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The Influence of Stim-HOTs Learning Model Toward Student's Critical Thinking Ability Reviewed from Academic Ability

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Abstract. Critical thinking abilities are one of the needed thinking skills to face the challenges of the 21st century. This research aims to determine the influence of the Stim-HOTs learning model toward student's critical thinking ability reviewed from the academic ability. Stim-HOTs is a learning model that can stimulate student's higher-order thinking skills, one of which is critical thinking. This research was a quasi-experimental research with posttest only nonequivalent control group design. The population of this research was all of the 11th-grade students of MIPA in SMA Negeri 5 Surakarta academic year 2019/2020. This research, using 2 classes for the sample, one class using Stim-HOTs learning model as experiment class, and the other class using discovery learning model as control class. The data were collected through a critical thinking essay instrument developed by Prihatiningsih that has been through expert validation. The data that has been tested for normality and homogeneity were analyzed by two-way ANOVA to test the hypothesis. The result using ANOVA two ways test shows 1) critical thinking ability based on learning model has a significant value higher than 0,050, 2) critical thinking based on academic ability has a significant value higher than 0,050, and 3) critical thinking based on learning model and academic ability has a significant value lower than 0,050. The research concluded that 1) Stim-HOTs learning model had a significant effect on critical thinking ability, 2) student's academic ability had a significant effect on critical thinking ability, and 3) there is no interaction between Stim-HOTs model and student's academic ability toward critical thinking ability.

Keywords: *Stim-HOTs, critical thinking, academic ability*

INTRODUCTION

The technological development of the 21st century can affect economic, cultural, and political conditions (Rahayu, 2018). Everyone is required to have competence and skill to face the challenge of the 21st century (Bezanilla, Fernández-Nogueira, Poblete, & Galindo-Domínguez, 2019). The role of education is important to create a qualified and competent human resource that capable of facing the era of globalization. 21st-century learning is not just providing information for students, teacher must be capable to create active, critical, analytical, and creative learning in class. This learning can be seen through the implementation of the 2013 curriculum in Indonesia (Sudarisman, 2015). According to Sajidan & Afandi (2017), science learning in the 21st century must be able to

create higher-order thinking processes in students. Critical thinking is one of the higher-order thinking processes required to prepare the student for facing the 21st challenge.

Critical thinking is collaborative thinking that has a purpose such as proving a point, interpreting means, and solving problems (Facione, 2015). According to Husamah, Fatmawati, & Setyawan (2018), the critical thinker will try to make the best conclusion and logical reason in understanding and making complex choices. A student who has a good critical thinking ability will show better academic performance (Changwong, Sukkamart, & Sisan, 2018). Ennis (1985) formulate aspects of the character of critical thinkers such as elementary clarification, basic support, inference, advanced clarification, and strategy and tactics.

The critical thinking skills of the student in Indonesia are still low compared to other countries. Data from PISA in 2018 shows that Indonesia is obtained a score of 396, lower than the average score of the participating country which is 489. This result put Indonesia in rank 70 out of 78 participating countries for the science performance (OECD, 2019). Meanwhile, the observation that was made at SMA Negeri 5 Surakarta shows that the critical thinking of 11th-grade students is still low. The low critical thinking of students is a challenge for educators to apply the right learning model that can stimulate critical thinking. Sajidan & Afandi (2017) formulate some learning models that can stimulate the student to think critically, one of that learning models is Stimulating HOTs (Stim-HOTs). Stim-HOTs is a new inquiry learning model developed from several learning theories. The Stim-HOTS learning model is a model that can improve student's higher-order thinking skills such as critical thinking, problem-solving, argumentative skill, creative thinking skills, and knowledge transfer skills (Sajidan & Afandi, 2017).

Theoretical Background

Critical Thinking

Critical thinking ability is one of the important abilities needed to deal with 21st-century challenges (Swart, 2017). A student who thinks critically will check the truth of the information based on evidence, logical reason, and awareness of bias (Larsson, 2017). Pratama & Pramesti (2018) express their opinion regarding critical thinking which is a process of assessment or decision making with several considerations in mind. Another opinion is expressed by Acharya (2017) regarding thinking critically which is the ability to think in different ways, see the situation from a different perspective, and think outside boundaries which leads to a creative solution. Ennis (2011) defines critical thinking as reasonable and reflective thinking which focused on the decision that is believed or made. Ennis also formulated five aspects which are the criteria of people who think critically. Five aspects of critical thinking are elementary clarification, basic support, inference, advanced clarification, and strategy and tactic (R. H. Ennis, 1985). Each aspect that was formulated by Ennis is still divided into several indicators of critical thinking. This study will only use five indicators include give and analyze arguments (elementary clarification), answer question that requires explanation (elementary clarification), observing and judging observation report (basic support), make deductions and judging the result of deductions (inference), use terms and define the right definitions that match criteria (advanced clarification). The five indicators used in this research are based on the characteristics of reproductive system material.

Stim-HOTs Learning Model

Stimulating higher-order thinking skill (Stim-HOTs) is an inquiry learning model developed by several learning models. This constructivist learning model requires students to be active in class. Stim-HOTs learning model can connect low-level thinking process to higher-order thinking process. This learning model is aimed to stimulate higher-order thinking skills of students through six syntaxes. The syntax of Stim-HOTs is orientation, questioning, exploration, discussion, explanation, and reflection (Afandi, 2018; Sajidan & Afandi, 2017). Stim-HOTS model can stimulate higher order thinking skills student such as problem solving (Rahmawati, Sajidan, Ashadi, Afandi, & Prasetyanti, 2019) and critical thinking (Saputri, Sajidan, Rinanto, Afandi, & Prasetyanti, 2019).

