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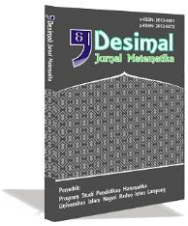

Mathematical critical thinking ability based on self-concept in discovery learning model assisted by ispring suite

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ABSTRACT

Students' cognitive abilities were influenced by several affective abilities, one of them was self-concept. Critical thinking ability is an important ability in learning mathematics. The purpose of this research was to describe mathematical critical thinking skills based on self-concept in the discovery learning model assisted by iSpring Suite. This research used a qualitative method. The research subjects were grouped based on self-concept category, where each category is chosen by two students to analyze their mathematical critical thinking skills. This research collects data by using mathematical critical thinking skills tests, self-concept questionnaires, interviews, observation, and documentation. Data validity used the triangulation technique. Data analysis techniques were carried out by data collection, data reduction, data display, and verification. The results showed that students with a high self-concept category were able to fulfill every indicator at the steps of clarification, assessment, conclusion, and strategy. The medium self-concept category was able to fulfill the indicators during the clarification and assessment steps. Meanwhile, the low self-concept category only fulfills the indicators at the clarification step.

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INTRODUCTION

In the 21st century, mathematics learning emphasizes the importance of developing 4C skills including creative thinking, critical thinking, collaboration, and communication. Critical thinking is one of the 4 competencies that students need to have. In the education sector, critical thinking habits can be developed in mathematics learning schools and universities.

According to Rochmad et al. (2018), critical thinking is a mental activity in studying and analyzing, evaluating certain problems using logic, being systematic, reflective, and focusing on how to get problem solutions. Critical thinking skills are an effective way to improve students' understanding of mathematical concepts because these abilities help concepts in managing, analyzing, imagining, and presenting data logistically and systematically (Chukwuyenum, 2013, as cited in Isti et al., 2017). Amir (2015)

revealed that by thinking critically someone can provide a solution to the problem and the solution is rational. Therefore, the ability to think critically is one of the most important mathematical abilities in solving problems and needs to be developed in learning mathematics.

But in reality, the quality of education in Indonesia is still not optimal. Indonesia is ranked 74th out of 79 nations according to PISA (Program for International Student Assessment) data from 2018. In the Mathematics category, Indonesia scored 379 while the average OECD (Organization for Economic Co-Operation and Development) score was 489 (OECD, 2019). In TIMSS (2015), Indonesia was ranked 46th out of 51 countries. The low results of PISA and TIMSS are caused because students are not used to solving math problems that require critical thinking skills (Nursyahidah & Albab, 2017). The ability and understanding of students' concepts are also still classified as very weak (Gunur et al., 2019). Another research states that students' critical thinking skills in Indonesia are still low because during the teaching and learning process they are still teacher-centered, which prevents students from actively participating in the learning process (Mulyanto et al., 2018; Widyatiningtyas et al., 2015).

Realizing the importance of mathematical critical thinking skills, teachers need to seek innovations in learning that can provide opportunities and encourage students to practice critical thinking skills. With the discovery learning model, students can develop concepts based on direct experience and be actively involved in building knowledge (Afriyanti et al., 2018). In addition, to create effective learning and motivate students' enthusiasm for learning, there is a need for a learning media that utilizes technology, one of which is the iSpring Suite learning media. Cahyanti et al., (2019) define the iSpring Suite as an animation program that can convert presentation files into flash and SCORM formats, which are forms commonly used in e-learning or LMS learning that can help students independently. Tani & Ekawati (2017) revealed that the iSpring Suite media can be used for online and offline learning purposes. With the iSpring Suite media, it can make it easier for teachers to deliver learning materials so that students are more conducive, focused, and easy to understand learning materials (Ramadhani et al., 2019). Here are some pictures of the iSpring Suite in this research, shown in Figure 1 and Figure 2.

