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Algebraic Thinking Ability Viewed From Students' Interest Learning In Cooperative Integrated Reading and Composition (Circ) With Realistic Approach

Mursari Pratiwi[a,*], Mashuri[b]

[a,b]*Mathematics Department, Mathematics and Natural Sciences Faculty, Universitas Negeri Semarang, Indonesia*
D7 Building 1st floor, Sekaran Campus Gunungpati, Semarang 50299

** Email Address: mursaripratiwi@students.unnes.ac.id*

Abstract

The purpose of this study was to determine the algebraic thinking ability viewed from students' interest learning in Cooperative Integrated Reading and Composition (CIRC) with realistic approach.

The method used in this study was a quantitative method with the Posttest Only Control Design. The population was class X1 students in one of Senior High School in Pati academic year 2018/2019. Technique of sampling by using cluster random sampling, obtained XI MIPA 5 class as the experimental class and XI MIPA 6 class as the control class. The technique of collecting data used tests, questionnaires, and interviews. The data was analyzed by using proportion test and t-test.

The results showed that (1) the algebraic thinking ability of students who get CIRC learning with a realistic approach achieved classical learning completeness, (2) the algebraic thinking ability of students who get CIRC learning models with realistic approach were better than algebraic thinking ability of students who get *Discovery Learning*, (3) students with upper interest learning tend to be able to fulfill generalization, transformational, and global meta-level activities, students with middle interest learning tend to be able to perform generational and transformational activities, but still tend difficult in conducting level-meta global activities, students with lower interest in learning tend to be able to do generational activities, but still tend difficult in carrying out transformational activities and level-meta global.

Keywords:

CIRC, Algebraic, Thinking Ability, Learning Interest

1. INTRODUCTION

Education is very important in human life. Now, education is a necessity for individuals. Because in the world with this increasingly developing technology, it seems to urge every individual to master technology with the provision of education and science. Education and science cover very broad things, one of which is mathematics. Mathematics is a branch of science that deals with numbers and operations. Mathematics has a very important role in shaping the character of individuals related to the environment, social, and government. However, at this time there are still many students who have difficulty with mathematics and become dissatisfied because they still face many obstacles.

Mathematics is often associated with numbers and operations. This happens because while studying at the elementary school level or equivalent to senior high school or how simple mathematics is, it is always identical to counting numbers. There are three branches of mathematics at the beginning, namely arithmetic, algebra and geometry. Algebra is one of the fields of study in mathematics (Nurlaeli et al, 2018). Algebra is often equated with symbol manipulation, solving complex equations and simplifying algebraic forms. But algebra is not just symbol manipulation. Students must understand the concepts of algebra, the structure and principles of symbol manipulation, and the symbols themselves can be used to store ideas and gain insight (NCTM, 2000). Based on the opinion of Carraher & Scliemann in Girit & Akyuz (2015), algebra is defined as a guideline for algebraic reasoning and is related to algebraic learning among students from the ages of 6 to 12 years. In this regard, it is said in the Principles and Standards

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(NCTM, 2000) that teachers can help students at the secondary level by giving them experience in algebra at the initial level.

Algebra has an important role in mathematics. Understanding of the basic concepts of algebra is important because it is the main prerequisite for a student to be able to learn material related to the form of algebra in the later stages. As one of the important aspects of mathematics, algebra provides many benefits for life that are not easily explained to students (Maudy et al, 2018). This role is a concern because of students' insufficient understanding of algebra. Some researchers prove that students in the elementary class have not been able to reach algebraic thinking (Tagle et al, 2016). Algebra in schools is usually taught and assessed in terms of manipulation and calculation and for students, algebra learning seems to emphasize procedural ability rather than conceptual (Jin & Wong, 2014). To overcome these concerns, better preparation is needed in schools in the base class (Cai & Knuth, 2005). Because of the importance of the algebra, the termemerged algebraic thinking. Algebraic thinking is mathematical thinking that is related to one aspect of mathematics, namely algebra (Nurlaeli et al, 2018). Ameron in Sari & Fiantika (2017) defines that algebraic thinking is a mental process such as reasoning something unknown, generalizing, and formalizing the relationship between magnitude and the development of variable concepts. The term algebraic thinking is used to present one of the abilities that students need to master in learning algebra in school. The ability to think algebra is one of the important abilities to be mastered because it includes a thinking activity needed in the learning process of mathematics that can develop students' abilities in solving problems. In National Council of Teacher of Mathematics (2000) it was explained that algebraic abilities are very important in life as a provision for work and preparation for post-high school education. Students must learn algebra. One indicator in the ability to think algebra is to solve a problem. Whereas Sumarmo is in Ruhyana (2016) means that one of the activities in problem solving is as an activity to solve story problems. According to Suyitno (2005), the question of the story is a matter that is associated in everyday life.