Academic Ability

Academic ability is a student's achievement in receiving and utilizing the knowledge obtained through learning in the classroom (Shoval, Sharir, Arnon, & Tenenbaum, 2018). Students' academic abilities can be seen from the results of learning from assessment, evaluation, and test (Gajda, Karwowski, & Beghetto, 2016). Every student has different academic abilities. The difference in student's academic abilities can be caused by the different bits of intelligence of each student. Students with high academic abilities usually have better critical thinking skills and cognitive learning outcomes than students with low academic abilities (Mamu, 2014; Muhfahroyin, 2009). The academic abilities in this study include high academic (HA), medium academic (MA), and low academic (LA) ability.

Purpose

Based on the background above, this research aims: to ascertain the influence of the Stim-HOTs learning model on student's critical thinking, to ascertain the influence of academic abilities toward student's critical thinking, and to ascertain the interaction between Stim-HOTs learning model and academic ability toward student's critical thinking.

METHOD

Research Design

This research was quasi-experimental research with a post-test-only non-equivalent control group design. Quasi-experiment research aims to find the difference of student's critical thinking between experiment class using stim-HOTs and control class using discovery learning as a commonly used learning model by the teacher in the class. Each student is categorized into three groups: high academic ability, medium academic ability, and low academic ability. The categorization of academic ability is based on the mean and standard deviation of students' final semester assessment (PAS) scores (Sudijono, 2008). In XI MIPA 5 class, a student who gets a score above 86 is included in the high academic, a student who gets a score between 69-86 is included in medium academic, and a student who gets a score below 69 is included in low academic student. Meanwhile, in XI MIPA 4, a student who gets a score above 90 is included in high academic, a student who gets a score between 71-90 is included in medium academic, and a student who gets a score below 71 is included in low academic. The data that has been tested for normality and homogeneity were analyzed by two-way ANOVA to test the hypothesis. H_0 is accepted if sig. value is higher than 0,050 ($sig. > \alpha$) and H_0 is rejected if sig. value is lower than 0,050 ($sig. < \alpha$).

Population and Sample

The population of this research was all of the 11th-grade MIPA students in SMA Negeri 5 Surakarta academic year 2019/2020. Simple random sampling is used to collect the sample of data in this research. Before using simple random sampling, the previous data of the population had been tested by normality and homogeneity tests. The sample of this research is using two classes as experiment class and control class. Stim-HOTs model is used in the experimental class, meanwhile, the control class is applying the discovery learning model as a commonly used learning model in those classes.

Research Instrument

The data result in this research were collected through instrument based on Ennis (1985) critical thinking indicator. The indicator used in this research include give and analyzing arguments (elementary clarification), answer question that requires explanation (elementary clarification), observing and judging observation report (basic support), make deductions and judging the result of deductions (inference), use terms and define the right definitions that match criteria (advanced clarification). The instrument of this research is using a critical thinking essay developed by Prihatiningsih, Zubaidah, & Kusairi (2018) and has been through expert validation. The assessment in

this study used an assessment rubric developed by Zubaidah, Corebima, & Mistianah (2015) with a score range between 0-5. Critical thinking abilities are well developed if the scores are in the 3-5 range.

RESULT AND DISCUSSION

Data Description

The data in this study is taken from experiment class and control class through critical thinking essay test instrument developed by (Prihatiningsih et al., 2018) which has been modified to reproductive system material for high school student. The critical thinking scores in this study have been converted into a scale of 1-100. The result of the critical thinking essay test based on the Stim-HOTs Learning model is presented in table 1 below.

TABLE 1. Scores of Critical Thinking Test Based on Learning Model

Classes	Number of Students	Score
Experiment Class	32	73,75
Control Class	31	63

Table 1 shows there are differences in critical thinking average score between experiment class and control class. The average score of student's critical thinking in the experiment class using Stim-HOTs was 73,75. Meanwhile, the average score in the control class using discovery learning was 63. Based on the data above, the experimental class using the stim-hots learning model obtained a higher average score than the control class.

The data of academic ability is obtained from final assignment (PAS) scores of the student in XI MIPA 4 and XI MIPA 5. Student's academic abilities in this research are categories into three groups: high academic (HA), medium academic (MA), and low academic (LA). The data of student's critical thinking ability based on academic ability can be seen in Table 2 below.

TABLE 2. Scores of Critical Thinking Test Based on Academic Ability

Classes	Number of Students	Score
High Academic Student	13	79,07
Medium Academic Student	37	70,05
Low Academic Student	13	53,53

Table 2 shows there are different scores of student's critical thinking based on academic ability. A student with high academic ability has the highest average score. Meanwhile, the student with medium academic ability has a higher average score than the low academic ability student.

The average score of student's critical thinking abilities based on the learning model and academic ability can be seen in Table 3 below.

