

## Teachers' Perceptions in Applying Mathematics Critical Thinking Skills for Middle School Students: A Case of Phenomenology

### M. Rais Ridwan

Corresponding author, Graduate School of Universitas Negeri Yogyakarta & Study Program of Mathematics Education, STKIP YPUP Makassar, Indonesia, [mr rais.2019@student.uny.ac.id](mailto:mr rais.2019@student.uny.ac.id)

### Heri Retnawati

Study Program of Research and Evaluation Education, Graduate School, Universitas Negeri Yogyakarta, Indonesia, [heri\\_retnawati@uny.ac.id](mailto:heri_retnawati@uny.ac.id)

### Samsul Hadi

Department of Electrical Engineering Education, Universitas Negeri Yogyakarta, Indonesia, [samsul\\_hd@uny.ac.id](mailto:samsul_hd@uny.ac.id)

### Jailani

Department of Mathematics Education, Universitas Negeri Yogyakarta, Indonesia, [jailani@uny.ac.id](mailto:jailani@uny.ac.id)

Critical thinking skills are thinking processes with rational decision-making based on the principle of truth. This study aims to determine the teacher's perception in applying the necessary thinking skills of junior and senior high school students in learning mathematics. This research is qualitative research with a phenomenological type of research with an emphasis on individual subjects. Data were collected by conducting interviews with twenty-one mathematics teachers in the South Sulawesi Region. The data analysis technique uses an interactive analysis model based on Miles and Huberman, namely data collection, reduction, presentation, and verification. The study results indicate that teachers' perceptions of applying critical thinking skills in learning Mathematics need support from using models, strategies, or learning approaches, focusing on the subject matter, and knowledge about essential skills of thinking indicators. The teacher's obstacle in applying students' critical thinking skills is the lack of basic understanding of mathematics, interest, and motivation to learn mathematics. In addition, teachers lack planning and time allocation in preparation for learning. Then, efforts by the school to overcome teacher obstacles are to provide motivational support and facilities as well as permission to participate in training related to learning Mathematics.

Keywords: teacher perception, critical thinking skills, mathematics learning, phenomenology, middle school students

## INTRODUCTION

Mathematics learning focuses on understanding concepts in solving mathematical problems and also their application in other sciences. Various concepts need to be known by students in their completion procedures to produce answers to the questions given. Students are often faced with problems in learning activities, significantly solving mathematical problems by finding solutions carefully, regularly, and precisely. For this reason, solving these problems is needed, one of which is by applying the ability to think logically, analytically, systematically, critically, and creatively, as well as the ability to work proactively in learning.

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Critical thinking is an activity that focuses on decisions about what to believe or through reflective thinking and reasoning activities (Ennis & Weir, 1985). Nelson (2013) also stated that critical thinking is a concept that involves cognitive skills and affective disposition and influences the way teachers convey ideas to students. Critical thinking skills are part of higher-order thinking skills (Trilling & Fadel, 2009; FitzPatrick & Schulz, 2015) with thinking activities such as analyzing, evaluating and drawing conclusions (Asyari, Al Muhdhar, Susilo, & Ibrahim, 2016; Widiawati, Joyoatmojo, & Sudiyanto, 2018). In addition, according to Ruggerio (2012), there are three activities in critical thinking, namely investigation, interpretation, and decision. The investigative activity is finding evidence from the critical questions of the problem, while performance is interpreting the meaning of the evidence reasonably. Then, thinking exercises students must do in solving mathematical problems (Perkins & Murphy, 2006; Vong & Kaewurai, 2017) consist of four activities. The four movements are analyzing or clarifying based on the data provided, providing an evaluation by giving reasons or examples, making conclusions or inferences, and making problem-solving strategies.

The development of a practical, logical, critical, and honest mindset that has an orientation on the application of mathematics is one of the efforts in solving problems to minimize errors in solving mathematical problems. Students' critical thinking skills in learning mathematics are needed to understand and solve a problem faced by analyzing, evaluating, and interpreting thinking. It is relevant to the research results by Komariyah & Laili (2018), which shows that critical thinking skills significantly affect mathematics learning outcomes. In addition, the application of students' critical thinking skills in learning can improve learning activities (Styers, Van Zandt, & Hayden, 2018).

