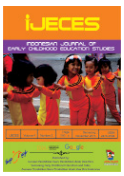
IJECES 5 (1) (2016)

Indonesian Journal of Early Childhood Education Studies

http://journal.unnes.ac.id/sju/index.php/ijeces



Cooperative Learning Model to Increasing Mathematical Concept for Early Childhood

Naili Rohmah ✉, **Rustono, Achmad Rifa'i**

DOI 10.15294/ijeces.v5i1.11277

Postgraduate Program, Semarang State University, Indonesia

Article Info

Received February 2016
Accepted May 2016
Published June 2016

Keywords:
Cooperative Learning, Early Childhood, Geometry, Pattern

Abstract

The aims of the research were to find the effectiveness of the model and identify the differences in the experimental group and the control group. The research was an experimental research of the type of nonequivalent control group design. It examined the cooperative learning model in developing mathematics for early childhood. It is limited to the introduction of mathematics skills in geometry and pattern capabilities. The sampling used purposive sampling, and the number of samples in each group was 30 children. From t-test results, it was found that the mean of the pretest of 47.47 turned into 31.07, so the experimental group increased by 16.4. It was found that tcount = -14.135 with the Sig. (2 tailed) <0.05. It means that there is a difference between the pretest and posttest in the experimental group. The results of t-test of the control group show that the mean of the pretest of 42.60 turned into 31.60, so the control group increased by 11. It was found that tcount = -10.322 with the Sig. (2 tailed) <0.05. It means that there is a difference between the pretest and posttest. However, the differences shown by the increase in the mean of the control group are smaller than the increase in the experimental group.

How to cite

Rohmah, N., Rustono, R., & Rifa'i, A. (2016). Cooperative Learning Model as Mathematic Concept Introduction for Early Childhood. Indonesian Journal Of Early Childhood Education Studies, 5(1), 53-58. doi:10.15294/ijeces.v5i1.11277

✉Corresponding author:
Postgraduate Program, Semarang State University, Indonesia
E-mail: nayliee23@gmail.com

p-ISSN 2252-8415
e-ISSN 2476-9584

INTRODUCTION

Mathematics has been common to us since by mathematics one can discover other corresponding sciences. Early mathematics skill is one of the important skills that must be possessed by children. When children have already been familiar with mathematics, it will be easier for them to develop other basic capabilities. The mathematical concepts that needs to be given to children are in the forms of numbers or counting, patterns and their functions, geometry, measurements, graphic, estimation, probability, and problem solving (Susanto, 2013: 101). Learning mathematics at preschool level is to develop important relationships as the basis of the knowledge acquired before entering formal education (Artut, 2009).

Preschool years are the best time for children to introduce counting, sorting, building shape (geometry), finding patterns, measurement, and estimation (Clements, 2001: 270). The National Council of Teachers of Mathematics (NCTM) suggests that teachers can make connections to children's real-world experiences to stimulate students' interest in mathematics (Guha, 2006).

One important element in preschool education is to help children get to know the basic concepts of geometry and teach them how, where, and when to use the concept in associating in real life (Inan & Temur 2010). Geometry is one of the disciplines that engage a child so that the science can be applied to the lives of the child later (Inan & Temur: 2010). Historically, geometry is one of the first mathematical skills which were taught; this was confirmed by Froebel in the 1850s who designed the curriculum with the practice of geometrical shapes and manipulation of celestial bodies (Copley 2000: 105).

According to Weaver and Charles (1970: 93), the introduction of geometry earlier will lead children to be able to do problem solving on what happened to them. Geometry should be introduced because many concepts of spatial relationships or spaces are needed at the preschool level (Runtukahu & Kandou 2014: 50). Early childhood studying number and pattern relationships can help them represent the symbols that are useful for building mathematical ideas, using simple numeric expressions and equations (Education 2007: 4). The ability of pattern is introduced with the aims to: 1) provide the vast diversity of experience that will help children to recognize relationships, both the patterned and non-patterned relationships; 2) show or hide the patterns by adding or subtracting subsequent pattern elements; 3) understand the patterns of number operations and encourage them to have algebraic thinking (Education 2005). Recognizing the concept of pattern is very important for children because it is the foundation and the beginning to use algebraic thinking at higher level. It is strengthened with the opinion of Sarama and Clements (2006) that younger children can get to know the relationships between the repeated pattern in the same unit or perceptually distinct.

