

The Effect of Mathematical Self-Efficacy on High Order Thinking Accelerated Learning Learning Inferentialism Approach

Mulyono
Universitas Negeri Semarang
 Semarang, Indonesia
Mulyono.mat@mail.unnes.ac.id

Yoshida Agung Ramadan
Universitas Negeri Semarang
 Semarang, Indonesia

Masrukan
Universitas Negeri Semarang
 Semarang, Indonesia

Abstract-The purpose of this study was to determine the effect of mathematical self-efficacy on higher-order thinking skills with the accelerated learning model inferentialism approach. The study was conducted using a type of combination research in which the design taken was sequential exploratory. The research subjects were based on the results of the self-efficacy questionnaire which were categorized into three namely subjects for the high, medium and low categories, each chosen 2 subjects who could explain the settlement well. The results showed that mathematical self-efficacy influences students' higher-order thinking skills where subjects with high categories have higher-order thinking skills with good analysis, good evaluation and create new ones well. While the subject is still lacking in solving higher-order thinking skills where the subject is still unable to create something. The subjects with low self-efficacy have higher-order thinking skills who are less able to analyze and create but can evaluate. Then all subjects in learning accelerated learning approach inferentialism with the differences in mathematical self-efficacy, the score of each category for high and medium are the same but subjects with low categories are still.

Keywords: *mathmatics self-efficacy, HOTS, inferentialism*

I. INTRODUCTION

Economic changes, increasingly evolving technology, varied transnational environments, the effects of globalization, all lead to the need for skills and knowledge that must be possessed by students to be able to face the life of the 21st century (Zubaidah, 2016). Therefore, one of the skills and knowledge in dealing with the 21st century is learning mathematics. Mathematics is a basic science that must be possessed by everyone besides mathematics can also develop the ability to think process. Mathematics plays an important role in various sciences and develops the ability to think (Nur & Palobo, 2018) and (Mulyono & Lestari, 2016). Mathematical learning is now implicitly focused on developing thinking skills (Ngilawajan, 2013). This was also confirmed by Jumaisyaroh, et al,

(2015) that problem-based mathematics learning improves thinking skills. Therefore, the competencies that students need to master in learning mathematics to face the 21st century can be developed thinking skills (Fajri, 2017).

The thinking skills referred to in this study are high-level mathematical thinking abilities. Higher-order thinking skills play an important role in teaching and learning activities, as well as educational processes and affect learning abilities, speed, and learning effectiveness (Heong et al., 2011).

So we need a model of learning mathematics to be able to develop high order thinking skills. Success in learning in class is influenced by the use of appropriate learning models (Rochmad & Masrukan, 2016). One of the right models is Accelerated Learning. The accelerated learning model can encourage students to actively learn, master the mathematical concepts taught and optimize student abilities and increase student confidence (Amelia, et al, 2018). Also according to Patchan, et al, (2016) Accelerated Learning can streamline learning time, streamline student learning strategies, provide flexibility in student learning, and increase student participation or involvement in learning. According to Marques (2012) Accelerated Learning can streamline learning time, save costs, students become confident, and absorb more information. Besides, Russel (2011) argues that accelerated learning is defined as the process of adding motor, cognitive and attitudes faster. The accelerated learning model facilitates students to be ready to think, demand activeness, construct information obtained, get more motivation, understand the knowledge built by the students themselves so that the accelerated learning model is expected to be able to develop students' high order thinking skills.

Furthermore, the accelerated learning model with the inferentialism approach will open more opportunities in developing students' high order thinking skills, because inferentialism is interpreting a concept through the representation of reasoning from a conclusion obtained from each thought. According to Peregrin (2012) inferentialism is a belief in meaning by the concept of individual thought, but it can also be

said as a modern representation or a more complex representation. Meanwhile, according to Bakker and Hußmann (2017) explains that inferentialism is to interpret a concept through reasoning or make conclusions based on representation. So that inferentialism is very suitable in learning mathematics and opens opportunities to develop students' high order thinking skills.

Peregrin (2012) inferentialism is interpreted analogically as a language rule to open meaningful spaces that were not previously available such as typical human communication, rational consideration, construct a theory, and others. According to Derry (2017) that when inferentialism is applied to education especially mathematics learning provides ways of thinking about teacher development, pedagogy, and knowledge that provide strong insights on important issues for educational problems. Therefore, inferentialism would be appropriate if combined with the accelerated learning model in opening opportunities to develop students' high order thinking skills.

