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RESEARCH ARTICLE

Mathematical Critical Thinking Abilities of Middle School Students in Tidore Based on Gender and Background

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ABSTRACT

This study was conducted to answer the question, "What is the description of the mathematical critical thinking ability of middle school students in Tidore city based on gender and background?". This question is essential to answer because it is motivated by the mathematical performance of students in Tidore is low nationally and is reinforced by the results of the 2015 and 2018 PISA and OECD surveys. Gender is used as a distinguishing factor because this factor is still culturally rooted in this area and affects the role of society in life socially. Tidore comprises three significant communities, namely coastal, urban, and mountainous communities, each of which has a unique pattern of social life. Therefore, researchers also use "background" as a distinguishing factor. Data collection was carried out in three schools representing the three communities using a questionnaire, math problems (arithmetic, geometry, algebra), and semi-structured interviews on two subjects (male and female) in each location. The results of the analysis show, based on gender and background the ability of students to think critically mathematically are categorized as sufficient (close to less) with a mathematical critical thinking (MCT) achievement ratio of 0.27. Male subjects had an achievement ratio of 0.3 (sufficient) higher than female subjects of 0.24 (insufficient). Based on the background subjects from urban areas had the highest MCT achievement ratio of 0.49 (sufficient) while the subject achievement ratio of the coast and mountains were 0.17 (insufficient) and 0.15 (insufficient), respectively.

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1. INTRODUCTION.

At present, schools ranging from elementary to secondary school levels in Indonesia including in North Maluku as part of eastern Indonesia, apply the 2013 curriculum (K-13) as a standard curriculum that has been mandated by the government. Learning in the 2013 curriculum prioritizes the application of high-level thinking skills that encourage students to think logically, critically, reflective, and creatively (As'ari, 2014). This characteristic is reflected in the essential competencies students must achieve in each subject they take. The critical thinking competency standard provides a framework for assessing students' critical thinking abilities (Paul, 2005).

At the level of primary education and even pre-school, critical thinking also become a target that is quite often raised (Florea, 2015). Although the ability to think critically naturally increases with age, a child can benefit from learning critical thinking (Mass, 2014). Some research findings even show that learning interventions that are carried out to improve critical thinking skills show positive results (Mass, 2014).

In learning mathematics, the ability to think critically is one crucial component. Even efforts to develop students' critical thinking skills in mathematics have become the main agenda in the mathematics education curriculum in many countries in the world (Mason, 2010). One definition of critical thinking in mathematics / mathematical critical thinking is the ability and disposition to combine previously owned knowledge, mathematical reasoning, and cognitive strategies to generalize, prove or evaluate unusual/ unknown mathematical situations, in a thoughtful way (Glazer, 2001).

However, several survey results from international institutions show that the ability of Indonesian students in the field of mathematics, in particular, is still relatively low compared to other countries. For example, the results of a 2015 PISA (Program for International Student Assessment) survey showed that Indonesia was ranked 63 out of 72 participating countries, with scores below the average (OECD, 2015). Likewise, the 2015 study conducted by TIMMS (Trends in International Mathematics and Science Study) in mathematics, Indonesia ranked 45 out of 50 participating countries (TIMMS, 2015). In eastern Indonesia, specifically North Maluku Province, it only has a Human Development Index (HDI) of 67.2, which is below the national HDI of 70.81 (BPS, 2018). The data can be used as an indicator of the need to identify problems in secondary education, one of which can be done by diagnosing the mathematical critical thinking skills of junior high school students, especially in North Maluku Province. In particular, the City of Tidore, according to the PUSPENDIK data, the average achievement of the National Examination for junior high school students in mathematics from 2015 to 2017 tended to decrease respectively 69.30, 58.61 and 63.39 (Puspendik, 2017).

