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The Effect of Early Numerical Literacy on Early Childhood Cognitive Development

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Abstract: The development of the times with increasingly advanced technology requires today's people to be able to be literate in numeracy and master it. The low numeracy literacy activity in adults indicates a lack of stimulation given early on. This study aims to determine the effect of numeracy literacy on the cognitive development of children aged 5-6 years in Kindergartens throughout Jambi City. The subjects of this study were 31 teachers in kindergarten. Data collection techniques using a questionnaire. This research uses quantitative methods and data acquisition is analyzed using simple linear regression. Data analysis in this study used SPSS version 29. The research findings showed that there was an effect of numeracy literacy on the cognitive development of children aged 5-6 years with a calculated F value of 29.713 with a significance level of 0.

Keywords: Cognitive Development, Early Childhood, Numeracy Literacy

A. Introduction

Literacy is simply understood as the ability to read and write. The development of the times with increasingly advanced technology, which requires humans today to be able to understand and master it. In its development literacy is not only limited to how the ability to read and write, how to speak, how to count, how to solve problems, and how to understand and use the potential that exists within. Literacy is currently developing, known by various types, for example: basic literacy, digital literacy, media literacy, library literacy, and visual literacy.

Literacy in early childhood is closely related to the development of children's language skills according to their age. This can be understood as a child's ability to understand language (receptive) and convey language (expressive) as well as interrelated early literacy. Numerization is a mathematical concept such as number operations (addition, subtraction, division and patterns of geometric shapes). Literacy in reading, writing and numeric. Students must master basic literacy, such as literacy: literacy, numeracy, science, finance, digital as well as culture and citizenship (Widodo et al., 2019).

The United Nations Educational, Scientific and Cultural Organization (UNESCO) explained that literacy is a set of real skills, literacy skills are the right of everyone and are the basis for lifelong learning (Ratnasari, 2020). Early literacy and numeracy are two skills that develop from an early age and become important factors in determining academic success later in life (Wahyuni et al. 2022). Children demonstrate the basic ability to think critically, creatively and collaboratively. Children can recognize and see relationships between patterns, symbols and data, and can use them to solve problems in everyday life.

Numerical literacy is a stimulus for the formation of components of cognitive skills through a visual process of eye-hand coordination on symbols that trigger attention to orderly sequences (RK & Watini, 2022). Early childhood cognitive and language abilities can be developed through the introduction of basic literacy concepts such as the introduction of the concepts of reading, writing and arithmetic, with the aim that children can easily accept more complex concepts at the next level of school (Novrani et al., 2021).

Numerical ability is the ability to apply number concepts and arithmetic operations skills in everyday life, for example, at home, work in people's lives, and the ability to explain information found around us (Maulidina, 2019). Numeracy skills in early childhood are also related to basic problem-solving skills and the application of mathematics in everyday life. Not just numeracy skills, but also includes algebraic thinking, geometry, measurement, data analysis and probability. The knowledge, skills, attitudes, and inclinations that a person needs to be able to use mathematics in a variety of situations. Early numeracy refers to the foundations of mathematical reasoning acquired at an early age.

Early literacy and numeracy are two skills that develop from an early age and become important factors in determining academic success later in life (Ministry of Education and Culture, 2017). Numerical literacy is the knowledge and skills to uses various numbers and symbols related to basic mathematics to solve practical problems in various contexts of everyday life and analyzes information presented in various forms (graphs, tables, charts, etc.) and then uses the interpretation of the results of the analysis to predict and made up my mind.

The implementation of the PAUD Program is an integration of education, care, protection, health and nutrition services which are organized in the form of units or programs Kindergartens/ Raudatul Athfal (RA), Bustanul Athfal (BA), Playgroups, Parks Child Day Care, and Similar PAUD Units. The Indonesian people are included in the category of 'low literacy activation' with a score of M=37.32. Jambi Province is also in the category of 'low literacy activation' with an index value of 34.37. Not apart from this program, in 2019 a literacy activity program was developed and focused

on the family environment and is known as the National Movement for Parents to Read Books (Gernas Baku). This aims to increase family participation, especially parents and PAUD institutions so that they can foster a reading culture in children from an early age (Indonesia, 2018).

Many literacy practices have identified as important for the Early Years. These include pre-reading (Kenner et al., 2017), writing (Dinehart, 2015), speaking/orality (Bateman, 2018) and comprehension (Lepola et al., 2016). The use of play to develop these skills is particularly important in the context of the Early Years (Wohlwend, 2011). Emphasis should be given to pre-literacy skills in the preschool years, with more formal skills being introduced in schools.

Recently, the use of orality in literacy teaching has gained a foothold in educational research (Cassidy et al.,2016). But other topics have dominated in the past, including phonics, phonological awareness, and reading recovery. There is still a lack of research discussing numeracy literacy and the limited space to explore this material at the early childhood education level. This makes researchers want to do more in-depth research on the effect of numeracy literacy on early childhood cognitive development (Ayriza, 1997).