Learning to children should receive the attention of educators because the learning model used will affect the results of children's learning achievement. The learning model selected was the cooperative learning. Vodopivec (2011) argues that life is a continuous interaction with others, so it is important for us to support children from an early age to develop social competence level. Cooperative learning is sourced from Piaget's theory of constructivism and it is also supported by Vygotsky's theory. Vygotsky's theory contribution on cooperative learning has the implications for child's socio-cultural talent in learning. Rusman (2014: 202) defines that cooperative learning is a form of learning by which students learn and work collaboratively in small groups with the members of four to six people in a heterogeneous group structure. The distribution of the number of children with a range of 4-6 children should be heterogeneous based on differences in gender and ability differences. Thus, in one group, the homogeneity of ability or gender does not occur.

The aims to be achieved in this research were as follows: 1) to analyze differences in the ability to know early mathematics for young children between the experimental class and control class; 2) to analyze the effectiveness of the use of the models of cooperative learning in developing the ability to know early mathematics for young children.

The benefits to be derived from the research results were theoretical and practical. The benefits can be explained as follows: 1) as the scientific information about the effects of the use of cooperative learning model on the ability to know early mathematics; 2) in practical, the usefulness of the research results is expected to develop the ability to recognize early mathematics, especially geometry and pattern capabilities. This research can also provide direct experience for teachers, especially in the use of cooperative learning model and can be used as an alternative model of learning in order to improve the learning process in order to improve the quality of learning in schools.

METHOD

The method used in this research was the method of experimental research because this research examined the validity of a model of learning. Experimental research is a research used to find the effect of a specific treatment on the other in a controlled condition (Sugiyono 2014: 107). This type of research used in this research was an experimental research. The research design used was quasi experimental design with the type of nonequivalent control group design (Sugiyono 2014: 109).

Table 1 Experimental Research Design

Group	*Pretest*	*Treatment*	*Posttest*
Experiment	O_1	X	O_2
Control	O_1	-	O_2

O_1 = Pretest
O_2 = Posttest
X = Treatment

In this design, there are two classes that each was chosen at the age of 4-5 years. The first class was treated (X) and the other class was not. The treated class is called experimental class and the untreated class is called control class. In real research, the effect of the treatment was analyzed using different tests. The sampling technique used was purposive sampling. The reasons of sample selection were based on: 1) the age range of children was not more than 6 months in the sample group; 2) the gender did not influence the sampling. The number of samples in the experimental class was 30 children and the number of sample in the control class was 30 children.

The independent variable in this study was the use of cooperative learning model. The dependent variable in this study was the introduction of the concept of geometry and pattern. The framework of the research instrument of this research is presented in Table 3.

Table 2. Basic Competence of Children Aged 4-5 years

Variable	Basic Competence
Introduction to Mathematics	Doing activities showing that the child is able to recognize objects by grouping various objects in his environment by the size, patterns, functions, properties, sound, texture, function, and other features

The methods of research data collection designed by the researcher were as follows. 1) The activity of observations is intended as a replacement of the test for children; 2) an oral test is used to answer the initial and end abilities of early math in children.

Table 3 Framework of Instrument

Aspects	Items of Questions
Mentioning geometric shape	1. Children mention the geometric shape shown.
Grouping geometric shapes	1. Children group the geometric shapes by colors. 2. Children group the geometric shapes by shapes. 3. Children group the geometric shapes by colors and shapes.
Creating shapes from geometric piles	1. Children makes simple shapes from geometric piles
Comparing things with geometric shapes	1. Children mention things similar to geometric shapes. 2. Children mention things shown with geometric shapes.
Reading patterns	1. Children read the patterns of shapes 2. Children read the patterns of colors 3. Children read the patterns of shapes and colors
Completing patterns	1. Children complete the missing patterns in the structure of AB-AB 2. Children complete the missing patterns in the structure of ABC-ABC
Putting patterns in a sequence	1. Children putting patterns in a sequence from big to small shapes 2. Children putting patterns in a sequence from small to big shapes

RESULTS AND DISCUSSION

The research results presented include the model effectiveness and analyzing mathematics skills before and after the treatments. The mathematics skills in children before the treatments in the experimental group and the control group can be seen from the results of the assessment using observation sheets and oral test. After obtaining the initial mathematics abilities in children, the table was then made. Table 4 presents the mathematics skills of children before and after the

treatments.

Table 4 The Results of Mathematics Ability

Score	Criteria	Experimental group		Control group	
		pretest	Post-test	pretest	Post-test
4	Well-Developed (BSB)	0%	56,6%	0%	23,3%
3	Developed as Expected (BSH)	16,6%	43,3%	10%	66,6%
2	Start to Develop (MB)	76,6%	0%	86,6%	10%
1	Not Developed (BB)	6,7%	0%	3,3%	0%

Based on the data in Table 5, early mathematics abilities (pretest) show that the majority of children in the experimental group are in the criteria of start to develop (76.6%) and the children in the control group are also on the same criteria (86.6%). Furthermore, the majority of children's post-test results in the experimental group were on the criteria of well-developed (56.6%) and the control group was on the criteria of Developed as Expected (66.6%).