TABLE 3. Scores of Critical Thinking Test Based on Learning Model and Academic Ability

Classes	Number of Students	Score
HA Experiment Class	6	80,66
MA Experiment Class	20	74,8
LA Experiment Class	6	63,33
HA Control Class	7	78
MA Control Class	17	64
LA Control Class	7	45

Table 3 above show us that there are differences between critical thinking scores of the student with high academic ability, medium academic ability, and low academic ability on experiment class and control class. The average score of the student with high, medium, and low academic ability in experiment class is higher than control class.

The Result of Two-Ways Anova on Student's Critical Thinking

The analysis result was conducted to the data of student's critical thinking test from both classes. The data have been tested with normality and homogeneity tests as prerequisites before being analyzed using two-way ANOVA. The decision was taken if the value is sig. > α then H0 is accepted and H1 is rejected. It means that there is no significant difference between the two samples. The result of two-ways ANOVA in this research can be seen in Table 4 below.

TABLE 4. Scores of Critical Thinking Test Based on Learning Model and Academic Ability

	Source	Sig.	Criteria	Result
Critical Thinking	Learning Model	0,000	Sig. < 0,050	H0 is rejected, there is an effect
	Academic Ability	0,000	Sig. < 0,050	H0 is rejected, there is an effect
	Model * Academic Ability	0,147	Sig. < 0,050	H0 is Accepted, there is no interaction

According to table 4, the significant value of the learning model and academic ability data is 0,000 or lower than 0,05, the H0 is rejected and the H1 is accepted. It means that there is an influence of the Stim-HOTs learning model on critical thinking and there is an influence of academic ability towards critical thinking. The different result is shown in the interaction of the learning model and academic ability data that has a significant value of 0,147 or higher than 0,050. The result shows H0 is accepted and H1 is rejected, which means there is no interaction between the Stim-HOTs model and academic ability toward critical thinking.

Student's Critical Thinking Based on Learning Model

The average critical thinking score in experiment class using Stim-HOTs learning model is higher than control class using Discovery Learning model. This result shows there is an influence of Stim-HOTs learning model toward critical thinking abilities. This research had a similar result with Saputri et al., (2019) which stated that the Stim-HOTs learning model is effective to improve student's critical thinking skills. The graph of student's average scores in experiment and control class can be seen in figure 1 below.

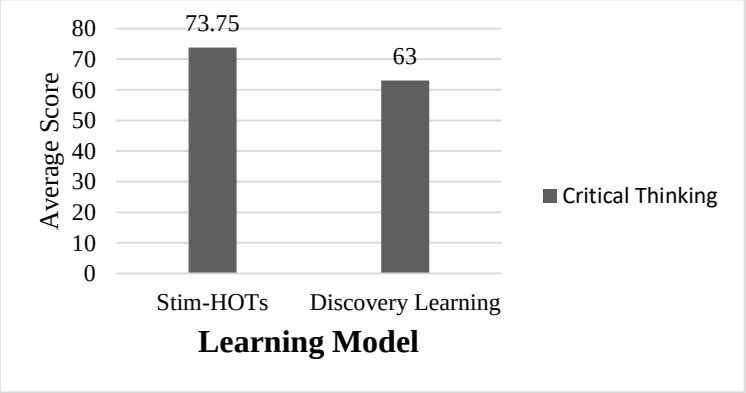

FIGURE 1. Average scores of critical thinking based on the learning model

From figure 1, we can see the difference in student's critical thinking scores in experiment class using Stim-HOTs learning model and control class using Discovery Learning. The average score of the experiment class is higher than the control class. It shows that in experiment class using Stim-HOTs learning model is affected on

student's critical thinking. Student's critical thinking can be trained through six syntaxes of the Stim-HOTs learning model.

The first syntax of the Stim-HOTs learning model is orientation. This stage begins with observations which are followed by investigating the problem from the results of observations. Students are directed to understand various terms, meanings, and frameworks of the material to be studied. Teachers play a role in building schemata through initial knowledge with newly acquired information (Afandi, 2018). This process is based on Piaget's theory which states that new knowledge is built from existing knowledge (Ibda, 2015). Students are also directed to master learning objectives that implement higher-order thinking processes, including critical thinking based on the bloom taxonomic level of thinking theory (Anderson & Krathwohl, 2001; Krathwohl, 2002). This syntax is developed by Piaget's theory and Bloom's theory (Afandi, 2018).

The second syntax of the Stim-HOTS learning model is Questioning. The questioning stage is developed by Dewey's theory of inventive thinking and the Socratic dialogue method (Afandi, 2018). Students formulate problems that were previously found through observation at the orientation stage. The teacher also provides questions about cases around which can stimulate the scientific thought processes of students, such as the Socratic question. Students' critical thinking skills can be stimulated through Socratic questions (Paul & Elder, 2008; Rizkasanti, Susilana, & Dewi, 2018). Educators also direct students to understand the concept of the problem and make hypotheses or alternative solutions to these problems based on concepts that have been understood (Pedaste et al., 2015). Students are expected to be able to think inventively in formulating solutions to a problem so that they can produce creative and innovative solutions. Creative and innovative ideas can be generated through the observations and learning experiences of students (Rahzianta & Hidayat, 2016).

The next syntax is exploration, which is developed by Bruner's theory of learning discoveries and Dewey's theory of reflective thinking (Afandi, 2018). Students carry out exploration activities to gather information from reliable and relevant sources. During exploration, the inquiry process takes place with an emphasis on student-centered learning. This activity is following Bruner's theory where students carry out learning activities such as laboratory activities, literature studies, and observations that can develop their initial knowledge into new knowledge (Dahar, 2011). Syntax exploration is supported by Dewey's theory where students will consider the correctness of information obtained from various sources (Dewey, 1933).

