



Mathematics Learning With The Accelerated Learning Method To Improve The Active Reasoning Skills Of Junior High School Students

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Abstract

The aim of this research is to find out whether the improvement of students' adaptive reasoning ability with accelerated learning method is better than ordinary learning. This research is a quasi experiment or quasi-experimental design with pretest-posttest control group design. The sampling technique uses a class random technique. The implementation of this study was carried out on eighth grade students in one of the State Junior High Schools in Bandar Lampung. The questions given are questions of adaptive reasoning ability in relation and function material, the test of adaptive reasoning ability test is theoretically tested by the validator with the description that test questions can be understood well and empirically validity and reliability meet the characteristics to be used in research, the level of difficulty and distinguishing power of the problem can already be used to determine the improvement of adaptive reasoning abilities. Quantitative data analysis was carried out using a mean difference test and N-Gain test. The results of this study were students whose learning to apply learning with the accelerated learning method improved adaptive reasoning ability was significantly better compared to students whose learning using ordinary learning was reviewed thoroughly.

Keywords: *Accelerated Learning, Adaptive Reasoning Ability.*

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INTRODUCTION

In the learning process, students need to be independent in order to develop and formulate their mathematical ideas. The National Council of Teachers of Mathematics (NCTM) in (Effendi, 2012; Septian, 2014) has established five mathematical competency standards that students must possess, namely problem solving, communication, connection, reasoning, and representation skills. According to Kilpatrick, Swafford, and Findell in (Aminah, 2015; Aristiyani & Setyaningsih, 2013; Widjajanti, 2011), five mathematical abilities need to be developed, namely conceptual understanding, procedural fluency, strategic competence,

adaptive reasoning, and productive disposition. Students need reasoning to generate ideas or concepts in solving problems so that they can understand mathematical concepts correctly (Bernard, 2015). Based on a preliminary survey, the researcher conducted an interview with a mathematics teacher, Mrs. Mutiarini, S. Pd, and obtained information that students' reasoning skills in learning mathematics were still very low.

In the learning process, conventional teaching methods are still used, with teachers dominating the learning process. During lessons, only a few students actively ask questions and answer questions posed by the teacher. Students who are less active in the learning process tend to listen and take notes on what the teacher says, so that learning is only one-way. As a result, students' adaptive reasoning skills are not yet apparent in the learning process.

Reasoning is a logical way of thinking for students using an inductive approach, whereby learning provides logical evidence to reach conclusions, and deductive learning, whereby problem-solving concepts are based on proven scientific knowledge so that students can think logically based on existing facts to draw conclusions (Bernard, 2015). According to Kilpatrick, Swafford, and Findell in (Aminah, 2015; Aristiyani & Setyaningsih, 2013), adaptive reasoning is the capacity to think logically, predict answers, provide explanations of the concepts and procedures used in the answers, and assess their mathematical correctness. Kilpatrick et al. also argue that adaptive reasoning does not only include deductive reasoning, which draws conclusions based solely on formal deductive proofs, but also includes intuition and inductive reasoning, which draws conclusions based on analogies and metaphors. Based on this statement, it can be interpreted that adaptive reasoning has a broader scope than reasoning in general, which only includes inductive and deductive reasoning, because in the process, adaptive reasoning also involves intuitive reasoning (Suhendra, Sugiatno, & Suratman, 2016). Intuitive reasoning is reasoning that bases a conclusion on appearance or whether a feeling is correct (an assumption) (Aminah, 2015). Adaptive reasoning not only emphasizes students to solve a problem, but also requires students to think logically, i.e., reasonably and using their reasoning correctly. This is based on previously known facts and really considers whether the solution procedure is in accordance with the applicable rules.

