Algebraic Thinking Ability Based on Mathematics Disposition in Learning Cycle 7E Model

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Info Artikel	Abstract
	The aim of this study are to determine the quality of the Learning Cycle 7E model and found a pattern of algebraic thinking ability of 7th grade students' in solving algebra problem viewed by disposition mathematics. The research uses mixed methods study with concurrent embeded design. The subjects of this research were 7th grade students. Quantitative data was tested with the z test and Independent t-test, whereas qualitative data were analyzed descriptively. Learning quality is assessed from the planning, implementation and evaluation stage. The result of this research shows that Learning Cycle 7E model in good criteria. Students in the high mathematical disposition category were able to solve the algebraic problem from the generalization level, the transformational level until the meta-global level. Students in the medium mathematical disposition category were able to solve the algebraic problem from the generalization level and the transformational level. And students in the low mathematical disposition category were able to solve the algebraic problem only at the the generalization level.

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INTRODUCTION

Mathematics is about looking for general patterns, formulate new assumptions, and determine the correctness of the evidence from the axiom and the definition chosen (Ziegler, 2010). The need for understanding and ability to use mathematics in daily life and it is getting bigger and steadily increasing in the work environment (NCTM, 2000).

Over the last decade Indonesian students had very low performances in mathematics and particularly in algebra, as revealed in the Trends in International Mathematics and Science Study (TIMSS 2007). In TIMSS 2007, on the topic of algebra, Indonesian students were in 36th position out of 48 participating countries (Mullis et al., 2008). In TIMSS 2011, similarly, Indonesian students were in 38th position out of 42 countries (Mullis et al., 2012). This result is an evaluation material for the development of the mathematics curriculum in schools and learning mathematics in class, especially in algebra. Mathematics curriculum need another aspect to develop student's algebraic thinking ability that is the teachers who not only can identify algebraically about mathematics but also can help students develop algebraic thinking ability (Gordillo&Godino, 2014).

The ability to use mathematics to solve problems in life makes students appreciate the role of mathematics in life (Setiawan, 2017). Mathematics disposition is one of the factors that determines the success of students in learning mathematics and solving algebra (Rakhmi et al., 2018). Yulianti in Miranti, et al (2015) stated that mathematics dispositions need attention because they will be related to other aspects of mathematical competences. In the context of mathematics, mathematics disposition related to how students perceive and solve problems, are confident, diligent, interested and flexible thinking to explore various alternative problem solving strategies (Rahayu&Kartono, 2014).

The difficulty of students thinking algebra is felt by most Indonesia students (Putriyani, 2016). Based on the results of an interview with one teacher from SMP Negeri 2 Pecangaan, student have difficulty thinking algebra because of the unclear basic concepts of algebra and settlement process that does not directly use formulas. Students have difficulties to understanding algebra and to use their knowledges to plan algebraic thinking strategies.

Students understand the basic concept of algebra, but when they faced with algebraic problems, students have difficulties to solve it. So, the efforts to improve algebraic thinking abilities that include generational abilities, transformational abilities and level meta-global abilities are important to do, because algebraic thinking ability is very important especially in learning mathematics (Badawi. et al., 2016; Mashuri. et al., 2018).

In order to improve student's algebraic thinking ability and student's mathematical dispositions are needed learning model that is able to construct students' understanding in understanding and solving algebaraic problem. And able to encourage positive attitudes: more diligent, persistent and never give up so that the algebraic thinking ability and mathematics dispositions is better.

Student centered learning approach encourages students to build knowledge, attitudes and behavior (Yulianingsih & Hadisaputro, 2013). Learning model and teachers are the main factors that can affect student learning outcomes. (Yulianti, et al., 2013). One of learning models that has a constructivist paradigm is Learning Cycle 7E model (Elicit, Engagement, Exploration, Explanation, Elaboration, Evaluatin and Extand). Learning Cycle 7E is one of student centered learning model which has stages of activities organized in such a way that students can proficient the competencies that must be achieved in learning by playing a role.