Students are directed to conduct discussions on the discussion syntax after the exploration stage is completed. Discussions were conducted in groups regarding information obtained by each individual from the exploration stage. The information that has been combined by each individual is then discussed into group data and written into student worksheets. The discussion syntax implements Vygotsky's theory of social constructivism. The theory states that a person's cognitive development results from interactions with the environment and the surrounding community (I.G.A. Lokita Purnamika Utami, 2016).

Students then explain the information results of the group discussion on syntax explanation. The data generated from group discussions were conveyed to other groups through presentations. At this stage, the group that did not present could provide comments or comments to the presenter group. Syntax explanation was developed through Dewey's learning theory of reflective thinking (Sajidan & Afandi, 2017). The student will consider the correctness of information from various sources during the discussion syntax which will then form group conclusions. The group conclusions conveyed through the presentation answered the problems previously proposed.

The last syntax in the Stim-HOTS learning model is reflection. This stage implements Marzano & Pickering (2006) theory of habits of mind and Dewey (1933) about reflective thinking as the basis for the development of the reflection syntax. The reflection syntax is considered to be able to train students' self-regulation. Students are directed to be able to evaluate the learning process so that they can find out what learning is following their characteristics. Students are also directed to activities to cultivate morals, scientific attitudes, and appreciation of divine values (Afandi, 2018).

This result is also affected for each critical thinking indicator examine in this study. This study only examines five indicators of the 12 indicators formulated by Ennis (1985). These indicators include observing and considering the results of observations (basic support), answering questions that require explanation (elementary clarification), providing and analyzing arguments (elementary clarification), making deductions and assessing deductions (inference), and using terms and determining definitions according to the right criteria (advanced clarification). The result of each indicator can be seen in figure 2 below.

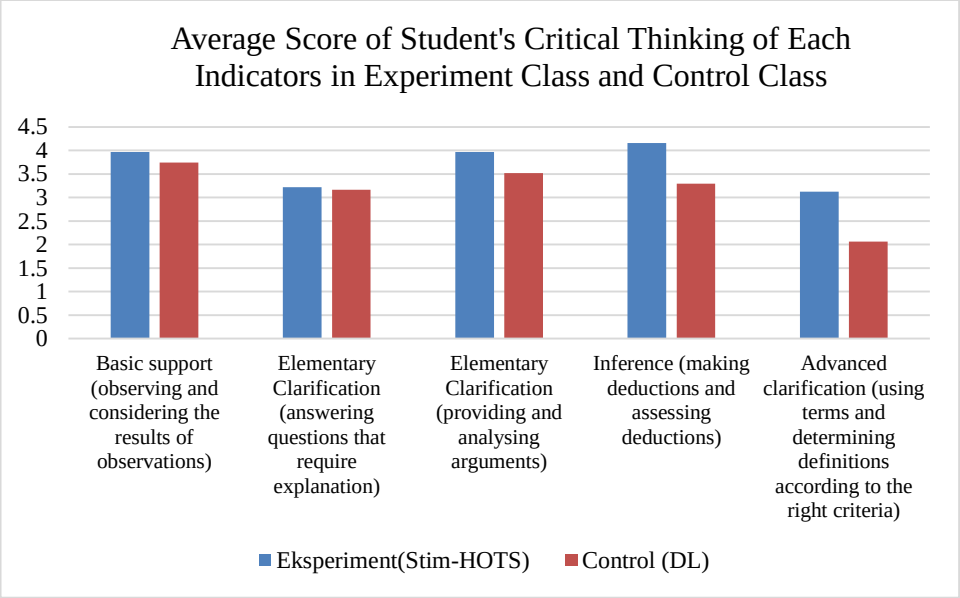

FIGURE 2. Average scores for each indicator of critical thinking based on the learning model

Based on figure 2, there is a difference in the average score of critical thinking skills for the five indicators studied in the experiment and control class. The indicators of determining the definition according to the right criteria in the control class are not well developed. This is indicated by the acquisition of an average score for this indicator in the 0-2 score range, which is 2.065 (Zubaidah et al., 2015). Meanwhile, the other four indicators show that students' critical thinking skills are developing well with the acquisition of an average score in the 3-5 range. The five indicators develop better in the experimental class that applies the Stim-HOTS learning model. The average value of students' critical thinking abilities on all the indicators studied in the experimental class was in the score range 3-5, which means that critical thinking skills developed well. The results of this study indicate that the Stim-HOTS learning model can stimulate the five indicators of critical thinking skills.

Observing and considering the result of observation (basic support)

There are differences in the value of critical thinking skills on the indicators of observing and considering the results of observations (basic support). The average critical thinking ability tends to be higher in the experimental class using the Stim-HOTS model. This indicator is stimulated in orientation and exploration learning syntax. The orientation stage starts from observation activities carried out by students on a problem. Learners record things needed during the observation. Observation plays a role in fostering the curiosity of students about the material to be studied (Arsal, 2017). Students also formulate hypotheses from these problems through the provision of their initial knowledge. Someone with good critical thinking will reduce presumptions by gathering evidence that corroborates these presumptions (R. H. Ennis, 2011). These criteria can be trained through the syntax exploration stage where the teacher will direct students to activities looking for information to answer problems and prove hypotheses from previous observation data.

