

# Management of Mathematics Learning through Cooperative Integrated Reading and Composition (CIRC) Learning Model to Improve Student's Higher-order Thinking Ability

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**Abstract**— The purpose of this study is to investigate the improvement of students' higher-order thinking ability through the management of the Cooperative Integrated Reading and Composition (CIRC) learning model. This research is a quasi-experimental with a pre-test post-test control group design. The population was all eleventh-grade students of SMA Negeri 2 Delima Pidie Regency. The samples in this study involved two classes, one class as the experimental class and another as the control class. The instruments used in this study were pre-test and post-test. The data were analyzed using t-test at a significance level of 0.05. The results revealed that learning management with CIRC model can improve students' higher-order thinking ability. The implication of this study is discussed further in this paper.

**Keywords**— Mathematics Learning Management, Cooperative Integrated Reading and Composition (CIRC), Higher Order Thinking Ability

## INTRODUCTION

The ability to think at a high level is an activity that involves the hierarchical cognitive level of bloom's taxonomy, according to Budiarta, high-level thinking ability (HOTS) can be interpreted as the ability of complex thinking processes that include parsing material, criticizing and creating solutions to problem solving [1].

Annuuru & Ali explained that the ability to think at a high level (HOTS) is the ability to combine facts and ideas in the process of analyzing, evaluating to the stage of creating in the form of giving an assessment of a fact learned or being able to create from something that has been learned [2]. The process of analyzing, evaluating and creating is part of the cognitive taxonomy created by Benjamin S. Bloom in 1956. It was eventually refined again by Anderson and Krathwohl [3] into C1-memory,

C2-understanding, C3-applying, C4- analysis (analysing), C5-evaluation (evaluating), and C6-creation (creating).

Recnick defines high-level thinking (HOTS) as: *higher-order-thinking is nonalgorithmic, that is the path action is not fully specified advance, (2) higher-order-thinking tends to be complex, (3) higher-order-thinking often yields multiple solutions, each with costs and benefits, rather than unique solutions, (4) higher-order-thinking involves nuanced judgment and interpretation, (5) higher-order-thinking is effortful, there is considerable mental word involved in the kinds of elaborations and judgments required* [4].

Meanwhile, according to Conklin [5] defining higher-order thinking ability (HOTS) is divided into three categories, (1) Transfer is requiring learners to understand and be able to use what they have learned, (2) critical thinking and (3) problem solving. Conklin also said that higher-order thinking ability (HOTS) includes critical and creative thinking and requires learners to be active in learning therefore, it can be classified that higher-order thinking is a thought process that requires students to use bright ideas because it is non-algorithmic, tends to be complex, has many open-ended answers and elaborative thinking, so that it can support the ability to think critically, creatively and reflectively. The indicators of higher-order thinking ability are as :

Table 1  
Indicators of High-Order Thinking Ability

Analyze	<p>a. Analyze incoming information and divide or structure the information into smaller sections to identify patterns or relationships.</p> <p>b. Able to recognize and distinguish the causes and consequences of a rumi scenario.</p> <p>c. Identify or formulate questions.</p>
Evaluate	<p>a. Provide an assessment of solutions, ideas and methodology using suitable criteria or existing standards to ascertain their effectiveness or benefit value.</p> <p>b. Make hypotheses, criticize and conduct testing.</p> <p>c. Accept or reject a statement based on the criteria that have been applied.</p>
Creating	<p>a. Make generalizations of an idea or perspective on something.</p> <p>b. Devising a way to solve the problem.</p> <p>c. Organizing elements or parts into a new structure that has never existed.</p>

The ability to think at a high level is very important in learning mathematics as well as the learning that is usually done by teachers today (Teacher Centered), causing the mathematics ability of school-level students to be still low. Based on the findings of PISA (Pogram for International Student Assessment), Indonesia is ranked 7th from the bottom (73) with an average score of 379 countries surveyed with an average score of 590 students' mathematical ability in Indonesia. This proves the low level of thinking skills, especially in creative thinking and problem solving.

The causes of low high-level thinking skills in mathematics lessons include in mathematics learning, teachers are considered as a storehouse of knowledge so that their teaching will be teacher-centered. Teachers give math lessons, prove formulas, and give examples of problems.

While students only act as good listeners, they sit neatly and listen to the explanations of the teacher, and imitate the teacher's way of doing the questions he has explained. These activities that are carried out continuously make students passive and tend to be less creative to express ideas. This can be seen from the

monotony of students answering the questions given by the teacher.

The learning conditions that have been at SMA Negeri 2 Delim still do not contribute completely to students, meaning that learning is still teacher-centered while students only accept what is conveyed by the teacher in this case causing students to be less trained in solving various problems that require high-level thinking skills.

One of the learning methods that can improve higher-order thinking skills and demand student activity is through the Cooperative Integrated Reading and Composition (CIRC) learning model An important idea in cooperative learning is to teach students the skills of cooperation and collaboration.

Cooperative Integrated Reading and Composition (CIRC) learning model, students are placed in small groups divided heterogeneously, consisting of 4 or 5 students. Within this group is distinguished gender, ethnicity, nation, or level of intelligence. So, preferably in this group there are students who are clever, moderate, weak and each feel compatible with each other. With this cooperative learning, it is hoped that students can improve their critical, creative, communication and social feelings.