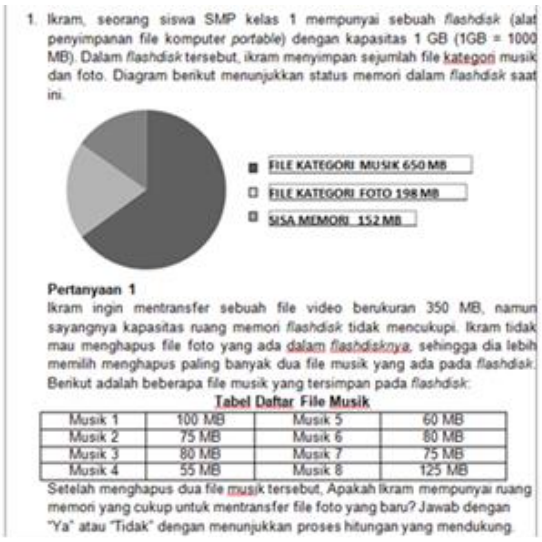
There are at least six reasons why assessing students 'critical thinking skills needs to be done, including 1) diagnosing students' critical thinking levels, 2) motivating students to be better at critical thinking, 3) providing information to teachers regarding their success in teaching students to think critically, 4) conduct research related to issues or issues related to critical thinking, and 5) provide information to stakeholders in schools regarding the direction of students' critical thinking (Soukup, 1999). So in this study, researchers wanted to describe in detail how the mathematical critical thinking skills of junior high school students in the City of Tidore.

2. METHODS

This research is a qualitative descriptive study. Researchers become the main instrument of research. In the pre-research phase, researchers design research models, determine research sites, arrange instruments, validate instruments, prepare research equipment, and take care of licensing. In the research phase, researchers collect and analyze data. Researchers collect data on the results of student work solving mathematical problems, conducting interviews to identify critical thinking abilities, coding, interpreting, triangulating techniques and triangulating time, and summarizing and describing research findings. In the post-research phase, researchers compile research reports.

The study sites included three junior high schools in the City of Tidore Islands, namely SMPN 2 Tikep, SMPN 1 TIKEP, and SMPN 6 TIKEP. According to the statistical data of the three regions, which are the locations of the study, some areas are centres of fishermen, cities, and plantations.

The primary data source in this study is the subject of the research itself, namely the second-grade junior high school students. The first type of data is verbal data, namely the results of interviews. The interview instrument was designed to explore information on critical thinking skills of research subjects according to critical thinking indicators while non-verbal data in the form of questionnaire results and results of mathematical problem-solving. The instrument was in the form of mathematical problems as well as interview guidelines designed by the researcher, validated by the mathematics partner research expert. The researchers provided 30 minutes to answer every problem. Here is the problem mathematics used as research instruments.


1. Ikram, seorang siswa SMP kelas 1 mempunyai sebuah *flashdisk* (alat penyimpanan file komputer *portable*) dengan kapasitas 1 GB (1GB = 1000 MB). Dalam *flashdisk* tersebut, ikram menyimpan sejumlah file kategori musik dan foto. Diagram berikut menunjukkan status memori dalam *flashdisk* saat ini.

Pertanyaan 1

Ikram ingin mentransfer sebuah file video berukuran 350 MB, namun sayangnya kapasitas ruang memori *flashdisk* tidak mencukupi. Ikram tidak mau menghapus file foto yang ada dalam *flashdisknya*, sehingga dia lebih memilih menghapus paling banyak dua file musik yang ada pada *flashdisk*. Berikut adalah beberapa file musik yang tersimpan pada *flashdisk*:

Tabel Daftar File Musik

Musik 1	100 MB	Musik 5	60 MB
Musik 2	75 MB	Musik 6	80 MB
Musik 3	80 MB	Musik 7	75 MB
Musik 4	55 MB	Musik 8	125 MB

Setelah menghapus dua file musik tersebut, Apakah Ikram mempunyai ruang memori yang cukup untuk mentransfer file foto yang baru? Jawab dengan "Ya" atau "Tidak" dengan menunjukkan proses hitungan yang mendukung.

Figure 1. Aritmatic Problem

Figure 2. Geometry Problem

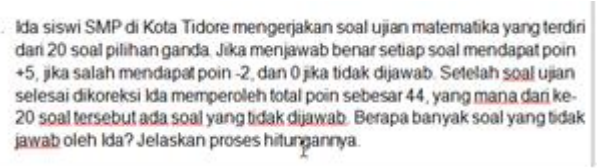

1. Ida siswi SMP di Kota Tidore mengerjakan soal ujian matematika yang terdiri dari 20 soal pilihan ganda. Jika menjawab benar setiap soal mendapat poin +5, jika salah mendapat poin -2, dan 0 jika tidak dijawab. Setelah soal ujian selesai dikoreksi Ida memperoleh total poin sebesar 44, yang mana dari ke-20 soal tersebut ada soal yang tidak dijawab. Berapa banyak soal yang tidak jawab oleh Ida? Jelaskan proses hitunganya.