An answering question that required explanation

The average value of the critical thinking ability of the indicators in answering questions that require explanation (basic clarification) in the experimental class is higher than the control class. This indicator can use the Stim-HOTS learning model in questioning, exploration, and discussion syntax. In questioning syntax, students make problem formulations from the results of the examination. The teacher will also ask students some questions related to the problems that require a scientific answer. Syntax questioning can stimulate scientific thinking so that students understand the concept of the problem and make hypotheses (Saputri et al., 2019). In the exploration stage, students

are directed to seek information from reliable sources through literature studies that are used to answer existing questions. The information obtained is then discussed and analyzed with group members through discussion syntax. Students will analyze and discuss related information from various sources that produce answers to the questioning syntax questions

Giving and analyzing the argument

The average score of students using the Stim-HOTS learning model as an experiment class is higher than the control class. This indicator can be stimulated through the Stim-HOTS learning model in questioning, exploration, and discussion syntax. R. Ennis (2011) said someone with a good critical thinker can identify the conclusion, reasons, simple assumption, and deviations. In the questioning syntax, students formulate several questions that are directed towards understanding the concept from the results of identifying and analyzing the problem. The teacher also plays a role in asking questions in the form of problems that can stimulate thinking skills, such as Socratic questions (Makhene, 2019). The exploration syntax can also stimulate the student to think critically. At this stage, students are directed to explore information from reliable sources through literature studies. Students will consider the correctness of the information obtained, this is one of the characteristics of a good critical thinker (R. Ennis, 2011). The information obtained from the exploration syntax is then discussed and analyzed with the group at the discussion stage. In the discussion syntax, students are trained to identify the answers of each group member by looking at the assumptions and theories used. This stage can stimulate students to be able to identify reasons and deviations from information on each group member.

Making deductions and judging the result of deductions (inference)

The average score of critical thinking skills in the experimental class using the Stim-HOTS learning model tends to be higher than the control class. This indicator can be trained using the Stim-HOTS learning model in the discussion and explanation syntax. In the discussion stage, the student will analyze information, then the results are evaluated with group members (Schunk, 2012). Information obtained by each member of the group can support or conflict with each other (Musfiqon & Nurdiansyah, 2015). The results of the discussion and analysis resulted in the group's conclusion that would be presented at the explanation stage. In the explanation stage, the results of the discussion and analysis of information are concluded so that they can answer and explain the problems of the topic being studied.

Use terms and define the right definitions that match criteria (advanced clarification)

This indicator can be stimulated in the syntax of orientation, exploration, and discussion. Students are directed to understand various basic terms, meanings, and basic material frameworks in the orientation syntax as a basis for training higher-order thinking skills (Afandi, 2018). In the exploration syntax, students will study literature that aims to develop old knowledge into new knowledge (Dahar, 2011). This process can stimulate the ability to determine the definition according to the right criteria because students will consider information obtained from various sources (Dewey, 1933). The next stage is to discuss the information sought through the discussion syntax. In the discussion stage, students and their groups discuss and analyze information obtained from each individual during the exploration stage (Afandi, 2018). The results of the discussion are used to determine the most appropriate answer.

The result of this research shows that student’s critical thinking is affected and more developed in experiment class using Stim-HOTs learning model rather than control class using discovery learning, but it doesn't mean discovery learning did not contribute to student's critical thinking. The Discovery learning model is an inquiry learning model which stimulates the student to be active in class by finding and investigating the concept of the material through five syntaxes (Veermans, 2007). Discovery learning can also effective to improve student’s critical thinking (Rudibyani, 2018; Safa’at, Turmudi, & Suhendra, 2019). These results could be due to the syntax of stim-HOTs and discovery learning. The orientation syntax of stim-HOTs is directed to understand basic terms, meanings, and basic material frameworks to stimulates student's higher-order thinking (Afandi, 2018). This syntax can stimulate critical thinking skills better on indicator use terms and define the right definitions that match criteria. Stim-HOTs learning models also have a questioning syntax that discovery learning doesn't have. This syntax provides questions by the teacher about cases around that match the material. The question on this syntax can

stimulate the student to think more critically, so it may cause a result for better critical thinking by using stim-HOTs rather than discovery learning.

Student's Critical Thinking Based on Academic Ability

The results of the two-way ANOVA calculation on the critical thinking ability scores of a high, medium, and low academic students showed a significant difference. The results of the analysis indicate that academic ability affects students' critical thinking skills. Students in the high academic category have the highest average value of critical thinking skills. The average score of students with moderate academic ability is higher than students with low academic ability. The graph of the average score of students' critical thinking skills based on academic ability can be seen in Figure 3 below.