Based on tha previous descriotion, the aim of this research is to : (1) knowing the quality of learning with the Learning Cycle 7E Model on algebraic thinking ability of 7th grade students in SMPN 2 Pecangaaan Jepara (2) analyze algebraic thinking ability 7th grade students of SMPN 2 Pecangaaan Jepara based on mathematics dispositions in Learning Cycle 7E model.

METHODS

This research is mixed method concurrent embedded design with qualitative research as the primary method. The type of this research is a quasi-experimental research with one group pretest-posttest design. The subjects in this research consist of 7th grade students in SMP N 2 Pecangaan Kab. Jepara.

The research was conducted at SMP N 2 Pecangaan Kab. Jepara in class 7 with Learning Cycle 7E model on sequence and material. The study time was selected in the even semester of the academic year 2017/2018. In the quantitative study selected one class sample. In qualitative research subject in research taken by purposive sampling technique where the taking is done with consideration and certain purpose (Sugiyono, 2012).

The quality of learning in this study includes planning, implementation and evaluation stage. Learning is said to be of quality if the result of device validation and learning instrument, the result of observation of the implementation and the result of the student's response to the learning on the minimum criteria is good. The determination of learning quality of Learning Cycle 7E model based on the achievement of learning mastery includes the average test of individual mastery and classical completeness, as well as the average algebraic thinking ability of students after subjected to Learning Cycle 7E is better than the average algebraic thinking ability before subjected to Learning Cycle 7E.

Algebraic thinking ability based on mathematics disposistions is analyzed descriptively based on the document of the test result and the interview with the student representative. The validity of the data using the source triangulation technique is the student representative interview. Qualitative data analysis follows the concept of Miles & Huberman (in Sugiyono, 2012) including data reduction, data presentation and conclusion drawing.

RESULT AND DISCUSSION

The mathematics dispositions questionnaire respondents consisted of 30 students. The detail of mathematics diapositions categories questionnaire is presented in Table 1.

Table1. Distribution of Mathematics Dispositions Categories

Student's Category	the number of students	Persentage(%)
High	9	30
Middle	16	53.33
Low	5	16.67
Total number	30	100

There are 9 students in high category, 16 students in medium category, and 5 students in low category from 30 students who have filled out the mathematics dispositions questionnaire in VII G class. Each mathematics disposition category is selected 2 students to analyze their algebraic thinking abilities in dept.

Low category student selection was obtained from 2 students with the lowest mathematics disposition score. Medium category student selection was obtained from 2 students with the middle mathematics disposition score. And high category student selection was obtained from 2 students with the highest mathematics disposition score. This is done in order to make a significant difference between students from all three categories in solving algebraic problems.

The quality of learning is qualitatively assessed from 3 stages. The first is planning stage where the researcher prepares learning instruments which are then validated by experts. The planning stage of each validator's assessment of learning instruments can be seen in table 2 below.

Table 2. Assessment Results of Learning Instrument

Learning Media	Mean	Criteria
Syllabus	4.34	Excellent
Lesson plan	4.10	Good
Teaching supplement	4.00	Good
Student worksheet	3.92	Good
TKBA	4.07	Good

Based on the results of the assessment of learning tools by expert validators, the average expert validator assessment was obtained in the good category. This means that the learning tools is suitable for use in research.

Stage of learning implementation is said in a good quality if the results of observations on the quality of learning and the implementation of learning at least in a good criteria. Implementation of learning done as much as 5 times. The results of the assessment on the quality of Learning Cycle 7E models are presented in Table 3. And the evaluation stage used students response questionnaire are presented in Table 4.

Table 3. Observation Results of Learning Quality

Quality	Mean	Criteria
Firs meeting	3.75	Good
Second meeting	3.75	Good
Third meeting	4.10	Good
Forth meeting	4.25	Excellent
Fifth meeting	4.25	Excellent

Average of the learning quality result during 5 meetings are good. This means that the researchers have carried out learning well.