Figure 3. Algebra Problem

After obtaining research subjects through a purposive sampling method that is through gender and background questionnaires with the number of research subjects two people in each school, researchers provide a test consisting of three questions with material including arithmetic, geometry, and algebra which amount respectively - one question each. Furthermore, researchers conducted interviews on both research subjects. In-depth interviews on research subjects do data collection. Interviews are conducted with semi-structured techniques so that the interviewer appears competent and fully prepared. The interview material was developed based on indicators of MCT thinking and all items of it. With this technique, it is expected that the data obtained are reliable and comparable. During the interview process, documentation and recording were carried out.

The raw data in the form of the results of the interview will then be converted into a transcript. The codes of the research subjects consist of background and gender codes. The background code consists of A = coastal area (fishermen), B = plantation area, and C = urban area. The gender code includes 1 = male, and 2 = female. Based on the transcript of the interview, the facts are compressed to get the core statement, then interpreted and the results of the interpretation are identified, analyzed, collected similar interpretations and then matched and categorized based on the items of each indicator of critical thinking while giving a score on each aspect, namely: 0 = None, 1 = insufficient, 2 = sufficient, 3 = good, and 4 = very good.

The next step is to summarize the acquisition of scores on each indicator (the number of scores of several items) to the total score (the total score of four indicators of MCT). The MCT performance ratio, which is the quotient between the total score of each indicator with the maximum score, is used as a representation of the MCT capability level. The maximum score list for each indicator is as follows:

Table 1. MCT indicators, Number of Items, Max score

Indicators	Number of Items	Maximum Score
Clarification	4	16
Assessment	3	12
Inference	3	12
Strategy	4	16

The total ratio is obtained by dividing the total score of all indicators with a total maximum score of 56 (16 + 12 + 12 + 16). The range of mathematical critical thinking achievement ratio is $0 \leq r \leq 1$. The achievement ratio obtained by research subjects is then categorized into four, namely: $0 \leq r < 0.25$ = insufficient, $0.25 \leq r < 0.5$ = sufficient, $0,5 \leq r < 0.75$ = good, and $0.75 \leq r \leq 1$ = very good. Descriptions that indicate the rationale of each item in each indicator are also provided to support the justification of the mathematical critical thinking ability of each research subject. The final analysis is carried out by comparing and observing the patterns of critical thinking characteristics based on gender and background, then describing it.

3. RESULTS AND DISCUSSION

Details about the results of the analysis of mathematical critical thinking abilities are separated based on three mathematical problem areas used as research instruments, namely arithmetic, geometry, and algebra.

3.1. Arithmetic Problem Field

Based on background, the ratio of MCT achievements in the field of arithmetic problems is shown in the table below.

Table 2. The Ratio of MCT Achievements in Aritmetic Based on Background

MCT Indicators	MCT Achievement Ratio					
	Coastal		Urban		Mountain	
	M	F	M	F	M	F
Clarification	0,500	0,563	0,813	0,875	0,625	0,313
Assessment	0,333	0,250	0,833	0,917	0,333	0,333
Inference	0,167	0,250	0,833	0,833	0,250	0,333
Strategy	0,000	0,188	0,313	0,313	0,125	0,188
Total	**0,250**	**0,321**	**0,679**	**0,714**	**0,339**	**0,286**

More clearly, the table above can be represented with the following diagram.

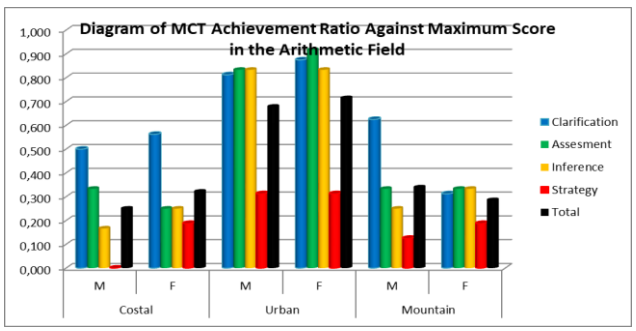


Figure 4. Diagram of MCT Achievement Rasio In Aritmetic Based on Background

Based on the table and diagram above the ratio of students' MCT achievement in arithmetic questions in urban schools is higher than the other two schools, namely schools in coastal areas and schools in mountainous areas. This happened in all aspects of the aspects of clarification, assessment, inference, and strategy. The consequence of this is the ratio of the total MCT achievement (ratio of the total score in all indicators to the maximum total score) of students with a background of urban society is higher ± 0.4 than students with a background of the coastal and mountainous community.

