
THE EFFECT OF DIGITAL EDUCATIONAL GAME "QREATIF EDUKATIF" ON THE DEVELOPMENT OF NUMERACY SKILLS IN 4-5 YEARS OLD CHILDREN

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ABSTRACT

KEYWORDS

Digital educational game, Qreatif Edukatif, numeracy skills

Children's numerical skills sometimes face challenges, therefore ways are needed to maximize early childhood numeracy learning outcomes. This study aims to determine the effect of the use of digital educational games on numeracy development in children aged 4-5 years conducted in one of the Global Kindergartens (pseudonyms) in Semarang City. The method used is pre-experimental research with a One Group Pretest-Posttest design. This participant consisted of 31 children in the Kindergarten A class. Data collection was carried out through pretest and posttest of numeracy skills developed based on the Regulation of the Minister of Education and Culture of the Republic of Indonesia Number 137 of 2014 (National Standard for Early Childhood Education). The results showed that the average pretest score was 28.00 and the posttest increased to 46.16 after the use of digital educational games. The normality test shows normal distributed data, while the N-Gain Score test produces an average score of 0.91 which is classified as a high category. The hypothesis test using the Paired Sample T-Test showed a Sig. (2-tailed) value of 0.000, which means that there is a significant influence of the use of digital educational games on children's numeracy skills. This increase shows that the proper use of digital games in learning can significantly improve early childhood numeracy skills. This study suggests the integration of digital educational games in the early childhood education curriculum as an effective alternative to improve numeracy skills.

INTRODUCTION

Numeracy skills are very important for basic mathematical understanding in early childhood (Hellstrand et al., 2020). Children who have a basic understanding of numbers, counting, and basic mathematical operations will be better prepared to understand higher mathematical concepts. The numeracy skills a child learns in school are critical to their future (Zippert & Rittle-Johnson, 2020). Early numeracy skills include counting, sorting numbers, and simple addition and subtraction skills. Early numeracy skills about numbers usually begin when children learn to pronounce numbers while counting. Children will understand how to count and sort numbers correctly. This can build an understanding that smaller numbers take precedence over larger numbers. This understanding will form the basis of mathematical symbolic knowledge at the next stage, namely in simple calculation operations in the form of addition and subtraction of numbers (Bar & Shaul, 2021).

Studies show that early childhood experience of numeracy is very important, by introducing mathematics from the age of three can help children get acquainted with real-world contexts and build a strong foundation for preparation for higher education (Hassan et al., 2018). Numeracy skills will develop gradually over time, but the process of developing this numeracy ability does not occur by itself (Bar & Shaul, 2021; Purpura et al., 2015), stimulation is needed to develop numeracy skills in early childhood. Stimulation of numeracy skills in the early stages can increase understanding of numbers as well as understanding how they describe counting thinking and help children in solving problems. This ability to count at an early stage

can be an indicator of a child's mathematical ability in the future and tends to remain stable during school. Through the right stimulation, children can learn to recognize numbers, understand the concept of numbers, develop basic mathematical operation skills, and be able to open up wider academic opportunities in the future (Nur Azizah et al., 2023).

Apart from the above indicators, it is not uncommon to find obstacles to the development of student numeracy. This happens because children are less interested in the learning that is carried out. (Ayu et al., 2020) Many learning activities are found monotonous with teachers as the only source of learning for children, especially in the current digital era, there are still teachers who have not used technology to the fullest (Wayan Aryani & Pramuditya Ambara, 2021).

Based on the above background, the researcher made observations to Global Kindergarten (pseudonym) in Kindergarten A class, in the process of teaching and learning activities, it was found that the development of children's numeracy was not well developed. This can be seen when children cannot get to know the concept of numbers. Teachers have also not been maximized in utilizing technology in the classroom, teachers prefer to use conventional methods, namely by providing material orally to a group of students. So a way is needed to stimulate numeracy skills in early childhood.

One way to overcome teacher verbalism in teaching is through the use of technology as a learning medium. Technology in this digital era has a big role in the field of education. Various educational applications are emerging as a way to improve children's development by providing a motivating and tailored learning environment (Barrocas et al., 2023; Hiniker et al., 2015). Digital learning media is an interactive media that can be applied by educators to support learning activities (Ulhusna et al., 2021).

