Combination of NHT and CTL Type Cooperative Learning in Improving Mathematical Literacy Ability in View of Cognitive Style

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Abstract. Every learning method always has advantages and disadvantages. The combination of various methods in learning can be an appropriate strategy to complement each other so that it can provide stronger leverage for quality learning. This experimental research combines cooperative learning type Number Head Together (NHT) and Contextual Teaching and Learning (CTL) in order to improve mathematical literacy skills, taking into account differences in cognitive styles. This research involved 63 students as samples. The experimental class, consisting of 30 students, was taught using a combination of NHT and CTL methods (hereinafter abbreviated as NHTCTL). Meanwhile, the control class, consisting of 33 students, was taught using the NHT method without involving CTL. The instruments used are a description test to measure literacy abilities, and the Group Embeded Figures Test (GEFT) to determine students' cognitive styles. The results of the analysis of variance (anova) show that NHTCTL is very effective in improving mathematical literacy skills, both in students with FI and FD cognitive styles.

Keywords: Combination; Cooperative Learning; Mathematical Literacy; Cognitive Style

1 Introduction

Literacy relates to the capacity to apply knowledge and skills in key subjects, and to analyze, reason, and communicate effectively as they identify, interpret, and solve problems in various situations [1], [2]. Literacy has been identified as an important precursor to academic success and, therefore, is a core aspect of school readiness [3]. Apart from that, mastering these skills will be a guarantee of career success in the future. Therefore, more and more people in the world need increased literacy skills to be able to find, select, interpret, analyze and produce information that is relevant to them [4].

Even though literacy is important for students' lives, attention to improving literacy skills is still quite minimal. This can be seen from several survey results conducted by PISA (Program for International Student Assessment). In 2003, Indonesian students' mathematical literacy abilities were ranked 39th out of 40 countries. In 2006 Indonesia's position had not changed much, Indonesia was ranked 38th out of 41 countries. The same thing also happened in 2009 where Indonesia was ranked 61st out of 65 countries. In 2012, Indonesia's position actually moved further down, ranking 64th out of 65 countries. In 2015, Indonesian students' mathematical literacy rose again, ranking 62nd out of 70 countries and in 2018 it was ranked

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73rd out of 79 countries [5]. This PISA survey data shows that the literacy skills of Indonesian students are still very low when compared with other countries in the world.

The same problem was also found at SMAK Santu Fransiskus Saverius Ruteng. Based on the results of observations in mathematics learning and also the results of student work analysis, it was found that the mathematical literacy abilities of SMAK Santu Fransiskus Saverius Ruteng students were still relatively low. When students work on contextual problems, for example, students are not yet able to formulate and communicate the problem in mathematical form. Students are also less able to apply mathematical concepts in solving various problems that are contextual and relevant to the material being taught.

Responding to the phenomena that occur both nationally and locally as described above, this research tries to apply NHT type cooperative learning combined with CTL. In NHT type cooperative learning, students are divided into small groups, and each group member is given a number. The teacher will ask questions and students will give answers according to their respective numbers. This learning prioritizes collaboration between students. In a learning atmosphere like this, students who have good literacy skills can help students who are less good [6]. On the other hand, the CTL model makes learning more meaningful and contextual because it connects learning experiences with the context of everyday life [7]. This kind of learning model makes the material studied by students easier to understand and remember. Thus, the combination of NHT and CTL will become collaborative contextual learning, so it is hoped that it can have a positive impact on students' mathematical literacy abilities.

2 Method

This research is a quasi-experimental research using a posttest control design. There are three variables involved in this research, namely cognitive style, learning model, and literacy skills. The first two variables are independent variables, while the other variables are dependent variables. Cognitive style variables consist of two types, namely Field Dependent (FD) and Field Independent (FI). Meanwhile, the learning method variable also consists of two types, namely the combination of KNHT-CTL and NHT. Thus, for analysis purposes, the design used is a 2×2 factorial design.

The population in this study were students of class XI IIS SMAK Santu Fransiskus Saverius Ruteng spread across six classes with a total of 193 students. Sampling was carried out using a random sampling technique, namely by randomly selecting two classes from six classes. The two selected classes are hereinafter referred to as the Experimental Class (KE) and the Control Class (KK). KE and KK respectively consist of 30 and 33 students respectively. KE is taught using a combination of KNHT-CTL methods. Meanwhile, KK is taught using the KNHT method without paying attention to CTL. Before giving treatment, the researcher carried out a class equality test to ensure that both classes had equal abilities.

The instruments used in this research are tests, which consist of two types, namely GEFT and description tests. GEFT is used to determine and group students based on cognitive style. In this research, researchers used GEFT developed by Witkin. Meanwhile, the description test, consisting of three items, is used to measure students' literacy abilities. Before using the test instrument, this description was tested to determine its validity and reliability.