As one of the determinants of student learning success, teachers need to be sensitive to innovation in education. Education is a determining factor for the progress of the nation that produces quality human resources. Students' initial ability in learning can only be known by the teacher so that appropriate actions can help increase student abilities. Such global experience informs that teachers play an influential role in understanding and improving their respective countries' educational learning process (Sultana, Yousuf, Din, & Rehman, 2011). However, current conditions indicate an increase in heterogeneous student abilities, the challenge of learning adjustment is also becoming increasingly tricky (Smets & Struyven, 2018). In addition, teachers from several countries teach with diverse circumstances using a learning approach for all conditions (Santangelo & Tomlinson, 2012).

Learning is still dominated by teachers who sometimes cannot develop students' critical thinking activities and skills in education. According to Ahmatika (2017), the factors influencing critical thinking skills do not grow in learning. The curriculum targets are only material, and learning activities by teachers are still dominated by the lecture method. Teachers only rely on the lecture method to convey concepts because it is easier even though, in general, it makes students more passive and makes them desperate to think critically (Mustofa, & Yuwana, 2016; Baguma, Bagarukayo, Namubiru, Brown, & Mayisela, 2019). On the other hand, active learning can improve critical thinking skills (Kusumoto, 2018).

The learning process by the teacher only emphasizes memorizing material and focuses a lot on content rather than evaluating and synthesizing material according to its true meaning (Rodzalan & Saat, 2015; Wijaya, Retnawati, Setyaningrum, Aoyama, & Sugiman, 2019). Learning by the teacher only diagnoses student learning difficulties based on the analysis of student test results. Another obstacle is that teachers can still distinguish between diagnostic tests, evaluations, and predictions. Such obstacles become the perception of some teachers stating difficulties in applying various learning models and not being a means to support students in understanding student material in class (Delisle, 2015).

In addition, learning by teachers should be more focused on developing students' critical thinking skills. The thinking process skills possessed by each student are different in using logical reasoning and reasoning in solving mathematical problems (Rahayuningsih & Kristiawan, 2018). Therefore,

teachers are expected to know the competencies needed to assess or evaluate students' critical thinking skills. So that they can train and improve these skills in solving mathematical problems. In this case, the teacher's knowledge significantly influences the implementation of learning based on the characteristics of the material and the condition of students in the classroom (Moosa & Shareefa, 2019).

The development of critical thinking skills in learning needs to be designed and carried out by teachers in learning tools. It is relevant to the results of research by Ismail, Muhammad, Kanesan, & Ali (2019) showing that teachers' perceptions and readiness in learning mathematics affect students' critical thinking skills. So that teacher must plan to learn well by choosing strategies and teaching and learning materials that are effective in improving students' critical thinking skills. In addition, the teacher's obligation in Permendikbud (2013) states that one of the competencies in the 2013 curriculum is developing creativity, curiosity, and the ability to formulate questions to form critical thoughts that are necessary for intelligent life and lifelong learning (Menteri Pendidikan dan Kebudayaan Republik Indonesia, 2013). According to Retnawati (2015), learning in the 2013 curriculum emphasizes attitude and skill competencies, not just cognitive competencies. However, in practice, some teachers still focus on cognitive achievement. It is evident in learning using instruments and assessments of students that focus on cognitive achievement (Azizah, Sahil, & Hashim, 2011; Sasai, 2017; Stanković, Maksimović, & Osmanović, 2018).

Learning with a focus on students' critical thinking skills requires selecting innovative learning models, strategies, or approaches by the characteristics of mathematics learning. Research using the reciprocal teaching-learning model Umam (2015) and creative problem-solving learning approaches (Novitasari, 2015; Shanti, Sholihah, & Martyanti, 2017) improves students' critical thinking skills compared to conventional learning. In addition, learning using a problem base (Alrahlah, 2016; Gholami et al., 2016) as well as problem-posing (Bonotto, 2013) are also effective in improving students' critical thinking skills in learning mathematics.