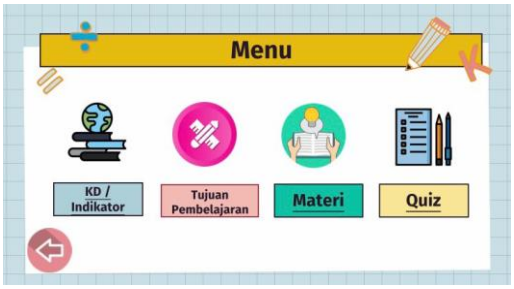

Figure 1. iSpring Suite Menu

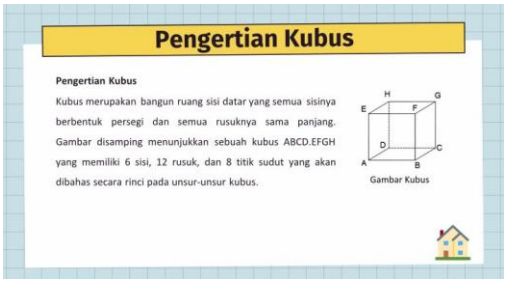

Figure 2. iSpring Suite Learning Materials

In addition to designing strategies in the learning process, teachers must also pay attention to students' affective abilities in learning mathematics, one of which is self-concept. Hurlock (1978) defines self-concept as a person's picture of himself which includes psychological, physical, social, emotional, aspirations, and achievements that have been achieved. Self-concept is very necessary for students because it helps them to be more responsible and optimistic in solving a challenging problem, and influences each other to have a positive view of mathematics (Pertiwi et al., 2018). Self-

concepts are divided into two categories, namely positive and negative self-concepts.

According to Susilawati et al., (2020) individuals who have a positive self-concept will cultivate attitudes such as self-confidence, self-esteem, and the ability to see themselves realistically. Conversely, a negative self-concept will describe insecurity, fear, and worry. The results of research by Nurmin et al. (2021) stated that there were differences in students' critical thinking skills based on high, medium, and low self-concept categories. Students with a high self-concept category have the best critical thinking skills, namely being able to fulfill all critical thinking indicators. The statement is relevant to Ayodele (2011) who reveals that students who have a positive self-concept will have good mathematics learning achievements.

Existing studies have not shown the relationship between mathematical critical thinking skills and self-concept in the iSpring Suite assisted discovery learning model. On the other hand, the discovery learning model assisted by the iSpring Suite is realistic to be applied to mathematics learning in junior high school. Therefore, this study aims to describe students' mathematical critical thinking skills in terms of self-concept in the iSpring Suite assisted discovery learning model.

METHOD

This research used a qualitative method. According to Creswell (2016), qualitative research is a type of research that focuses on understanding the significance of several individuals or groups of people originating from social problems. This research was conducted at SMP N 1 Kedung, Jepara Regency for the academic year 2021/2022. The subjects in this study were 6 students from 30 students of class VIII C grouped by self-concept category. Where the 6 students were taken each 2 students from the high, medium, and low self-concept categories to analyze their mathematical critical thinking skills.

Data collection in this research is by testing mathematical critical thinking skills, self-concept questionnaires, documentation, observations, and interviews. The data obtained were analyzed based on the adaptation of Miles and Huberman (Sari et al., 2020) namely data collection, data reduction, data display, and verification. Meanwhile, to check the validity of the data using triangulation techniques. According to Moleong (2014) triangulation is a method for validating data that compares the data to something else outside the data for verification or comparison. The triangulation used in this research is source triangulation and method triangulation. This study would show the flowchart method, presented in Figure 3.

