the subjects that is difficult and intimidating to learn. Therefore, stimulation was provided in the form of play methods, resulting in children's mathematical abilities at the pre-cycle stage being 42%, at Cycle I being 72.3%, and at Cycle II being 99.1%. Additionally, children were already observed to 1) enjoy playing, 2) like new things, and 3) get bored easily, necessitating variations in media and teaching methods.

Mathematics is the science of logic, shapes, arrangements, magnitudes, and concepts (algebra, analysis, and geometry) that are interconnected. It plays an essential role in the advancement of science and technology, organizing the thinking process/human thot patterns so that they can solve problems creatively (Fahma & Purwaningrum, 2021). In the realm of children's education, mathematics falls under the cognitive aspect alongside science and logic. In children's education, there are two core areas in teaching mathematics to young children, namely 1) numbers, and 2) geometry and measurement (Handayani et al., 2022).

Mathematical ability is an essential component of cognitive development in early childhood (Husna & Nurhafizah, 2022). The introduction of mathematical concepts is not limited to counting skills but also includes understanding numbers, patterns, geometric shapes, measurements, comparisons, and simple problem solving in daily life. Early exposure to mathematical concepts helps children develop logical, systematic, and critical thinking skills (Puspitasari et al., 2020; Widodo, 2022). However, in practice, mathematics learning in ECE is often perceived as abstract and less engaging for children if it is not supported by appropriate media and teaching methods suited to their developmental characteristics.

Numerous studies indicate that the use of appropriate learning media can enhance the effectiveness of mathematics learning in early childhood. Learning media function as tools to convey instructional messages in a more concrete, engaging, and comprehensible manner. Visual and audiovisual media are considered capable of increasing children's attention, motivation, and active participation in the learning process (Hariyati & Nurhafizah, 2023; Rahayu et al., 2023). One learning medium that is considered effective and aligned with the characteristics of early childhood learners is animated video media.

Animated videos are audiovisual media that combine moving images, text, color, sound, and narration, enabling learning materials to be presented in an engaging and interactive way. The use of animated videos in early childhood learning helps transform abstract concepts into more concrete representations, enhances imagination, and facilitates children's ability to remember the material presented (Irmadiyah & Islami, 2023; Knapp et al., 2022). In addition, animated videos provide enjoyable learning experiences, reducing pressure during the learning process.

In the context of early childhood education, play based learning is highly recommended. Play is a natural activity for children and can serve as a medium to develop various aspects of development, including cognitive and mathematical abilities. One form of play based learning that is highly relevant to the Indonesian cultural context is traditional games. Traditional games such as snakes and ladders, congklak, and engklek have great potential to stimulate counting skills, pattern recognition, number concepts, and simple problem solving abilities (Anggraini & Nurhafizah, 2020; Darmawati & Widyasari, 2022; Pertiwi et al., 2018).

For example, the snakes and ladders game helps children recognize number sequences, count steps, and understand the concepts of forward and backward movement. Congklak trains counting skills, grouping, and simple strategies, while engklek helps children recognize patterns, shapes, and sequences indirectly. Integrating traditional games into modern learning media, such as animated videos, represents an innovation that bridges local cultural values with the learning needs of the digital era (Ahmad, 2024; Nuria & Abidin, 2024).

Several studies have shown that the use of visual and play based learning media significantly enhances children's engagement, conceptual understanding, and learning outcomes in early childhood education (Maghfiroh & Suryana, 2021). Media that integrate storytelling, attractive visuals, and play activities have been proven to create more meaningful learning experiences aligned with children's developmental characteristics.

However, preliminary observations at Oswald Siahaan Kindergarten indicate that children's mathematical abilities have not yet developed optimally. Children still experience difficulties in recognizing number concepts, counting sequentially, and understanding measurement and shape concepts. The learning process tends to remain teacher centered and lacks the use of interactive and contextual learning media. In addition, the utilization of traditional games in mathematics learning remains very limited.