According to Jeremy Kilpatrick et al., students can demonstrate their adaptive reasoning when they encounter three conditions, namely: 1) Having sufficient basic knowledge. In this case, students have good prerequisite skills before entering new knowledge to support the learning process; 2) Tasks that are understandable and can motivate students; 3) The context presented is familiar and enjoyable for students. The indicators of adaptive reasoning are: 1)

making conjectures; 2) giving reasons for the answers provided; 3) drawing conclusions from a statement; 4) checking the validity of an argument; 5) finding patterns in a mathematical problem (Widjajanti, 2011). Several studies on student reasoning have been conducted. The results of research by Sumarno in (Aminah, 2015) found that students' scores in mathematical understanding and reasoning were still low. Other studies also concluded that reasoning skills are still low using conventional learning (Muharom, 2014; Utami, Mukhni, & Jazwinarti, 2014). Therefore, appropriate learning is needed to accommodate the improvement of student competence so that learning outcomes can be better, especially adaptive reasoning skills, one of which is learning with the Accelerated Learning method.

According to Meier, the Accelerated Learning model is “a learning model that can accelerate and improve learning by inviting students to be directly involved in the learning process” (Suciutari, Wiarta, & Putra, 2013). Accelerated Learning focuses on a learning process that is fast, enjoyable, and satisfying. Enjoyable in this context means arousing students' interest in learning and getting them fully involved so that learning is more meaningful (Adiguna, Suara, & Semara, 2014; Parasti, Ngadino, & Dwiji, 2012). Mathematics learning using the Accelerated Learning method has been carried out by (Aristiyani & Setyaningsih, 2013; Putra, 2014; Suryaningtyas, 2014). The Accelerated Learning method has also been widely used in science learning by (Adiguna et al., 2014; Eskarina, Miharty, & Thaib, 2015; Parasti et al., 2012; Rohman, 2012; Suciutari et al., 2013; Sugiarta, Widian, & Tastra, 2016; Sumarau & Suherman, 2013; Taufiq & Husna, 2016). The results of the study show that the Accelerated Learning method can be used in the learning process, namely it can contribute positively in terms of improving learning outcomes, learning achievement, learning activities, and influencing students' mathematical abilities such as mathematical communication, critical thinking skills, and mastery of concepts.

Some of the key principles of Accelerated Learning according to Meier are: Total learner involvement in improving learning; learning is not passively gathering information, but actively creating knowledge; cooperation among learners greatly helps improve learning outcomes; activity-centered learning is often more successful than achievement-centered learning, and activity-centered learning can be designed in a much shorter time than that required to design achievement-centered teaching (Adiguna et al., 2014). The Accelerated Learning method is divided into six basic steps, namely: motivating your mind, acquiring the information, searching out the meaning, triggering the memory, exhibiting what you know, and reflecting on how you have learned.

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Several studies have been conducted on the Accelerated Learning method in learning activities, which have a significant effect on students' critical thinking skills (Fitriani, Indrowati, & Karyanto, 2015), learning outcomes (Rafikasari, 2014; Suciutari et al., 2013) and student learning activities (Rafikasari, 2014). Research on the application of the accelerated learning method has successfully improved learning outcomes (Jainudin, 2014; Mukhta, 2014; Rohman, 2012), learning achievement (Eskarina et al., 2015), student activity (Rohman, 2012), concept mastery (Parasti et al., 2012), and students' mathematical communication skills (Putra, 2014). Research to measure students' reasoning abilities has also been conducted using various models or methods such as Problem-Based Learning (Setiawan, 2015), the problem-based learning and Group Investigation models (Aristiyani & Setyaningsih, 2013), and the Student Teams Achievement Division (STAD) model (Muharom, 2014) and Think Pair Square learning (Utami et al., 2014). This study innovatively applies the Accelerated Learning method to measure students' adaptive reasoning abilities. This study focuses on three indicators, namely: 1) proposing conjectures; 2) providing reasons for the answers given; 3) finding patterns in mathematical problems. The researcher only took these three indicators because they cover what is meant by adaptive reasoning according to Kilpatrick, Swafford, and Findell, and they meet the indicators of relational and functional material.

Based on the description of the background of the problem, the research question in this study is: Does the accelerated learning method improve students' adaptive reasoning skills better than conventional learning?