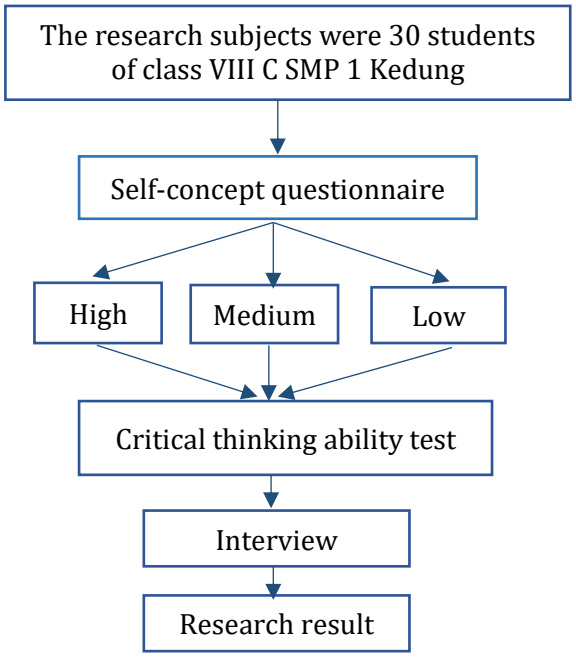

Figure 3. Flowchart Method

Figure 3 shows the flowchart of this research method. For self-concept, the questionnaire is compiled based on aspects and indicators according to Fennema & Sherman (1976) in Table 1.

Table 1. *Self-concept* Indicator

No	Aspects of *Self-concept*	Indicator
1.	*The attitude toward success in mathematics*	Can receive compliments without pretending to be humble. Can receive awards without feeling guilty.
2.	*The teacher*	Looking at the attitude of the teacher during the teaching and learning process includes the attitude and confidence of the teacher in conditioning students during the teaching and learning process.
3.	*The confidence in learning mathematics*	Confidence in following the steps of the mathematics learning process, such as when discussing and presenting the results of the discussion.
4.	*The mathematics anxiety*	Have confidence in his ability to solve problems and solve mathematical problems.
5.	*The effectiveness of motivation in mathematics*	Have high motivation in learning mathematics. Have high motivation in solving math problems.
6.	*The mathematics usefulness*	Convinced that mathematics is useful in every daily activity. Convinced that mathematics is useful in his life now and in the future.

RESULTS AND DISCUSSION

Based on a self-concept questionnaire that has been done by 30 students of class VIII C of SMP N 1 Kedung, each is categorized based on high, medium, and low self-concepts. The following are the results of student self-concept categorization.

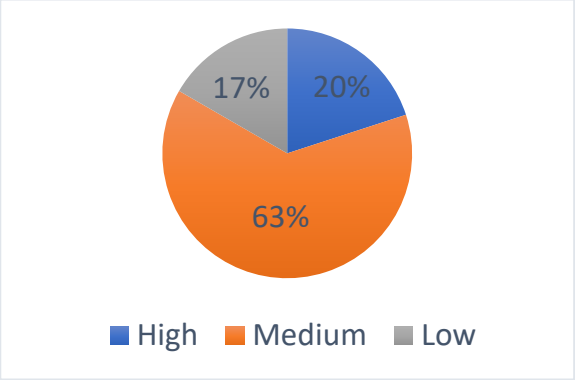

Figure 4. Category of Students based on Self-concept

Analysis of Students' Mathematical Critical Thinking Ability Viewed from the High Self-Concept Category

Students with a high self-concept category at the indicator clarification step, propose mathematical problems to be discussed, can write down the information contained in the problems, and formulate problem questions completely and correctly. As well as being able to explain in their language which means students can understand the questions well. At the assessment step with indicators proposing logical reasons in the form of concepts/ideas as valid and relevant evidence, students can use facts to be applied to concepts or formulas correctly and use evidence, meaning that high self-concept students can understand the concept of building cubes and blocks with appropriate. The conclusion step with indicators concludes the relationship between ideas to solve mathematical problems, students can write down the steps of work based on facts coherently and continuously. At the strategy step with indicators taking action in the form of solving mathematical problems, students with high self-concept categories can provide detailed answers and complete calculations correctly. This is indicated by the results of student work below, it appears that students can carry out settlement strategies appropriately and are also able to write conclusions at the end of completion.