The prerequisite test results describe the results of normality and homogeneity tests to the data of the experimental group and the control group on the implementation of the pretest.

Table 5 Prerequisite test results

Tests		Pretest	Posttest
Normality	Experiment	0.200	0.200
	Control	0.110	0.200
Homogeneity		0.988	0.265

H_0 : The samples are from the populations with normal distribution.

H_a : The samples are from the populations with non normal distribution.

Data is said to be normal when the level of sig. on Kolmogorof- Smirnov is higher than □; and then the data has normal distribution. When it is lower than □, the data distribution is not normal. The value of □ used was 0.05. In the above results, the significance level is obtained and the pretest of group 1 (experimental class) is 0.200, and the class 2 (control group) is 0.110. Because sig > □, then H_0 is accepted. Thus, the data of the control and experimental classes is derived from the population with normal distribution.

Homogeneity test is intended to show that two or more data sample groups come from the populations having the same variance or homogeneous. The data homogeneity test used Bartlet test. The results of the homogeneity value of pretest data can be seen in the sig which is in the same direction as Based on Mean. When the result of Sig > 0.05, H_0 is accepted. Based on the sig. and Based on Mean, the value obtained is 0.988 which means that the value is greater than 0.05; then H_0 is accepted. While the homogeneity value of pretest data shows the value of 0.265. Therefore, it is concluded that both data groups of pretest and post-test have homogeneous data.

Table 6 The results of t-test in the experimental and control groups

Groups	Data	Mean		T	Sig. (2-tailed)
Experiment	Pretest	31,07	16,4	-14.135	0,000
	Posttest	47,47			
Control	Pretest	31,60	11	-10.322	0,000
	Posttest	42,60			

From the table above, the mean of the initial pretest was 47.47 and turned into 31.07, so the experimental group increased by 16.4. It is obtained that t_{count} = -14.135 with the Sig. (2 tailed) <0.05, which means that there is a difference between the pretest and posttest of the experimental group. From the table above, the mean of the initial pretest was 42.60, and turned into 31.60, so the control group increased by 11. It is obtained that t_{count} = -10.322 with the Sig. (2 tailed) <0.05, which means that there is a difference between the pretest and posttest. However, the differences shown by the increase in the mean of the control group is smaller than the increase in the experimental group.

The introduction of mathematics used in this research had more emphasis on the achievement of learning outcomes. Learning outcome is a specification of what students have learned from the study period (Baktinia 2012: 91). Learning outcome is a behavioral change of learners after experiencing learning activities (Rifa'i & Anni 2012: 69). The mean of the learning outcomes of children in the experimental group had an increase in score of 16.4, while the control group had an increase in score of 11.

Based on the research results, it shows that the cooperative learning model is effectively used in introducing mathematics concepts. In addition, cooperative learning can sharpen children's ability to work together. The effectiveness of the model can be seen from the increase in the value of the experimental group. Based on the mean of the initial pretest of 47.47 which turned into 31.07, so the experimental group increased by 16.4.

The advantages of cooperative learning are: 1) No children of the cooperative learning group hid; they helped each other, did not threaten the environment when trying to give ideas and asked for help (Slavin 1987). Vodopivec (2011) explained that cooperative learning situations aim to link the positive participation between a child and another child. 2) Cooperative learning is a teaching method used to facilitate active learning for children, and it is an important aspect of mathematics that really appreciates mathematics educators and researchers (Artut 2009). 3) Tarim (2016) examined the effects of working activities based on children's cooperative learning on the pattern recognition skills in pre-school level and analyzed the opinion of the teachers on the implementation of the learning process. The interviews to the teachers indicated that, in addition to the pattern recognition skills, children developed additional skills such as solidarity, sharing, active listening, and fulfill their personal responsibilities in cooperative learning.

The cooperative learning used in this research was by grouping children and combining about 4-6 children according to the learning plan. Isjoni (2014: 15) explains that cooperative learning is a learning model that is widely used today to make teaching and learning activities centered on students (student oriented), particularly to overcome the problems found by teachers to enable the students who cannot cooperate with others, aggressive, and do not care about the others .

