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Analysis of Mathematical Critical Thinking Ability viewed from Habits of Mind

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Abstract: This study aims to describe mathematical critical thinking ability viewed from habits of mind. Type of research was qualitative with case study method. Research subjects were 28 students of class XI SMAN 1 Tembilahan Hulu. Data collection technique used mathematical critical thinking ability test, habits of mind questionnaire and interview guidelines. Data analysis technique was carried out stages which included data reduction, data presentation, and drawing conclusions. Based on results of the study, it shows that students with high habits of mind have high critical thinking skills which are characterized by students being able to master three critical thinking indicators. Students with moderate habits of mind have abilities in moderately critical category, which is characterized by students being able to master two critical thinking indicators, while students with low habits of mind have abilities in moderately critical category where students being able to master one indicator of critical thinking skills.

Keywords: critical thinking ability, habits of mind, mathematic, analysis.

Abstrak: *Penelitian ini bertujuan untuk mendeskripsikan kemampuan berpikir kritis matematis ditinjau dari habits of mind. Jenis penelitian ini adalah kualitatif dengan metode studi kasus. Subjek penelitian merupakan siswa kelas XI SMAN 1 Tembilahan Hulu berjumlah 28 orang. Teknik pengumpulan data menggunakan instrumen tes kemampuan berpikir kritis matematis, angket habits of mind dan pedoman wawancara. Teknik analisis data dilakukan melalui tahapan yang meliputi reduksi data, penyajian data, dan penarikan kesimpulan. Berdasarkan hasil penelitian menunjukkan bahwa siswa dengan habits of mind tinggi memiliki kemampuan berpikir kritis tinggi yang ditandai dengan siswa mampu menguasai tiga indikator berpikir kritis. Siswa dengan habits of mind sedang memiliki kemampuan pada kategori cukup kritis yang ditandai dengan siswa mampu menguasai dua indikator berpikir kritis sedangkan siswa dengan habits of mind rendah memiliki kemampuan pada kategori cukup kritis dimana siswa hanya mampu menguasai satu indikator kemampuan berpikir kritis.*

Kata kunci: *kemampuan berpikir kritis, habits of mind, matematika, analisis.*

▪ INTRODUCTION

Mathematics as the queen of science that supports the development of science and technology and that is often used in various fields to solve various problems is still a frightening specter for students today (Basir & Apriliya, 2019; Cysarah, Jumroh, & Destiniar, 2021). Mathematics is continuous and has complex elements that require students to be able to develop critical thinking skills. This is in line with the opinion (Maulana, 2017; Setiana, 2018; Zetriuslita, Ariawan, & Nufus, 2016) that mathematics directs students to think critically, logically, systematically, creatively and carefully so that they are able to understand the mathematical concepts studied in order to be able to find solutions to mathematical problems that require analytical reasoning, evaluation and interpretation of thoughts. This shows the importance of critical thinking in learning mathematics. In line with Permendikbud Number 20 of 2016 concerning Competency

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Standards for Elementary and Secondary Education Graduates, on the skills dimension students are expected to have critical thinking skills.

In the era of the industrial revolution 4.0, it demands the preparation of human resources who have 4C skills, namely critical thinking, communication, collaboration, and creativity, in other words, the ability to think critically is one of the skills demands in learning in the industrial revolution era 4.0 (Afriana, Halim, & Syukri, 2021; Ansari & Agussani, 2020). According to (Herlina & Dahlia, 2018), critical thinking ability is a component of higher order thinking skills. In line with opinion (Afriana et al., 2021), one of the skills that students must master to solve complex math problems is critical thinking skills.