A number of studies show that digital educational games can improve and develop the creative thinking process and increase children's interest in learning (Behnamnia et al., 2020; Cook & Bush, 2018). Digital educational game learning media is a teaching method that incorporates educational or learning content into video games by involving students (Coffey, 2009; KAVAK, 2022). There are two perspectives of this digital educational game, namely thinking about how students learn from the game and the perspective of how educators use games to teach learning materials to students (Humaida & Suyadi, 2021a; Putri, 2018). This digital educational game can have a positive effect on critical thinking, creative and problem-solving skills (Behnamnia et al., 2023). By implementing digital educational games in the learning process, it is able to increase children's curiosity and find new ways to solve problems because the visual appeal displayed from the game can increase children's interest in learning (Behnamnia et al., 2020; Lin et al., 2020).

Previous research findings related to the use of digital educational games show that through digital educational games are able to increase the cognitive development ability of early childhood (Humaida & Suyadi, 2021b). Further research also shows that digital application media can improve early childhood geometry skills (Susanti et al., 2022). Based on previous research, it can be said that the use of digital educational games is very effective in improving early childhood cognition. However, the study emphasizes children's cognitive abilities on problem-solving and geometry only, there has been no research that examines the use of digital educational games to develop early childhood numeracy skills. The digital educational game used in this study is a game application produced by an educational application developer called Qreatif Edukatif. This platform provides various applications that make the learning process more interactive, quality, and easily accessible from various digital devices. The application used is an application in the form of recognizing the numbers 1-10 for children aged 4-5 years. So this study discusses the reliability of digital educational games as a tool to help stimulate numeracy skills in early childhood. The data presented in this article was obtained from an experimental study in one of the kindergartens in Semarang City, with

the aim of determining the influence of the use of digital educational games on the ability to develop numeracy in early childhood.

RESEARCH METHOD

This research is an experimental research in the form of Pre-experimental Design research. The design of this research is One Group Pretest-Posttest Design. The one group pretest-posttest design consists of one group that has been determined. Prates were given to the experimental class. After the pretrates, the researcher provided treatment in the form of learning the numbers 1-10 using digital educational game media, in the final stage the researcher gave a posttest. The results of the treatment can be known to be more accurate because it can be compared with the situation before the treatment.

The location of this research was carried out at Global Kindergarten (pseudonym) in Semarang City, Central Java. The sample of this study is group A students with a total of 31 children. The variable in this study is the learning medium Game Digital education as an independent variable and the development of early childhood mathematical symbolic thinking skills as a dependent variable.

The test technique was used to collect data and information in this study. The pretest-posttest technique is used to collect primary data, namely the score of increasing number recognition. The next technique is used to collect secondary data, namely observation of the learning outcomes of group A students when learning numbers obtained from class teachers.

The instruments used in this study are in the form of pretest and posttest assessment sheets for early childhood number recognition skills with scoring using the Likert scale, with the criteria: Not Developed (BB) with a score of 1, Starting to Develop (MB) with a score of 2, Developing as expected (BSH) with a score of 3, and Developing Very Well (BSB) with a score of 4. The assessment instrument indicators are adapted from the Regulation of the Minister of Education and Culture of the Republic of Indonesia No. 137 of 2014.

The statistical hypotheses in this study are:

H0 = There is no effect of the use of digital educational games "Qreatif Educative" on the development of numeracy skills in children aged 4-5 years.

H1 = There is an effect of the use of digital educational games "Qreatif Edukatif" on the development of numeracy skills in children aged 4-5 years.

Table 1. Children's Numeracy Ability Assessment Rubric

Variable	Indicator	Items	Value Criteria			
			BB	MB	BSH	BSB
AUD Math Symbolic Thinking Ability	Counting a lot of objects 1-10	Children are able to determine larger numbers				
		Children are able to determine smaller numbers				
		Children are able to count the number of images according to their type				
		Children are able to sort the numbers 1-10				
	Getting to know the concept of numbers	Children are able to write the sequence of empty number symbols				
		Children are able to sum up pictures				
		Children are able to sort numbers from small to large				

Recognizing number symbols	Children are able to write symbols of the numbers 1-5
	Children are able to write symbols of the numbers 6-10
	Children are able to write number symbols based on number names (1-5)
	Children are able to write number symbols based on the names of numbers (6-10)
	Children are able to find number symbols among many numbers

RESULTS AND DISCUSSION

Result

The purpose of this study is to determine the numeracy ability of children aged 4-5 years before and after using the media chosen by the researcher, as well as to determine the influence of the use of digital educational games on the numeracy ability of children aged 4-5 years. In this study, all data analysis uses SPSS software version 26.