METHOD

This research method uses a quasi-experiment consisting of two research groups, namely the experimental group, which is a group of students whose learning applies the Accelerated Learning method, and the control group, which is a group of students whose learning does not

apply the Accelerated Learning method (conventional). The research was conducted at a public junior high school in Bandar Lampung. The population consisted of all eighth-grade students at a public junior high school in Bandar Lampung in the odd semester of the 2016/2017 academic year. Sampling was conducted using a random class technique, which involved taking samples at random without considering the abilities of the students in the class. Based on this technique, class VIII H was selected as the experimental class (the class that received accelerated learning) with 29 students, and class VIII J was selected as the control class (the class that received conventional learning) with 30 students, with the assistance of the vice principal and teachers, bringing the total sample to 59 students. The material taught was relations and functions.

The author collected data for hypothesis testing from four experimental class meetings and four control class meetings. To measure students' adaptive reasoning abilities, the author used a pretest-posttest control group design, which involved two randomly selected groups. The study was conducted by administering a pretest before the treatment to determine the initial adaptive reasoning abilities of students in the experimental and control classes. At the end of the session after the treatment was given, a posttest was administered to see the results of the treatment that had been given.

The research design will determine whether the adaptive reasoning abilities of students with accelerated learning are better than those with conventional learning. The research was conducted using a non-equivalent control group design as follows:

R ₁	O ₁	X ₁	O ₂
R ₂	O ₃	X ₂	O ₄

Description:

R₁ = Experimental group

R₂ = Control group

X₁ = Learning treatment using the accelerated learning method

X₂ = Learning treatment using the lecture method (conventional learning)

O₁ = Pre-test for the experimental group

O₃ = Pre-test for the control group

O₂ = Post-test for the experimental group

O₄ = Post-test for the control group

The data analysis techniques used in this study were descriptive statistical tests and

inferential tests. Descriptive tests were used to describe the mean, standard deviation, gain, and N-gain of adaptive reasoning. The inferential tests used were normality tests and homogeneity tests. If the data were normally distributed and homogeneous, hypothesis testing was performed using the t-test.

RESULTS AND DISCUSSION

Results

Based on the data from the pretest results of Grade VIII junior high school students, tests of normality, homogeneity, and equality of means were conducted. After passing these tests, it was found that all eight classes were normally distributed and had the same variance (homogeneous). From the eight classes in the population, two classes were selected as the research sample, namely Grade VIII H as the experimental class and Grade VIII J as the control class.

This study was conducted on 32 eighth-grade junior high school students. Initial data was obtained through a pretest of active thinking skills, observation of learning activities, and brief interviews with mathematics teachers. The pretest results showed that the average active thinking skills of students were still relatively low, with an average score of 58.2 out of 100. Only 21.9% of students achieved a high score. In addition, the observation results showed that most students were reluctant to ask questions, tended to be passive in group discussions, and waited for the teacher's instructions rather than taking the initiative to find solutions.

The accelerated method was applied during six meetings with a focus on two-variable linear equations and functions. The learning strategy included: Brief presentation of material emphasizing core concepts. Graded exercises with rapidly increasing levels of difficulty. Collaborative activities in the form of quick group discussions. Individual reflection through daily learning journals. Teachers act as facilitators and guides, while students are required to actively discover patterns, propose hypotheses, and solve problems within a limited time.

Results of Student Activity Observations. Changes in student behavior were apparent after three meetings. Initially, only about 35% of students were active in discussions, increasing to 78% by the end of the sixth meeting. The number of students who dared to ask and respond to questions also increased significantly.