The ability to think critically is an important thing, but the reality on the ground is not as expected. One of the problems that have occurred from the educational review is that thinking skills have not been achieved and optimized (Suripah & Sthephani, 2017). Based on the 2015 TIMSS survey, Indonesia is ranked 44th out of 49 countries. The survey illustrates that Indonesian students are low in mastery of the material and have difficulty answering questions that require reasoning. Meanwhile, the results of the 2018 PISA survey state that the mathematical ability of Indonesian students is still relatively low where the scores obtained have decreased compared to the 2015 survey. Based on research by Siregar & Andhany (2020) students' mathematical critical thinking skills are still relatively low because mathematics learning is still teacher-centered. In line with this, research by (Fasha, Johar, & Ikhsan, 2018; Uciasaputri, Nurhayati, & Pagiling, 2020) explained that students' mathematical critical thinking skills are still relatively low because students still have difficulty solving problems during the learning process, especially those that require the ability to analyze and solve problems.

Aware of this, critical thinking skills are very important for students. One way that can be done so that students have these abilities is by training students to work on mathematical problems that require critical thinking skills. Critical thinking skills that are continuously trained will improve students' mathematical abilities because students will be motivated to carry out various activities such as facing various challenges in learning, finding new things and solving unusual problems (Wahyuni & Angraini, 2019). The ability to think critically is not only focused on the ability to solve problems but also teaches how students are able to evaluate the truth of solving a problem (Ariawan & Zetriuslita, 2021).

Students with high critical thinking skills are better at solving mathematical problems than students with low critical thinking skills. According to (Ratnawati, Handayani, & Hadi, 2020) mathematical critical thinking skills provide students with a number of benefits, including the ability to form and develop conceptual thinking and understanding skills that help solve more complex problems more easily. Critical thinking skills are part of life skills in industry 4.0. This requires every student to act and make decisions seriously and quickly. To overcome this problem, it is important for every student to have the ability to think critically. According to (Muslimahayati, 2020) the assessment of students as good critical thinkers is reflected in the ability of students to find facts, data, and concepts, as well as the ability to find the right solution to a problem.

Critical thinking is the ability to process, evaluate, and analyze information and generate ideas for each meaning to develop logical solutions. This is expressed by Amir (2015) which states that critical thinking is a person's mental activity in collecting, analyzing and evaluating information in order to make conclusions to solve a problem. Critical thinking is a systematic process that allows students to be able to formulate and evaluate their own arguments or based on facts and evidence that underlies the opinions of others so that students can develop and express their opinions with confidence (Junaidi, 2017). According to Mutakinati, Anwari, & Yoshisuke (2018), critical thinking refers to the ability to analyze information, to determine the relevance of the information collected and then interpret it in solving problems.

One of the mathematics learning materials that can be used to develop critical thinking skills is the derivative of algebraic functions. The concept of derivative is closely related to everyday life and high-level thinking skills are needed to determine the derivative value of a function with a certain x value. This material is quite challenging and expects the ability to think critically in the discovery process and the operation process before finding the final answer. However, the reality on the ground shows unsatisfactory results.

SMA Negeri 1 Tembilahan Hulu is a favorite school and a role model for schools in Indragiri Hilir Regency. As a favorite school, it is important for researchers to ensure that their students have applied critical thinking skills in solving mathematical problems. Based on the results of observations and open interviews of researchers during PPL with mathematics teachers at SMA Negeri 1 Tembilahan Hulu, that there are still some students experiencing difficulties and confusion in solving math problems given by the teacher in the learning process. Students tend to remember formulas, perform calculations following procedures that are already in the textbook or rely on examples given by the teacher, resulting in a lack of students' mathematical critical thinking skills, especially in the material derived from algebraic functions. Many students ask the teacher to repeat the explanation in each learning process and there are still many students who have difficulty working on problems related to derivatives of algebraic functions. In addition, there has never been a test of students' critical thinking skills so that teachers do not know the extent of students' critical thinking skills in solving math problems, especially in the material derived from algebraic functions.

In an effort to develop students' critical thinking skills, it is inseparable from the ability of students themselves in developing the abilities that exist in themselves. One thing that must be instilled in students is habits of mind. Habits of thinking or habits of mind of students is an important factor that supports the achievement of the National Education Goals and the objectives of learning mathematics in the affective aspect. Individuals with adequate habits of mind are expected to be able to compete and simultaneously be able to work together to face increasingly tough global challenges. In the end, students' habits of mind can be used as a benchmark to achieve good results.