The resemblance of the achievement ratio of MCT students in the three backgrounds lies in the ratio of the achievement of the strategic aspects that do not reach 0.5. In other words, students are less able to propose completion steps based on logical reasoning, do not check out the steps that have been done, and are reluctant to look for alternative steps.

In the assessment and inference indicators, both students with coastal and mountainous community background both have an achievement ratio of ± 0.3. Students are less able to identify mathematical concepts needed in solving arithmetic problems and arrange relationships between known information, including finding additional information that is useful in supporting finding solutions. Whereas in the clarification aspect, 5 out of 6 students from the three backgrounds had relatively good scores. Students do not experience any problems in identifying information and understanding arithmetic problems contained in the problems.

The table below shows the ratio of MCT achievement scores in the arithmetic problem field based on gender.

Table 3. The Ratio of MCT Achievements in Aritmetic Based on Gender

MCT Indicators	MCT Achievement Ratio					
	Male			Female		
	Coastal	Urban	Mountain	Coastal	Urban	Mountain
Clarification	0,5	0,812	0,625	0,562	0,875	0,312
Assessment	0,333	0,833	0,333	0,25	0,916	0,333
Inference	0,166	0,833	0,25	0,25	0,833	0,33
Strategy	0	0,312	0,125	0,187	0,312	0,187
Total	**0,25**	**0,678**	**0,339**	**0,321**	**0,714**	**0,285**

More precisely, the following diagram represents the table above.

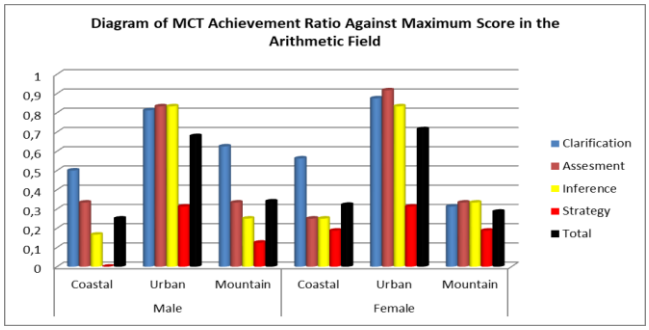


Figure 5. Diagram of MCT Achievement Ratio In Aritmetic Based on Gender

In the field of arithmetic problems, both gender groups (male and female) have an average ratio of the total achievement of MCT ± 0.4. Based on the diagram, it can be observed that in the two gender groups, the subjects with the background of urban society achieved the highest MCT ratio. Overall, the performance ratio in the indicator of assessment, inference, and strategy is below the number 0.3. Especially in the indicator of strategy, the average

achievement ratio in the two gender groups only reached ± 0.2. This evidence shows that in the field of arithmetic subjects in both gender groups are less capable in 1) Proposing specific steps that lead to solutions, 2) Proposing alternative steps, and 3) Checking completion steps.

The following is an example of the results of the student's work on arithmetic problems by female subjects with a coastal community background.

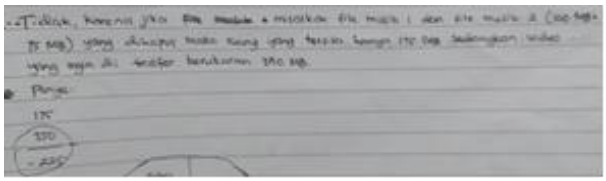


Figure 6. Examples of student work on arithmetic problem

Based on the results of the students' work and interviews, a description of each MCT indicator can be performed as follows.

Clarification

Subjects are quite adequate to understand the questions given. The subject confirmed that the problem in the problem was whether it was possible by choosing two music files to be deleted that could insert the video onto a flash disk. However, the subjects did not explain how the criteria for the size of two music files could be chosen.