Based on these problems, namely (1) the importance of applying algebraic thinking ability and (2) students 'low algebraic thinking ability, a learning model that is better than thelearning model Discovery Learning that can improve students' algebraic thinking ability is needed. That is a learning that is able to improve student learning outcomes, especially in solving questions in the form of descriptions and a learning that can make students think from their perspective. Ahuja (1994) defines cooperative learning as a learning method where students are encouraged to group in tasks to achieve a goal. Then he explained that the group members shared their perspectives, argued from their perspective, and modified their opinions. So, so that students' algebraic thinking abilities increase, one of the things that can be done is to apply cooperative learning or divide students into several groups during learning and apply learning that is able to improve student learning outcomes, especially in solving questions in the form of descriptions.

Learning models that are thought to be able to overcome these problems are Cooperative Integrated Reading and Composition (CIRC). Cooperative learning type CIRC in terms of language can be interpreted as a cooperative learning model that integrates a reading thoroughly and then composes it into important parts. As quoted in Suyitno (2005), Slavin (1985) said that improving student learning outcomes especially in solving questions in the form of descriptions is one of the advantages of a cooperative learning model, namely CIRC. This is supported by research that concludes that the CIRC type cooperative learning model is effective against the ability to solve story problems (Setyaningrum et al, 2012). The same thing was also concluded by Dewi et al (2017) in her research that there was the effect of type CIRC cooperative learning on the ability to solve story problems compared to the lecture method. By applying themodel Cooperative Integrated Reading and Composition (CIRC) in mathematics learning it is expected that students can develop the ability to think algebra in solving mathematical problems. In addition, so that learning becomes meaningful to students, learning needs to be created that connects the problems being discussed with real problems. This is so that students become easy to understand the material and easy to remember. Therefore, a modification is needed in the learning model offered, in this case the CIRC learning model, which is a realistic approach. Lestari and Yudhanegara (2015) say that a realistic approach is carried out by placing the reality and experience of students as the starting point of learning. Realistic problems are used as a source of emergence of mathematical concepts or formal mathematical knowledge that can encourage problem solving activities, find problems, and organize the subject matter. This is in line with the results of a study by Ahmad (2017) which says that realistic mathematical approaches are effective against the application of cooperative learning models.

Education is a mathematical learning approach that prioritizes student activities in the learning process in the classroom with the aim that students are able to build their own knowledge of mathematical problems being faced.

Based on research by Yueni (2018), the factors that make it difficult for students to understand mathematics in the subject of algebra, including factors of the student's own personality, student learning factors that tend to memorize subject matter, lack of students' interest in learning mathematics, which considers mathematics is a difficult lesson. Interest means high enthusiasm or a great desire for something. Interest according to Slameto (2010: 180) is a feeling of being more like and feeling interested in something or activity, without being told. Interest is one of the things that can affect the quality of student learning outcomes in certain subjects. A student will pay more attention to certain subjects they are interested in compared to other subjects. High interest in a particular subject makes students more eager to learn to get a good achievement. Interest is also a strong source of motivation for students to achieve success in learning. For example, students experience difficulty in doing mathematics. If there is no interest in trying to solve math problems, students will not want and will not be able to solve the problem. However, if there is interest from students to solve math problems, then this can be a motivation so that students are able to solve math problems correctly.