In addition to students' high order thinking skills and the accelerated learning model the inferentialism approach to achieving educational goals through mathematics learning, Mathematics self-efficacy is also needed. Because Math self-efficacy is one's belief in the ability to solve mathematical problems. According to Ayotola and Adedeji (2009) revealed that mathematical self-efficacy contributes independently to mathematics learning achievement, and can predict solving mathematical problems at a greater level. This means that mathematical self-efficacy in a person affects one's mindset. According to Burnham in Ünlü & Ertekin (2013) that mathematical self-efficacy is one's belief in one's ability to succeed in mathematics. According to Pajares & Miller in Widodo, et al (2018) that mathematical self-efficacy can predict problem-solving, is useful for mathematics, as well as prior experience with mathematics. Widodo et al., (2018) also explained that mathematical self-efficacy is a belief in the ability of mathematics to solve a given problem. Besides being useful in predicting, mathematical self-efficacy also makes learning mathematics effectively. This is confirmed by Chen, et al (2015) that mathematical self-efficacy for students, obtains the benefit of effectiveness in learning mathematics. Therefore, mathematical self-efficacy is needed in mathematics learning. The purpose of this research is to find out whether there is an effect of mathematical self-efficacy on students' high order thinking skills and to describe students' high order thinking skills based on mathematical self-efficacy in accelerated learning approaches inferentialism.

II. METHODS

This research is a combination of research with a descriptive explanatory design. The research

began with a preliminary study and then quantitative data collection and analysis and interpretation of qualitative data.

This research was conducted at SMA Negeri 1 Banyumas with population class XI in the academic year 2019/2020. Subjects as many as 36 people use the accelerated learning model inferentialism approach. Subject taking is based on a mathematical self-efficacy questionnaire of 2 people in each category from a high, medium, and low using the type of purposive sampling.

Quantitative data collection techniques use a high order thinking skills test. Whereas qualitative data collection techniques used questionnaires, interviews, and documentation. Quantitative data analysis using tests of normality, homogeneity, simple regression. Whereas qualitative data analysis uses data reduction, data presentation, drawing conclusions and verification.

III. RESULTS AND DISCUSSION

From the results of the final test of high order thinking skills after learning with accelerated learning, it was found that the final test data of high order thinking skills of students came from populations that were normally distributed with a value of sig = 0.367 and the homogeneity value was 0.55, so the final test data of thinking ability High-level mathematical students have the same variance. The results of simple regression test calculations are presented in table 1.

Tabel 1. Result of Correlation Calculation

$\sum x_i$	$\sum y_i$	$\sum x_i y_i$	n	r	t_{tabel}	t_{hit}
2426,67	2658,33	179694,44	36	0,34	2,03	2,08

Based on table 3 the value of $r = 0.34$ which shows that there is a correlation or relationship between mathematical self-efficacy and high-level students' mathematical thinking abilities. The value of $r = 0.34$ means the relationship or correlation is not too strong so that the effect of mathematical self-efficacy is not too significant on the ability to think mathematically at a higher level. Furthermore, the testing criteria reject H_0 if $t \geq t_{(1-0.5\alpha)}$, with $t_{(1-0.5\alpha)}$ obtained from table t where the degree of freedom is $(n-2)$ while the degree of trust used is 5%. Based on the calculation results obtained $t_{count} = 2.08$ while $t_{table} = 2.03$ so $t_{count} \geq t_{table}$. Therefore, H_0 is rejected, which means that there is an effect of mathematical Self-Efficacy on students' high order thinking skills on the learning model of Accelerated Learning inferentialism approach.

Description of students' high order thinking skills is done based on the final test of students' high order thinking skills. Students' high-level verbal mathematical thinking skills are seen based on the observations of researchers when the Accelerated Learning approach to Inferentialism takes place and

the interview process. Subjects T1 and T2 are students with Higher Self Efficacy Mathematics, subjects S1 and S2 are students with moderate Self Efficacy Mathematics, subjects R1 and R2 are students with low Mathematical Self Efficacy.

Subject T1 is a student with high Self Efficacy Mathematics. The initial test results of high order thinking skills on the subject T1 showed the acquisition of a value of 66.67, while the final test results of the high order thinking skills on the subject T1 showed the acquisition of a value of 87.5. This shows that the Accelerated Learning Inferentialism approach improves the ability of high-level mathematical thinking for T1 subjects. The students' answers are presented in Figure 1 below.