The subject is quite adequate to explain the scope of the mathematical problem in the problem. The subject explained that the scope of the problem is which two music files can be eliminated so that the video size of 350 Mb, can enter the flash disk with a capacity of 1000 Mb with 152 Mb of memory remaining. Nevertheless, she can not explain how much memory it needs so that the video can be entered into the flash disk.

The subject is quite capable of identifying the information in the problem. The information that has been identified includes the total capacity of the flash, large photo files, the total size of the total music files including the size of the eight music files in the problem, and the remaining memory. However, the subject cannot mention some of the hidden information, for example, the amount of memory needed to insert the video, an extensive list of two music files that can be eliminated, even though the hidden information is the key to solving the problem including the subject being unable to explain why the memory space is not enough to insert a video.

Assessment

Subjects are less able to understand the information available. Subjects only understood a little information that was written on questions such as the amount of flash capacity and the size of existing photos and music files. However, subjects were not able to understand how much memory is required to insert video. Besides that, the subjects compared the amount of memory of two music files with the large video capacity that would be entered to decide whether to delete the two music files enough to insert a video with a size of 350 Mb into the flash disk. It means that the subject does not understand that what should be compared is the amount of memory needed with the amount of memory of two deleted music files.

The subject is less able to identify what mathematical concepts are required to solve the problem. Subjects only mention the concept of addition, whereas subtraction and comparison of two numbers are not mentioned.

Inference

Subject less able to frame the relationship between known facts including the fact of the relationship between the size of the video and the amount of free memory, and the fact of the relationship between the sums of two deleted music file sizes and the required memory space.

Subjects could not find enough additional information needed to solve the problem including information about the amount of memory space needed to transfer videos of 350 Mb in size, a list of two music files that could be eliminated, and the criteria for the size of two music files that could be eliminated so they could insert videos.

Strategy

The subject is not able to propose alternative steps to solve the problem, not make particular efforts to check out the completion steps that have been done. Subjects are less able to solve problems accurately. The idea of a proposed settlement is not backed by sufficient information, so the decision taken is not right. However, the subject has chosen one step sufficient to lead to completion by comparing the amount of memory space of the two music files 1 and 2, each measuring 100 Mb and 75 Mb to compare with the size of the video file to be sent.

3.2 Geometry Problem Field

Based on the background, the ratio of MCT achievement scores in the field of geometry problems is shown in the table below.

Table 4. The ratio of MCT achievements in Geometry Based on Background

MCT Indicators	MCT Achievement Ratio					
	Coastal		Urban		Mountain	
	M	F	M	F	M	F
Clarification	0,062	0,312	0,437	0,375	0,187	0,187
Assessment	0,083	0,166	0,416	0,25	0,083	0,166
Inference	0,083	0,083	0,333	0,25	0	0
Strategy	0,125	0,125	0,187	0,125	0	0
Total	0,089	0,178	0,339	0,25	0,0714	0,089

More the diagram below could be a representation of the table above.

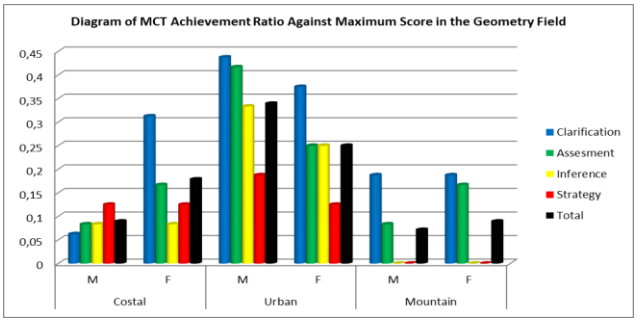


Figure 7. Diagram of MCT Achievement Rasio In Geometry

Based on the table and diagram above, it can be observed that

none of the students from the three community backgrounds achieved an MCT achievement ratio of over 0.5 in geometry problems. Students with the background of urban society have the highest achievement ratio in all aspects (classification, assessment, inference, strategy) and automatically the total ratio.

In this geometry problem, the lowest achievement ratio is in the indicators of inference and strategy. Both students with a mountain community background have an achievement ratio of 0 (zero) on both aspects. It means that the student cannot frame the relationship between parts or facts in the problem, find and add supporting information, draw conclusions based on logical reasoning, and check the completion steps that have been carried.

Based on the gender, the MCT achievement ratio in geometry problems is shown in the table below.

