



THE RELATIONSHIP OF SCRATCHJR-BASED EDUCATIONAL GAME ACTIVITIES TO THE COGNITIVE ABILITY OF CHILDREN AGED 4-5 YEARS KEMALA BHAYANGKARI KINDERGARTEN 1 SERANG CITY

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Abstract

The implementation of learning at an early age needs to pay attention to the use of structured methods in a directed manner so that learning activities can take place more easily and effectively. Methods are a way used to manage the learning process as a means of achieving goals through systematic and planned steps. Therefore, the choice of learning methods is very important in supporting early childhood development. The purpose of writing this article is to find out the relationship between ScratchJr-based educational game activities and the cognitive abilities of children aged 4-5 years at Kemala Bhayangkari 1 Kindergarten, Serang City. This study uses a quantitative correlational approach to determine the relationship between ScratchJr-based educational game activities as an independent variable and the cognitive ability of children aged 4-5 years as a dependent variable at Kemala Bhayangkari 1 Kindergarten, Serang City. The results of this study are first, based on the results of simple linear regression analysis, it is known that ScratchJr-based educational game activities (variable X) have a very strong positive influence on children's cognitive abilities (variable Y). A determination coefficient value (R^2) of 0.999 indicates that 99.9% variation in children's cognitive abilities can be explained by variations in educational play activities. Furthermore, a positive and significant regression coefficient ($p < 0.05$) showed that an increase in educational game activities would be followed by an increase in children's cognitive abilities. Second, based on the results of the Pearson correlation test, the p-value obtained was 0.000, which is less than $\alpha = 0.05$. This shows that the relationship between ScratchJr-based educational game activities and children's cognitive abilities is statistically significant. This means that the increase in educational play activity is directly proportional to the increase in the child's cognitive abilities, and this relationship is not coincidental but real and powerful.

Keywords: Early Childhood, Educational Games, Cognitive Abilitie

INTRODUCTION

Early childhood is a period when the child's age has not been able to optimize his or her abilities. The role of parents, teachers, or the community is very important as a supporting factor in helping children develop their abilities. Many parents leave it entirely to the school for the development of their children's abilities. According to Sujiono (2013) quoted in Veronica, early childhood education is a variety of efforts made by parents and educators in providing a learning environment that supports children to gain hands-on experience. Through this environment, children are given the opportunity to observe, imitate, and try various things by involving all the potential abilities they have. Therefore, the implementation of early childhood education, both through formal, informal, and non-formal channels, needs to be developed because it has an important role in supporting children's growth and development in the future. Early childhood development includes improvements in various aspects, such as cognitive, social-emotional, language, physical, motor, and religious and moral values. From these various aspects, cognitive development is an important part to pay attention to because it is related to the thinking process in children.

Cognitive abilities are the thinking processes of children that allow them to make connections, think, and consider events or situations. Cognition is an individual's ability to feel, remember, and give reason to imagine. On the other hand, cognitive development does not only include math and science, but it also includes problem-solving skills. Cognitive abilities in the preoperational stage begin with mastery of structured language, playing with symbols, imitating, and imagining mentally. The process of children's cognitive development takes place through various sequences. This stage helps explain how children think, store information, and adjust to the surrounding environment. The media used in

children's cognitive abilities at the kindergarten level is generally a safe and fun medium. However, based on a lot of experience in the field, teachers often do not make the most of this potential as today, there are many digital game tools that can be used by teachers or parents to support early childhood cognitive development.

