



## (Critical Thinking Ability of Class VIII Students in terms of Conceptual Knowledge and Mathematical Dispositions)

Ilmi Alifia Aryani , Hardi Suyitno, Supriyadi Supriyadi

Universitas Negeri Semarang, Indonesia

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### Abstract

The purpose of this study was to describe the critical thinking skills (CT) of grade VIII A Madrasah Stanawiyah (MTs.) Sultan Agung Sukolilo students in terms of conceptual knowledge (CK) and mathematical disposition (MD). This research is qualitative research. The subjects of this study were students of class VIII A MTs. Sultan Agung Sukolilo which is divided into nine categories based on CK and MD. The results of this study are two students in the category of sufficient conceptual knowledge and high mathematical disposition have good CT abilities. Both students can analyze, develop, and create well. Twenty-six students from nine categories had moderate CT abilities. Meanwhile, six students from the categories of good conceptual knowledge and low mathematical disposition, sufficient conceptual knowledge and moderate mathematical disposition, sufficient conceptual knowledge- low mathematical disposition, and poor conceptual knowledge and moderate mathematical disposition were included in the category of students with poor CT abilities. the results above, most students have moderate critical thinking skills, namely 76% of students, it is necessary to improve critical thinking skills both in analyzing, based, and creating. Based on the results of tests, some students think critically in analyzing, namely determining relations, domains, codomains, and ranges, and finding sets and re-coordinating sets that are good. Meanwhile, in making new associations related to everyday life and determining the relations of an image and about stories, it is still lacking.

#### Correspondence:

Kedungwinong 09/04, Sukolilo, Pati  
E-mail: [ilmialifiaa@gmail.com](mailto:ilmialifiaa@gmail.com)

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## INTRODUCTION

Referring to the regulation of the Minister of Education and Culture No. 20 of 2016, in realizing the national education goals, the government strives for every student to achieve the ability, attitude, knowledge, and skills as formulated. Therefore, this research is interested in researching the three capabilities that have been developed, including mathematical disposition as attitude ability, conceptual knowledge as knowledgeability, and critical thinking ability as skill ability.

Seeing the goals of National Education and the current reality on the ground is very concerning. Based on interviews with the Madrasah Tsanawiyah (MTs) teacher Sultan Agung Sukolilo, very few participants liked mathematics. Various reasons were given, from complex mathematics, many formulas to be memorized, the questions were different from the examples, and many students were still confused and could not even multiply and divide. Students also often complain during lessons, especially when given practice questions and daily tests.

Various reasons were given, both indicating a negative attitude towards mathematics, their conceptual knowledge, and their level of thinking. These three things need to be well known by each student's teacher.

Critical thinking is a cognitive skill that develops in a planned learning process. The following critical thinking theory starts from Bloom's works on the cognitive domain, which has six levels. Level one to level three is included in the level of low-level thinking. Meanwhile, the following levels, namely four, five, and six, are higher-order thinking levels. Analysis, the fourth level, is defined as critical thinking that focuses on the parts and functions of the whole. The fifth level, namely synthesis, is critical thinking that focuses on putting parts together to form something original or new. Meanwhile, critical thinking that focuses on assessing and making informed judgments is the definition of evaluation. So, according to Duron, Limbach, and Waugh, critical thinking will occur if students carry out cognitive dimensions at the level of analysis, synthesis, and evaluation of Bloom's taxonomy (Duron, Limbach & Waugh, 2006; Mustajab, Senen & Waspada, 2018).

In addition to critical thinking, the teacher's ability of conceptual knowledge also needs to be considered. Conceptual knowledge includes knowledge of categories, classifications, and relationships between two or more categories or knowledge classifications that are more complex and organized. Conceptual knowledge includes schemas, mental models, or implicit theories in various cognitive psychology models (Anderson & Krathwohl, 2001). Meanwhile, according to Johnson and Schneider, conceptual knowledge is knowledge about concepts whose level of relationship reflects one's expertise (Johnson & Schneider, 2015). Haapasalo and Kadjevich also explain that conceptual knowledge also shows knowledge of and skilled drivers of a particular network, elements in the form of concepts, rules (algorithms, procedures, Etc.) (Kadjevich, 2018).

Likewise, with the mathematical disposition. Mathematical disposition is an attitude, interest, and motivation towards mathematics (Kusmaryono, Suyitno, Dwijanto, & Dwidayati, 2019). Likewise, NCTM (2000) explains that "people who view the world mathematically are said to have mathematical dispositions." Another opinion comes from Watson (2015) that mathematical disposition is a set of beliefs that affect a person's mathematical beliefs, their willingness to persevere in the face of obstacles in solving mathematical problems, and their views on the ability to understand, use, and assess mathematics. These beliefs then guide and influence students in acting with mathematics. Meanwhile, Hendriana, Rohaeti & Sumarmo conclude several different opinions that "mathematical disposition is a positive view of mathematics" (Hendriana, Rohaeti & Sumarmo, 2017).