Habits of mind are habits of thinking flexibly, acting on impulses, listening with empathy, solving problems effectively, habits of applying knowledge that has been possessed to new situations, habits of communicating, thinking clearly, involving all senses when gathering information, trying different ways and find new ideas, the habit of responding, the habit of taking risks, being responsible, having a sense of humor, getting used to interacting with others, being open and never giving up. Therefore, the

long-term learning goal is to improve students' skills so that they can further develop themselves and be able to solve the problems they face (Miliyawati, 2014). Based on the explanation above, this research was conducted to describe students' mathematical critical thinking skills in terms of habits of mind.

▪ METHOD

Research Design and Procedures

This type of research is a qualitative research with a case study method that aims to describe the state of mastery of students' critical thinking skills based on habits of mind in the form of a description. This research was conducted at SMAN 1 Tembilahan Hulu in the academic year 2021/2022. The procedure of this research begins with students filling out a habit of mind questionnaire to determine the level of students' habits of mind. Before students take the test, learning is carried out to stimulate students' critical thinking skills. Next, students take tests to determine students' mathematical critical thinking skills. After that, the researcher conducted in-depth interviews with six students consisting of two students with high habits of mind, two students with moderate habits of mind, and two students with low habits of mind.

Participants

The research subjects were 28 students of class XI SMAN 1 Tembilahan Hulu for the Academic Year 2021/2022. Class selection is carried out using a purposive sampling technique as stated by (Sugiyono, 2021) that the sampling technique that is often used in qualitative research is purposive sampling which in this case is based on the results of discussions between researcher and mathematics teacher who is in charge of class XI MIPA. All students were subject to a written test of critical thinking skills and a questionnaire on habits of mind. For analysis purposes, subjects were selected using a purposive sampling technique, namely two subjects for each level of high, medium, and low habits of mind. Determination of the subject on a small scale is intended to be able to dig deeper information through interviews. The data collection technique is a test technique in the form of a mathematical critical thinking ability test and a non-test technique in the form of a questionnaire of habits of mind and interviews.

Research Instruments

The form of the instrument used in this study is critical thinking ability test sheet, habits of mind questionnaire and interview guidelines. Habits of mind questionnaires and tests were given to all students in one class. Then based on the questionnaire analysis, six students were selected to be analyzed and interviewed further.

Table 1. Indicators used in the habits of mind questionnaire

No	Indicator
1	Persevere or never give up, don't give up easily
2	Regulate conscience, think reflectively
3	Understanding others and empathizing
4	Think flexible
5	Metacognitive thinking
6	Work carefully and precisely
7	Ask and raise problems effectively

8	Leveraging old experiences and analogies
9	Think and communicate clearly and precisely
10	Making use of the senses
11	Creating, imagining, and innovating
12	Eager to respond
13	Dare to be responsible and take risks
14	Humorous
15	Thinking interdependent
16	Continuous learning

Habits of mind questionnaire is used to classify students based on the level of habits of mind is high, medium, and low. The habits of mind questionnaire consists of 32 statements which are arranged based on the habits of mind questionnaire grid. The preparation of the questionnaire instrument uses a Likert scale with four answer choices, namely strongly agree, agree, disagree, strongly disagree (Sugiyono, 2021). The answer to each statement is given a score of 1-4. The indicators used in the habits of mind questionnaire are presented in Table 1. After the indicators and grids have been determined, then the questionnaire statement items are arranged according to the grid. The sample of the habits of mind questionnaire is presented in Table 2.

Table 2. Habits of mind questionnaire sample

No	**Statements**	**Answers**			
		SS	**S**	**TS**	**STS**
1	Saya sabar dan berdoa ketika gagal dalam ulangan matematika.				
2	Saya mengabaikan materi lama, ketika saya mempelajari materi matematika yang baru.				
3	Saya tidak mau mencari tahu kesalahan saya ketika memperoleh nilai matematika yang belum sempurna.				
4	Saya memeriksa kembali jawaban dari soal yang telah saya kerjakan.				
5	Saya mencoba cara lain ketika belum berhasil menyelesaikan soal matematika dengan benar.				
6	Saya bersemangat jika diajak teman untuk berdiskusi terkait persoalan matematika.				
7	Perasaan saya tertekan selama pembalajaran matematika.				
8	Saya hanya belajar ketika akan menghadapi ulangan harian matematika.				