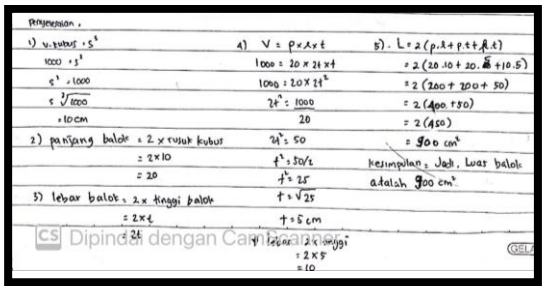

Figure 5. High Self-concept Student Work

Based on the results of the analysis of Figure 5, it was found that students with a high self-concept category had good mathematical critical thinking skills. Students can write the $V. Cuboid = p \times l \times t$ in the first step to find the volume of the bath, then find the time it takes for the tub to be filled with the formula t=v/t. Overall, students in the high self-concept category were able to fulfill all the indicators, it's just that on the indicator of taking action in the form of solving mathematical problems there were several parts of the strategy that were not complete.

Students with a high self-concept category have a sense of optimism in working on the questions given and do not give up easily when faced with problems. Students are also actively involved and able to interact with teachers and other students. This is consistent with the findings of Sadikin et al. (2016), who stated that individuals who have high self-concepts will feel confident in their condition and have positive expectations for the learning process, and have a positive assessment of mathematics and the learning process. Muyana (2017) also argues that students with a high self-concept category have the spirit to move forward and excel, so students with high self-concepts can contribute to their academic achievement and persistence in achieving goals.

Analysis of Students' Mathematical Critical Thinking Ability Viewed from Medium Self-concept Category

Students with a medium self-concept category, at the indicator clarification step, propose mathematical problems for discussion and can write down the information contained in them completely and correctly, meaning that students can understand the questions well. At the assessment step with indicators, proposing logical reasons in the form of concepts/ideas as valid and relevant evidence, students can use facts to be applied to concepts or formulas completely and correctly, even though there are still certain flaws caused by inaccurately written formulas. The conclusion step with indicators concludes the relationship between ideas to solve mathematical problems, students with a medium self-concept are less able to write down the steps of working coherently and continuously. Because in some questions students are incomplete in writing and must be provoked first to explain the process of the steps they are looking for. So that will affect the next calculation. In the strategy step with indicators of taking action in the form of solving mathematical problems, students are less able to complete calculations correctly. Because some questions are less thorough in writing the strategies that are used correctly and there are errors in the calculations that result in not being able to find the right final result. This is shown by the results of the student's self-concept work below.

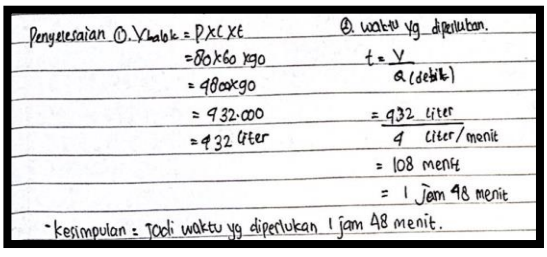

Figure 6. Medium Self-concept Student Work

Mathematical critical thinking ability shown in Figure 6, shows that students in the self-concept category are less able to fulfill all indicators. In Figure 3 students can write $V = s^3$, to find the length of the

edge of the cube, then the next step is to write V= p x l x t to find the height of the cuboid. However, when looking for the surface area of a block, students were less careful in doing calculations so the final result was wrong. Overall, students are only able to fulfill the indicators of proposing mathematical problems for discussion and indicators of proposing logical reasons in the form of concepts/ideas as valid and relevant evidence, while the indicators conclude the relationship between ideas students are less able to fulfill. There are obstacles when taking action in the form of solving mathematical problems so it has an impact on difficulties in connecting problems to obtain the right solution.