Jenis Kendaraan	Jumlah Karung (makanan ringan)	Jumlah Karung (sabun)
Truk (x)	≤ 14	≤ 14
Colt (y)	8	8
$x+y \geq 28$	≤ 272	≤ 208

Figure 1. Result of Subject T1

The results showed that the subject T1 was able to meet the C6 indicator (Creating) that is able (1) create a new perspective, (2) design a way to solve the problem, and (3) organize the parts into new structures. Subject T1 is able to meet the indicator C5 (evaluating), namely (1) providing an assessment of the solution by using suitable criteria to ensure its effectiveness, (2) conducting a test, (3) accepting or rejecting a statement based on established criteria. Whereas for indicator C4 (analyzing) subjects T1 is able to (1) identify or formulate questions, but are less able to (2) analyze incoming information and structure information into smaller sections to recognize patterns, and (3) recognize and distinguish factors cause and effect of the scenario.

The initial test results of high order thinking skills on the subject T2 showed the acquisition of a value of 66.67, while the final test results of the high order thinking skills on the subject T2 showed the acquisition of a value of 79. This shows that the Accelerated Learning Inferentialism approach improves the ability of high-level mathematical thinking for subjects Q2. The answers to the subjects T2 are presented in Figure 2 below.

Misal Truk = 14
Colt = 8

Jenis Kendar	Jumlah Karung	Jumlah Sabun
Truk (x)	14	14
Colt (y)	8	8
28	≤ 272	≤ 208

Figure 2. Result of Subject T2

The results showed that the subject T2 was able to meet the C6 indicator (Create) that is able (1) create a new perspective, (2) design a way to solve the problem, and (3) organize the parts into new structures. Subject T2 is able to meet the C5 indicator

(evaluating), namely (1) providing an assessment of the solution using suitable criteria to ensure its effectiveness, (2) conducting a test, (3) accepting or rejecting a statement based on established criteria. Whereas for indicator C4 (analyze) T2 subjects are less able (1) identify or formulate questions, and less able in (2) analyzing incoming information and structuring information into smaller sections to recognize patterns, but able (3) to recognize and differentiate causal factors and consequences of the scenario.

The initial test results of high order thinking skills on the subject S1 showed the acquisition value of 73.33, while the results of the final test of the ability of high-level mathematical thinking on the subject S1 showed the acquisition of a value of 66. This shows that the Accelerated Learning Inferentialism approach improves learning does not improve mathematical thinking ability high level for S1 subjects. The S1 subject answers are presented in Figure 3 below.

Jenis kendaraan	Jumlah karung (makanan ringan)	Jumlah Karung
Truk (x)	≤ 14	≤ 14
Colt (y)	8	8
$x+y \geq 28$	≤ 272	≤ 208

Figure 3. Result of Subject S1

The results showed that the subject S1 in indicator C6 (Creating) was less able (1) to make a new perspective, but able (2) to design a way to solve the problem, and be able (3) to organize the parts into new structures. S1 subject is able to meet the C5 indicator (evaluating), namely (1) providing an assessment of the solution using suitable criteria to ensure the effectiveness value, (2) conducting a test, (3) accepting or rejecting a statement based on established criteria. As for the C4 indicator (analyze) S1 subjects are able to (1) identify or formulate questions, and are less able to (2) analyze incoming information and structure information into smaller sections to recognize patterns, but are able (3) to recognize and distinguish factors cause and effect of the scenario.

The initial test results of high order thinking skills on the subject S2 showed the acquisition value of 73.33, while the results of the final test of high order thinking skills on the subject of S2 showed the acquisition of a value of 75. This shows that the Accelerated Learning Inferentialism approach improves the ability of higher-order mathematical thinking for subject S2. The answers to the subject S2 are presented in Figure 4 below.

Jenis kendaraan	Karung	Sabun
Truk (x)	14	14
Colt (y)	8	8
≥ 28	≤ 272	≤ 208

Figure 4. Result of Subject S2

The results showed that the subject S2 was able to meet the C6 indicator (Creating) namely (1) creating a new perspective, (2) designing a way to solve the problem, and (3) organizing parts into new structures. Subject S2 is able to meet the indicator C5 (Evaluate), namely (1) provide an assessment of the solution by using suitable criteria to ensure the value of its effectiveness, (2) conducting a test, (3) accepting or rejecting a statement based on established criteria. As for the C4 indicator (analyze) the subject S2 is able to (1) identify or formulate questions, and are less able to (2) analyze incoming information and structure information into smaller sections to recognize patterns, and less able (3) recognize and distinguish causal factors and consequences of the scenario.