The test instrument consists of four questions in the form of a description. The questions used in this test use material derived from algebraic functions. The test instrument is arranged based on the test grid and is accompanied by a scoring rubric. The questionnaire and test instruments that have been compiled were then validated by one lecturer of mathematics education at the Islamic University of Riau and two lecturers of mathematics education at UIN Suska Riau. Furthermore, the calculation of the reliability of the instrument is carried out. The instrument is said to be reliable if

r_count>r_table (Lestari & Yudhanegara, 2018). The reliability results of the questionnaire and test instruments respectively were 0.866 and 0.871 and the validity is 0.794 and 0.847 with valid category. This shows that both instruments are declared valid and reliable.

Data Analysis

The analysis of the results of the habits of mind questionnaire was used to determine the level of habits of mind of each student. While the analysis of test results is carried out based on critical thinking indicators, namely identifying the assumptions used, analyzing or evaluating algorithms, generalizing algorithms, identifying and justifying concepts. The process of data analysis in this study refers to the stages according to Miles and Huberman which are carried out through several stages, namely data reduction, data presentation, and drawing conclusions. At the data reduction stage, the researcher analyzed the results of the questionnaires and tests that had been done by students and then grouped them into three levels of habits of mind and test results to determine which students would be interviewed. Analysis of the results of the mathematical critical thinking ability test was carried out by giving a score based on the scoring guidelines which were then converted into scores with a scale of 1-100. Criteria for critical thinking skills based on test results can be seen in Table 2. Then interviews were conducted to strengthen the results of test analysis. At the data presentation stage, it is done by presenting the results of the analysis of critical thinking skills tests, questionnaires of habits of mind and interviews. While at the conclusion drawing stage, the researcher draws conclusions from the data that has been presented.

Table 3. Criteria for critical thinking ability based on test results

Interval	Criteria
$80{,}0 < \bar{M} \leq 100{,}0$	Very Critical
$60{,}0 < \bar{M} \leq 80{,}0$	Critical
$40{,}0 < \bar{M} \leq 60{,}0$	Critical Enough
$20{,}0 < \bar{M} \leq 40{,}0$	Less Critical
$0{,}0 \leq \bar{M} \leq 20{,}0$	Very Less Critical

▪ RESULT AND DISSCUSSION

Habits of Mind

Habits of mind data was obtained from the habits of mind questionnaire scores given to students. Students' habits of mind are grouped based on the criteria for grouping habits of mind in Table 4.

Table 4. Habits of mind grouping criteria

Criteria for Mathematical Critical Thinking Ability	Information
$x \geq (\bar{x} + SD)$	High
$(\bar{x} - SD) < x < (\bar{x} + SD)$	Moderate
$x \leq (\bar{x} - SD)$	Low

Based on the analysis of the results of the habits of mind questionnaire, there are 4 students with high habits of mind, 16 students with moderate habits of mind, and 8

students with low habits of mind. Then from the grouping, two students were selected to be interviewed regarding their mathematical critical thinking skills.

Table 5. Analysis results data of habits of mind

Habits of Mind	**Many Students**	**Research subject**
High	4	S-26
		S-27
Moderate	16	S-1
		S-7
Low	8	S-14
		S-22

Critical Thinking Ability

The results of the analysis of mathematical critical thinking skills based on the indicators used from all students are presented in Table 6.