Based on these conditions, there is a need for innovative learning media that integrate visual elements, play activities, and local cultural values in an engaging and interactive manner. The development of animated videos incorporating traditional games such as snakes and ladders, congklak, and engklek is expected to serve as an alternative solution to improve early childhood mathematical abilities. Therefore, this study aims to experimentally examine the

effect of using animated video media on improving children's mathematical abilities at Oswald Siahaan Kindergarten. The findings of this study are expected to provide both theoretical and practical contributions to the development of innovative learning media that align with early childhood characteristics while supporting the preservation of traditional games within educational contexts.

2. Methods

This study employed a quantitative approach with an experimental research type. The method used was a quasi experimental design with a one group pretest posttest. This quasi-experimental design is an adaptation of the pre-experimental design, so this study only involves one experimental class with pre-test and post-test, aimed at determining the effect of using animated video media on the mathematical ability of early childhood children (Sugiyono & Lestari, 2021).

The study was conducted at Oswald Siahaan Kindergarten during the odd semester of the 2024/2025 academic year. The research subjects were Group B children aged 5–6 years. The population in this study consisted of 20 children, and the sampling technique used was saturated sampling, so the entire population was taken as the research sample.

The variables in this study consisted of an independent variable, namely the animated video learning media based on traditional games (snakes and ladders, congklak, and hopscotch), and a dependent variable, namely the mathematical ability of early childhood children. The mathematical abilities measured included understanding number concepts, simple counting skills, recognition of patterns and shapes, and understanding measurement concepts. Traditional game animation videos are created using AI, CapCut, and Canva. Each video has a duration of about 4-5 minutes and is in MP4 format for playback. The animated videos of traditional games have been validated by media experts and received a score of 85% with a valid category. The following media expert instruments can be seen in the table below:

Table 1. Media Expert Validation Instruments Aspect Question Items

Aspects	Question Item
Image	Appropriate image type selection
	Appropriate image size
	Appropriate color, image, and background
Audio	Appropriate background sound selection in video media
	Synchronization between background sound and narrator's voice
	Appropriate music volume in video media
	Appropriate music selection with teaching content
	Appropriate narrator articulation/pronunciation
	Appropriate narrator tempo
	Appropriate narrator intonation and pronunciation
Animasi	Appropriate animation with material description
	Appropriate frame transitions

	Appropriate object movement	
	Appropriate animation placement	
	Relationship of images used with material	
Video	Appropriate video quality	
	Appropriate duration used for children	
	Appropriate video opening	
	Appropriate video closing	

Source : **(Enjela et al., 2024)**

Data collection was conducted through structured observation using an instrument sheet for children's mathematical abilities, which had been adjusted to the developmental indicators of early childhood. Observations were conducted twice: a pretest before the treatment was given and a posttest after the children participated in learning using the animated traditional game videos. The following is a validation instrument for early childhood mathematics skills:

Table 2. Validation Instrument for Mathematics Skills

No	Aspect	Indicator
1	Understanding Number Concepts	Children are able to recognize number symbols
		Children are able to count objects from 1-10
2	Simple Arithmetic Operations	Children are able to complete simple addition calculations using concrete objects
		Children are able to complete simple subtraction calculations using concrete objects
3	Introduction to Geometric Shapes	Children are able to recognize basic shapes (circles, triangles, squares)
4	Understanding the Concept of Size	Children understand simple concepts of size (many-few)
5	Simple Problem Solving	Children are able to solve simple problems

Source : **(Utoyo et al., 2025)**

The research procedure began with the administration of a pretest to determine the children's initial mathematical abilities. Next, the children received treatment in the form of learning activities using animated videos of traditional games, designed visually and contextually according to the characteristics of early childhood. The animated videos were used in several learning sessions to provide a meaningful and enjoyable learning experience. After all learning sessions were completed, a posttest was conducted to assess the improvement in children's mathematical abilities.

The data obtained were analyzed quantitatively using a paired sample t-test to determine the difference in the average mathematical ability of children before and after the treatment. This test was chosen because the data came from the same group and aimed to examine the effectiveness of the implemented learning media. Data analysis was conducted at a significance level of 0.05 using statistical software.

The primary outcomes measured in this study were the improvement of early childhood children's mathematical abilities after participating in learning using animated video media based on traditional games. The implementation of this learning approach is expected to provide a positive contribution to mathematics teaching practices in early childhood education through the use of innovative and culturally-based media.