B. Methods

The research method used in this study is a quantitative method. Where this research is intended to determine the relationship between independent and dependent variables. The independent variable is initial numeracy literacy, while the dependent variable is children's cognitive development. This research was conducted in kindergartens throughout Jambi City in the odd semester (I) of the 2022/2023 academic year. The subjects in this study were 31 kindergarten teachers to examine the initial numeracy literacy variable and 31 children to examine the child's cognitive development variable. The data collection technique used in this study was using a Likert scale which includes an initial numeracy literacy scale aimed at children to obtain data on children's initial literacy abilities based on activities given by teachers to children and a cognitive development scale based on teacher observations at school. The data analysis technique in this study is using simple linear regression analysis. Before the simple linear regression test was carried out, First, a prerequisite test is carried out which includes the normality test, linearity test and heteroscedasticity test. Calculation of prerequisite tests and hypothesis testing in this study used the SPSS 29 for Windows 11 application.

C. Results and Discussion

The influence of children's initial numeracy literacy on children's cognitive development can be known in advance by conducting prerequisite tests and hypothesis testing. Prerequisite tests include normality tests, linearity tests, and heteroscedasticity tests. The results of each of these tests are as follows:

Normality test
The normality test aims to test whether in the regression model, the sample used in the study has a normal distribution. The normality test in this research is to use the Kolmogorov-Smirnov test. The decision making, criterion is that if the probability is sig > then the data is normally distributed and if the probability value is sig < then the data is not normally distributed. The value used is 0.05. Based on the results of the normality test with the Kolmogorov-Smirnov test it can be seen that the significance value is 0.976. It can be seen that the significance value is > 0.05, so it can be concluded that the data is normally distributed.

Linearity Test
Linearity test is carried out to determine the form of the relationship between the variables being studied (Wibowo, 2012). The basis for determining the decision is if the Deviation from Linearity value is sig. > 0.05, then there is a significant linear relationship between the independent variables and the dependent variable. Conversely, if the Deviation from Linearity value is sig. < 0.05, there is no significant linear relationship between the independent variables and the dependent variable. Based on the results of the linearity test, it can be seen that the value of Deviation from Linearity Sig > 0.05 is 0.528. So, it can be concluded that the data has a significant linear relationship.

Heteroscedasticity Test
The heteroscedasticity test is a test used to test whether there are symptoms of variance inequality from the residuals in the observation of the regression model (Wibowo, 2012). The basis for the analysis is if the independent variable statistically significantly affects the dependent variable, it can be seen that if the sig value is <5% or 0.05 then it indicates heteroscedasticity and vice versa if the independent variable does not affect the dependent variable, with sig> 5% or 0.05 then it does not indicate heteroscedasticity. Based on the results of the heteroscedasticity calculation above, it can be seen that the significance value is 0.278 > 0.05, so it can be said that there are no symptoms of heteroscedasticity in the regression model.

Hypothesis testing
The hypothesis is a temporary guess based on the formulation of the problem, so it is necessary to test it to find out the truth. The statistical analysis test used is a simple

linear regression test. On the basis of a decision if the Sig value > 0.05 then H0 is accepted, conversely if the Sig value < 0.05 then H0 is rejected. Simple linear regression test calculations in this study used the SPSS 29 for Windows 11 program.

Table 1. Summary Models

Model	R	R Square	Adjusted R Square	std. Error of the Estimate
1	.711a	.506	.489	2.41031

a. Predictors: (Constant), LITERACY (X)

Based on the table above, it can be seen that the value of the correlation/relationship (R) is 0.711 and the coefficient of determination (R Square) is 0.506, which means that the effect of the secure attachment variable on the independence variable is 50.6% and the rest is influenced by other factors such as environment, stimulus, and so forth.

Table 2. ANOVAa

Model		Sum of Squares	d f	MeanSquare	F	Sig.
1	Regression	172,619	1	172,619	29,713	<.001b
	Residual	168,478	29	5,810		
	Total	341,097	30			

a. Dependent Variable: COGNITIVE (Y)
b. Predictors: (Constant), LITERACY (X)

From the output above, it can be seen that the calculated F value is 29.713 with a significance level of 0.001 <0.05. So, it can be said that Ho is rejected and Ha is accepted, which means that the numeracy literacy variable (X) affects the cognitive development variable (Y).

From the results of the simple linear regression test, it is known that the constant value (a) is 7.814 and the cognitive value (b/regression coefficient) is 0.534. So that the regression equation can be written as follows:

$$Y=a+bX$$
$$Y = 7.814 + 0.534$$

The explanation of the simple linear regression equation formula is as follows:

a. The constant value is 7.814 which means that the cognitive variable has a consistent value of 7.814.
b. The value of the regression coefficient X is 0.534, which means that for every 1% addition of numerical literacy, the child's cognitive abilities will increase by 0.534.