Several indicators from this article, the researcher use a mathematical disposition indicator consisting of seven (7) components according to Hendriana et al., which were adopted from Polking and NCTM 2000 (Hendriana et al., 2017). The seven indicators include 1) confidence in using mathematics, solving problems, giving reasons, and communicating mathematical ideas; 2) think flexibly and try alternative methods in exploring mathematical ideas and solving problems; 3) diligently working on mathematical tasks; 4) show interest, curiosity, and inventiveness; 5) monitor and

reflect on your performance and reasoning; 6) assess the application of mathematics to other situations in mathematics and everyday experience, and 7) appreciate the role of mathematics as a tool and as a language.

The importance of a positive attitude towards mathematics or mathematical disposition is very supportive of critical thinking skills (Aminah, 2015; Sa'adah & Zanty, 2019). In addition, students with good dispositions can create self-confidence open thinking, and it is easier to solve problems (Mahmudi, 2010; Patmalasari, Afifah & Resbiantoro, 2017). Likewise, disposition is the key to learning mathematics (Feldhaus, 2014)

Therefore, based on the explanation above, there is a need for research to determine the critical thinking skills of class VIII MTs students. Sultan Agung is based on conceptual knowledge and mathematical disposition. In this study, before analyzing students' critical thinking skills, the researcher grouped students based on each student's conceptual knowledgeability and mathematical disposition. Thus, by knowing the results of each student's ability, it is hoped that the teacher can improve and develop students' critical thinking skills. In addition, teachers are expected to support the development and realization of educational goals. They will make it easier to determine actions, methods, models, and learning tools that will be carried out in the learning process in the classroom.

**METHOD**

This research is qualitative. Qualitative research is a method for exploring and understanding the meaning of social and humanitarian problems, involving questions and procedures, collecting specific data, and analyzing data inductively or from specific themes to general themes (Creswell, 2016).

This research was conducted in MTs. Sultan Agung Sukolilo for the 2019/2020 school year. The subjects in this study were students of class VIII A, where the choice was obtained from the suggestions of the VIII class mathematics teacher and school principal.

The research subjects were grouped into nine based on conceptual knowledge and mathematical disposition. Nine groups, namely the combination of the categories of good conceptual knowledge (G-CK), sufficient conceptual knowledge (S-CK), poor conceptual knowledge (P-CK), with the high mathematical disposition (H-MD), moderate mathematical disposition (M-MD), and low mathematical disposition (L-MD).

Data collection techniques using tests, interviews, and questionnaires. The qualitative data analysis technique in this study uses analytical techniques. According to Miles and Huberman, the procedure conducts qualitative data analysis. Namely, Data reduction includes all data in the form of critical thinking ability test results will be reduced or choose main things to obtain important data, data presentation in Qualitative research uses narrative text, and the third step in this analysis technique is verification or concluding. The results obtained in the entire analysis process for students on each type of conceptual knowledge and mathematical disposition were then concluded in a comparative descriptive manner with critical thinking abilities by looking at the data findings found during the research process (Sugiono, 2009).

**RESULTS AND DISCUSSIONS**

The results of this study, namely students' critical thinking was analyzed based on two abilities, namely the ability of conceptual knowledge in table 1 and mathematical disposition in table 2 below.

**Table 1** Results of Conceptual Knowledge Test Recapitulation

Category	Total	Percentage
Good	7	20.59%
Sufficient	20	58.82%
Poor	7	20.59%

Based on table 1 above, in each category there are students who fulfill it. As for the category of

conceptual knowledge ability, the most is in the sufficient category.

**Table 2** Results of the Recapitulation of the Mathematical Disposition Questionnaire

Category	Total	Percentage
High	5	14.71%
Moderate	23	67.65%
Low	6	17.65%

Based on table 2 above, each category for mathematical disposition has students who fulfill it. Meanwhile, for the category of students' mathematical disposition ability, most students are in the medium category.

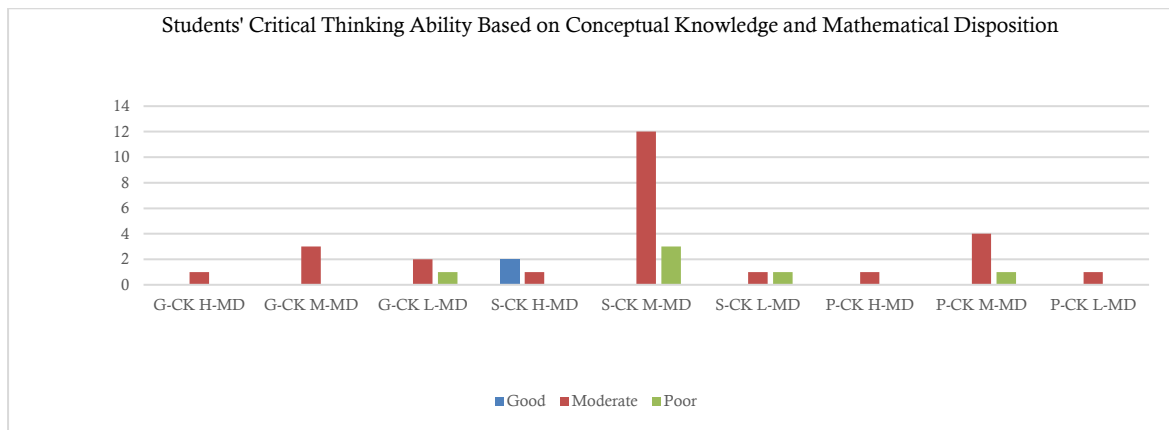
Based on the results of the table above, there are six categories of conceptual knowledge and mathematical disposition, namely good conceptual knowledge (G-CK), sufficient conceptual knowledge (S-CK), poor conceptual knowledge (P-CK), high mathematical disposition (H-MD), moderate mathematical disposition (M-MD) and low mathematical disposition (L-MD), will be combined