Instrument Validity Test

The validity test of the instrument was carried out by testing question items about numeracy skills to a total of 30 children from one of the different kindergartens in Semarang City, then analyzed through a construct validity test.

Table 2. Validity Test Results

Variable	Indicator	Calculate r value	Table r values	Information
AUD Math Symbolic Thinking Ability (X)	A	0,493	0,361	Valid
	B	0,487	0,361	Valid
	C	0,442	0,361	Valid
	D	0,430	0,361	Valid
	Y	0,417	0,361	Valid
	F	0,564	0,361	Valid
	G	0,451	0,361	Valid
	H	0,454	0,361	Valid
	I	0,481	0,361	Valid
	J	0,532	0,361	Valid
	K	0,628	0,361	Valid
	L	0,498	0,361	Valid

Source: Primary data processed, 2024

Based on the validity test in table 2 above that the researcher has conducted regarding the research instrument to 30 respondents, results can be obtained with a calculated r value in all variables > a table t-value of 0.361, in this case all indicators are said to be valid, because they meet the requirements for calculating r calculation > r table.

Reliability Test

After the validity test is carried out and the test items are declared valid, then there is a reliability test, which is to evaluate the consistency and reliability of a measurement instrument or test.

Table 3. Reliability Test Results

No.	Variable	Standard Alpha	Cronbach Alpha	Information
1.	AUD Math Symbolic Thinking Ability	0,67	0,718	Reliable

Source: Processed Primary Data, 2024

Based on the results of the reliability test with Cronbach's Alpha at Table 3 above, shows that all variables have a coefficient Cronbach's Alpha i.e. > 0.7 . So it can be concluded that all statements on each indicator are said to be reliable and suitable for further hypothesis testing.

Pre-test Results of Children's Numeracy Skills

Table 4. Pre-test Scores

Test	Number of samples	Total Value	Minimum Values	Maximum Value	Rata-rata
Pretest	31	868	15	44	28,00

Source: Primary data processed, 2024

Based on table 4 above, it appears that the average pretest score is 28.00. This average score is in the category of quite low or it can be said that children's numeracy skills before being given treatment in the form of the use of digital educational games are still in the category of Beginning to Develop (MB).

Post-test Results of Children's Numeracy Skills

Table 5. Post-test scores

Test	Number of samples	Total Value	Minimum Values	Maximum Value	Rata-rata
Posttest	31	1431	44	48	46,16

Source: Primary data processed, 2024

Based on table 5 above, it is clearly illustrated that the average score of the posttest is 46.16. This average score increased compared to the average score at the time of the pretest, meaning that in children's numeracy skills after being given treatment in the form of using digital educational games, it was included in the Very Good Development (BSB) category.

Testing Requirements Analysis

Normality Test

The normality test is required for the prerequisites of the Paired Sample T Test test on pretest and posttest data. The normality test was carried out by analyzing pretest and posttest data using the Shapiro-Wilk Test.

Table 6. Normality Test Results

No.	Result of the Score	Sig.	Information
1.	Pretest	0,193	Usual
2.	Posttest	0,086	Usual

Source: Primary data processed, 2024

Based on the results of the normality test with the Shapiro-Wilk technique in table 6 above, it shows that all data have a value of Sig. > 0.05 . So it can be concluded that the pretest and posttest data are normally distributed. The normally distributed data is followed by the N-Gain test.

N-Gain Test

The N-Gain Score test aims to determine the effectiveness of using a method or treatment. The N-Gain test is carried out by calculating the difference between the posttest score and the pretest. The n-gain value can be seen in the following table:

Table 7. Overall N-Gain Test Results

Data	Amount of Data	N-Gain Minimum Value	Maximum Value N-Gain	Average N-Gain	Interpretation/ Category
N-Gain Posttest-Pretest	31	0,76	1	0,91	Tall

Source: Primary data processed, 2024

Based on table 7 above, the results of the descriptive analysis of children's numeracy skills, data with an average n-gain value of 0.91 which means there is an increase in the high category, and it can be concluded that the application of digital educational games to develop children's numeracy skills at 4-5 years old is successful.