Another obstacle in determining the progress of achieving educational goals with learning in schools affects leadership. School leadership is an integral part of school policy formulation, implementation, and assessment in educational institutions. In this case, school leadership has an essential role in school achievement. Research by Luthan (2015) shows that many school staff believes that school leaders determine school progress. School leaders are responsible for creating a communicative and friendly academic atmosphere to achieve school goals successfully. In addition, based on hypothesis testing in the research of (Iyekolo, Okafor, & Abdulazis, 2020) shows that the perception of high school teachers towards women as school principals does not differ based on gender but differs based on the length of experience guiding teachers. In general, teachers' perceptions of the need for education policies to develop innovative approaches in the education system (Yilmaz, 2021). The emphasis is on administrators and teachers who must get permission to build learning activities using innovative methods in curriculum implementation.

Based on the explanation above, research is needed to see the teacher's perception of students' critical thinking skills in learning mathematics. The formulation of the problem in this study is how the teacher's perception in using the critical thinking skills of high school students in learning mathematics. Thus, based on these problems, it is necessary to conduct qualitative research that aims to determine the obstacles of teachers in applying the critical thinking skills of high school students in learning mathematics. In addition, this study also aims to determine the activities of teachers in applying students' critical thinking skills in the South Sulawesi region.

## **METHOD**

### **Methodology approach**

The methodological approach in this study is qualitative research using a phenomenological approach. According to Bogdan and Biklen (in Martens, 2010), phenomenological analysis emphasizes the subjective experience of individuals. Phenomenological studies are designed to describe and interpret experiences by determining the meaning of experiences experienced by people who have participated in them (Ary, Jacobs, Sorensen, & Razavieh, 2010). In addition, according to Giorgi (in Creswell, 2014), phenomenology is defined as an inquiry design that comes from philosophy and physiology in which researchers describe individual life experiences about phenomena as described by respondents. This description will finish on the essence of the experience for several individuals who have all experienced the phenomenon. This design has a solid philosophical basis and usually involves conducting interviews or questionnaires.

### **Participants**

The sample in this study consisted of twenty-one teachers who teach at the secondary school level in the South Sulawesi region. The teachers who teach comprised five teachers in Pinrang Regency, four teachers each in Gowa and Bone Regencies, and one teacher each in Makassar and Palopo Municipalities, Jeneponto Bulukumba, East Luwu, Pangkajene Sidrap, Pangkajene Islands, and Maros Regency. Sixteen teachers teach at senior high schools, and five others teach at junior high schools with five to fifteen years of teaching experience. In this study, the sample is grouped based on public and private secondary schools where seventeen schools with general status and four personal statuses and the last academic education of respondents with fourteen master degrees and seven others have bachelor degrees.

### **Data collection tools**

The main instrument for data collection in this study was a questionnaire with a phenomenological approach. The development of the instrument by the researcher is based on the indicators of the problems in the research. Then validation by qualitative and measurement experts. The instrument contains questions consisting of two parts. The first part consists of teacher demographic information, namely questions regarding the length of time the respondent has worked as a teacher, the last academic education, the level of the respondent teaching, the institution where he teaches. The second part contains questions about critical thinking skills indicators in learning mathematics, material objects, and difficulties in applying these skills in learning. Another question is the support of the school in the participation of respondents in teaching workshops or seminars to minimize obstacles in using critical thinking skills.

Questionnaire data retrieval can be done using the internet consisting of email (Creswell, 2014) or the like, namely through a google form by giving questions to respondents. The questionnaire uses google form in the form of questions and responses in the form of descriptions using Indonesian. The responses obtained were then transcribed and labelled based on the characteristics of the school where the teacher taught using the code format [R1, AEM, SHS, PU]. The label provides information on a) the teacher identification number, b) the last academic education (AEM: Master; AEB: Bachelor), c) The level of the school where the teacher teaches (SHS: High School; JHS: Junior High School and d) School status a place to teach teachers (PU: State; PR: Private).

The focus of this study is on researchers who provide questions that are tailored to the research objectives. So, get accurate information related to teacher perceptions of teacher constraints in applying students' critical thinking skills in learning Mathematics. In this case, the researcher does not

take a position that supports and opposes all respondents' responses but is neutral and shows the same opinion towards all respondents.