Table 6. Test results based on critical thinking indicators

Number Question	**Mathematical Critical Thinking Indicator**	**Score**		**Criteria**
		$\bar{x}$	%	
1	The ability to identify and justify concepts, namely the ability to provide reasons for mastery of concepts	1.21	30.36%	Less Critical
2	Ability to analyze algorithms, namely evaluating or checking an algorithm	1.61	40.18%	Critical Enough
3	The ability to generalize is the ability to complete supporting data or information	2.43	60.71%	Critical
4	Ability to identify assumptions used	2.5	62.5%	Critical

Based on Table 6, it is known that the indicator of mathematical critical thinking ability with the highest average value is the indicator of the ability to identify the assumptions used, namely the critical criteria and the average value of 2.5. This shows that students are better able to identify the assumptions used than to analyze algorithms, generalize algorithms or identify and justify concepts. The mathematical critical thinking indicator with the lowest average score is an indicator of the ability to identify and justify concepts, namely the ability to provide reasons for mastery of concepts with less critical criteria and an average value of 1.21. This shows that students' abilities are still classified as very weak and need to be improved in identifying and justifying concepts that include the ability to provide reasons for mastery of concepts.

Analysis of mathematical critical thinking skills was then carried out in depth on the six selected research subjects. Critical thinking skills are analyzed using critical thinking indicators, namely the ability to identify and justify concepts, namely the ability to provide reasons for mastery of concepts, the ability to analyze algorithms, namely evaluating or examining an algorithm, generalizing abilities, namely the ability to complete supporting data or information, and the ability to identify assumptions used. Based on the results of tests and interviews with six research subjects who have high,

medium and low habits of mind, the analysis results are obtained as presented in Table 7 and Table 8.

Table 7. Results of analysis of critical thinking ability viewed from habits of mind

No	Habits of Mind	Score Each Critical Thinking Indicator				(%)	Category
		1	2	3	4		
1	High 1 (S-26)	3	3	1	3	62.5	Critical
2	High 2 (S-27)	2	4	3	3	75	Critical
3	Moderate 1 (S-1)	1	2	2	2	43.75	Critical Enough
4	Moderate 2 (S-7)	1	2	3	3	56.25	Critical Enough
5	Low 1 (S-14)	3	2	1	3	56.25	Critical Enough
6	Low 2 (S-22)	3	2	2	2	56.25	Critical Enough

Table 8. Summary of critical thinking ability analysis from the habits of mind

Habits of Mind	Percentage (%)	Critical Thinking Category
Tinggi	67.19	Critical
Sedang	47.27	Critical Enough
Rendah	41.41	Critical Enough

Based on Table 7 and Table 8, information is obtained that students' mathematical critical thinking skills in terms of habits of mind indicate that at each level of habits of mind students have different mathematical critical thinking abilities. The highest score percentage was obtained by the group of students with high habits of mind at 67.19. The second highest score was obtained by the group of students with moderate habits of mind, which was 47.27. While the lowest average was obtained by the group of students with low habits of mind at 41.41.

Research by Hanifah et al. (2018) shows that there is a significant relationship between mathematical critical thinking skills and habits of mind. In other words, the higher the students' mathematical critical thinking ability, the higher the students' habits of mind. Based on the results obtained by previous researchers, there are differences with the results obtained by researchers. According to the researcher's analysis, there are several reasons why students with low habits of mind have sufficient critical thinking skills. The causes are: 1) Before giving the critical thinking ability test questions, the researcher re-explained the important material from the derivative of algebraic functions so that with this treatment, students could recall and understand the material of the derivatives of algebraic functions well, 2) The mathematics teacher asked that the test results be This mathematical critical thinking ability is used as a daily assessment value (PH), so that students become more serious in working on problems.

Habits of Mind High

Based on the results of the study, it was found that in the indicator of the ability to identify and justify concepts, the subject of S-26 understood the questions well and gave the correct answers, while S-27 had not been able to solve the questions. Subjects S-26 and S-27 are less able to identify and justify concepts. During interviews, students were less than optimal in giving reasons related to the concepts used to solve the problems. Figure 1 is a transcript of the researcher's interview to explore indicators to identify and

justify the concept. So it can be concluded that there is still a shortage of students in identifying and justifying concepts, namely the ability to provide reasons for mastery of concepts.