Hypothesis Testing

Data analysis was carried out with t-test statistics with the help of SPSS 26. The t-test technique was used to test the comparison before and after the treatment. The decision-making criteria in the hypotest test are based on the statistical t-probability value (Sig.t) obtained based on the significance level (α) = 0.05. If the p value < 0.05 , it means that there is influence and significant.

Table 8. Results of the Paired Sample T Test Hypothesis Test

Value	t	Df	Sig. (2-tailed)	Information
Pretest - Posttest	-14,357	30	0,000	H0 rejected

Source: Primary data processed, 2024

Based on table 8 above, it shows that the value of Sig. is 0.000, because the probability value of $0.000 < 0.05$ can be concluded that H0 is rejected and H1 is accepted. This proves that there is an influence of the use of digital educational games with the theme of number recognition on the development of numeracy skills in children aged 4-5 years. Then at 14.357, for the ttable value with a confidence level of 0.05, the ttable value was 2.042, thus the ttable $> tcount$ was $14.357 > 2.042$, so there was a significant difference between the numeracy ability before and after the treatment was given.

Discussion

The data that has been presented above shows that the use of digital educational games has an effect on the development of numeracy skills in children. Before testing the hypothesis, the researcher first made a grid of research instruments in the form of a rubric for assessing children's numeracy skills where the grid of instruments had been approved by expert validators. After receiving approval from expert validators, the researcher tested the validity of the contents of the rubric grid for the assessment of children's numeracy skills. There are 12 items that are declared valid and reliable, so the 12 test items are used as research instruments.

Based on the research that has been carried out, it shows that the average score of children's numeracy in the 3 assessment indicators before being given treatment (pretest) is in the category of Beginning to Develop (MB), and after being given treatment (posttest) there is an increase to the category of Very Good Development (BSB), this proves that the game Digital educative is suitable to be used as a medium to improve early childhood mathematical numeracy skills, such as children are able to count many objects from 1 to 10, recognize the concept of numbers, and recognize number symbols.

The results of the study show that the use of digital educational games significantly improves children's numeracy skills. This is evidenced by the difference in the average score of pretest and posttest, where the average pretest is 28.00 and the average posttest increases to 46.16. The normality test showed that the data was normally distributed, while the results of the N-Gain Score test with an average of 0.91 indicated a high and significant improvement. Hypothesis testing using the Paired Sample T Test showed that H₀ was rejected and H₁ was accepted, which means that there was a significant influence of the use of digital educational games on the development of children's numeracy skills.

The increase in the average score in the pretest from 28.00 to 46.16 in the posttest showed substantial progress in children's numeracy skills after using digital educational games. This increase is not only seen in the increase in the average score, but also in the N-Gain Score of 0.91, which is included in the high improvement category. This shows that digital educational games are an effective medium to improve numeracy skills in children aged 4-5 years.

These findings are in line with previous research that shows that the use of digital technology in early childhood education can improve children's learning outcomes. Previous research has also shown that educational games can improve early childhood cognitive abilities. However, this study is more specific in the context of using (Married and Lesbian, 2021).games with the theme of number recognition in one of the kindergartens in Semarang City.

Early Childhood Education Institutions, especially kindergartens, can consider integrating digital educational games in the school curriculum. The use of technology not only makes learning more engaging for children, but also significantly improves their numeracy skills. Theoretically, this study strengthens the argument that technology learning can improve educational outcomes in a variety of contexts, including in early childhood.

For further research, it is recommended to be able to explore the use of educational games with various other themes to see if similar results can be achieved. Long-term research can also be conducted to see the sustainable impact of the use of educational games on early childhood cognitive development.

CONCLUSION

The digital educational game application with the theme of number recognition produced by the developer of the Qreatif Educative application has proven to be effective in introducing the numbers 1-10 to early childhood. This can be seen from the increase in pretest and posttest results, the average score of children before using digital educational games is 28.00 and after using digital educational games is 46.16. Based on the analysis of the results, the N-Gain Score shows a score of 0.91 with a high category, which means that using digital educational games

is able to improve early childhood numeracy skills. Based on the results of the paired sample t test, it was revealed that H_0 was rejected and H_a was accepted, so there was a significant difference after using digital educational games. Therefore, this media can be an alternative educational means in introducing numbers 1-10 to early childhood. In conclusion, this study shows that the use of digital educational games with the theme of number recognition significantly improves the numeracy ability of children aged 4-5 years.

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