Then, in this study, to minimize bias in data collection, the researcher provided information to respondents regarding the research objectives. In addition, the element of confidentiality is also maintained where the responses are given are only for research purposes as reflection material for future learning and do not affect the position or rank of the respondent. The next element is to provide information to respondents regarding researchers to avoid changing words or sentence meanings that are out of context.

Research data collection was carried out from April to May 2020 by sending a google form link via the WhatsApp application to respondents with an academic background in Mathematics. Some respondents who received the link responded that they were not teachers but worked in the government sector, and others were teachers in elementary schools. The number of respondents to the questionnaire conducted online using the google form was twenty-one teachers from sixty-two respondents with an academic background in mathematics.

### **Data analysis**

Qualitative data analysis in this study used an interactive analysis model based on Miles & Huberman (1994) with stages consisting of data collection, data reduction, data presentation, and conclusion drawing or data verification. The step after data collection based on online questionnaire responses using google form is data reduction. Activities at the data reduction stage consist of reviewing notes based on the questionnaire results and separating data that are considered essential or not essential to be described. The review and separation of the data are carried out by re-checking to check for possible misclassification. Then, the researcher presented the data by defining the data based on the data classification by taking into account the focus and objectives of the research. The final stage in analyzing this data is concluding by making a definitive analysis of research results

### **FINDINGS**

The phenomenological approach in this study uses a questionnaire in which the researcher tries to understand the meaning of events and their relation to ordinary people in certain situations. Researchers tried to see the activities of teachers as respondents in applying students' critical thinking skills in learning mathematics. The results showed that most of the teachers responded to the difficulties and actions of teachers in the implementation of mathematics learning by applying critical thinking skills. Conceptually, the responses given by respondents are divided into two main aspects. The first aspect is the obstacle in applying critical thinking skills based on students' lack of knowledge in understanding the subject matter, lack of teacher planning in learning, and knowledge in applying critical thinking skills. The second aspect, teacher activities in the application of critical skills, consist of using models or methods in education, habituation with a focus on learning materials, and teacher knowledge related to indicators of critical thinking skills in learning mathematics.

Essentially, the application of critical thinking skills in learning has been written in the 2013 Curriculum, where these abilities are required for every teacher to apply to Mathematics learning. Like respondents in the study said that

The 2013 curriculum outlines the application of critical thinking skills. [R18, AEM, SHS, PU]

However, the application in learning is still dominated by teachers who sometimes have difficulty developing students' critical thinking skills in learning mathematics. These critical thinking skills do not grow in knowledge because the curriculum targets are only material, and learning activities by teachers are still dominated by the lecture method (Ahmatika, 2017). Teachers only use the lecture

method in conveying concepts because it is easier even though, in general, it makes students more passive and makes them desperate to think critically (Mustofa, & Yuwana, 2016; Baguma et al., 2019). Another teacher's difficulty developing critical thinking skills is the lack of lesson planning and knowledge in applying critical thinking skills.

There is still a lack of learning planning in applying the procedures for critical thinking skills and learning time allocation. [R7, AEM, SHS, PU]

Teachers still need the ability to be able to apply thinking skills in learning. Need more experience and knowledge in using critical thinking in education. [R6, AEM, SHS, PU]

The development of critical thinking skills in learning needs to be designed and carried out by teachers in learning tools. One of the character developments of students' critical and creative thinking skills is by giving duration questions, not at all learning meetings (Asdarina, Johar, & Hajidin, 2019). However, the essential component in developing students' critical thinking skills is the teacher's readiness to learn. Teacher readiness in learning mathematics affects students' critical thinking skills (Ismail et al., 2019). So that teachers must plan to learn well by choosing effective teaching and learning strategies and materials in improving students' critical thinking skills. The problem of lack of learning planning by teachers in innovating may be due to the limitations of teachers in finding information and participating in seminars or workshops. Based on the response data provided, the number of teachers who participated in training activities or mathematics learning seminars related to applying critical thinking skills was as many as eight teachers or 38.10%. At the same time, the other teachers have never participated in the training activities.

