International Journal of Education, Information Technology And Others (IJEIT)
https://jurnal.unibrah.ac.id/index.php/IJEIT
Vol. 4, No.1, April 2021

The Effect of Instruction Using Arithmetic Bowling and Snake and Ladder Games In Increasing Cognitive Development of Early Childhood In Ambon City

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Article Info
Article History:
Received : March 9, 2021
Revised : March 21, 2021
Published: April 2021
e-ISSN: 2623-2324
p-ISSN: 2654-2528
DOI: 10.5281/zenodo.4668005

Abstract
Abstract: This study aims to 1) determine the effect of arithmetic bowling on cognitive development in early childhood education institutions in Ambon city, 2) determine the effect of the snakes and ladders game on cognitive development in early childhood education institutions in Ambon city, 3) determine the effect of differences in learning in early childhood education by using arithmetic bowling, snake and ladder game in improving cognitive development of children in early childhood education institutions in Ambon city. This study used a quasi-experimental method, with an ex-post-facto approach. The population of this study were all students of Mawar early childhood education Faculty of Education Pattimura University Ambon. 20 respondents were taken by using the proportional random sampling technique which randomly carried out 2 classes. The data were collected through the observation instrument of the cognitive abilities of mathematical concepts. The results of this study indicated that 1) children in the experimental group Mawar early childhood education had a cognitive ability of mathematical concepts using bowling arithmetic game. They showed very good activity with the lowest score of 28 and the highest score of 40, the average value is 35.4 with a median of 35.5 and mode. 35, 2) Children in the control group have cognitive abilities in mathematical concepts using snake and ladder game, showing well-developed activities with the lowest score of 24 and the highest score of 38, the average value is 30.4 with a median of 30.5 and a mode of 31, 3) There was a difference in the average cognitive ability of mathematical concepts of children aged 5-6 years between students taught using bowling arithmetic and students taught using snake and ladder games with a count value = 2.78 while t_{table} with n1 + n2 degrees of freedom -2 = 18 at the significance level $\alpha = 0.05$ can be 30 1.73 then $t_{count} > t_{table}$, this means the difference both means are significant at the 0.05 level. It can be concluded that there is a difference in the average cognitive ability of early childhood science concepts in the experimental group and the control group. Thus, it can be concluded that there was an effect of experimental methods and demonstration methods on the cognitive ability of children aged 5-6 years in early childhood education of Ambon City.

Keywords: Arithmetic Bowling, Snakes and Ladders Game, Cognitive Ability, Mathematical Concepts

INTRODUCTION

Children are individual figures as socio-cultural beings who are undergoing a process of development that is fundamental to life and an organization that is a complete physical and spiritual unity with all its biological and psychological structures and devices so that it becomes a unique figure. Children experience fundamental development, meaning that developmental experiences can have a strong enough influence and have a long enough time to underlie the subsequent children's development process. Every child experiences very rapid development so that the period of child development in early childhood education is called the golden age, experts argue that the early age period of 0-6 years is a sensitive period as well as a critical period of the entire human life cycle. At this time children experience development in themselves physically and mentally so that efforts to develop all potential must be started so that growth and development can be achieved optimally by laying the foundations for the development of physical abilities, social-emotional language, self-concept, art and morals, values, and religion.

Early childhood education basically includes all efforts and actions taken by educators and parents in the process of caring for, nurturing and educating children by creating an aura and an environment where children can explore experiences that give them the opportunity to know and understand the learning experiences obtained from the environment, through ways of observing, imitating and experimenting which takes place repeatedly and involves all the potential and intelligence of the child. Because children are unique individuals and go through various stages of personality development, the environment that parents strive for, which can provide opportunities for children to explore various experiences in various situations, should pay attention to the uniqueness of children and be adjusted to their level of development.
Learning in early childhood must use the concept of learning through playing, learning by doing and learning by stimulating, the content of the curriculum must really be accounted for in order to optimize all the potential of the child. related to six aspects of child development, namely the value of art, and religious values as well as cognitive development, social-emotional language and language. The way of providing stimulation to children is by providing or creating activities that include aspects of child development by providing facilities or learning media needed by children according to their needs, the methods used are more playful, therefore the learning method in early childhood education is better known. with the method of learning through play. Likewise, to improve children's abilities in the positive aspects, various media need to be applied in order to improve children's development through learning and playing techniques.