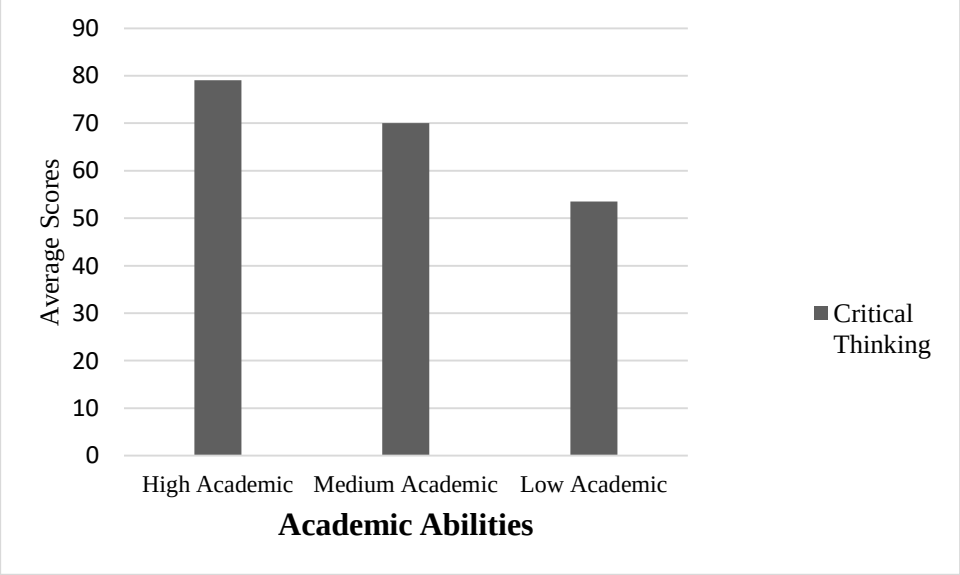

FIGURE 3. Average scores of critical thinking based on academic abilities

From figure 3, we can see the difference critical thinking score of the student with the high academic ability (HA), middle academic ability (MA), and low academic ability (LA). The average score of HA's critical thinking abilities is the highest among other academic categories, which is 79. The average score of MA's critical thinking ability is 70, higher than the LA category, which is 53.

The results of the analysis are in line with the results of research conducted by Mamu (2014), which is a significant influence between critical thinking skills and academic abilities. Abbasi & Izadpanah (2018) is also stated that academic ability can affect students' critical thinking skills. Increased critical thinking skills can improve academic achievement. Students with higher academic abilities tend to have the potential to have better critical thinking skills (Changwong et al., 2018). The average score of the critical thinking ability for each critical thinking indicator based on academic abilities also showed the same results. Graphs of the average value of the high, medium, and low critical thinking skills of academic students on each indicator studied can be seen in Figure 4 below.

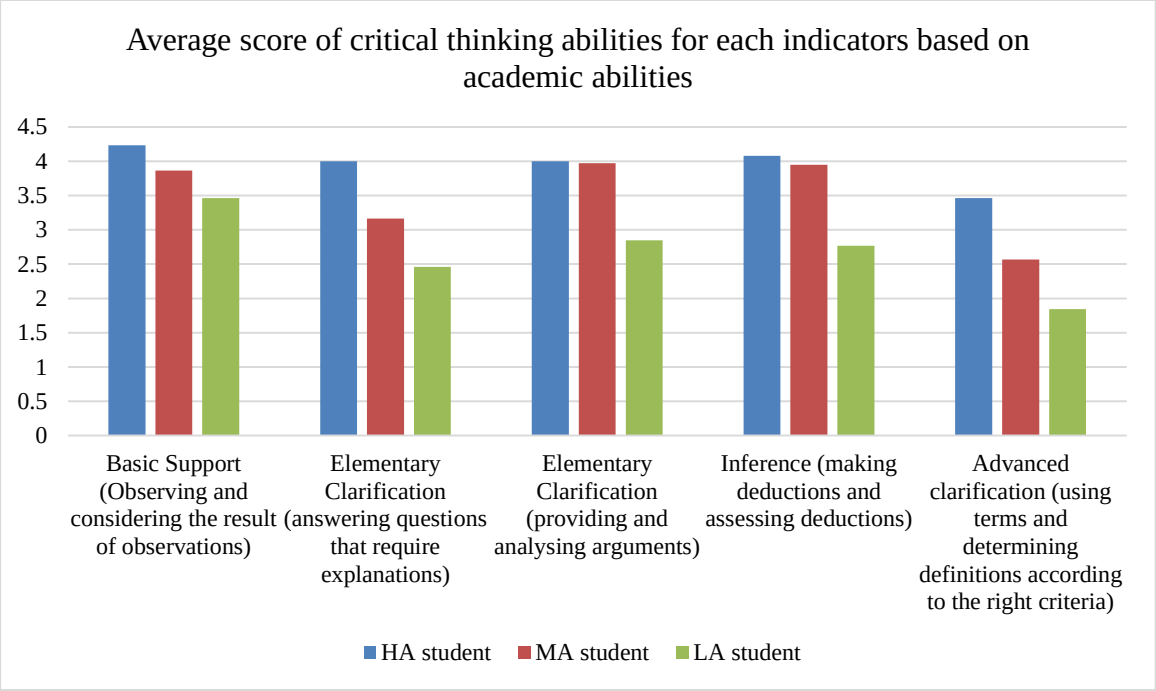

FIGURE 4. Average scores of critical thinking based on academic abilities for each indicator

The data in Figure 4 shows that the critical thinking skills of the five indicators tested on high academic students get the highest score. Students with middle academics are getting higher scores in all categories than students with low academics. The results of this analysis are in line with Mamu's (2014) research which states that students with high academic abilities are more likely to have better critical thinking skills.

The interaction between learning model and academic abilities toward critical thinking abilities

The average value of students' critical thinking skills based on the learning model and academic abilities shows a difference. The graph of the average value of students' critical thinking skills based on the learning model and academic ability can be seen in Figure 5 below.