The next difficulty in applying critical thinking skills is the lack of students' understanding of the subject matter. The following respondents explain the condition of the students' difficulties.

Students' thinking ability is still lacking because they are not used to it. [R6, AEM, SHS, PU]

The ability of students who are very heterogeneous in a class, as well as the power of students who do not understand the basic concepts of mathematics, even the most basic ones still do not understand, such as integer operations, etc. [R4, AEM, SHS, PU]

Basic knowledge of students' mathematics still lacks. For example, students can still operate the addition and subtraction of integers, fraction operations, and others. The motivation for students who are lacking in learning so that learning is still complex to think critically, let alone. [R16, AEM, JHS, PU]

There is still a lack of student interest in learning mathematics and a lack of learning planning in applying the procedures for critical thinking skills and the allocation of learning time. [R7, AEM, SHS, PU]

Based on the four responses given by the teacher above, it shows that the difficulties experienced by the teacher in applying critical thinking skills are influenced by the ability of students who are still lacking in understanding the material. Students' initial ability in learning can only be known by the teacher so that appropriate actions can help improve student abilities. However, based on current conditions, it shows an increase in heterogeneous student abilities so that the challenges of learning adjustments are also becoming increasingly tricky (Smets & Struyven, 2018). In addition, the next difficulty factor is the lack of interest and motivation of students to learn mathematics. The results of the teacher's response regarding the difficulty factor stated that

There is still a lack of student interest in learning mathematics [R7, AEM, SHS, PU]

The process of arousing/motivating students to begin their critical thinking. Eighty percent of them always find math difficult, so even simple questions are reluctant to think. It is closely related to their attitude towards mathematics. [R9, AEM, JHS, PU]

The statement given by the teacher above is relevant to the research conducted by Yunita, Rosyana, & Hendriana (2018) by analyzing critical thinking skills based on the mathematics learning motivation of junior high school students. The results showed that the ability to think critically based on learning motivation had a positive effect of 16.2%, while 83.8% was influenced by factors other than student motivation. Students' motivation to learn mathematics can be influenced by several aspects. In general, some students already like mathematics, and others only fulfill the obligation to study mathematics (Puspitarani & Retnawati, 2020).

The teacher's activities applied students' critical thinking skills in learning mathematics using models or teaching approaches. Here are some responses were given by teachers regarding the application of critical thinking skills based on aspects of using models or methods in learning.

Implement several learning models that foster critical thinking habits, such as discovery, problem-solving, and others. [R9, AEM, JHS, PU]

Trying to make students active in learning and find and use learning models can improve students' critical thinking skills. [R19, AEM, SHS, PU]

The application of critical thinking skills with the learning model proposed by the respondents above supports the results of research by Nafisah & Wardono (2019). The results showed that the Multimedia-assisted Discovery learning model was able to generate student activity in the learning process to improve the critical thinking skills of junior high school students. The results of subsequent studies that problem-based learning can improve junior high school students (Jumaisyaroh, Napitupulu, & Hasratuddin, 2014). The following teacher's response states that it is relevant to the above research that the application of critical thinking skills in mathematics learning uses problem-based learning methods, that is to say

In students' mathematics learning activities, they involve problems in everyday life. [R13, AEM, SHS, PU]

The following response given by the teacher is related to the procedure of applying critical thinking skills using models or methods in learning that

Usually provides some picture (table or graph) or an explanation of the material to be given. After that, provide feedback through questions that guide students to find concepts from the material being taught or answer questions. The method used in learning is to form discussions or small groups and provide opportunities for other students to respond to statements or answers from their friends to create a learning community in the class. [R15, AEM, SHS, PU]

Students find their application of the formula. For example, the teacher is only directing. [R11, AEM, SHS, PR]

The following learning method in applying critical thinking skills proposed by respondents is the same as the results of research conducted by Liberna (2015), showing that the improved learning method on the material of a two-variable linear equation system can improve students' critical thinking skills. Student activities in learning with the Improve method are group learning in solving problems. The group consists of heterogeneous students with interactions such as conducting questions and answers, exchanging opinions, and debating between students.