In accordance with the design, the data analysis techniques used in this research are descriptive analysis and two-way analysis of variance. Descriptive analysis is intended to present data about the average, maximum, minimum and standard deviation values for each

category. Meanwhile, two-way analysis of variance was used to determine (1) differences in mathematical literacy abilities based on teaching methods (KK versus KE), and (2) differences in students' mathematical literacy abilities based on cognitive style. To get more exact results, researchers analyzed the data using the SPSS application.

3 Results and Discussion

The results of descriptive statistical calculations clearly show that there are differences in the mathematical literacy abilities of students in the experimental class and the control class for both students with FI and FD cognitive styles (see Table 1 and Table 2). If we look at the average scores, FI students in the experimental class and control class respectively got scores of 72 and 53. It can be seen that the average score of students in the experimental class was much higher than in the control class. The same thing also happened to FD students. The average scores of FD students in the experimental and control classes are 75 and 71 respectively. The difference is also quite clear.

The results of inferential statistical calculations using two-way ANOVA show that the significance value for the comparison of the two learning methods is 0.000 <significance level = 0.05. This shows that there is a significant difference in the mathematical literacy abilities of students taught using the NHTCTL and NHT methods. The mathematical literacy abilities of students taught using a combination of NHT and CTL methods (NHTCTL) are much better when compared to students taught using the NHT method. The results of this combination are of course new findings in the world of education.

Table 1. Descriptive Statistics Calculation Results

Cognitive Style	Statistical Measures	Class	
		Experiment	Control
Field Independent (FI)	Average	72,222	53,409
	Maximum	83,75	73,75
	Minimum	57,5	40
	Variance	103,189	134,716
Field Dependent (FD)	Average	61,726	46,932
	Maximum	75	71,25
	Minimum	47,5	30
	Variance	83,668	139,84

Tabel 2. Tests of Between-Subjects Effects

Source	Type III Sum of Squares	Df	Mean Square	Sig.
Corrected Model	4923[a]	3	1641.060	0.000
Intercept	185959.563	1	185959.563	0.000
NHTCTL-NHT	3835.245	1	3835.245	0.000
Cognitive Style	974.869	1	974.869	0.005
NHTCTL-NHT* Cognitive Style	55.040	1	55.040	0.492
Error	6782.762	59	114.945	
Total	213523.563	63		
Corrected Total	11704.942	62		

Learning using the NHT type cooperative method does have a positive impact on various learning domains. Several previous studies have shown that in general NHT has a positive effect

on increasing students' mathematical learning achievement [8]. Learning using the NHT method has also been proven to improve students' critical thinking abilities [9] and problem solving abilities [10]. However, the combination with CTL will provide a much better impact, as has been shown in this study. Through its combination with CTL, students in small groups do not just learn mathematical concepts, but try to relate them to real life contexts. This combination of course makes learning more fun, contextual and meaningful so that students will be more interested in studying mathematics. Previous research results also show the positive effects of implementing CTL. The application of CTL can improve higher order thinking abilities (HOTS) [11] and critical thinking abilities [12]. This makes sense because in CTL students are encouraged to use their thinking skills to understand and solve various contextual problems. Thus, the application of CTL can also increase students' involvement in learning mathematics, they do not become passive subjects who are only ready to listen to the teacher's explanation [13]. The combination of NHT and CTL will thus have a tremendous impact on mathematics learning outcomes, including mathematical literacy skills, of course.

The results of the ANOVA calculation also show that the significance value for the comparison of the two cognitive styles is 0.000 <significance level = 0.05. This value implies that there is a significant difference in the mathematical literacy abilities of students with FI and FD cognitive styles. The results of descriptive statistical calculations also show the same thing. In this regard, previous research results tend to be varied and inconsistent [14]. ome studies conclude that internal interventions, for example the application of certain learning methods, only affect students with FI cognitive styles [15], other studies actually show the opposite [16]. Regarding the inconsistencies in the results of this research, it can be suspected that there are other factors that influence student learning outcomes, such as interest, resilience, and so on which are not strictly controlled. In carrying out experiments, external factors (other variables not studied) must be strictly controlled in order to obtain valid results. However, this seems rather difficult because the subjects studied are humans, not plants, animals or other objects. Strict control is only possible in laboratory experiments.

4 Conclusion

Every learning method always has advantages and disadvantages. A combination of various methods in learning can be the right choice to complement each other so that they can have a stronger positive impact on student learning outcomes. In this research, the combination of NHT and CTL had a stronger impact on increasing mathematical literacy skills for both students with FI and FD cognitive styles. This implies that teachers should not only rely on one particular method in learning. There needs to be a combination with other methods so that it can provide greater leverage on both affective, psychomotor and cognitive aspects of students..

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