Children learn to think using their minds, cognitive song behaviour involves the ability to think creatively in solving new problems, is automatic and fast in finding new solutions in a routine process through various learning media or better known as the Educational Game Tool (APE). The various forms of APE used in Early Childhood Education institutions vary greatly so that it is expected to develop six aspects of child development. Early childhood is introduced to various educational play tools so that they are expected to stimulate the development of children's thinking as well as improve children's development from cognitive, social-emotional, and cognitive aspects. language, moral and physical motor. Many innovative methods and media are still needed to improve children's development. In practice, especially in Ambon city, there are still many teachers who rarely use snake and ladder games and arithmetic bowling games. Snakes and ladders games and bowling arithmetic are sometimes only displayed in closets in early childhood education institutions as decoration while teachers teach many storytelling methods.

Thus, it is necessary to conduct research on: The effect of learning using bowling arithmetic and snakes and ladders games in improving early childhood cognitive development in Ambon City.

RESEARCH METHOD

Research Design
This study used an ex post facto research design. The design used in this study was a pretest-posttest control group design which procedurally followed the pattern as shown in table 3.1.

Table 1. Experimental Procedure Pretest-Posttest Control Group Design, Adapted from (Tukman, 1999)

Group			
Experimental Group	.1		.2
Control Group	.3		.4

Information:
01 = pretest in the experimental group
X = application of arithmetic bowling game
02 = postest in the experimental group
03 = pretest in the control group
x = the application of the snake and ladder game media
04 = postest in the control group
Research subject

The subjects in this study were Mawar early education institutions, Faculty of Education Pattimura University Ambon. The determination of the sample in this study was carried out in two stages: first, comparing the value of learning outcomes carried out in 2019 using the snake and ladder game / APE while the Arithmetic Bowling game was taken from learning outcomes in 2020 in January, and second, the results of class learning where all students from the school their learning outcomes will be taken as a comparison.

Research variable

The research variables consisted of one independent variable, one dependent variable, two moderator variables. The independent variables in this study were the bowling arithmetic media and the snake and ladder game media, while, the independent variable was cognitive abilities. Control variables are factors that the researcher controls or neutralizes, because if they influence the relationship between the independent variables and the dependent variable. Other variables that are controlled are 1) facilities and infrastructure, 2) learning time, 3) seriousness of students and teachers in learning, 4) teaching materials, and 5) interactions that occur during research activities. The relationship between the variables of this study is aimed at Figure 3.2 below:

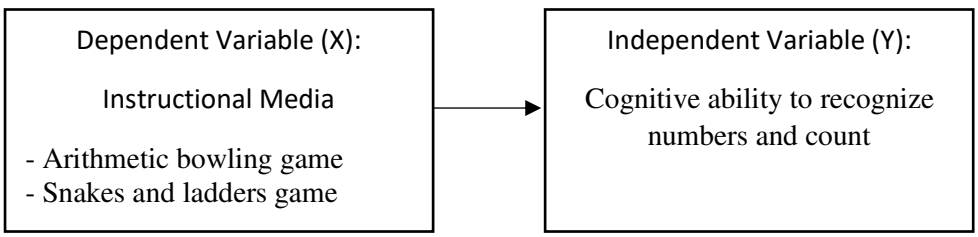

Figure 1. The relationship between research variables

Research Procedure

1. The experimental preparation stage

2. Research implementation stage

3. Final Stage of Research Implementation

Research Instruments

The instruments used in this study were grouped into three types: instruments for measuring cognitive abilities, validation and reliability of research Instruments.