Another aspect of teacher activity in applying critical thinking skills based on the results of the reduction of data collection is the habituation of learning with a focus on learning materials in class. The following teacher responses provide statements related to learning materials to think critically, namely:

Familiarize students with HOTS questions. [R8, AEM, SHS, PU]

Examples of the material, such as the application of number patterns to the number sequence material. [R10, AEM, SHS, PU]

The data reduction results above show that applying critical thinking skills in working on items with the Higher Order Thinking Skills (HOTS) type is an obstacle for some students (Kempirmase, Ayal, & Ngilawajan, 2019). The results showed that students' critical thinking skills in solving HOTS questions on arithmetic sequences and four questions were still deficient. Students were more likely to find it difficult when entering the analyzing and evaluating stage.

The teacher's knowledge related to indicators of critical thinking skills in supporting the application of critical thinking skills in mathematics learning based on the results of questionnaire data reduction, several teachers stated that

It solves mathematical problems by understanding concepts, analyzing, applying, and evaluating based on the information obtained. [R4, AEM, SHS, PU]

Provide mathematical problems to solve problems by generalizing, proving, evaluating mathematical situations in a reflective manner. [R7, AEM, SHS, PU]

Finding information or identifying problems, planning problem solving, carrying out problem-solving, then rechecking the truth. [R12, AEB, JHS, PR]

Based on the results of the reduction of respondents' data above shows that the indicators of critical thinking skills in learning mathematics as in research conducted by Purwati, Hobri, & Fatahillah (2016) and also Karim & Normayanto (2015) by using arrows of students' critical thinking skills in solving quadratic equation questions consisting of the interpretation phase, namely the ability to understand the problem, the analysis stage by identifying the relationships between statements and concepts, the evaluation stage where using appropriate strategy in solving problems, written in total, and correct in doing calculations and inference stages, which can conclude exactly according to questions.

The next element or component is related to the support of the school in mathematics learning activities in the application of critical thinking skills. The school's efforts are to provide motivational support and infrastructure and permit teachers to participate in several training or seminars for learning mathematics. As the results of the following teacher response data reduction, it is stated that

... in teaching children by applying critical thinking skills, we usually hold MGMP workshops by inviting supervisors as resource persons. [R15, AEM, SHS, PU]

...has directed that students are more active in learning. [R19, AEM, SHS, PU]

Providing the facilities and infrastructure needed during learning, such as computer laboratories, libraries, and other supporting infrastructure. [R13, AEM, SHS, PU]

... very support to facilitate the teacher in the process of critical thinking. Various policies are undertaken to include teachers in multiple courses and provide facilities related to this. [R9, AEM, JHS, PU]

School leadership is an integral part of school development in policy formulation, implementation, and assessment of educational institutions. In this case, school leadership has an essential role in school achievement. Such as by providing motivational support and infrastructure and permitting teachers to attend several learning seminars to become experienced and gain learning knowledge in applying critical thinking skills. The suggestions that become the hope of some teachers in using critical thinking skills in learning mathematics require several supporting aspects, namely:

The teacher needs the rest to prepare learning content that makes students aroused to want to think critically. That's all for our homework. [R9, AEM, JHS, PU]

... not as mathematical knowledge but how students are challenged to solve problems that are considered quite complex. [R1, AEB, SHS, PR]

... It's just necessary to do continuous coaching for teachers in this case so that teachers do not just apply as a way of teaching but can familiarize themselves with critical thinking. [R6, AEM, SHS, PU]

Some of the suggestions given by the teacher want that learning requires readiness or learning planning by the teacher so that it can improve students' critical thinking skills and by habituation by the teacher, hopefully, students can solve problems that are considered quite complex in everyday life. Other responses want ongoing coaching that learning by applying critical thinking skills becomes a habit in every learning process.

## DISCUSSION

This qualitative research describes empirical evidence regarding teachers' perceptions of the difficulties and activities in applying students' critical thinking skills in secondary schools in learning mathematics in the South Sulawesi region. Data collection using an online questionnaire, namely the google form, consists of two parts of questions. The first part consists of demographic questions of respondents. In contrast, the second part contains inquiries related to knowledge of critical thinking skills indicators, material objects, and difficulties in applying these skills in learning and support from the school in the participation of respondents in learning workshops or seminars. Based on the data collection results, twenty-one teachers consisted of sixteen who teach in high school while the other five were in junior high school.