Based on this description, further research will be carried out with the title **"Algebraic Thinking Ability Viewed from Students' Interest Learning in Cooperative Integrated Reading and Composition (CIRC) with Realistic Approach ".** The subject matter used in this study was the material of circle for class XI in the academic year 2018/2019. In circle material, students will learn about the circle equations, the position of two circles, and power of the circle. Circle material is one part of Algebra.

2. METHODS

This research method used quantitative methods. The research design in this study is True Experimental Design in the form of Posttest Only Control Design. In this study there were experimental and control classes. The experimental class was given CIRC model learning with a realistic approach, while the control class was given Discovery Learning.

The population in this study was grade XI in one of Senior High School in Pati even semester academic year 2018/2019. In this population, the age of students when admitted to high school is relatively the same, students get material based on the same curriculum, students get the same lesson time and students who become objects of research sit at the same class level where class division is not based on ranking. The sampling technique in this study was cluster random sampling, which is random sampling regardless of the strata in the population (Sugiyono, 2015: 122). The chosen sample was students of XI Mathematics and Science 5 class and XI Mathematics and Science 6 class at one of Senior High School in Pati. In this study, XI Mathematics and Science 5 one of Senior High School in Pati was chosen as experiment class. Before determining the research subject, students were given a questionnaire about the students' interest learning scale and then classified into groups of students who have upper, middle, and lower interest learning. Each level of student interest learning will be taken by two research subjects. The results of selected subject work are then used as the basis for conducting interviews.

The preliminary data used in this study is the final grade of the odd semester students of class XI MIPA 5 in SMA 1 Juwana which then carried out the normality test, homogeneity test, and t-test test on the data. The results of the normality test indicate that the Sig value= 0.518> 0.05. This means that H_0 is received, so it can be concluded that the data comes from normally distributed population, so the hypothesis testing can be done using parametric statistics. The homogeneity test results show that the Sig value is $0.660 > 0.05$. This means that H_0 is received, so it can be concluded that there is no difference in variance between the experimental class and control class. Based on the results of the test calculation, the value of $t\_calculation = 1.312$ is obtained and the value ofobtained $t\_tabel = 2{,}000$ is with α = 5%, $dk = 60$, and opportunity $= \left(1 - \frac{1}{2}\alpha\right)$. Because the value of $t\_calculation = 1.312$ lies between the value t_tabel is -2.000 and 2.000, then H_0 accepted. So, it can be concluded that there is no difference in initial abilities between the two experimental class and the control class.

Final data which is used is the test value of algebraic thinking ability. These data was tested by normality test, homogeneity test, proportion test, and t-test.

3. RESULT AND DISCUSSION

Based on the initial data, it was obtained that Based on the results of students' algebraic thinking ability test, the following is a summary of the results of tests of algebraic thinking ability.

Tabel 1. Results of Algebraic Thinking Ability Students

Descriptive	Eksperiment	Control
Number of Students	34	28
The Highest Score	98	90
The Lowest Score	70	68
Number of Complete Students	30	20
Number of Disomplete Students	4	8

The results of the normality test showed that a significant value for testing algebraic thinking ability was 0.237. Because the value of Sig $= 0.237 > 0.05$, H_0 accepted. So, it can be concluded that the value of the test of algebraic thinking ability comes from a population that is normally distributed, so hypothesis testing can be done using parametric statistics.

The homogeneity test is used to determine whether the two sample groups have the same variance or not. The homogeneity test in this study used Levene test. The homogeneity test results showed that a significant value for the students' algebraic thinking ability test was 0.992. Because $Sig = 0.992 > 0.05$, H_0 accepted. So, it can be concluded that there is no difference in the variance of the students' algebraic thinking ability test between the two classes.

The proportion test was conducted to find out whether the completeness proportion of the results of the algebraic thinking ability tests of students who received CIRC learning with a realistic approach to achieving classical learning completeness was 75% of all students who achieved the minimal completeness criteria score. Based on the results of the z test, $z\_calculation = 1,838$ and obtained $t\_table = 1{,}640$ with $\alpha = 5\%$. Because $z\_calculation = 1.838 > 1.640 = z\_table$, then H_0 is rejected. So, it can be concluded that the percentage of algebraic thinking ability of students who get CIRC learning with a realistic approach achieves classical learning completeness.