3. Result and Discussion

Based on the research conducted at Oswald Siahaan Kindergarten, the validity test assessed by the expert Dr. Setio Utoyo, M.Pd., showed that the research instrument was declared highly valid with a score of 95%. Subsequently, a reliability test was conducted, yielding a Cronbach's Alpha value of 0.874 > 0.5, indicating that the instrument is reliable. Thus, the measurement instrument used has a high level of confidence and consistency and can be applied to other samples with similar characteristics.

Furthermore, the analysis of pretest and posttest data in both the control and experimental classes showed differences in learning outcomes for both pretest and posttest. The results of this analysis are presented as follows:
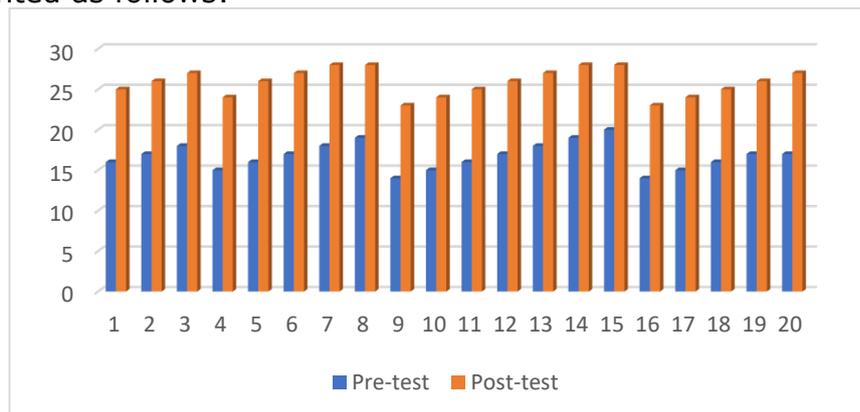

Figure 1
(a) Pretest and Posttest Results of the Experimental Class
Source: Excel Output

Based on the large group trial results, before using animated videos of traditional games in the learning activities, the average pretest score for children's mathematical ability was 16.75 out of an ideal score of 28, equivalent to 2.39. When converted to a 1-4 rating scale, the average score indicates that the children's mathematical abilities were generally in the "Beginning to Develop" category (MB) moving toward "Developing as Expected" (BSH). Meanwhile, the posttest score for children's mathematical ability was 25.80 out of an ideal score of 28, equivalent to 3.69. On a 1-4 scale, the average achievement reached 3.69, indicating that the children's mathematical abilities were generally in the "Very Good Development" category (BSB).

The comparison between pretest and posttest scores shows that all children experienced an improvement in mathematical ability. To determine the level of improvement after implementing the animated

video of traditional games, an N-Gain test was conducted on the pretest and posttest data of the large group. The results of the N-Gain test are as follows:

Effectiveness of N-Gain Score	
Percentage (%)	Description
<40%	Not effective
40% - 55%	Less effective
56% - 75%	Quite effective
>76%	Effective

Source: (Sugiyono, 2020)

N-Gain Score Classification	
N-Gain Value	Description
g > 0.7	High
0.3 </ g </ 0.7	Medium
g < 0.3	Low

Source: (Sugiyono, 2020)

$$N\ Gain = \frac{Posttes\ Score - Pretest\ Score}{Ideal\ Score - Pretest\ Score}$$

$$N\ Gain = \frac{25,80 - 16,75}{28 - 16,75}$$

$$N\ Gain = 0,80$$

Based on the N-Gain score, a value of 0.80 > 0.7 was obtained, indicating high effectiveness. Therefore, it can be concluded that animated videos of traditional games are highly effective in improving the mathematical abilities of early childhood children.

Furthermore, the pretest and posttest data were analyzed using a paired sample t-test to determine the effectiveness of animated video development of traditional games in significantly improving children's mathematical abilities. The paired sample t-test was chosen because the analyzed data were paired, coming from the same subjects with the same number of observations. One prerequisite for using the paired sample t-test is that the data must be normally distributed. The results of the normality test are presented in the following table.