P : *Apa yang kamu pahami dari soal tersebut?*
S27 : *Diketahui* $f'(-1) = 0, f'(0) = -3, f(-1) = 4, f(1) = 0$, *apakah* $f'(2) = 6$ *sudah benar dan saya jawab salah karena* $f'(2) = 9$ *bu.*
P : *Konsep apa saja yang dapat digunakan untuk menjawab soal tersebut?*
S27 : *Substitusi bu.*
P : *Substitusi saja? Tidak ada konsep lain?*
S27 : *Tidak ada bu.*
P : *Mengapa kamu memilih konsep tersebut?*
S27 : *Untuk mencari nilai* a, b, c, d.
P : *Apakah kamu yakin konsep yang kamu gunakan sudah tepat?*
S27 : *Masih belum.*
P : *Apakah hasil perhitunganmu sudah menjawab soal tersebut?*
S27 : *Belum bu.*

Figure 1. Transcript of researcher interview with S-27

Furthermore, for indicators of analyzing algorithms, these two students can examine or evaluate the steps presented in the questions and give the correct answers. For indicators of generalizing the algorithm, these two students were able to solve the problem by completing the points contained in the problem well even though they only came to the step of finding the p' value.

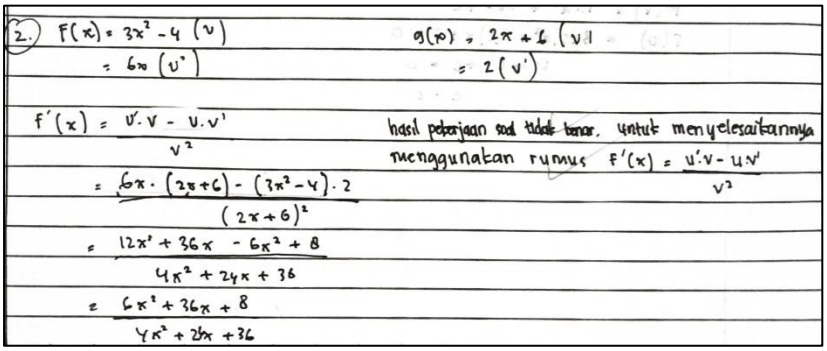

Figure 2. Answers of S-27 students to question number 2

Then for the indicator to identify the assumptions used, the two students were able to fulfill these indicators which was indicated by the subject writing down the information that was known and asked from the questions. Furthermore, on this indicator, the subject is able to re-explain the information given in the problem with mathematical sentences that are arranged by themselves even though there are several sentences that are the same as the information sentences contained in the problem. Based on the discussion, students in the high habits of mind category are still lacking in indicators of identifying and justifying concepts, namely the ability to give reasons for mastery of concepts compared to the three other mathematical critical thinking

indicators. They are able to analyze the algorithm well and identify the assumptions used and generalize the algorithm, namely the ability to complete supporting data or information.

Habits of Mind Moderate

Based on the results of the study, it was found that in the indicator of the ability to identify and justify concepts, the subjects of S-1 and S-7 had not been able to solve the problems correctly and did not have enough knowledge related to the concepts used to solve the problems. Subjects S-1 and S-7 are less able to identify and justify concepts. During interviews, students were confused and less than optimal in giving reasons related to the concepts written when solving problems. So it can be concluded that there is still a shortage of students in identifying and justifying concepts, namely the ability to provide reasons for mastery of concepts. This is what happened to students with high habits of mind.

Furthermore, for indicators of analyzing algorithms, namely the ability to evaluate or check algorithms, these two students understand the questions that are marked by writing the correct solution but the formula used is wrong, resulting in the wrong answer. During interviews, students were able to provide information on the problem with what was being done, but these two students were incomplete in giving reasons. For indicators of generalizing the algorithm, these two students were able to solve the problem by completing the points contained in the problem even though they only came to the step of finding the p' value. However, at the time of the interview, they were not able to state the concept used.