Tabel 4. Students Response to Learning

Response	Percentage (%)
Positive response	80,00
Negative response	20,00

Third stage is the evaluation stage. Evaluation stage involves giving student response questionnaire to Learning Cycle 7E model that have been done and analysis of test result of algebraic thinking ability of students, students who respond positively to learning achieve more than or equal to 70%. The number of students who gave a positive response to learning reached 80%. This indicates that the majority of students assess the learning that has been well implemented.

The quality of learning is quantitatively determined based on classical completeness test and average difference test. Te data used for completeness test and average difference is the students' posttest results (Table 5).

Table 5. Postes Results

Average Postes	
Experiment Class	79.33333
Control Class	70.28125

The evaluation stage is analysis of students' algebraic thinking ability test. Before making an analysis on final data, normality test is completed toward final data, it obtains significance value = 0.096 = 9,6%> 5%, therefore it is know that final data is from normal distributed population. Based on classical completeness test, it is obtained zcalculated = 2.05 which is more than ztable = 1.64, with significance level at 5%, hence H_0 is rejected. It means that the algebraic thinking ability completeness proportion of students in experimental class applying Learning Cycle 7E model accomplishes established classical passing grade, whereas students who accomplish minimum completeness are more than 75%.

The result of differentiation mean test on students' algebraic thinking ability is t calculated = 4,95. The value of t table is 2,00, therefore is

rejected. Hence, it can be concluded that the mean of student's algebraic thinking ability after given learning with the Learning Cycle 7E model is better than before given the learning with the Learning Cycle 7E model.

Based on the description above, Learning Cycle 7E model is the quality learning model. Because: (1) validator's assessment of learning tools is good; (2) observation of learning quality is good; (3) students' positive response for learning reached more than 70%; (4) students who accomplish minimum completeness are more than 75%; and (5) the mean of student's algebraic thinking ability in experiment class after given learning with the Learning Cycle 7E model is better than control class. The result of this study are in accordance with the research conducted by Aziz, Z. et al. (2013); Sofuroh, et.al (2014); Tyas, et.al (2015); Kasmadi, et al (2016); Darojat,L. & Kartono (2016); Partini. et al,.(2017); Zuhra, et al,(2017); Hepi, A. et al,.(2018). They stated that the learning Cycle 7E model effectively improved student learning outcomes.

The description of students' algebraic thinking ability based on mathematics disposition is:

(1). Students in low category mathematics disposition have a little difficulty in solving problems in generational abilities. Students in middle category mathematics disposition can solve problems in generational abilities. And Students in high category mathematics disposition also can solve problems in generational abilities.

(2). Students in low category mathematics disposition have difficulties in solving problems in transformational abilities. Students in middle category mathematics disposition have a little difficulty in solving problems in transformational abilities. And Students in high category mathematics disposition can solve problems in transformational abilities.

(3). Students in low category mathematics disposition have difficulties in solving problems in level meta-global abilities. Students in middle category mathematics disposition have a little difficulty in solving problems in level meta-global abilities. And students in high category mathematics disposition can solve problems in level meta-global abilities.

CONCLUSION

The results of the study obtained the quality of Learning Cycle 7E model on student's algebraic thinking ability in solving algebraic problems in generational abilities, transformational abilities and level meta-global abilities in good quality. This results are indicated by: (1) validator's assessment of learning tools is good; (2) Learning quality is good; (3) students' positive response for learning reached more than 70%; (4) students who accomplish minimum completeness are more than 75%; and (5) the mean of student's algebraic thinking ability in the Learning Cycle 7E model is better than the mean of student's algebraic thinking ability in the expository learning model.

RECOMMENDATION

Based on the above conclusion, it is given several recommendations as follow. (1) Learning Cycle 7E model is considered quality and can improve student's algebraic thinking ability. So, this learning model can be applied in teaching and learning process; (2) Student response to learning model of Learning Cycle 7E in good criterion, it is recommended for students to choose effective way of learning and according to their mathematics dispositions to improve algebraic thinking ability; and (3) The results show that students with low and medium category of disposition mathematics are only able to achieve several ability of algebraic ability. Its recommended for students with low and medium category of disposition mathematics can be given more guidance and motivation in order to solve algebra problems.

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