The regression coefficient is positive so that it can be said that the direction of the influence of variable X on variable Y is positive

This research was conducted by collecting data through the distribution of numeracy literacy and cognitive development questionnaires which were used as data collection instruments, with a total number of statements of 15 items for the cognitive development scale and 15 items for the numeracy literacy scale which are valid and reliable. The independence questionnaire sheets were distributed to group B educators to find data on children's cognitive development based on the observations of teachers at school and the numeracy literacy questionnaires were distributed to teachers and school principals to find data on children's initial literacy abilities based on activities given by teachers to children and cognitive development scales based on observations teacher at school.

After the results of the questionnaire are obtained, the next step is to analyze the data, which aims to determine whether there is an effect of early numeracy literacy on the cognitive development of children aged 5-6 years in Kindergartens throughout Jambi City. The data analysis phase is carried out by analyzing prerequisites and testing hypotheses. Prerequisite testing consists of three stages, including the normality test, which aims to determine whether the data is normally distributed or not. Linearity test, which aims to determine the form of the relationship between the variables being studied. Furthermore, the heteroscedasticity test aims to test whether or not there are symptoms of variance inequality from the residuals in the regression model. After doing the prerequisite test, the last step in this research is hypothesis testing. The analysis used in this research is using simple linear regression analysis. Simple linear regression testing using the SPSS program.

Based on the results of the simple linear regression test that was carried out by the researcher, the F-count value was 29.713 and the t-count was 5.451 with a significant level or probability of 0.001 <0.05 so it can be concluded that H is accepted and H0 is rejected. Which means that early numeracy literacy affects the cognitive development of children aged 5-6 years in Kindergartens throughout Jambi City. Initial numeracy literacy has a positive and significant effect of 50.6% on the cognitive development of children aged 5-6 years in Kindergartens throughout Jambi City.

The analysis of this study illustrates that there is a positive and significant effect of early numeracy literacy on the cognitive development of children aged 5-6 years in Kindergartens throughout Jambi City. Numerical literacy is a stimulus for the formation of components of cognitive skills through a visual process of eye-hand coordination on symbols that trigger attention to sequence order (Douglas, 2018). The results of other studies which state that Early childhood cognitive and language abilities can be developed through the introduction of basic literacy concepts such as the introduction of the concepts of reading, writing and arithmetic, with the aim that children can easily accept more complex concepts at the next level of school (Wahyuni, 2022). This finding is also reinforced by research which states that in the introduction of early numeracy literacy students are directly involved in identifying images, cutting and pasting them which are related to cognitive, social emotional and language abilities which include child development (Ratnasari, 2020). Based on this research, it is understood that the more positive the initial numeracy literacy in children, the higher the level of achievement of cognitive development. Conversely, the more negative the initial numeration of the child, the lower the achievement level of cognitive development. This is in line with the results of obtaining data on filling out questionnaires by teachers who carry out numeracy literacy activities.

Based on the data obtained above, it can be seen that the teachers carried out several activities that included numeracy literacy in children, such as telling stories and creating reading corners, median literacy trees, introducing the concept of numbers, grouping objects according to size, etc. Early numeracy literacy stimulation for children is very good at increasing children's cognitive abilities. A study shows that the development of literacy and numeracy are interrelated. Numerical literacy is related to solving mathematical problems.

Mathematical knowledge learned in the school curriculum is needed to develop numeracy literacy. If mathematics material is not designed with a specific purpose, it will not be able to develop numeracy skills. Cognitive abilities in exploring mathematical ideas, training reasoning, and being creative in solving problems, can be done by getting used to giving mathematical problem solving, assignments (Ratnasari, 2020). Stimulating activities that contain literacy and numeracy learning in kindergarten are generally carried out with various types of learning such as assignments, projects, experiments, and storytelling which are carried out at certain times. This is in line with the results of research which states that the stimulus of numerical literacy with attention over a span of time during the process of directing until the implementation of learning activities can improve children's cognitive skills. From this discussion it can be understood that the initial numeracy literacy given to children can influence aspects of children's development, especially cognitive development. Therefore, it is necessary to provide numeracy literacy activities that contain fun and meaningful learning according to children's needs.

D. Conclusion

There is an influence between numeracy literacy on the cognitive development of children aged 5-6 years in Kindergartens throughout Jambi City. There is a positive sign on the value of the regression coefficient which indicates that numeracy literacy gives a positive direction to the cognitive development variable so that there is a positive and significant effect of numeracy literacy on the cognitive development of children aged 5-6 years in Kindergartens throughout Jambi City.

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