The following table presents the development of students' active thinking skills based on

observation results:

Table 1. Presents The Development Of Students' Active Thinking Skills Based On Observation

Active Thinking Skills Indicators	Meeting 1	Meeting 3	Meeting 6	Final Category
The Courage to ask questions	28%	53%	81%	Tinggi
Ability to express opinions	31%	59%	84%	Tinggi
Participation in group discussions	35%	66%	78%	Tinggi
Ability to connect concepts	25%	52%	75%	Tinggi

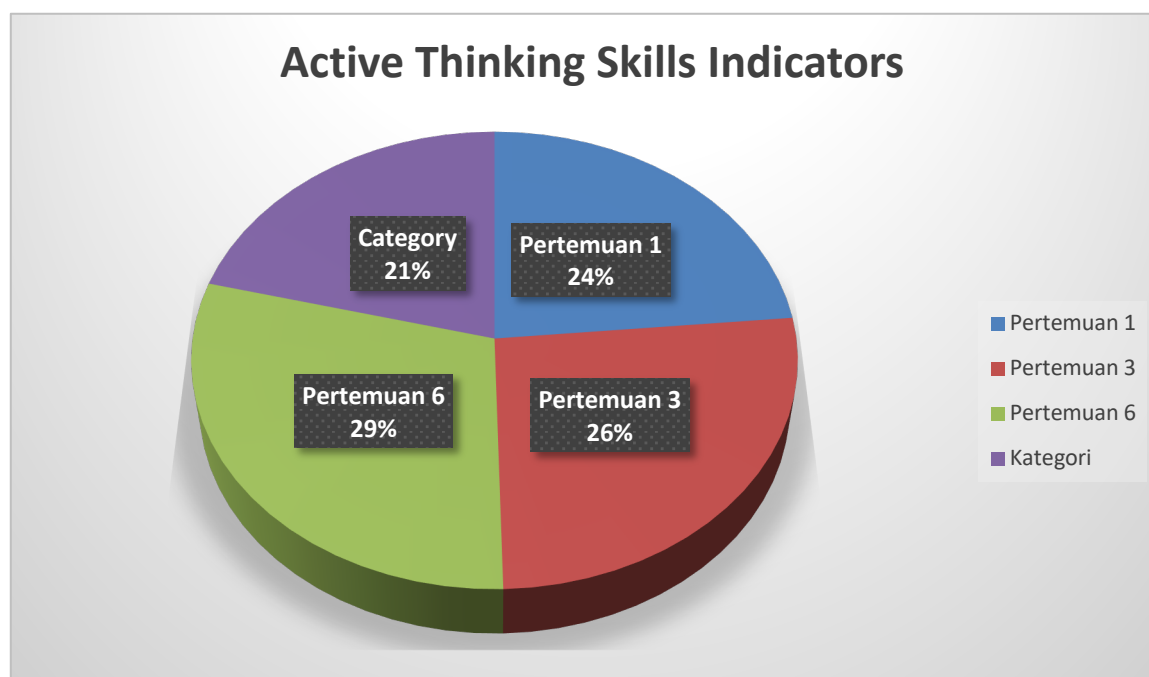


Figure 1. Active Thinking Skills Indicators

Final Test Results (Posttest) After the treatment, a posttest of active thinking skills was conducted in the form of mathematical problem-solving questions. The results showed a significant improvement: Average posttest score: 81.4 (up from 58.2 on the pretest). The number of students who achieved a high score increased to 71.9%. The improvement in active thinking skills was reflected in the students' ability to analyze story problems, propose more than one alternative solution, and explain the reasoning behind their answers.

In addition to quantitative improvements, several qualitative findings were also obtained. Students showed higher motivation to learn because the challenges of acceleration made them more focused. Study time felt shorter because this method encouraged faster thinking. Teachers felt that the accelerated method required more thorough preparation, but the results were worth it due to the increase in student activity.

Overall, the application of accelerated learning methods in mathematics education has successfully improved junior high school students' active thinking skills in terms of participation, courage, and analytical abilities. It provides a more challenging and enjoyable learning experience for students. It can be used as an alternative innovative learning model in an effort to improve the quality of mathematics education at the junior high school level.

Adaptive reasoning ability data were obtained through pre-tests, post-tests, and N gains. The following is a description of the pre-tests, post-tests, and N gains in the experimental and control classes.