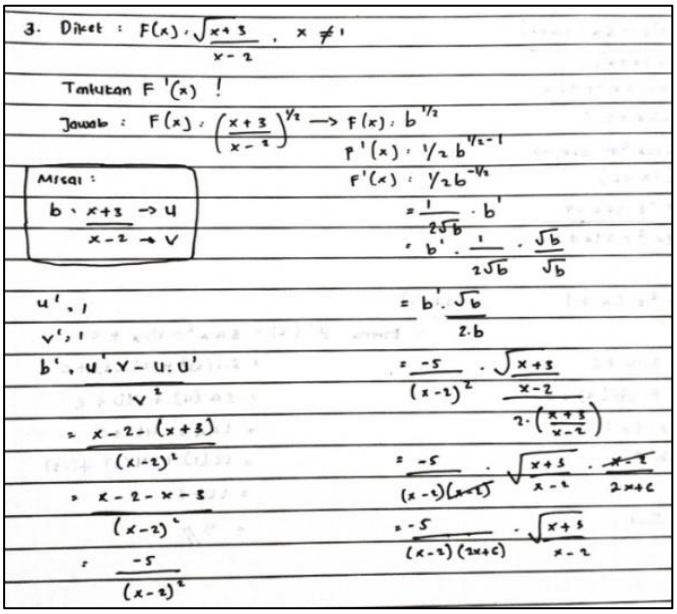

Figure 3. Answers of S-7 students to question number 3

Then for the indicators to identify the assumptions used, both students were able to fulfill these indicators as indicated by the subject understanding what was known, asked and the adequacy of the elements in the questions. At the time of the interview,

the subject was able to re-explain the information provided on the question in the same sentence as the information contained in the question. Based on the discussion, students in the habit of mind category are still unable to identify and justify concepts, namely the ability to give reasons for mastering concepts and generalize algorithms. They are able to identify the assumptions used, but there are shortcomings in the indicators of analyzing algorithms, namely the ability to examine or evaluate an algorithm.

P : *Apakah kamu memahami soal tersebut?*
S1 : *Paham bu*
P : *Menurut kamu, apa yang diketahui dan ditanya dari soal tersebut?*
S1 : *Diketahui* $y = (3x-7)^4(x+1)$ *dan nilai* $\frac{dy}{dx} = (ax+b)^3(cx+d)$ *dengan* a, b, c, d *bilangan bulat positif sedangkan yang ditanya* $a+b+c+d$
P : *Menurut kamu, apakah informasi yang ada pada soal sudah cukup digunakan untuk menjawab masalah yang ditanyakan?*
S1 : *Menurut saya pribadi cukup*
P : *Uraikan dengan jelas langkah-langkah yang kamu gunakan untuk menjawab soal tersebut.*
S1 : *Cari turunan* y *kemudian sesuaikan dengan yang diketahui yaitu* $(ax+b)^3(cx+d)$.

Figure 4. Transcript of researcher interview with S-1

Habits of Mind Low

Based on the results of the study, it was found that in the indicators of the ability to identify and justify concepts, subjects S-14 and S-22 subjects were able to identify concepts but were incomplete in mentioning the concepts used. During the interview, the subject could not explain the solution he wrote and gave inappropriate reasons. So, it can be said that these two students have not been able to meet the indicators of justifying the concept, namely giving reasons for mastering the concept.

P : *Apa yang kamu pahami dari soal tersebut?*
S14 : *Yang ditanyakan adalah benar atau tidak* $f'(2) = 6$. *Tapi saya ketemunya* $f'(2) = 9$ *jadi pernyataan pada soal itu salah.*
P : *Konsep apa saja yang dapat digunakan untuk menjawab soal tersebut?*
S14 : *Saya menggunakan substitusi dan eliminasi untuk mencari nilai* $a, b, c,$ *dan* d.
P : *Mengapa kamu memilih konsep tersebut?*
S14 : *Karena ini yang mudah dipahami.*
P : *Apakah kamu yakin konsep yang kamu gunakan sudah tepat?*
S14 : *Mungkin sudah.*
P : *Apakah hasil perhitunganmu sudah menjawab soal tersebut?*
S14 : *Ya.*

Figure 5. Transcript of researcher interview with S-14

Furthermore, for indicators of analyzing algorithms, namely the ability to evaluate or check algorithms, these two students have been able to evaluate the completion steps of the problem but are less precise in showing the location of the error and giving the correct reason. During interviews, students were able to provide information on the problem with what was being done, but the final answer given was inaccurate because the subject misunderstood the concept of division and was less thorough in operating a number of numbers.