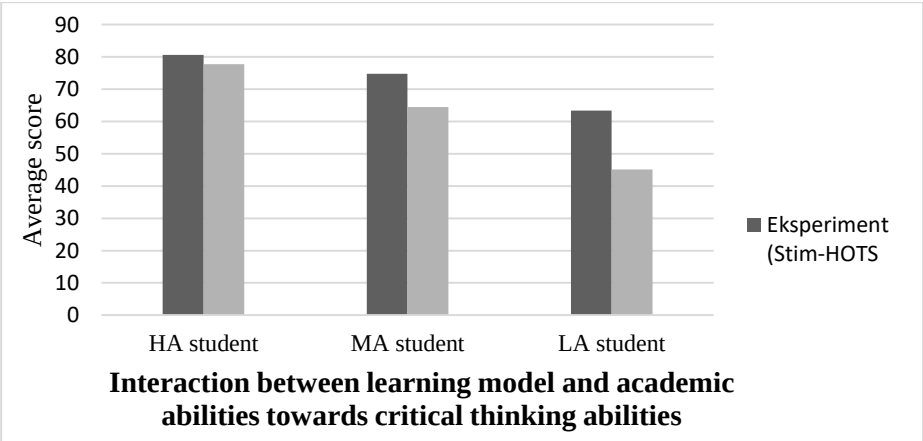

FIGURE 5. Critical Thinking of student based on learning model and academic abilities

Based on figure 5, there is a significant difference between the critical thinking ability scores in the academic ability category. This difference in average value is in line with the research of Abbasi & Izadpanah (2018) which states that academic ability affects students' critical thinking skills. Students in the upper academic ability category in both classes obtained the highest average score. Students in the medium academic ability category from both classes obtained a higher average score than students in the low academic ability category. These results are also following Mamu (2014) which students with higher academic abilities tend to have higher potential to have better critical thinking skills.

The difference in the average scores of the three categories in the Stim-HOTS and Discovery Learning classes is due to the different treatment of the learning model in the two classes. The average scores of critical thinking skills of students in the Stim-HOTS class in the upper, medium, and lower academic categories is higher than students in the Discovery Learning class. The results showed that the Stim-HOTS learning model proved influential in stimulating students' critical thinking skills. These results are in line with the research (Saputri et al., 2019) that the Stim-HOTS learning model affects students' critical thinking skills.

The application of learning models in the classroom and the academic abilities of students can sometimes interact with each other. Interaction is a reciprocal relationship, in this study the variables of learning models and academic abilities influence each other. In the results of this study, there was no interaction between the two variables of the learning model and academic ability on students' critical thinking skills. These results are shown through the two-way ANOVA test which shows the sig value. less than the value 0.050. The interaction between learning models and academic abilities can be seen in Figure 6 below.

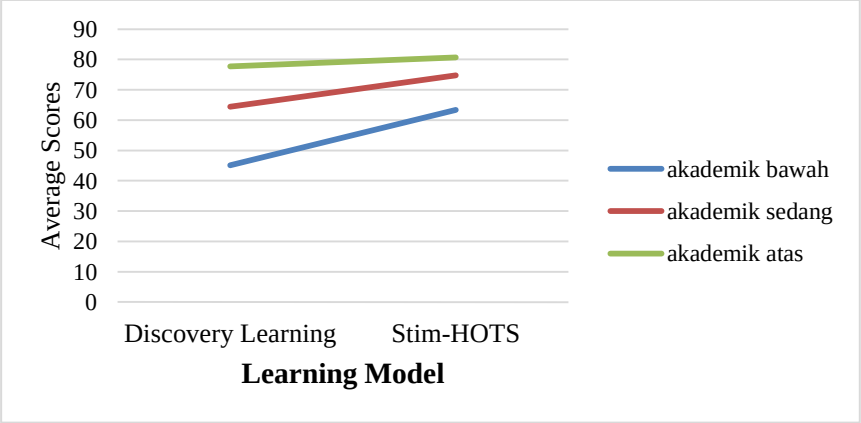

FIGURE 6. Interaction between learning model and academic abilities toward student's critical thinking

The results of the analysis shown in Figure 4.4 do not show any intersection of line patterns between students in the high, medium, and low academic ability categories. This graph shows that there is no interaction between the learning model used and the academic ability of students on critical thinking skills. The two variables, namely the learning model and academic ability, both affect the critical thinking skills of students, but both are not interrelated in influencing students' critical thinking skills. Critical thinking skills on the five indicators based on academic ability and learning models also show differences. The graph of the average value of critical thinking skills for each indicator tested based on academic ability in the experimental and control classes can be seen in Figure 7 below.