The implementation of learning in early childhood needs to pay attention to the use of methods that are structured in a directed manner so that learning activities can take place more easily and effectively. Methods are a way used to manage the learning process as a means of achieving goals through systematic and planned steps. Therefore, the choice of learning method is very important in supporting early childhood development. One of the methods that is widely applied in early childhood education is learning through play activities. Playing is a very popular activity, especially by children, because for them play activities have a very big role in their daily lives. Playing is an activity that is done repeatedly for fun, because the more interesting the learning activity, it will be very helpful for early childhood to enjoy learning in play methods such as applying game media in learning. At this time, the game media that children are very fond of is technology, where children's education in the early stages is increasingly crucial and technology is a tool that can help improve the quality of learning and help children understand the material. Current technological developments affect various things in life, including early childhood education, technology plays an important role in helping the learning process and children's growth and development from an early age and is an effective and fun learning tool for children (Asmawati, 2021). The importance of learning media that uses computers, mobile phones or laptops such as educational games, in encouraging children's creativity and offering interesting and innovative learning experiences (Dea Reskyadita & Kusuma Ayu Laksitowening, n.d.) Considering that early childhood today also understands and understands some technology but it is still very often not directed or taught to use technology and some other educational digital games correctly such as to train early childhood cognitive development, because it is still very often used to watch some videos on media platforms or play games that are negative and make children addicted to technology.

Educational media activities based on *digital games* can be stimulated through several applications and one of the educational games, namely ScratchJr, an application that implements an educational digital game system for early childhood that supports children in creating entertaining animations, interactive stories, and interesting games on their own. ScratchJr-based educational games can provide children with coding introduction in a clear and efficient way, having various advantages over other applications. Children's cognitive growth is influenced by interactions with others and the tools used in the learning process. In this case, ScratchJr can be seen as a link that expands the child's learning experience as well as encourages them to think in an organized and systematic way. By undertaking projects and overcoming technical problems, children learn to analyze problems, devise steps, and understand the ideas of algorithms and symbols that they represent. Based on observations at Kemala Bhayangkari 1 Kindergarten in Serang City, the method of using digital-based educational media is still rarely applied in every learning game and teachers in general still use manual methods in making games in learning so as to make children feel less interesting because children at Kemala Bhayangkari 1 Kindergarten in Serang City already know technology at home, therefore children can get used to it if they are in the learning game method using ScratchJr-based educational games, so it is very important to provide directions to use digital-based educational game technology to provide good benefits for the cognitive development of children aged 4-5 years at Kemala Bhayangkari 1 Kindergarten in Serang City.

Based on the research background, several problems can be identified, namely the use of digital-based educational media in the learning process at Kemala Bhayangkari 1 Kindergarten in Serang City is still not optimal because teachers use more conventional learning media. In addition, children aged 4–5 years are familiar with technology in the family environment, but its use is more often used as an entertainment medium than an educational learning medium. In addition, it is not yet clear what is known about the relationship between ScratchJr-based educational game activities and the cognitive abilities of children aged 4–5 years at Kemala Bhayangkari 1 Kindergarten, Serang City.

RESEARCH METHODS

This study uses a correlational quantitative approach to determine the relationship between ScratchJr-based educational game activities as an independent variable and the cognitive ability of children aged 4-5 years as a bound variable at Kemala Bhayangkari 1 Kindergarten, Serang City. The

choice of the correlational method is based on Jean Piaget's theory of cognitive development (1972) which states that early childhood acquires knowledge through active interaction with its environment without any external manipulation. Therefore, this approach can be used to analyze the natural relationship between digital stimulation in the form of ScratchJr and the development of children's cognitive abilities. This approach is also in line with the concept of educational play in Vygotsky's theory (1978), which sees social interaction as a driver of development, as well as Seymour Papert's theory of constructionism (in Bers & Resnick, 2015), which encourages the use of technology for the construction of active knowledge. This research was carried out over a period of nine months, namely from September 2025 to May 2026. The implementation of the research was complemented by the Decree of the Dean of the Faculty of Teacher Training and Education on behalf of the Rector of the State Islamic University Sultan Ageng Tirtayasa. In order for the research to run according to the predetermined time, the preparation of a schedule of research activities is considered necessary as a guideline for future implementation. This research was conducted at Kemala Bhayangkari 1 Kindergarten, Serang City. The selection of the location was based on the results of initial observations that showed the need for the use of digital learning media such as ScratchJr in supporting the improvement of early childhood cognitive abilities. In addition, this school already has basic technology facilities and the students are also quite familiar with the use of digital devices.