Table 5. The Ratio of MCT achievements in Geometry Based on Gender

MCT Indicators	MCT Achievement Rasio					
	Male			Female		
	Coastle	Urban	Mountain	Coastle	Urban	Mountain
Clarification	0,062	0,437	0,187	0,312	0,375	0,187
Assesment	0,083	0,416	0,0833	0,166	0,25	0,166
Inference	0,083	0,333	0	0,083	0,25	0
Strategy	0,125	0,187	0	0,125	0,125	0
Total	0,089	0,339	0,071	0,178	0,25	0,089

More precisely, the table above can be represented with the following diagram.

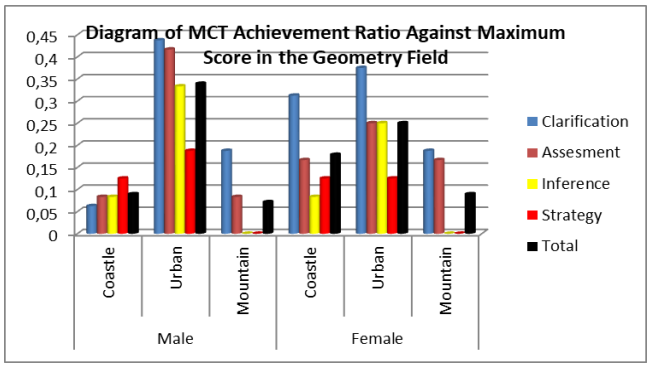


Figure 8. Diagram of MCT Achievement Rasio In Geometry Based on Gender

The average ratio of total MCT achievements in both gender groups (male and female) is almost the same, which is ± 0.17. These two gender groups together barely meet the indicators of MCT. Two of the six subjects had a ratio of 0 on aspects of inference and strategy. Most subjects cannot understand well the mathematical problems in the problem, identify hidden key information, and make mistakes in conjecture. It is the primary factor in the subject being unable to find the right solution.

The following are examples of the results of the work of geometry problems by a male subject with a background in urban society.

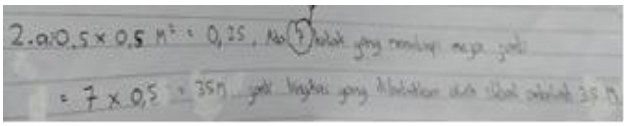


Figure 9. Examples of student work on geometry problem

Based on the results of work and interviews, each MCT indicator can be illustrated as follows.

Clarification

Subjects do not understand the mathematical problems that exist in the problem. In determining the length of the yellow line comprising three segments, the subject did so by counting the many tiles the line passed through. It is appropriate for vertical and horizontal lines (yellow), but cannot apply to slashes (yellow).

Subjects are less able to explain the scope of mathematical problems. The subject is merely able to explain that the length of the frame (yellow line) is to add up to three line segments, but how to calculate the length of each line segment cannot be adequately explained.

Subjects could quite identify the information, but hidden information related to the length of the vertical and horizontal lines that formed a right triangle with a yellow slash as a sloping side, could not be identified.

Assessment

The subject was capable of understanding the information that has been identified. As for information that has not been found, it is not entirely understood. Subjects are less able to identify all mathematical concepts needed. Concepts that have not been diagnosed include the concept of Pythagoras, the concept of length, and aggregation.

The subject is quite competent to make a conjecture, i.e. by mounting many tiles through which the yellow line passes, then multiplying many tiles by the length of the tile side (0.5 m). However, the subjects applied the same method to determine the length of the slash, which should first determine the length of the horizontal and vertical lines that form a right triangle, then determine the length of the slash using the Pythagoras principal.

Inference

Subject quite able to frame the relationship between facts in the problem including; the relationship between the many crowns crossed by vertical and horizontal yellow lines is four tiles with the side length of each tile is 0.5 meters by multiplication operation. It is appropriate, but when subjects estimate many tiles that are crossed by three slabs of yellow with the same method as is worked out on the horizontal lines and yellow vertical lines produce an incorrect answer of 3.5 meters.

Subjects are less able to add supporting information. The subject also determines the extent of any tile that is 0.25 m2, which is not demanded to solve the problem. Subjects are less able to draw logical conclusions because they determine the length of the yellow

slash by only estimating the equivalent (3 tiles), so it produces an incorrect answer.