Analysis of Students' Mathematical Critical Thinking Ability Viewed from Low Self-concept Category

Students with a low self-concept category at the clarification step with indicators suggesting mathematical problems to be discussed can write down the information contained in the problems and formulate problem questions completely and correctly. In addition, he can explain the problem in his language even though there are some shortcomings and the language used is not quite right. But overall able to answer well during the interview. At the assessment step with indicators, propose logical reasons in the form of concepts/ideas as valid and relevant evidence, students are less able to use facts to be applied in concepts or formulas completely and correctly. This is because students are still less able to observe the information on the problem and lack understanding of the concept so errors occur in the calculation process. At the conclusion step with indicators concluding the relationship between ideas to solve mathematical problems, students are not able to write down the steps coherently and continuously. Due to the previous indicators, students were less able to use facts to be applied to concepts/formulas so the indicators concluded the relationship between ideas, and many errors occurred. In the strategy step with indicators of taking action in the form of solving mathematical problems, students are not able to provide detailed answers and complete calculations correctly. Students can write down the strategies used but there are many errors, and even some questions are not resolved. This is indicated by the results of student work below, it can be seen that in the calculation process there were a lot of errors so the final result was not found. Because in the previous two indicators students are less able to fulfill.

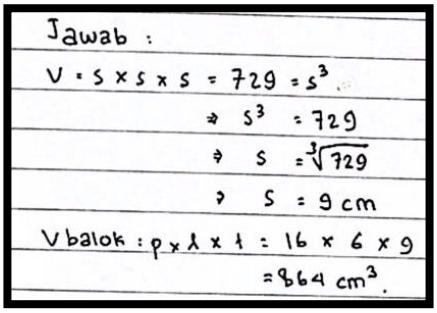

Figure 7. Low Self-concept Student Work

The mathematical critical thinking ability shown in Figure 7 shows that students in the low self-concept category are not able to fulfill all indicators. In Figure 4 students are not able to find the volume of the block correctly, although students can write the formula $V\ cuboid = p\ x\ l\ x\ t$, the solution strategy used is wrong. Overall, students are only able to fulfill the indicators of proposing mathematical problems to be discussed, while for other indicators, students are less able to fulfill.

Students with low self-concept categories tend to be insecure/pessimistic about competition, and feel weak and worried indicating that these students have negative self-concepts. Individuals who have negative attitudes and views on their abilities do not have the motivation to achieve brilliant achievements. The statement is relevant to Liu (2009) stated

that students with less positive academic self-concepts tend to be less motivated in learning, causing decreased academic performance. Conversely, students who have a positive self-concept will be able to know their potential, so when learning, students will better prepare and use their potential. Indirectly it will also improve and actualize self-potential that has not been optimized. This is in accordance with Alfansuri et al. (2018) statement that the most important thing is to actualize the potential in oneself that can be obtained if a person has a good self-concept.

Thus, the opinion by Sugandi (2019) says that there are several factors that influence students' mathematics learning outcomes, including students' attitudes towards mathematics, namely self-concept and the anxiety experienced by students in learning mathematics. In this way, it can be concluded how important the ownership of self-concept is to student learning outcomes and motivation in mathematics.

CONCLUSIONS AND SUGGESTIONS

Based on the results of the research, it was concluded that students with high self-concept categories were able to fulfill every indicator at the critical thinking step, namely the steps of clarification, assessment, conclusion, and strategy. Students with the medium self-concept category are only able to fulfill the indicators at the clarification and assessment steps. But at the conclusion and strategy steps students are less capable fulfill it because they are less thorough in solving questions and sometimes still not able to understand the questions. Students with low self-concept categories are only able to fulfill the indicators at the clarification step because students don't understand the concept so errors occur in the assessment step indicators and continue to the inference steps indicators and strategies that can't be fulfilled.

Referring to the results of the research and conclusions that have been discussed, the researcher suggested to teachers that the use of critical thinking problems in mathematics needs to be cultivated because it would hone students' critical thinking skills and affective aspects such as teachers should consider self-concept. All attention, guidance, and motivation given to students can change students' self-concept for the better or positive.

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