The response based on the data collection results is then data reduction is carried out by conducting a study, namely separating data that is considered essential or not essential to be described. The results of the data reduction selected teacher responses that represent the problems in this study as many as eleven teacher responses who teach in high schools with details of nine people in public schools and two other schools with private status. As for the response of teachers who teach in junior high schools, as many as three people with two people in state school status and one in private schools. The results of data reduction show that the difficulty of teachers in applying critical thinking skills of high school students in learning mathematics is the lack of students' knowledge in understanding the subject matter. Another difficulty is the lack of planning and teacher knowledge in applying critical thinking skills in learning.

Student's lack of knowledge of students in understanding lessons at the junior high school level is related to addition and subtraction operations of integers and fractions. While students at the secondary school level also can understand basic mathematical concepts, they are still lacking. The ability of students who are also very heterogeneous in a class makes it difficult to develop critical thinking skills. Such conditions are a challenge for teachers in adjusting learning to the conditions of students in the classroom (Smets & Struyven, 2018). The research by Saifiyah & Retnawati (2019) explicitly shows that most students have difficulty solving mathematical problems in pictures because

they cannot represent mathematical expressions or symbols. In addition, these students cannot solve problems in the form of written text using image representations. Other students' difficulties when working on questions in the form of reasoning, such as the results of research conducted by Zaini & Retnawati (2019), showed that difficulties in understanding, transforming, and processing skills were 24.14%, 19.54%, and 18.39%, respectively. Meanwhile, the difficulty in coding is 37.93%.

Another teacher's difficulty in implementing critical thinking skills in senior high schools consists of a lack of lesson planning and knowledge in applying critical thinking skills. Their response stated that teachers still need more experience and expertise in using critical thinking skills in learning. Barriers to teachers in applying students' critical thinking skills include activities or socialization carried out by the authorities that have not provided a comprehensive and comprehensive understanding of the curriculum (Retnawati, 2015). Teachers still find it challenging to manage time in lesson planning, lesson planning, attitude assessment, and the selection of knowledge and skills to prepare assessment instruments. The development of critical thinking skills in learning needs to be designed and carried out by teachers in learning tools. Teacher readiness in learning mathematics affects students' critical thinking skills (Ismail et al., 2019). So those teachers must plan to learn well by choosing strategies and teaching and learning materials that are effective in improving students' critical thinking skills.

The teacher's perception of activities in applying students' critical thinking skills in learning mathematics uses models or teaching approaches. The response given by the teacher who teaches at the junior high school level states that the teacher in planning learning uses learning models such as discovery learning and problem-solving learning to foster students' critical thinking habits. At the same time, the response from high school teachers stated that in the learning process, by giving feedback to students through guiding questions to find concepts from the material being taught. Then, form a discussion or small group by providing opportunities for students to respond to each other's answers or statements given by other students. In addition, the teacher involves problems in everyday life in learning. The application of the learning model also impacts student learning activities so that it can improve students' critical thinking skills.

The above shows that teachers can use several models or methods in planning and implementing learning to improve students' critical thinking skills. The research results support the teacher's efforts by Nafisah & Wardono (2019), which shows that the multimedia-assisted discovery learning model can help active students in the junior high school learning process with research results increasing students' critical thinking skills. The same effect is also that research by applying problem-based learning (Jumaisyaroh et al., 2014; Alrahlah, 2016; Gholami et al., 2016) can improve the critical thinking skills of junior high school students. The following relevant research regarding learning using the Improve method can also Improve students' critical thinking skills (Liberna, 2015).

The next teacher activity in applying critical thinking skills is based on learning material which states that in the learning process, getting used to giving high-level questions or questions in the form of Higher Order Thinking Skills (HOTS). The activities of the learning process by teachers at the high school level by providing HOTS questions for arithmetic sequences and series have been carried out by Kempirmase et al. (2019). The results showed that critical thinking skills were still deficient where students were more likely to find it challenging to analyze and evaluate. On the other hand, research by Retnawati, Djidu, Kartianom, Apino, & Anazifa (2018) shows that teacher knowledge is still low in improving students' abilities and solving HOTS-based questions. In addition, teachers are also still lacking in assessing students' HOTS abilities. However, there is the fact that teachers have understood the essence of learning by using HOTS questions and using learning with innovative learning models.