Data analysis technique

In this study, the data collected were analyzed by means of analytical techniques: 1). Descriptive analysis to describe inferential variables, and 2). Inferential statistics. The data obtained from this study will be analyzed using the following formulas:
1. Normal test

The normality test uses the Liliefors test using the following formula:
Lo = F (z) - S (z)

Where:
L = Lillefors count
F (z) = the probability of each z value based on the z table
S (z) = relative cumulative frequency of each z Homogeneity

Homogeneity test using the Bartlett test using the following formula:

$\lambda = (\text{in}10) \{B- (\sum db) \log Si^2\}$

2. t-test

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

Where:

t = value of research results
= the average value of a class teaching using the inquiry method

RESULTS AND DISCUSSION

Research result

A. Data description

In this section, the data description of each treatment in the conceptual trial will be discussed which includes: treatment for early experimental group treatment in the control group using the Patita approach in 5-6 years of early childhood at Mawar early childhood education, Faculty of Education Pattimura University Ambon on the cognitive ability approach in older children, An overview of the statistical data from the above trial activities can be presented in the following 2 ways:

1. The results of cognitive abilities using arithmetic bowling media in the experimental group treatment (X1)

Based on the test data of cognitive ability scores with bowling arithmetic learning media in the experimental group about the theoretical score of 10 - 40 and obtained a range of argument scores with the lowest score of 28 and the score achieved 40, the average price is 35.4 with a Median of 35.5 and Mode 35 Which can be seen in the following table:

Table 2. Frequency Distribution of cognitive abilities with bowling arithmetic game

No	Class Interval	Absolute Frequency	Relative Frequency (%)
1	28–30	1	10
2	31–33	2	20
3	34–36	3	30
4	37–39	4	40
5	40–42	5	50
	Jumlah	**10**	**100**

Table 3. Frequency Distribution of cognitive abilities with bowling arithmetic game

No	Class Interval (%)	Absolute Frequency	Relative Frequency (%)
1	24–26	2	20
2	27–29	2	20
3	30–32	3	30
4	33–35	2	20
5	36–38	1	10
	Jumlah	**10**	**100**

Based on the calculations listed in table 1.1, the respondents obtained a score of cognitive ability using bowling arithmetic game in the experimental group after conducting the largest trial between 34 - 36, namely 3 people (30%) who obtained an average score of 7 people (70%) and get a score below the average of 3 people (30%). These results indicate that the frequency distribution of cognitive ability data using bowling arithmetic game for early childhood in the

experimental group is in a good category. Furthermore, to see the tendency of the distribution of cognitive ability scores using the bowling arithmetic media of early childhood in the experimental group.
The image of the frequency distribution of cognitive ability scores using Bowling Arithmetic media in the experimental group shows that the distribution tends to be on the normal curve so that it can be classified in the good category. 2. Cognitive Ability Results using Snakes and Ladders media in the control group (X2) Based on the test data for cognitive ability scores using snake and ladder media, the control group has a theoretical score range of 10-40 and a range of argument scores with a low score of 24 and the highest score of 38 is obtained The average price is 30.4 with a median of 30.5 and the mode is 31 which can be shown in the table below:

Table 4. Frequency distribution of cognitive abilities using snake and ladder game in the control group (X2).

No	Class Interval	Absolute Frequency	Relative Frequency (%)
1	24–26	2	20
2	27–29	2	20
3	30–32	3	30
4	33–35	2	20
5	36–38	1	10
	Jumlah	**10**	**100**

From the table above shows that almost part of the early education in the Mawar Early Education Institution, 3 people (30%) have cognitive abilities using Snakes and Ladders game at a score of 30-32 or at average values and above average, while almost half are at the score above the average is 88 - 99. From these results it shows that the frequency distribution of cognitive ability data using snake and ladder game before treatment is categorized as good.

The image of the frequency distribution of cognitive ability scores using the Snakes and Ladders game in the control group above shows that the distribution tends to be on the normal curve so that it can be classified in the good category.