The two-proportion similarity test, was used to test whether student learning outcomes for algebraic thinking ability that received CIRC learning with a realistic approach achieved completeness more than student learning outcomes on algebraic thinking ability that acquired Discovery Learning. The results of the two-proportion similarity test calculation obtained $z\_calculation = 1.667$ and $z\_table = 1.640$. Clearly, that $z\_calculation = 1{,}667 \geq 1{,}640 = z\_table$, then H_0 is rejected. So, it can be concluded that student learning outcomes on algebraic thinking ability that obtain CIRC learning with a realistic approach achieve more completeness than student learning outcomes on algebraic thinking ability that obtain Discovery Learning.

The mean similarity test was used to find out whether the algebraic thinking ability of students who received CIRC learning with a realistic approach was more than students who learned Discovery Learning. Based on the calculation of t, obtained by $t\_calculation = 2,472$ and $t_{table} = 1,671$ with $\alpha = 5\%$. Because $t\_calculation > t\_table$, then H_0 is rejected. So, it can be concluded that the algebraic thinking ability of students who get CIRC model learning with a realistic approach is more than the algebraic thinking ability of students who get Discovery Learning.

The results of student learning interest questionnaire analysis were obtained by 9 students with high learning interest categories, 19 students with moderate learning interest categories, and 6 students with

low student learning interest categories. For example, 6 subjects were chosen to represent upper, middle, and lower interest learning categories by researchers to conduct interviews.

Algebraic thinking ability test results in the order of students from the upper interest learning category namely E-27 students to E-29, middle interest learning categories namely students E-30 to E-28, and lower interest learning categories, namely students E-14 to E-11 indicate that the results of test of algebraic thinking ability are viewed from students' interest learning. Students who have upper interest learning obtain the results of the algebraic thinking ability test 75 getting various test results of algebraic thinking ability. Students with middle interest learning, as many as 15 students obtained the value of the algebraic thinking ability test ≥75 and 4 students obtained the test scores of algebraic thinking ability <75. While students whose have lower interest learning get score of the algebraic thinking ability test ≥75. Conclusions from the data result of the algebraic thinking ability viewed from students' interest obtained learning were not fixed.

1. Algebraic Thinking Ability Viewed from Upper Interest Learning

1) Generalization

E-31 and E-24 were able to do generalizations well. E-31 and E-24, students with upper interest learning can determine the variable meanings of a problem and present problems in relationships between variables. On these indicators, students with upper interest learning tend to have no difficulty in determining the variable meanings of a problem and presenting problems in relationships between variables.

2) Transformational

E-31 and E-24 are able to determine equations that are equivalent to known equations. Students with upper learning interests tend to be able to carry out transformational activities in determining equations that are equivalent to known equations. E-31 and E-24 have been able to carry out transformational activities on indicators performing algebraic form operations. Students with upper interest learning tend to be able to carry out transformational activities on indicators performing algebraic form operations. E-31 and E-24 are able to carry out transformational activities with indicators determining the completion of an algebraic equation well. Students with upper interest learning tend to be able to do transformational activities in determining the completion of an algebraic equation well.

3) Level-meta Global

E-31 cannot conduct level-meta global activities in using algebra to analyze changes, relationships, and predict problems in mathematics. While E-24 can use algebra to analyze changes, relationships, and predict a problem in mathematics. E-31 and E-24 are able to model problems and solve them. Students with upper interest learning tend to have no difficulty in modeling problems and solving them. E-31 cannot solve problems related to other fields of science. Whereas E-24 is able to carry out global meta-level activities on indicators solving problems related to other fields of science.

2. Algebraic Thinking Ability Viewed from Middle Interest Learning

1) Generalization

E-06 and E-21 are able to carry out generalizations in determining the variable meaning of a problem. Students with middle interest learning are tend to have no difficulty in determining the variable meaning of a problem. E-06 and E-21 are able to carry out generalization activities in presenting problems in inter variable. Students with middle interest learning were tend to have no difficulty in presenting problems in the relationship between variables.