from each category of conceptual knowledge to each category of mathematical disposition. The number of students for each category in terms of conceptual knowledge and mathematical disposition can be seen in table 3 below.

**Table 3** Number of Students in the Category of Conceptual Knowledge and Mathematical Disposition

Type	MD			
	High	Moderate	Low	
CK	Good	1	3	3
	Sufficient	3	15	2
	Poor	1	5	1

Based on table 3, it is known that in each category there are students who meet. The largest group in the category S-CK M-MD. Furthermore, in Figure 1, the critical thinking skills of 34 grade VIII students are obtained based on conceptual knowledge and mathematical disposition.



**Figure 1** Students' Critical Thinking Ability Based on CK and MD

Figure 1 shows each category based on CN and MD; students have moderate critical thinking skills. Students with good critical thinking skills are in the category of students with KN-C MD-T. Meanwhile, students with poor critical thinking skills are in G-CK L-MD, S-CK M-MD, S-CK L-MD, P-CK L-MD.

**Discussions**

Based on the results of Figure 1 above, that two students who have good critical thinking skills, both are in the S-CK H-MD category. The two students are for indicators of analyzing, evaluating,

and creating in good categories. Although they have not been able to analyze the truth of the pair of a relationship and the researcher suspects that the two students are less thorough in understanding the questions. However, both students could answer correctly on each indicator more than 70%.

Students with moderate critical thinking skills can analyze, evaluate, and create in the medium category. Meanwhile, students with G-CK L-MD who have poor critical thinking skills on the indicators of analyzing and evaluating are still lacking, for indicators of creating in the medium category. 1 Student with S-CK M-MD who has less

critical thinking ability because they have not been able to achieve the three indicators well. Meanwhile, 2 S-CK M-MD students and 1 S-CK L-MD student who have poor critical thinking skills because at evaluation level is still lacking. 1 student with P-CK M-MD with less critical thinking ability because at the level of evaluating and creating students is still lacking.

Critical thinking will occur if students carry out cognitive dimensions at the level of analysis, evaluation, and creation. The results of this study obtained that the level of student analysis in determining the relationship of two sets, determining the domain, codomain, and range was quite good, while in determining the relations of new sets related to everyday life, determining the relationship of an image, and determining the relationship of story questions were still lacking.

Students' critical thinking at the next level is the ability to evaluate. The ability of students to evaluate in expressing a relation in the form of arrow diagrams, tables, sequential pairs, stating a function or not a function of a set relation, stating the function of two related images, explaining a relation which is a one-to-one correspondence function and investigating a function of story questions, included in the excellent category.

Meanwhile, at the level of creating, namely formulating functions that can be formed from the given set, it is included in the excellent category. However, in formulating the relationship between an image and a story problem, it is in the poor category.

Overall, seeing the result of critical thinking, the ability to analyze and create is still moderate, while the ability to evaluate is in the good category. Meanwhile, overall, it can be said that students' critical thinking skills are in the sufficient or moderate category. Therefore, with the above results, it is hoped that critical thinking skills can be implemented for all mathematics materials with the aim of increasing cognitive abilities. This is in accordance with the opinion of Kusmaryono, et al. that the power of mathematics which is part of higher order thinking is the focus of the development of mathematics education in the 21st century (Kusmaryono & Suyitno, 2015).

## CONCLUSION

Based on the analysis and discussion, it was found that one student with the G-CK H-MD category had moderate critical thinking skills. Three students in the G-CK M-DM category, the level of critical thinking skills of the three in the medium category. Meanwhile, three students are in the G-CK L-MD category, two in the medium category, and one in the less category.

Two students in the S-CK H-MD category have good critical thinking skills, while one is at a moderate level. There are 12 students with moderate critical thinking skills in the S-CK M-MD category and three students with less critical thinking skills. Meanwhile, one student with S-CK L-MD at a moderate level of thinking ability and one at a lower level.

One student in the P-CK H-MD category and one in the P-CK L-MD category had moderate critical thinking skills. While in the P-CK M-MD category, four students have moderate critical thinking skills, and one has poor critical thinking abilities.

Based on the findings during the study, it is suggested: (1) teachers should pay attention to conceptual knowledge and students' positive attitudes towards mathematics to improve critical thinking skills; (2) the importance of collecting data on students' knowledge abilities before starting learning, with the aim of students with fewer knowledge abilities getting more than attention; (3) the importance of instilling a positive attitude towards mathematics with fun learning and appropriate learning tools so that students enthusiastically and happily participate in learning mathematics.

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