The population in this study includes all children enrolled in Kemala Bhayangkari 1 Kindergarten, Serang City, with a total of 45 children based on school data. The population was chosen because it is in accordance with the focus of research that focuses on early childhood, so that it can provide an overview of the development of children's cognitive abilities in the educational environment. The sampling technique used in this study is *Purposive Sampling*. This technique is a way of determining samples based on certain considerations or criteria that are tailored to the purpose of the research. The use of this technique was carried out to obtain research subjects who have special characteristics, namely children aged 4–5 years who are in the stage of preoperational cognitive development according to Jean Piaget's theory. Using this technique, researchers can determine the sample that is considered the most relevant and representative in answering the formulation of the research problem. With this approach, research can comprehensively analyze early childhood cognitive abilities without compromising the accuracy of the data. (Sugiyono, 2024).

The data collection technique in this study was carried out through participatory observation, the implementation of cognitive ability tests, and documentation. This approach corresponds to the quantitative method of correlation because it allows simultaneous measurement of variables X and Y without external manipulation, so that it can identify natural relationships based on Piaget's theory (active interaction with the environment), Vygotsky (social interaction), and Papert (construction of knowledge through technology). Data were collected systematically for 4-6 weeks, with a focus on children aged 4-5 years at Kemala Bhayangkari 1 Kindergarten, Serang City.

The analysis technique of the results of the instrument test in this correlational quantitative study was carried out to ensure that the participant observation instruments (for independent variables: ScratchJr-based educational game activities) and cognitive ability tests (for dependent variables: cognitive abilities of children aged 4-5 years) were valid, reliable, and able to distinguish subjects well. The instrument uses a Likert scale of 1-5, so the analysis focuses on construct validity (item total correlation), internal reliability (Cronbach's Alpha), to see if the item distinguishes high vs. low ability). This is in accordance with Jean Piaget's (1972) theory of cognitive development, which measures the goal measurement of cognitive aspects such as the understanding of symbols and cause-effect; Lev Vygotsky (1978), who considers social interaction in validity; and Seymour Papert (in Bers & Resnick, 2015), who ensure the measurement instrument of knowledge construction through technology. If the item is invalid/reliable, revision or removal is performed. The following are the test of the instrument, namely validity and realilbty test.

Validity is the degree of accuracy of the instrument in measuring what is supposed to be measured, i.e. a variable construct. In the context of this study, the validity of the construct was tested to ensure the instrument items actually measured aspects of ScratchJr's activity (such as simple programming and collaboration) and cognitive abilities (such as causal understanding and creativity). Based on Piaget's theory, validity ensures the item reflects the child's symbolic thought process; Vygotsky emphasizes social validity (e.g., collaboration items); and Papert ensures the validity of the technology (e.g., coding items). Instrument testing is an important stage that is carried out before the

implementation of the main research. One of them is the validity test, the implementation of validity tests using respondents outside the research sample, with the implementation of instrument trials outside the research sample, it is hoped that the instruments used in the main research can produce accurate, valid, and reliable data, so that the quality of the research results becomes more guaranteed. The data compiled by the researcher first needs to be tested for validity. Through the testing process, the researcher can find out whether the questions made have been declared valid or not.

The results of the validity test will show which question items are valid and can be maintained, as well as which are invalid and need to be revised or discarded. Thus, this process is an important step to ensure the quality of research instruments so that the data obtained is more accurate, and can be scientifically accounted for. According to Sugiyono (2024), a validity test is an instrument used to measure what should be measured. A test can be said to be valid if each question item in it is able to accurately describe what is the purpose of the test measurement. The assessment criteria in the validity test used are as follows, if the significance value is < 0.05 , then there is a correlation between variables, and if the significance value is > 0.05 , then there is no correlation between variables. (Azuar, 2016). With the test criterion, which is to compare the significance value with 0.05, it can be concluded that of the 32 instrument statements that were tested to 17 students (outside of the respondents who were used as samples). 34 of the statements were valid, so the researcher decided to take 32 instrument statements.