Then, information on the next activity is based on the teacher's knowledge regarding indicators of critical thinking skills in learning mathematics. The three high school teacher responses gave uniform responses with different interpretations stating that critical thinking skills are the ability to solve

mathematical problems by understanding concepts, analyzing, applying, and evaluating based on the information obtained. A study conducted by Purwati et al. (2016) uses indicators of students' critical thinking skills in solving quadratic equation questions consisting of interpretation, analysis, evaluation, and inference. The interpretation stage is a procedure for understanding the problem, while the analysis stage is by identifying the relationships between statements and concepts. Then, using a strategy by the issue, the evaluation stage was completed utterly and correctly in doing calculations. The next step, namely inference, is where students conclude correctly based on the questions.

In addition, according to Orlich et al. (in Shanti et al., 2017), there are several essential elements in critical thinking that students must learn to have critical thinking skills. The components consist of identifying the problem, identifying the relationship between the elements, inferring implications, inferring motives, combining independent aspects to create new patterns created from thinking, and making original interpretations. The same thing is the thinking activity that students must do in solving math problems (Perkins & Murphy, 2006; Vong & Kaewurai, 2017; Asyari et al., 2016; Widiawati et al., 2018).

Furthermore, the school supports junior high school teachers to increase knowledge related to applying critical thinking skills by permitting them to participate in training activities or mathematics learning seminars. Then for teachers who teach at high schools by providing motivational support and infrastructure to carry out locally by inviting competent resource persons from the education office. School leadership is an integral part of school development in policy formulation, implementation, and assessment in educational institutions. In this case, the relationship between the school's leadership, the principal influences motivation, interpersonal communication, and teacher performance in implementing learning in schools. The results of relevant research conducted by Madu & Jailani (2013) show a relationship between the principal's leadership on motivation, interpersonal communication, and teacher performance with a correlation of 0.889 and the regression model  $Y = 59.840 + 0.084X_1 + 0.377X_2 + 0.799X_3$ . Many school staff believes that school leaders determine school progress (Luthan, 2015). School leaders are responsible for creating a communicative and friendly academic atmosphere to achieve school goals successfully.

## CONCLUSION AND SUGGESTIONS

Teachers' perceptions of applying critical thinking skills of high school students in learning mathematics have two main aspects, namely aspects of difficulty and teacher activities in using students' critical thinking skills in secondary schools in the South Sulawesi region. The first aspect, the difficulty of teachers in applying critical thinking skills, is students' lack of knowledge in understanding the subject matter. Another difficulty is the lack of planning and time allocation and teachers' ability to apply critical thinking skills in learning mathematics. The second aspect, teacher activities in using critical thinking skills, need support from models or approaches in learning, focus on learning materials, and knowledge of indicators of critical thinking skills in learning mathematics. The school supports increasing teacher knowledge in applying students' critical thinking skills in the South Sulawesi region, providing motivational support and infrastructure. Another effort is to permit teachers to participate in several pieces of training or seminars related to learning mathematics.

The contribution in this study is the use of qualitative research using a phenomenological approach to determine the teacher's obstacles in applying students' critical thinking skills in learning mathematics in the South Sulawesi region. Another contribution is that not many studies have conducted qualitative research to determine teacher perceptions in applying the critical thinking skills of high school students in learning mathematics. The limitations in this study are based on data collection techniques using only interviews by asking questions in the form of google form. Interviews can be conducted face to face, via telephone, and using Focus Group Discussion (FGD) (Creswell, 2014). Therefore,

suggestions for future research to produce more informative interview data using the three interview methods. The following limitation regarding data description is based on interview data reduction. So, suggestions for further research require quantitative research for data collection based on factors that influence the difficulties or obstacles of teachers in applying students' critical thinking skills in high school mathematics learning. Another action is to permit teachers to participate in several training or seminars related to learning mathematics.

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