Table 2. Descriptive Statistics of Adaptive Reasoning Ability

Nilai	Eksperimen				Kontrol			
	N	$\bar{x}$	SD	%	N	$\bar{x}$	SD	%
<i>Pre-test</i>	30	38,103	14,965	38,1	29	39	16,26	39
<i>Post-test</i>	30	75,86	9,826	75,8	29	68,66	11,29	11,2
<i>N-gain</i>	30	0,624	0,006		29	0,492	0,009	
Skor Maksimum Ideal = 100								

Based on Table 2 above, the pre-test mean for the experimental class was 38.103 and for the control class was 39. The pre-test means of the two classes were relatively the same before the treatment was given. The percentage score was obtained from the result of dividing the mean score by the ideal score multiplied by 100%. The average post-test score for adaptive reasoning ability in the experimental class was 75.86, higher than the control class with an average post-test score of 68.66. The average N gain for adaptive reasoning ability in the experimental class was 0.624, classified as moderate improvement, and for the control class it was 0.492, also classified as moderate improvement. The following is a summary of the comparison of the average pre-test, post-test, and N gain scores for adaptive reasoning skills.

Tabel 3. Average Skor *Pre-test*, *Post-test* and *N-gain* Scores for Students' Adaptive Reasoning Skills

Kelas	<i>Pre-test</i>	<i>Post-test</i>	<i>N-gain</i>
Eksperimen	38,103	75,86	0,624
Kontrol	39	68,66	0,492

From Table 3 above, it can be seen that the pre-test averages of the experimental class and the control class are not much different, with the experimental class averaging 38.103 and the control class averaging 39, indicating that the initial abilities of the two

classes were relatively the same before the treatment was given. Meanwhile, the post-test average of the experimental class, which applied accelerated learning, showed better results with an average score of 75.86 compared to the control class, which received regular learning with an average score of 68.66.

Analysis of N-gain scores for adaptive reasoning ability using normalized gain data. Normalized gain data also shows the classification of students' score increases compared to their ideal maximum scores. The average N-gain describes the increase in adaptive reasoning ability of students who apply accelerated learning methods and those who receive regular learning. A summary of the average N-gain adaptive reasoning ability of students in the experimental class and control class is presented in the following table.

Table 4. Average and Classification of N-gain Adaptive Reasoning Ability

Kelas	Rataan <i>N-gain</i>	Klasifikasi
Eksperimen	0,624	Sedang
Kontrol	0,492	Sedang

Table 4 above shows that students who applied accelerated learning (experimental class) had an average N-gain score of 0.624, while students who received conventional learning (control class) had an average N-gain score of 0.492. This indicates that the improvement in adaptive reasoning skills of students in the experimental class was better or higher than that of the control class. However, to confirm whether the improvement in adaptive reasoning skills of students who applied accelerated learning methods was indeed better than that of students who received conventional learning, further statistical tests need to be conducted.

Based on the results of the normality test, it was concluded that the N-gain scores of the experimental and control classes were normally distributed, and that the N-gain scores for adaptive reasoning ability of students in the experimental and control classes came from a homogeneous variance. A summary of the results of the N-gain homogeneity test at a significance level of $\alpha = 0.05$ can be seen in the following table:

Table 5. N-gain Homogeneity Test

Kelompok	N	F_{hitung}	F_{tabel}	Keputusan
Eksperimen	29	1,501	1,867	H_0 diterima
Kontrol	30			

Based on the results of the table above, $F_{count} = 1.501$ and $F_{table} = 1.867$, it can

be seen that $F_{count} < F_{table}$. The conclusion is that H_0 is accepted and the sample comes from a homogeneous population, which means that the increase in adaptive reasoning ability of students in the experimental class is better than that of students in the control class. Thus, it is proven that the hypothesis stating that the increase in adaptive reasoning ability of students who apply conventional learning is correct. Hypothesis testing with two equal means, using a parametric t-test. A summary of the N-gain hypothesis test results at a significance level of $\alpha = 0.05$ is shown in the following table:

Table 5. N-gain Hypothesis Test Results

Kelompok	Rata-rata	Varians	t_{hitung}	t_{tabel}	Keputusan
Eksperimen	0,624	0,006	5,662	2,002	H_0 ditolak
Kontrol	0,492	0,009			