The data analysis technique in this correlational quantitative research was used to test the relationship between independent variables, namely ScratchJr (X)-based educational game activities, and dependent variables, namely the cognitive abilities of children aged 4–5 years (Y) at Kemala Bhayangkari 1 Kindergarten, Serang City. The data analysis process is carried out with the help of SPSS statistical software version 22 or later to improve the efficiency of data processing, although it can be done manually if required. The data analyzed came from participant observation instrument scores (X) and cognitive ability tests (Y), with a sample of 34 children aged 4-5 years. The analysis consists of an assumption test (normality), and an inferential (correlation test). It is based on Jean Piaget's (1972) theory of cognitive development, which emphasizes the measurement of cognitive relationships through active interaction; Lev Vygotsky (1978), who considered social interaction in the analysis; and Seymour Papert (in Bers & Resnick, 2015), who ensure analysis reflects the construction of knowledge through technology. The results of the analysis are visualized in tables, graphs, and narratives for interpretation, according to a correlational methodology that focuses on natural relationships without intervention.

RESULTS OF RESEARCH AND DISCUSSION

There are several findings in the field about this research based on the results of observation, testing, and documentation, so the researcher presents the data and analysis as follows, namely:

a. The Relationship Between Scratchjr-Based Educational Game Activities and the Cognitive Abilities of Children Aged 4-5 Years at Kemala Bhayangkari Kindergarten 1, Serang City.

In this section, the researcher will describe the results of data analysis related to the relationship between ScratchJr-based educational game activities and the cognitive abilities of children aged 4–5 years at Kemala Bhayangkari 1 Kindergarten, Serang City. This analysis aims to find out whether or not there is a relationship, as well as the level of strength of the relationship between the variables of ScratchJr-based educational game activities as an independent variable (X) and children's cognitive abilities as a dependent variable (Y). Before the correlation test is carried out, an analysis prerequisite test is first carried out which includes a normality test and a linearity test. The results of the prerequisite test showed that the data was normally distributed and had a linear relationship, so it was eligible for correlation analysis. In this section, the researcher presents the results of data analysis regarding the relationship between ScratchJr-based educational game activities and the cognitive abilities of children aged 4–5 years at Kemala Bhayangkari 1 Kindergarten, Serang City. This analysis was carried out to find out whether there is a relationship and how strong the relationship is between the variables of ScratchJr-based educational game activities as an independent variable (X) and children's cognitive abilities as a dependent variable (Y). Before the correlation test is carried out, an analysis prerequisite test is first carried out which includes a normality test and a linearity test. The test results show that the data is normally distributed and has a linear relationship, so it is eligible to proceed to correlation analysis. Furthermore, the relationships between variables were analyzed using the Pearson Product Moment correlation technique. This technique is used to determine the direction of the relationship,

whether positive or negative, as well as to measure the strength of the relationship between the two variables studied. The results of this correlation test produce correlation coefficient values (r) and significance values (sig) which are then used to interpret the results and answer the research hypothesis. Through this analysis, the researchers were able to find out the extent to which ScratchJr-based educational game activities are related to early childhood cognitive abilities. The results obtained are expected to provide an empirical picture of the importance of using digital learning media in supporting the cognitive development of children aged 4-5 years. The following are the results of the normality test, namely:

Tests of Normality						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Aktivitas Game Edukasi Anak	.121	34	.200 [*]	.976	34	.649
Kemampuan Kognitif Anak	.113	34	.200 [*]	.979	34	.733

^{*}. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Figure 1. Tests of normality

With the test criteria comparing the significance value to 0.05, it can be concluded that the data is normally distributed because the significance value is greater than 0.05. (Abigael Soesana, 2023). In this study, the results of the normality test also showed that the data obtained had been distributed normally. To strengthen the results of the data normality test, the researcher also conducted a visual analysis through histogram graphs. Histograms are used to see the pattern of data distribution whether it forms a normal curve (bell) or not. Normally-distributed data will generally form a symmetrical pattern, not skewed to one side, and have a peak in the middle. Through this histogram, researchers can get an initial picture of the distribution of data on each variable, so that it can support the results of the normality test that has been carried out previously.