The CIRC learning model has eight components. The eight components include [6]:

1. Teams, which is the formation of heterogeneous groups of 4 or 5 students.
2. Placement test, for example, obtained the average of previous test scores or based on report card scores so that teachers know the strengths and weaknesses of students in certain fields.
3. Student creative, carrying out tasks in a group by creating situations in which the success of an individual is determined or influenced by the success of his group.
4. Team study, which is the stage of learning action that must be carried out by the group and the teacher provides assistance to the group in need.
5. Team scorer and team recognition, which is scoring the results of group work and providing criteria for rewarding groups that succeed brilliantly and groups that are considered less successful in completing tasks.
6. Teaching Group, which is to give material briefly from the teacher ahead of the assignment of the group.
7. Facts test, which is the implementation of a test or test based on facts obtained by students.

8. Whole class unit, which is the provision of a summary of the material by the teacher at the end of the learning time

According to the findings from research by Muhsin [7] explained that higher-order thinking skills can be improved through O2EMQ learning. Furthermore, according to Hava [8] it was shown that measurable thinking skills in the intervention group were 40% compared to 4% in the control group. The most improved thinking skills are future thinking skills and creative thinking skills. The results of these findings are in the form of improving higher-order thinking skills through Cooperative Integrated Reading and Composition (CIRC) learning.

## METHODOLOGY

This research is an experimental study because the researcher gave treatment to the research sample to further want to know the effect of the treatment. The treatment given is CIRC-type cooperative learning in experimental classes and conventional learning in control classes. The experimental design used in this study was Pretest-Posttest Control Group Design [9]. The hypotheses tested are:

The form of the statistical hypothesis is as follows:

$$H_0 : \mu_1 = \mu_2$$

$$H_1 : \mu_1 > \mu_2$$

Information:

$\mu_1$  : average posts high-level thinking ability of experimental class students

$\mu_2$  : average high-level thinking ability posts control class

This research was conducted at SMA Negeri 2 Delima. The population in this study was all students of class X SMA Negeri 2 Delima and the sample of the study was class X<sub>1</sub> as an experimental class and class X<sub>3</sub> as a control class. The data in this study were obtained from a high-level thinking ability test instrument in the form of a description test question where the test questions used had been tested for validity, reliability, differentiability and difficulty levels. The processed high-level thinking ability data are initial test data and normalized gain data (N-gain). Data processing using t-tests with the help of Statistical Package for the Social Science (SPSS) software

## FINDING AND DISCUSSION

Data analysis of improving higher-order thinking skills through Cooperative Integrated Reading and Composition (CIRC) learning, begins by first testing the normality of data distribution and homogeneity of variance. If the data meets the requirements of normality and homogeneity,

then it uses the t-Test, while if the data is normal but not homogeneous using the t-Test', and for data that does not meet the normality requirements, using a non-parametric test that is using the Mann-Whitney Test.

The normality test result of the high-level thinking ability pretest of the experimental class was 0,200 and the control class was 0,150. Likewise for the n-gain values of the experimental class and the control class of 0,130 and 0,180. Based on the significance value of  $\alpha = 0,05$  and the value of  $\text{Sig.}(2\text{-tailed}) > \frac{1}{2}\alpha$  then  $H_0$  is accepted, so that it can be concluded that the distribution of data for high-level thinking ability is normally distributed.

Furthermore, a variance homogeneity test was carried out which aimed to see whether there was a difference in variance from each distribution of students' abilities according to the research group. The results of the homogeneity test of pretest score variance and n-gain of high-level thinking ability of experimental class and control class students are sig values, respectively. = 0.160 and 0.135. By taking the significance value  $\alpha = 0.05$  because of the sig value. = 0.160 and 0.135  $> 0.05 = \alpha$  then it gives the conclusion that the variance of high-level thinking ability of students of experimental class and control class is homogeneous.

Once it was discovered that the scores data of pretests, posts and gains of experimental classes and control classes came from homogeneous variances, then continued with a two-average difference test aimed at determining whether the improvement in high-level abilities of students with CIRC learning was better than that of students with conventional learning. Test the mean difference of postes using t-test, with the Compare Mean Independent Samples Test at significance  $\alpha = 0.05$ .

“Improving students' higher-order thinking skills taught with a CIRC-type cooperative learning model is better than learning taught with a conventional model”

Independent to t-test using SPSS 16. Testing the  $H_0$  hypothesis and its counterpoint  $H_1$  with a one-way test at the significance level  $\alpha = 0,05$ . The test criterion is reject  $H_0$  if  $\text{Asymp.Sig.}(1\text{-tailed}) < \alpha(0,05)$ . The one-way and two-way test Significance value relationship of the SPSS output is  $\text{Sig.}(1\text{-tailed}) = \frac{1}{2} \text{Sig.}(2\text{-tailed})$ . The results of the test of the average difference in Gain-Normalized mathematical communication ability of students obtained an  $\text{Asymp.Sig}(1\text{-tailed})$  score of  $0.001 < \alpha(0.05)$  then  $H_0$  was rejected, so  $H_1$  was accepted. This concludes that the improvement of students' higher-order thinking ability with CIRC cooperative learning is better than that of students with conventional learning.

This is in accordance with previous research conducted by Muhsin based on the results of his research showing that the cooperative learning model type Cooperative

Integrated Reading and Composition (CIRC) can improve students' mathematical communication skills [10]. Likewise, Atik Yuliana's research at SMP N 13 Malang was found that there was an increase in students' skills in solving story problems using the CIRC model by 89.47% in the second cycle [11].

### CONCLUSION AND RECOMMENDATION

Based Based on the analysis of research data, it is known that learning with Cooperative Integrated Reading and Composition (CIRC) has an influence on improving students' higher-order thinking skills. Next, it can be concluded that the management of mathematics learning through CIRC can influence and improve students' higher-order thinking abilities, through the stages of planning, organizing, applying and controlling.

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