Strategy

The subject was quite capable of proposing specific steps that lead to the solution, although it uses the estimation method in determining the length of the yellow slash, so it produces an incorrect final answer. However, the subject cannot explain well how to determine the length of the vertical and horizontal yellow lines.

In the process of work, subjects cannot propose alternative steps (they have identified no alternative steps) and evaluate completion steps. When working on, the subject does not do steps to evaluate the steps that have been made.

3.3 Algebra Problem Field

The table below represents the ratio of the score of MCT achievement in algebra problem field based on the background.

Table 5. The Ratio of MCT achievements in Algebra Based on Background

MCT Indicators	MCT Performance Ratio					
	Coastle		Urban		Mountain	
	M	F	M	F	M	F
Clarification	0,25	0,375	1	0,312	0,187	0,125
Assessment	0,083	0,166	1	0,166	0,166	0,083
Inference	0	0	1	0	0	0
Strategy	0	0	0,5	0	0	0
Total	0,089	0,142	0,857	0,125	0,0892	0,053

More the table above can be represented with the following diagram.

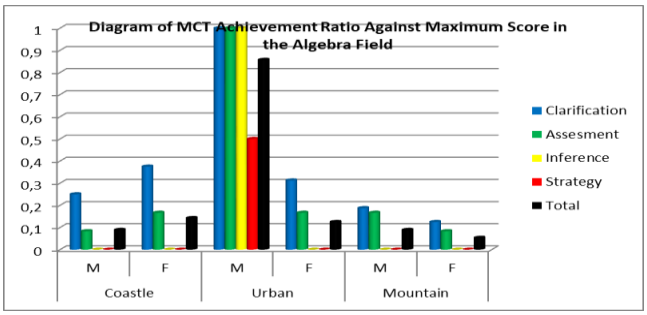


Figure 10. Diagram of MCT Achievement Rasio In Algebra Based on Background

In Algebra questions, students from the background of urban society still occupy the highest MCT achievement ratio, but five students comprising two students from coastal schools, two students from mountain schools, and one female student from urban schools have an achievement ratio below 0.5 in all indicators. Even the five students have a ratio of 0 (zero) on two indicators, namely inference and strategy. It means that in algebra questions, the five subjects do not have the ability: 1) Framing the relationship between parts or facts in the problem, 2) Finding and adding supporting information, 3) Draw conclusions based on logical reasoning, 4) Propose specific steps which lead to a solution, 5) Propose alternative steps, and 6) check ate the completion steps. One of the five research subjects, namely male students, has a reasonably good achievement ratio of 0.857.

Based on the gender, the ratio of MCT achievement scores in the algebra problem is shown in the table below.

Table 6. The ratio of MCT achievements in Algebra Based on Gender

MCT Indicators	MCT Performance Ratio					
	Male			Female		
	Coastle	Urban	Mountain	Coastle	Urban	Mountain
Clarification	0,25	1	0,187	0,375	0,312	0,125
Assessment	0,083	1	0,166	0,166	0,166	0,083
Inference	0	1	0	0	0	0
Strategy	0	0,5	0	0	0	0
Total	**0,089**	**0,857**	**0,089**	**0,142**	**0,125**	**0,053**

More the table above can be represented with the following diagram.

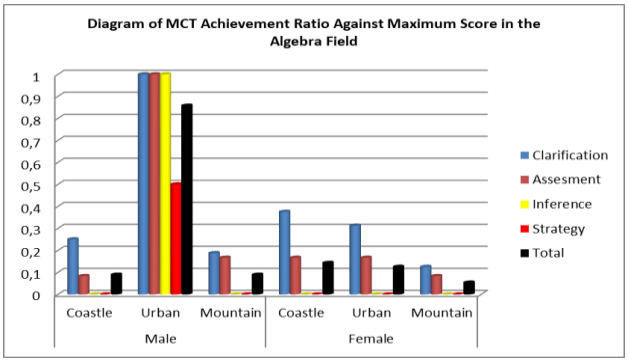


Figure 10. Diagram of MCT Achievement Rasio In Algebra

Based on tables and diagrams, the average ratio of total MCT achievements for men is higher than for women. It is caused by one male subject from the city community background who achieved a quite high MCT ratio of over 0.8, while five other subjects (two men and three women) only had an MCT achievement ratio of ± 0.1. In algebra in both male and female gender groups, both of them hardly fulfil all indicators of MCT (clarification, assessment, inference, strategy). Five out of six subjects in all gender groups have an MCT ratio of zero in two indicators, namely inference and strategy.