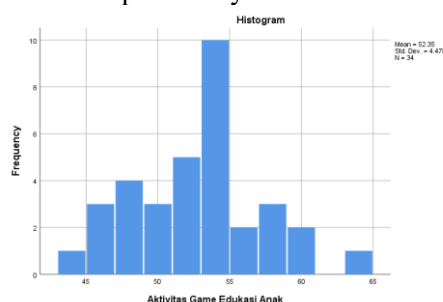


Figure 2. Histogram

Because the assumption of data normality has been met. The homogeneity test in this study was not carried out because the purpose of the homogeneity test was to find out whether the variance of several populations was the same or the same. In this study, the research sample consisted of only 1 single class (34 respondents) and used questionnaire instruments. Therefore, the homogeneity test is not relevant to be performed. Furthermore, the research was continued with a simple linear regression test to determine the influence of ScratchJr-based educational game activities on children's cognitive abilities. The following are the results of the linearity test, namely table 1.

Table 1 Anova

ANOVA Table						
			Sum of Squares	df	Mean Square	F
Kemampuan Kognitif Anak * Aktivitas Game Edukasi Anak	Between Groups	(Combined)	665.196	16	41.575	848.125
		Linearity	665.063	1	665.063	13567.284
		Deviation from Linearity	.133	15	.009	.181
	Within Groups		.833	17	.049	
	Total		666.029	33		

Based on the results of simple linear regression analysis, it is known that ScratchJr-based

educational game activities (variable X) have a very strong positive influence on children's cognitive abilities (variable Y). The value of the determination coefficient (R^2) of 0.999 indicates that 99.9% of the variation in the child's cognitive ability can be explained by the variation in the educational game activity. In addition, a regression coefficient with a positive and significant value ($p < 0.05$) indicates that an increase in educational game activities will be followed by an increase in children's cognitive abilities. Thus, it can be concluded that ScratchJr-based educational game activities have a positive and significant influence on the cognitive abilities of children aged 4–5 years at Kemala Bhayangkari 1 Kindergarten, Serang City. The results of this analysis also show that there is a very strong relationship between the two variables, so it can be interpreted that the higher the activity of educational games, the more children's cognitive abilities also increase. (Abdul Muin, 2022).

b. Significant Relationship Between Scratchjr-Based Educational Game Activities and Cognitive Abilities of Children Aged 4-5 Years at Kemala Bhayangkari Kindergarten 1 Serang City

To find out the extent to which ScratchJr-based educational game activities affect children's cognitive abilities, it is necessary to analyze the relationship between the two variables. Educational game activities are one of the interactive and fun learning methods for early childhood, which can stimulate thinking, creativity, and the ability to solve problems independently. Meanwhile, children's cognitive abilities are an important indicator of their intellectual development and readiness to receive further learning. This relationship analysis is important because it provides an empirical picture of the effectiveness of educational games as a learning medium. By knowing the level of relationship between educational game activities and cognitive abilities, teachers and educators can design learning strategies that are more targeted, so that children can get the maximum benefits from technology-based learning activities. This study aims to find out whether the increase in educational game activities is directly proportional to the improvement of children's cognitive abilities, as well as whether the relationship is statistically significant in Kemala Bhayangkari 1 Kindergarten, Serang City, so that it can be used as a basis for educational decision-making based on learning innovation.