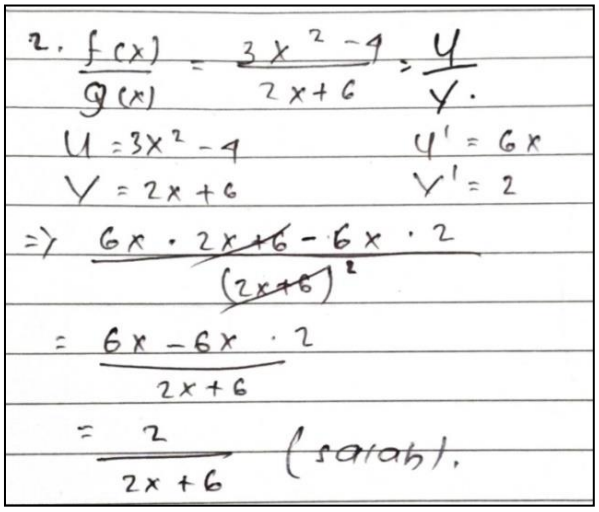

Figure 6. Answers of S-14 Students to Question Number 2

For the indicators of generalizing the algorithm, these two students did not fully understand the steps presented in the questions so they could not state the concepts used. Then for indicators to identify the assumptions used, the two students were not maximal in identifying problems and understanding the questions on the questions indicated by the subject writing down information that was known and asked about but incomplete. During the interview, the subject was less able to give a good explanation. Based on the discussion, students in the category of low habits of mind are still unable to identify and justify concepts, namely the ability to give reasons for mastery of concepts, less than optimal in analyzing algorithms, generalizing algorithms, and identifying assumptions used.

From the results of the data analysis that the researchers have done, it is found that most students have low abilities on the indicators of identifying and justifying concepts, namely the ability to give reasons for mastery of concepts. This can be caused by various factors, one of which is the students' habits of mind. The results showed that students with high habits of mind had better mathematical critical thinking skills than students with moderate and low habits of mind. Based on research results (Hanifah et al., 2018), shows a significant relationship between mathematical critical thinking skills and students' habits of mind in learning mathematics. In other words, the higher the students' mathematical critical thinking ability, the higher the students' habits of mind. Furthermore (Miliyawati, 2014), explained in his research that the habits carried out by individuals greatly determine the success he gets, habits that are carried out continuously will be increasingly attached and firmly settled on the individual so that it

is difficult to change. Research conducted by (Dwirahayu et al., 2018) also informed that the ability of mathematical generalization is influenced by the habits of mind of students by 42.5%. Mathematical thinking habits that are carried out continuously through discussion activities to explore contextual problems can support the achievement of students' mathematical concept mastery abilities (Qadarsih, 2017). The study showed a significant relationship between habits of mind and mathematical ability. However, the abilities studied were different, namely the ability to generalize mathematically and the ability to mathematical concepts.

▪ CONCLUSION

Based on the results of data analysis and discussion of students' mathematical critical thinking skills, it can be concluded that students' mathematical critical thinking abilities vary at every level of habits of mind. This study shows that students with high habits of mind have high critical thinking skills which are characterized by students being able to master three critical thinking indicators. Students with moderate habits of mind have abilities in the critical enough category which are marked by students being able to master two critical thinking indicators while students with low habits of mind are only able to master one indicator of critical thinking skills which are included in the critical enough category. By knowing the habits of students' minds and their critical thinking skills, it is hoped that they can provide consideration for teachers in designing, implementing, and evaluating the learning process so that students have good potential to develop their critical thinking skills in the future. For the sake of improving the quality of education, it is hoped that further research is based on the results of this study, including through efforts to improve students' critical thinking skills by paying attention to habits of mind.

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