Based on the N-gain hypothesis test of adaptive reasoning ability in relation and function material, it can be seen that $t_{count} = 5.662 > t_{table} = 2.002$, which means that at a significance level of $\alpha = 0.05$, H_0 is rejected. This means that the average adaptive reasoning ability using the accelerated learning method is greater than the average adaptive reasoning ability using conventional learning, indicating that the adaptive reasoning ability of students using the accelerated learning method is better than that of students using conventional learning. The results of this study are supported by Jaya Dwi Putra's research, which concluded that students who received accelerated learning had better mathematical communication skills than students who received conventional or regular learning (Putra, 2014). Another supporting study was conducted by Edo Bawono, which found that the accelerated learning method is one of the learning methods that can be used in mathematics learning because it can improve mathematical comprehension skills (Bawono, 2015).

Discussion

The results of the study indicate that the application of accelerated learning methods in mathematics education can have a positive impact on improving the active thinking skills of junior high school students. This can be seen from the increase in average pretest to posttest scores and the development of student activity indicators during the learning process.

Significant improvements in the indicators of courage to ask questions, ability to express opinions, and participation in group discussions show that the accelerated method is

able to stimulate students to be more active in the learning process. Students who were previously passive became more motivated to ask questions and respond to the problems given. These findings are in line with constructivist theory, which states that effective learning occurs when students actively construct knowledge through interaction and learning experiences.

The accelerated method emphasizes speed, focus, and a gradual increase in the level of difficulty of the material. This makes students more adept at thinking quickly, organizing information, and making decisions in a relatively short time. Under these conditions, students' active thinking skills are honed more optimally. This study supports previous research findings that challenging and interactive learning methods can improve students' critical and creative thinking skills.

In addition to improving cognitive skills, this study also found changes in students' motivation and learning attitudes. Students felt more challenged and enthusiastic about attending classes because the accelerated method was different from conventional lecture methods. Collaborative activities such as quick discussions made students more involved and responsible for their learning process. This is in line with the opinion that intrinsic motivation can grow if students are given challenges that match their abilities.

Although the results were positive, the implementation of the accelerated method also faced several obstacles. Teachers were required to prepare material that was dense, systematic, and challenging but still easy for students to understand. In addition, not all students had the same thinking speed, so teachers needed to provide additional guidance to students who had difficulties. This shows that the success of the accelerated method is greatly influenced by the readiness of teachers in designing adaptive learning strategies.

Based on the results and findings of the study, it can be concluded that accelerated learning is highly relevant to mathematics lessons in junior high school. This method not only improves students' active thinking skills but also encourages the creation of a more interactive and meaningful learning atmosphere. Thus, the accelerated method can be an alternative learning innovation that supports the achievement of 21st-century educational goals, particularly in training students to have critical, creative, and communicative thinking skills.

CONCLUSION

Based on the discussion, it can be concluded that students whose learning applies accelerated learning methods show significantly better improvement in adaptive reasoning skills compared to students whose learning uses conventional learning methods when viewed as a whole. Based on the results of research and discussion regarding the application of accelerated learning methods in mathematics learning at the junior high school level, several conclusions can be drawn as follows: Accelerated learning methods are effective in improving students' active thinking skills. This is demonstrated by an increase in the average pretest score from 58.2 to 81.4 on the posttest, as well as an increase in the percentage of students in the high category from 21.9% to 71.9%. Students' learning activities have undergone significant changes. Students became more courageous in asking questions, active in discussions, expressing their opinions, and able to relate mathematical concepts to real-world problems. Accelerated learning fosters students' motivation and positive attitude towards mathematics. Students feel more challenged, motivated, and enjoy the learning process that emphasizes speed, independence, and collaboration. The success of this method is greatly influenced by the role of the teacher. Teachers are required to prepare systematic, concise, and challenging material, as well as provide assistance to students with relatively slow thinking abilities. Thus, it can be concluded that the accelerated learning method is a viable alternative innovative learning model for improving the active thinking skills of junior high school students, especially in mathematics.

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