Before the relationship analysis was carried out, the variable data of ScratchJr-based educational game activities and children's cognitive abilities were checked for normality and linearity. The results of the examination showed that the two variables were normally distributed and had a linear relationship, so the relationship analysis was performed using the Pearson correlation test, which is appropriate for continuous numerical data. The following are the results of the Pearson correlation test, namely:

Correlations			
		Aktivitas Game Edukasi Anak	Kemampuan Kognitif Anak
Aktivitas Game Edukasi Anak	Pearson Correlation	1	.999**
	Sig. (2-tailed)		.000
	N	34	34
Kemampuan Kognitif Anak	Pearson Correlation	.999**	1
	Sig. (2-tailed)	.000	
	N	34	34

** . Correlation is significant at the 0.01 level (2-tailed).

Figure 3. Correlation

Based on the results of the Pearson correlation test, a value of $p = 0.000$ was obtained, which is smaller than $\alpha = 0.05$. This suggests that the relationship between ScratchJr-based educational game activities and children's cognitive abilities is statistically significant. This means that the increase in educational game activity is directly proportional to the increase in children's cognitive abilities, and this relationship is not a coincidence, but a real and strong one. (Karimuddin Abdullah, 2022).

A hypothesis is a provisional conjecture proposed in a study based on the study being conducted. In general, the hypothesis is divided into two, namely, hypothesis zero (H_0) = There is no relationship between the activities of ScratchJr-based educational games with the cognitive abilities of children aged 4–5 years at Kemala Bhayangkari 1 Kindergarten in Serang City, and the alternative hypothesis (H_1) = There is a relationship between the activities of ScratchJr-based educational games and the cognitive abilities of children aged 4–5 years in the kindergarten. In this study, the researcher proposed an alternative hypothesis (H_1) because based on the results of data collection through questionnaires, 32 instrument statements were obtained, all of which were declared valid. In addition, the instrument is also declared reliable because the value of Cronbach's Alpha is greater than 0.60, as well as the data is

normally distributed because the significance value is greater than 0.05. Based on the results of the Pearson correlation test, the value $p = 0.000$ was obtained which was smaller than $\alpha = 0.05$. This shows that the relationship between ScratchJr-based educational game activities and children's cognitive abilities has very strong statistical significance. Thus, the increase in educational game activities is in line with the improvement of children's cognitive abilities, and the relationship is real and significant, not coincidental.

CONCLUSIONS AND SUGGESTIONS

Conclusion

Nowadays, the most popular game media for children is technology, so education at an early age is becoming increasingly important. Technology also plays a role as a means that can help improve the quality of learning while making it easier for children to understand the material. The results of the study showed that ScratchJr-based educational game activities had a positive and significant influence on the cognitive abilities of children aged 4-5 years at Kemala Bhayangkari 1 Kindergarten, Serang City. This is proven through a normality test by comparing the significance value to 0.05. From the test results, it was obtained that the significance value was greater than 0.05 so that the data was declared to be normally distributed. Thus, the results of this study show that there is a significant relationship between ScratchJr-based educational game activities and the cognitive abilities of children aged 4–5 years in the kindergarten.

Based on the results of the Pearson correlation test, a value $p = 0.000$ was obtained which was smaller than $\alpha = 0.05$. This shows that the relationship between ScratchJr-based educational game activities and children's cognitive abilities has very strong statistical significance. Thus, the more educational game activities increase, the more children's cognitive abilities will also increase, so that the relationships formed are real and not accidental. The researcher in this case proposed an alternative hypothesis (H1), namely that there is a relationship between ScratchJr-based educational game activities and the cognitive abilities of children aged 4–5 years at Kemala Bhayangkari 1 Kindergarten, Serang City. This is based on the results of data collection through a questionnaire which shows that all 32 statements are declared valid. In addition, the instrument is also declared reliable because the value of Cronbach's Alpha is greater than 0.60, as well as the data is normally distributed because the significance value is greater than 0.05. Thus, the test results reinforce the conclusion that the relationship between the two variables is statistically significant and consistent.

Suggestions

Based on the results of research that show a significant relationship between ScratchJr-based educational game activities and the cognitive abilities of children aged 4–5 years, it is recommended that teachers be able to use digital learning media such as ScratchJr more optimally in classroom learning activities, because it is proven to be able to stimulate children's thinking skills, creativity, and problem-solving. In addition, schools are expected to provide adequate supporting facilities so that technology-based learning can run well. For future researchers, it is recommended to develop this study with broader variables or add other aspects of child development, so that the results of the study become more comprehensive and in-depth.

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