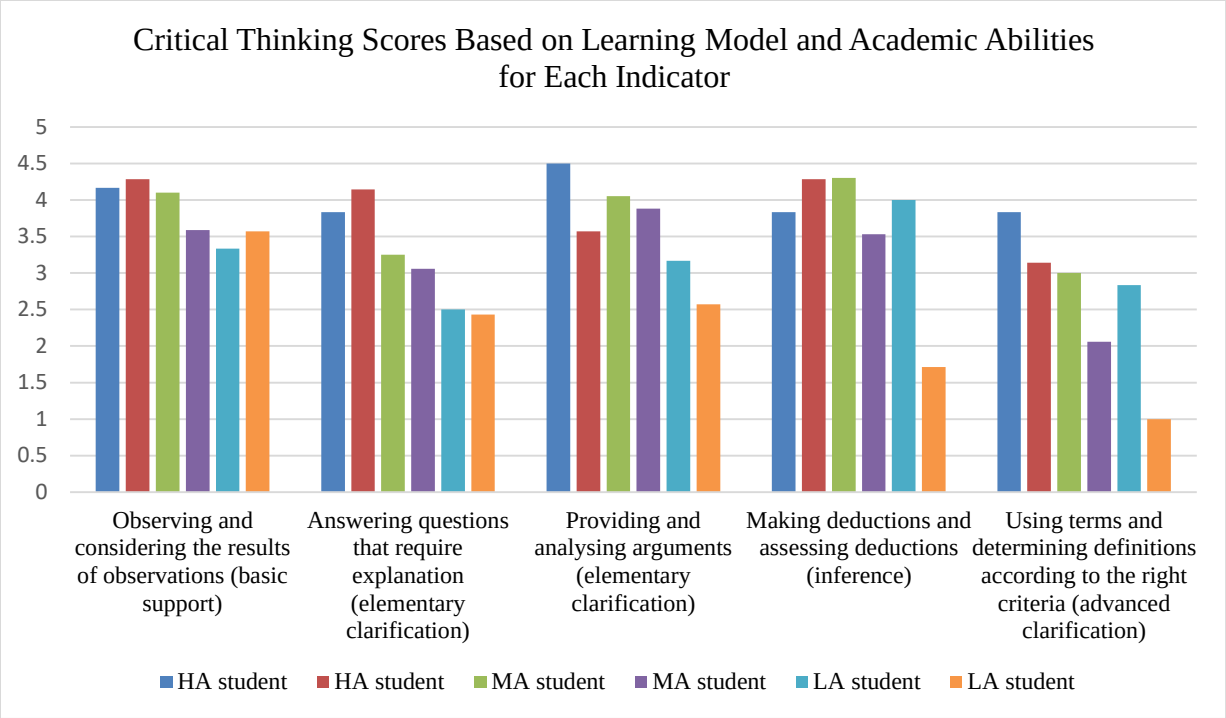

FIGURE 6. Critical Thinking of student based on learning model and academic abilities for each indicator

Based on figure 6 above, there are differences for each indicator of critical thinking scores. The indicator determines the definition according to the right criteria in the experimental class obtaining higher scores than the control class in all categories of academic ability. It can be caused by the orientation syntax of stim-HOTs directed students to understand various basic terms, meanings, and basic material frameworks. The indicator of giving and analyzing the arguments of the experimental class also obtained a higher average score than the control class in all categories of academic ability. It can be caused by questioning syntax in stim-HOTs can stimulate better critical thinking. The results of these two indicators are in line with the research of Saputri et al., (2019) which states that the Stim-HOTS learning model affects critical thinking skills. The Stim-HOTS learning model can improve critical thinking skills. This result is also in line with the research of Abbasi & Izadpanah (2018) which states that academic ability affects students' critical thinking skills. Students who have high academic abilities tend to have better critical thinking skills (Changwong et al., 2018).

Different results are shown in the indicators of providing and analyzing arguments in the control class. The average value of critical thinking skills shows results that are not following theory. The scores of students with moderate academic abilities are higher than students with high academic abilities. This can be due to other factors that affect students' critical thinking skills such as psychological character, intelligence, and learning environment (Budsankom, Sawangboon, Damrongpanit, & Chuensirimongkol3, 2015). This factor allows the ability to think critically in students with moderate academics better than students with high academic abilities.

The indicator of observing and considering the results of observations in the high and low academic ability categories in the control class using Discovery Learning obtained higher scores than the experimental class using stim-HOTs. Whereas for students with moderate academic ability, the average score of the experimental class was higher than the control class. These results can be caused by this indicator is stimulated by the observation and exploration stage of information which is also found in the discovery learning syntax. Indicators answering questions that require explanation to students with moderate and low academic ability in the experimental class obtain a higher average score than the control class. Whereas in the high academic ability category, the control class obtained a higher score than the experimental class.

The acquisition of the indicator value makes deductions and assesses the deduction of students with moderate and low academic ability in the experimental class higher than the control class. Different results are found in the

category of students with high academic abilities. In this category, the control class obtained a higher average value than the experimental class. Students with moderate and low academic abilities in the experimental class received higher scores than students with high academic abilities in the experimental class. The three indicators above show that there are differences in the results of the analysis with the theory of the effect of academic ability and learning models based on critical thinking skills. This difference can be due to other factors that can affect critical thinking skills such as psychological character, intelligence, and the learning environment (Budsankom et al., 2015). Students besides that also have their way of solving the problems they face (Herlina & Suwatno, 2018).

CONCLUSION

Based on the result of the ANOVA test and data analysis we can conclude student's critical thinking is more developed using the stim-HOTs learning model rather than the discovery learning model on limited indicators. The experiment class using the Stim-HOTs learning model shows a higher score in the critical thinking test than the control class using discovery learning. Critical thinking is also affected by student's academic ability. The student with high academic ability will show a higher score than the student with low academic abilities. Both Stim-HOTs and student's academic ability are affected by students' critical thinking, but there is no interaction between these two variables.

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