B. Testing Data Analysis Requirements

As has been stated that the analysis test used in testing the hypothesis is the t-test if the two group data are normally distributed or homogeneous. For this reason, it is necessary to test the normality of the data using the Liliefors analysis technique and the homogeneity test with the Barlett test. (Ruseffendi, 1998: 291-297).

1. Normality Test Results

By using the Liliefors analysis technique, the Lo value is smaller than the Lt. Thus, it is concluded that the group data in the experimental group and the group before treatment are normally distributed so that the results of the calculation of the normality of the two groups can be seen in table 1.3.

Table 5: Results of the Cognitive Ability Score Normality Test in the experimental group and the control group

Group	L_0	L	Distribution

Experimental group (X)	0.1210	0.258	Normal
Control group (X_2)	0.1398	0.258	Normal

Information:
Lo = The largest absolute price difference between the odds of the standard score with the proportion of the standard score that is smaller or equal to the standard score being calculated.
Lt = Critical test value Liliefors test with (α) = 0.5
Accept H0 (normally distributed if Lo… L_{Count}

2. Homodenity Test Results

Homogeneity testing is done by using the Barlett test (Ruseffendi, 1998: 297). This requirement is related to the variance similarity between the group data in the experimental group and before. Based on the results of calculations for both groups of data in the experimental group and before treatment, it turns out to be "homogeneous". The results of the homogeneity test are presented in the following table.

Table 6. The variance similarity test

Variance for Group	**Dk**	***x²* hitung**	***x²* tabel**	**Conclusion**
Eksperimental group	9	0.02	3.84	Homogenous
Control group	9	0.02	3.84	Homogenous

The complete calculation of the normality test and homogeneity test for all variables can be seen in the appendix.

C. Research Hypothesis Testing

After the analysis requirements test is carried out and it turns out that all the test group scores meet the requirements for further testing, then the hypothesis testing is carried out. " There is a difference in the average Cognitive Ability using Bowling Arithmetic game in the experimental group with cognitive abilities using Snakes and Ladders media in the control group with the statistical hypothesis formula:
Ho: $\mu = \mu_2$

H: $\mu > \mu_2$

Analysis of differences in cognitive abilities using Bowling Arithmetic media in the experimental group (X1) with Cognitive abilities using Snakes and Ladders game in the control experimental group (X2) using t-test analysis for independent samples from one or two different groups to determine whether the research hypothesis can be accepted or rejected, from the calculation results as stated or shown in the attachment. After the normality and homogeneity tests were carried out, then proceed with the t-test with independent sample 1 with the formula:

$$\text{Uji t} = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\left(\frac{JK1 + JK2}{(N1+N2)-2}\right)\left(\frac{1}{N_1} + \frac{1}{N_2}\right)}}$$

Information:
X1 = Average score of group 1
X2 = Average score of group 2
JK1 = Sum of squared deviations for group 1
JK2 = The sum of the squared deviations for group 2
N1 = Number of research subjects in group 1
N2 = number of study subjects in group 2

From the calculation results obtained t count = 2.78 while t table with degrees of freedom n1 + n2 -2 = 18 at the level of significance ... = 0.05 obtained 1.73 then $t_{count} > t_{table}$, this means that the difference between the two means is significant at level 0,05. Thus, it can be concluded that there is a difference in the average cognitive ability in the experimental group and in the control group.