The introduction of geometry was introduced by the introduction of two-dimensional geometric shapes, geometric properties, and associated geometry to real objects. Children of kindergarten age develop an understanding of geometry from topological concept (Runtukahu & Kandou 2014: 150). Topology here is a qualitative geometry study without numbers or measurements. It means that, in providing geometry introduction to children, it is performed by introducing the form and properties of geometry and does not teach calculations related to geometry concepts.

The pattern introduced was the concept of AB-AB with reading criteria, completing, and putting patterns in a sequence. Shaw (2005) states that recognizing the concept of pattern is very important for children because it is the foundation and beginning to use algebraic thinking in higher level. It is strengthened by the opinion of Sarama and Clements (2006) that younger children can get to know the relationship between repeated patterns in the same unit and the ones which are perceptually distinct.

In general, the research results suggest that the use of cooperative learning is effective in introducing mathematics for young children. In other words, the cooperative model has a significant influence on the mathematics concept for early childhood.

CONCLUSION

The conclusions that can be drawn based on the results and the discussion state that the cooperative learning model is effective in introducing mathematics skills for young children. The effectiveness of the model shows an increase in the learning outcomes in the experimental group and it also answered that there are differences in the learning outcomes between the experimental group and the control group. From t-test results, it was found that the mean of the pretest of 47.47 turned into 31.07, so the experimental group increased by 16.4. It was found that t_{count} = -14.135 with the Sig. (2 tailed) <0.05. It means that there is a difference between the pretest and posttest in the experimental group. The results of t-test of the control group show that the mean of the pretest of 42.60 turned into 31.60, so the control group increased by 11. It was found that t_{count} = -10.322 with the Sig. (2 tailed) <0.05. It means that there is a difference between the pretest and posttest. However, the differences shown by the increase in the mean of the control group are smaller than the increase in the experimental group.

REFERENCES

Artut, P. D. (2009). Experimental evaluation of the effects of cooperative learning on kindergarten children's mathematics ability. *Journal IJEDURES 48*

Baktinia, T. G. (2012). Pengaruh supervisi kepala sekolah terhadap kinerja guru dan hasil belajar siswa (studi tentang pengaruh supervisi kepala sekolah SMP terhadap kinerja guru dan hasil belajar siswa pada SMPN di lingkungan dinas pendidikan kota Bandung). *Disertasi.* SPS UPI

Clements, D. H. (2011). *Mathematics in the Preschool*. NCTM

Copley, J. V. (2000). *The young child and mathematic.* NAEYC

Education, Ontario Ministry. (2005). *A guide to effective instruction in mathematics kindergarten to grade 3*. Ministry of Education

Guha, S. (2006). Using mathematics strategies in early childhood education as a basis for culturally responsive teaching in India. *International Journal of Early Years Education* Vol. (14), No. 1, March 2006, pp. 15–34

Inan, H. Z. & Temur, O. D. (2010). Understanding kindergarten teachers' perspectives of teaching basic geometric shapes: a phenomenographic research. *ZDM Mathematics Education* 42:457–468

Isjoni. (2014). *Cooperative Learning: efektifitas pembelajaran kelompok.* Bandung: Alfabeta

Rifa'I, A. & Anni, C. T. (2012). *Psikologi Pendidikan.* Semarang. Unnes Press

Runtukahu, J. T. & Kandou, S. (2013). *Pembelajaran matematika dasar bagi anak-anak berkesulitan belajar.* Yogyakarta: Ar Ruzz Media

Rusman. (2014). *Model-model pembelajaran: Mengembangkan profesionalisme guru.* Jakarta: Rajawali Press

Sarama, J. & Clements, D. H. (2006). Mathematics in kindergarten. In D. F. Gullo (Ed.), *K Today: Teaching and learning in the kindergarten year* (pp. 85–94). Washington, DC: National Association for the Education of Young Children.

Shaw, J. M. (2005). *Sorting, Classifying, and Patterning: Critical to Mathematical Understanding in Kindergarten*. Houghton Mifflin

Slavin, R. E. (1987). *Cooperative Learning and the Cooperative School.* Educational Leadership

Sugiyono. (2014). *Metode Penelitian pendidikan.* Bandung: Alfabeta

Susanto, A. (2014). *Perkembangan anak usia dini: pengantar dalam berbagai aspeknya.* Jakarta: Kencana

Tarim, K. (2015). Effects of Cooperative Group Work Activities on Pre-school Children's Pattern Recognition Skills. *Journal ESTP 16 (1)*

Vodopivec, JL. (2012). Cooperative learning and support strategies in the kindergarten. *Journal Metodicki obzori 12, vol. (6)2*

Weaver, J. D & Charles T. W. (1970). *Modern mathematics for elemntary teachers*. USA