2) Transformational

E-06 and E-21 can perform transformational activities in determining equivalent algebraic forms. Students with middle interest learning tend to have difficulty in determining equivalent algebraic forms. E-06 and E-21 are able to carry out transformational activities in performing algebraic form operations. In this transformational activity, students with middle interest learning tend to have no difficulty in performing algebraic forms of surgery. E-06 and E-21 are able to carry out transformational activities in determining the completion of an algebraic equation. Students with middle interest learning tend to have no difficulty in determining the completion of an algebraic equation.

3) Level-meta Global

E-21 are able to use algebra to analyze changes, relationships, and predict problems in mathematics, while E-06 are ot able to use algebra to analyze changes, relationships, and predict a problem in mathematics. In this global meta-level activity, E-21 with middle interest learning tend to have no difficulty in analyzing changes, relationships, and predicting problems in mathematics and E-06 with middle interest learning tend to have difficulty in analyzing changes, relationships, and predicting a problem in mathematics. E-06 and E-21 are able to model problems and solve them. In this global meta-level activity, students with middle interest learning tend to have no difficulty in modeling problems and solving them. E-21 are able to solve problems related to other fields of science, E-06 are not able to do it well. In this global level-meta activity, E-21, student with middle interest learning tend to have no difficulty in solving problems related to other fields of science and E-06, student with middle interest learning tend to have difficulty in solving problems related to other fields of science.

3. Algebraic Thinking Ability Viewed from Lower Interest Learning

1) Generalization

E-15 and E-03 are able to determine the variable meaning of a problem. In this generalization activity, students with lower interest learning tend to have no difficulty in determining the variable meanings of a problem. E-15 and E-03 are able to present problems in relationships between variables. In this generalization activity, students with lower interest learning tend to have no difficulty in presenting problems in relationships between variables

2) Transformational

E-15 and E-03 are able to determine the equivalent algebraic form. Students with lower interest learning tend to have no difficulty in determining equivalent algebraic forms. E-03 are able to determine the completion of an algebraic equation, while E-15 are not able to determine the completion of algebraic equation. E-15 and E-03 are able to operate algebraic forms. In this transformational activity, students with lower interest learning tend to have no difficulty in performing algebraic forms of surgery.

3) Level-meta Global

E-03 are able to use algebra to analyze changes, relationships, and predict problems in mathematics, while E-15 are not able to do it well. E-15 and E-03 are able to model problems and solve them. Students with lower interest learning tend to have no difficulty in modeling problems and solving them. E-15 are able to solve problems related to other fields of science, while E-03 are not able to do it well.

4. CONCLUSIONS

Based on the results of the research and discussion, it was concluded that (1) the algebraic thinking ability of students who received CIRC learning with a realistic approach achieved classical learning completeness, (2) algebraic thinking ability of students who received CIRC learning models with a realistic approach better than the algebraic thinking ability of students who received the Discovery Learning model: (i) the proportion algebraic thinking ability of students who received CIRC learning with a realistic approach is more than the algebraic thinking ability of students who have learned Discovery Learning, (ii) the average algebraic thinking ability of students who received CIRC learning with a realistic approach is more than the algebraic thinking ability of students who received the Discovery Learning model, (3) Description of algebraic thinking ability in terms of students' interest learning in CIRC with a realistic approach are as follows (i) students with upper learning interest tend to be able to fulfill generalization, transformational activities , and level-meta global, (ii) students with middle interest learning tend to be able to do generalization and transformational activities, but still tend to have difficulty in conducting level-meta global activity, (iii) students with lower interest learning tend to able to carry out generalization activities, but still tend to have difficulty in carrying out transformational activities and level-meta global.

Based on the research that has been done, suggestions that can be given by researchers are (1) the application of the CIRC model with a realistic approach can be used as an alternative teacher so students can be actively involved in learning so as to improve students' algebraic thinking ability, (2) students with middle and lower interest learning still tend to have difficulty in conducting level-meta global activities, so that teachers can guide students more intensively, and (3) teachers should provide more motivation in

each learning process, both at the beginning and at the end of learning to increase students' interest learning.

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