The initial test results of high order thinking skills on the subject of R1 showed the acquisition of a value of 73, while the results of the final test of the ability of high-level mathematical thinking on the subject of R1 showed the acquisition of a value of 71. This shows that the Accelerated Learning Inferentialism approach does not improve the ability of high-level mathematical thinking to subject R1. The answer to subject R1 is injected in Figure 5 below.

misal : truk = x
 colt = y

Jenis kendaraan	Jumlah karung
truk (x)	14
colt (y)	8
20	≤ 272

Figure 5. Result of Subject R1

The results showed that the subject R1 in indicator C6 (Creating) was less able (1) to create a new perspective, but able (2) to design a way to solve the problem, and be able (3) to organize parts into new structures. Subject R1 is able to meet the C5 indicator (evaluating) namely (1) providing an assessment of the solution using suitable criteria to ensure its effectiveness, (2) testing, able (3) accepting or rejecting a statement based on established criteria. Whereas for indicator C4 (analyzing) subject R1 is able to (1) identify or formulate questions, and less able to (2) analyze incoming information and structure information into smaller sections to recognize patterns, and less able (3) recognize and distinguish causal factors and consequences of the scenario.

The initial test results of high order thinking skills on the subject of R2 showed the acquisition of a value of 73, while the results of the final test of the ability of high-level mathematical thinking on the subject of R2 showed the value of 71. This shows that the Accelerated Learning Inferentialism learning approach does not improve the ability of high-level mathematical thinking to subject R1. The answers to the subject R2 are presented in Figure 6 below.

Jenis kendaraan	Jumlah karung makanan ringan	total karung
truk (x)	14	14
colt (y)	8	8
20	≤ 272	≤ 208

Figure 6. Result of Subject R2

The results showed that the subject R2 in indicator C6 (Creating) was less able (1) to make a new perspective, but able (2) to design a way to solve the problem, and be able (3) to organize parts into new structures. Subject R2 is able to meet the C5 indicator (evaluating) namely (1) providing an assessment of the solution by using criteria that are suitable to ensure the value of its effectiveness, (2) conducting a test, being able (3) accepting or rejecting a statement based on established criteria. As for the C4 indicator (analyze), the subject R2 is able to (1) identify or formulate questions, but is less able to (2) analyze incoming information and structure information into smaller sections to recognize patterns, and less able (3) recognize and distinguish causal factors and consequences of the scenario.

According to Jailani and Retnawati (2016) the use of problem-based learning tools is effective in improving students' high order thinking skills. Accelerated Learning learning tools inferentialism approach one of which is worksheet which contains problems that must be worked on by students so Accelerated Learning learning inferentialism approach is also effective in improving students' high order thinking skills even though not all research subjects are effective in improving their high order thinking skills. In addition, according to Sumarni (2015) students who get new learning models gain increased thinking skills. Learning with the accelerated learning model inferentialism approach in this study is included in the model that has not been implemented in teaching and learning activities in the previous class, in teaching and learning activities the teacher implements the Discovery Learning model so that students have increased thinking skills.

According to Kurniati, et al (2016) students with high scores were able to identify the main ideas, had quite good analytical skills, reasonably good evaluation skills and pretty good creative skills by writing down answers and reasons that were quite clear, while students with low scores less able to identify the main idea, poor analytical skills, poor evaluation skills and poor creative abilities. In this study quite in accordance with the statement, but in terms of analyzing is still not appropriate. According to Tambunan and Naibaho (2019) the ability of teachers in teaching and learning activities can affect the formation of students' high-level thinking skills. This is in accordance with the results of research that has been done in which some subjects after learning by using the Accelerated Learning model inferentialism approach have changed values while the ability of the teacher here is interpreted in making

learning tools with good results.

IV. CONCLUSIONS

There is a relation or relationship between mathematical self-efficacy and students' high order thinking skills but the relationship is not very strong. The influence of mathematical Self-Efficacy on students' high order thinking skills on the accelerated learning model inferentialism approach but not too significant. Students with high category mathematical self efficacy have high level mathematical thinking abilities students are able to meet the analyzing indicators that identify, recognize and distinguish the causes and effects of scenarios but are less able to analyze incoming information and process in smaller forms to recognize patterns, whereas indicators evaluate and create students able to fulfill it. Students with mathematical self-efficacy category are having high order thinking skills students are able to analyze and evaluate but for creative indicators students are able to design and organize parts into new structures to solve problems and less able to create new perspectives. Students with low self-efficacy mathematics category have high level mathematical thinking ability, students are able to evaluate, but for indicators to analyze and create, there are deficiencies. This research still needs further research in order to obtain perfect results. This research still has not obtained perfect results due to the limited time factor during learning, children who do not attend lessons, and activities that reduce teaching and learning. Research needs to be done related to students' high order thinking skills with other variables or other learning models in order to obtain a description of the maximum high order thinking skills.

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