DISCUSSION

Efforts to improve cognitive abilities through Bowling Arithmetic game

The test results clearly show that there is a significant difference between treatment in the experimental group and treatment in the control group as evidenced by $t_{count} = 2.78$ while t_{table} with degrees of freedom $n + n_2 - 2 = 18$ at the significance level $\alpha = 0.05$ can be 1, 73, then $t_{count} > t_{table}$, this means that the difference between the two means is significant at the 0.05 level. This proves that the effect of the experimental method on the development of cognitive abilities in early childhood science concepts so that using this method is highly recommended for educators so that in planning and implementing the learning process they can use and apply experimental methods to develop various aspects of physical development, the use of experimental methods suggests that in its use as a method, it always provides opportunities for children to practice direct proof by conducting experiments, observing the experimental process and finding conclusions on events in the research process, the cognitive ability of the concept of science because science is part of our lives, and our lives are an important part of learning science. One of the main characteristics of learning science in early childhood is the interaction between children and the environment, this is because science education is the same as other education which has an important role in shaping children's personality and intellectuality. Thus, in addition to developing cognitive abilities, the concept of science, in this case, shows aspects of development and develops the ability to recognize the environment around the child, it must be given the opportunity to be in direct contact with the object that is being or is being studied. In learning activities like this, the child is learning about what is called science. Children are guided to search for problems, look for various explanations of the phenomena and events they see, physical motor development and train to use their reasoning to solve and find solutions to problems faced by conducting relevant experiments.

Science for early childhood has a component: science is a product, and science is a process. as a product, science is a well-organized body of knowledge about the physical nature. As a scientific process, it includes conducting research experiments and observing. This is very important because children can participate in the scientific process so that the skills they acquire will be carried over to other developments and benefit the child's life.

Through science learning, it can train thinking skills, if children's thinking skills develop: then children can manage their learning acquisition, find various kinds of alternative problem solving and develop mathematical logic skills. In addition, children also have the ability to be able to sort, classify and prepare for the development of thinking skills. This is in accordance with the opinion of Wahid and Yanto (2015) that introducing science from an early age means helping children to think critically and logically. Science helps children experiment, explore, and observe their surroundings. This is slowly being able to build children's character to get used to scientific thinking, trained to solve problems, and have high analysis.

Especially for educators, they have new experiences to increase their professionalism in developing various materials and activity programs at early education institutions and are able to carry out their duties and responsibilities as professional early education educators.

Based on the explanation above, it can be concluded that there is a significant difference in the average cognitive ability of science concepts between the experimental group and the control group through the use of the experimental method. This is because these activities are in accordance with the principles of learning for early childhood, namely containing elements that are familiar to children, simple, learning while playing, using sensory, and learning by doing. Soluble and insoluble material experiment activities are simple materials for children and involve children directly to explore with concrete objects. In accordance with the statement of Sophia (2005: 30) that the principles of learning for early education must be fulfilled in order to reach an optimal stage of development. Supported by Piaget (Slamet Suryanto 2005:

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The enthusiasm of children being directly involved in conducting experiments shows that by being directly involved children's motivation increases and can measure children's science process skills. Previously conducted by Nurmaleni (2014) and Djamarah (2000)

suggested that the experimental method is a method of giving opportunities to early childhood individuals or groups, with the aim of being trained to carry out a process and experiment. This is also added by Winataputra (2005) that the experimental method is a method of teaching which in the presentation or addition of material according to the results of the experiment or the individual tries something along with the process of observing in a process.
Based on the descriptions above, it can be concluded that the experimental method is a method or method of presentation in which children actively and explore, seek and discover for themselves what they learn. This is obtained through a process of experimentation and observing what individuals do to compare what they get.

From the explanation of the research results that have been described, it is known that the teacher has a role in helping children develop scientific concepts through experimental and demonstration methods. The explanation, information and questions provided by the teacher can guide and find answers in their own way. Ali Nugraha (2008: 136-137) explains that in science learning teachers have roles, among others, as initiators, facilitators, observers, elaborators, and motivators. The teacher has the role of opening the child's initiative, creating conducive learning, observing children's activities, asking stimulating questions and providing reinforcement. The role of the teacher, the role of friends in the group also helps children develop basic science process skills. It was found by the researcher that in carrying out activities in groups children interacted with group friends, held discussions, and helped friends in groups who had difficulties. Vygotsky (William Crain, 2007: 371) explains the concept of the zone of proximal development that the level of development that is difficult for children to achieve can be achieved with guidance from adults or in collaboration with more capable peers. The ability of children to accept explanations and directions given by the teacher shows that early childhood has high curiosity and easily absorbs the information provided. This indicates that children also have good cognitive abilities. It was also found by researchers that in group activities, children interact with group friends, expressing ideas. Hold discussions and help friends in groups who are in trouble. It is explained by Vygotsky's opinion (Slamet Suryanto, 2005: 128) that when playing children usually express ideas in words, ask themselves, and answer their questions or internal speech.