Tabel 3. Paired Samples Test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Pre test - Post Test	-8,95	2,77	,62	-10,25	-7,65	-14,37	19	,000

Based on the table above, the significance value (2-tailed) was 0.000 < 0.05 with α = 0.05, so it can be concluded that H₀ is rejected. This indicates a significant difference in the average pretest and posttest scores of children's mathematical ability in the effectiveness test. The data analysis results indicate that the development of animated videos of traditional games is effective in significantly improving early childhood mathematical abilities. The media used in this study were as follows:

Figure 2
(a) Animated video media of traditional games used in the study
Source : AI, canva and capcut

The results of this study indicate that the use of animated video learning media integrating traditional games significantly improves the mathematical abilities of early childhood children. These findings are in line with previous studies stating that visual and play based learning media can enhance children's cognitive concept understanding more optimally than conventional learning (Irmadiyah & Islami, 2023; Liu & Elms, 2019; Tullah et al., 2022).

The increase in posttest scores shows that animated videos can present mathematical concepts more concretely and contextually. Children not only see numbers and symbols but also understand mathematical concepts through familiar play activities, such as snakes and ladders, congklak, and hopscotch. Snakes and ladders help children understand number sequences and forward backward concepts; congklak trains counting and grouping skills, while hopscotch helps children recognize patterns and shapes indirectly. These findings reinforce the results of (Matulessy & Muhid, 2022; Mukhlis & Mbelo, 2019), who stated that traditional games are effective in stimulating early childhood numeracy skills.

The high N-Gain value indicates that learning with animated videos not only improves quantitative learning outcomes but also provides meaningful learning experiences. Audiovisual media can

enhance children's attention, motivation, and active involvement during the learning process (Fadilah et al., 2023; Nisa & Sujarwo, 2020). This aligns with findings emphasizing that learning involving visual elements, stories, and play activities is easier for young children to understand (Mills & Brown, 2022).

The paired sample t-test results, showing significant differences between pretest and posttest scores, further support the empirical evidence that animated videos of traditional games are highly effective in improving children's mathematical abilities. These results are consistent with studies by Riani & Maryani (2022) and Utoyo (2017), which state that interactive learning media can help children build a deeper and longer-lasting conceptual understanding.

Moreover, integrating traditional games into animated video media also adds value from a cultural preservation perspective. Children not only learn mathematics but are also introduced to traditional games that are becoming less common. This aligns with (N. W. U. R. Dewi et al., 2021; Putri et al., 2024), who emphasize the importance of integrating local cultural values in early childhood education to build children's identity and character from an early age.

This study is also highly relevant to the needs of early childhood education, which emphasizes a holistic and child centered approach. Children aged 5–6 years are in a rapid cognitive and social development stage, so they learn optimally through direct experience, play, stories, and social interaction (Enjela et al., 2024). Therefore, using animated videos integrating traditional games such as snakes and ladders, congklak, and hopscotch is very suitable for children's learning characteristics, providing meaningful, enjoyable, and life-relevant learning experiences.

In addition to enhancing mathematical abilities, the use of animated videos of traditional games also contributes to children's social and cultural development. Traditional games not only train counting and pattern recognition but also foster cooperation, patience, sportsmanship, and cultural awareness. Thus, animated video media of traditional games function not only as cognitive learning tools but also as a means of character building and preserving local culture in early childhood education.

4. Conclusion

Based on the research conducted at Oswald Siahaan Kindergarten with 20 children in Group B aged 5–6 years, it can be concluded that animated video learning media based on traditional games is proven effective in improving early childhood mathematical abilities. The analysis of pretest and posttest results showed significant improvements in understanding number concepts, simple counting skills, recognition of patterns and shapes, and understanding measurement concepts. The high N-Gain category and significant paired sample t-test results further support that this media can present mathematical concepts concretely, contextually, and enjoyably, thereby motivating children and promoting active engagement during learning.

In addition to enhancing cognitive abilities, the use of animated videos of traditional games also contributes to children's social and cultural development. Children are introduced to traditional games such as snakes and ladders, congklak, and hopscotch, which support local cultural preservation while instilling values of cooperation, patience, sportsmanship, and responsibility. This media functions not only as a mathematics learning tool but also as a means of strengthening children's character. The study has limitations in terms of sample size and unexamined external factors, so future research is recommended to expand the sample, involve control groups, and explore combinations with other interactive digital media to further improve the quality of early childhood mathematics education.

5. Acknowledgements

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