It can be concluded that in developing science process skills, the interaction of children and adults and peers affects children's thinking. Thus, in developing basic science process skills for early childhood, the application of cooperative learning that allows for brainstorming is highly recommended. Another thing that affects basic science process skills is the experience that the child has brought or already had. Sofia Hartanti (2005: 30) explains that learning should be linked to the experiences that children already have. In the pre-operational phase, Piaget (in Slamet Suryanto, 2005: 130) explains that the object of permanence has begun to develop. At this time the child begins to be able to connect the causes and effects that have a direct impact. The object of permanency is shown when the child can guess objects that are soluble and insoluble, guess the taste of the solution before tasting, and even reject something that is not liked. The child's behavior shows that the child already has experience with the objects used in the experiment. So, in learning science, there needs to be an appreciation to bridge the previous knowledge with the knowledge that will be learned in order to hone the ability of the object permanence. In addition, introducing new knowledge should be linked to what the child already knows.

From the above discussion, it can be concluded that the cognitive abilities of science concepts in children aged 5-6 years in Ambon City are influenced by internal and external factors, internal factors are factors that come from within the child, namely the child's cognitive ability. Cognitive abilities in this study include the ability to solve problems and the ability to think logically. While external factors are factors that come from outside the child, including the implementation of learning, the role of teachers and peers, as well as the child's previous

experiences. Therefore, the development of cognitive abilities in the concept of science by showing exploratory and probing activities, showing creative attitudes in solving problems, planning activities to be carried out by recognizing the cause and effect of the environment should be carried out through experimental methods and demonstrations in groups using concrete objects. and the teacher acts as a facilitator who provides information and direction.

Research Limitations

This research has limited scope, which only discusses the concept of science in soluble and insoluble experimental activities using demonstration and experimental methods. This indicates that there is a need for further research on different themes and topics to elaborate on the concept of science more deeply.

CONCLUSION

Based on the results and discussion, it can be concluded that overall early childhood learning scientific concepts using experimental methods and demonstration methods have a very good effect on children's development. In more detail are as follows:

1. Children in the experimental group at Mawar early education have cognitive abilities in mathematical concepts using bowling arithmetic media. They show very good activity with the lowest score of 28 and the highest score of 40, the average value is 35.4 with a median of 35.5 and mode 35.
1. Children in the control group have cognitive abilities with mathematical concepts using the game of snakes and ladders, showing well-developed activities with the lowest score of 24 and the highest score of 38, the average value is 30.4 with a median of 30.5 and a mode of 31.
2. There is a difference in the average cognitive ability of children aged 5-6 years of math concepts between students taught using bowling arithmetic game and students taught using snake and ladder game with a count value = 2.78 while t table with n1 + n2 -2 degrees of freedom = 18 at the significance level $\alpha = 0.05$, it gets 30 1.73 then $t_{count} > t_{table}$, this means that the difference between the two means is significant at the 0.05 level. It can be concluded that there is a difference in the average cognitive ability of early childhood science concepts in the experimental group and the control group. Thus, it can be concluded that there is an effect of experimental methods and demonstration methods on the cognitive ability of children aged 5-6 years in early education Ambon City.

SUGGESTION

Based on the results of the research, analysis, and the conclusions described above, the authors propose that the cognitive scientific abilities of children aged 5-6 years can develop very well as follows:

1) For Teachers
    a. Carry out learning using experimental methods with concrete objects to develop cognitive abilities for mathematical concepts.
    b. Become a facilitator for children in the learning process to help children find new knowledge
    c. Conducting apperception to link the knowledge that the child already has with the knowledge that will be learned.
2) For Principals of School Institutions

Provide encouragement with opportunities for teachers to develop various methods / models / strategies using natural materials APE to improve cognitive abilities of science concepts for all early education.

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