The following is an example of the results of the work of algebra problems by male subject with a background in urban society.

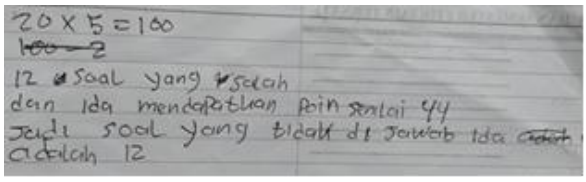


Figure 10. Examples of student work on Algebra problem

Based on the results of the student's work and interviews, a description of each indicator achieved can be described as follows.

Clarification

Subjects are less able to understand mathematical problems. Based on the interviews, the subject explained that the mathematical problem was to determine many questions that missed. However, distant subjects cannot describe the relationship

between many questions that are not answered with information that is known in the problem.

The subject cannot explain the scope of the mathematical problem in the problem. The scope of mathematical problems such as 1) many questions answered correctly, many questions answered incorrectly, many questions that missed and the total number of questions available, and 2) scores on each question answered and the total score obtained along with the form of mathematics cannot be identified and explained by subjects.

The subject is less able to identify the information contained in the problem. Some information was successfully identified includes many questions 20, the score for the correct answer 5, the total points obtained 44. The subject can not identify some information includes the score for each wrong answer, the score for the questions that are not answered, for questions that are not answered, and also does not mention information that there are questions that are not answered. The subjects mentioned that the maximum score that could be obtained was 100 (20 × 5) 20 × 5), but this additional information was not needed in the search for a solution.

Assessment

Subjects are less able to understand the information in the questions. One thing that is confirmed is that subjects do not understand that the total score got (44) is a combination of the total score got from several questions that are answered right, wrong, and not answered. While the subjects understood it, the score (44), was only obtained from several questions that were answered correctly by ignoring the questions that were answered incorrectly and were not answered.

Subjects are less able to identify mathematical concepts in the problem. The subject mentioned the concept of multiplication as a mathematical concept needed in work on the problem. Mathematical concepts that have not been identified include the concept of multiplication with negative numbers (-2), and mathematical forms (equations).

The subject cannot make the right conjecture that leads to the discovery of the correct solution. Conjectures made are many questions that are not answered 12, but further subjects can not explain the reasons for the selection of the conjecture logically.

Inference

The subject could not frame the relationship between facts and information in the problem. The relationship between the number of questions answered (true, false, not answered) with the many questions available (20), and the relationship between the number of times the score of each problem worked (correct, false, not answered) with points got, the two key relationships were not identified. Subjects could not find additional information. Additional information is a lot of correct answers a minimum of 10 (with a score of 5 for each question) to be able to get a score of 44. This information will lead to the step trial-error (a combination of many questions answered right, wrong, and not answered) until the correct answer is obtained.

Strategy

In the process of work, subjects cannot propose alternative steps. The subject explained, did not have other ideas that could be applied to find the right solution and did not make an evaluation of the work done. It was confirmed due to the time spent working.

4. CONCLUSION

4.1. Students 'Critical Mathematical Thinking Abilities Based on Gender

Here is a diagram that represents students' mathematical critical thinking abilities based on gender.

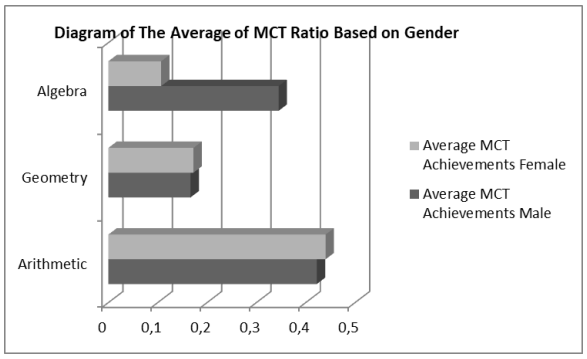


Figure 10. Diagram of The Average of MCT Ratio Based on Gender

Overall, in all problem areas, the average ratio of critical thinking achievement of male students was higher than female students, namely 0.3115 for male students and 0.240 for female students. This difference is classified as insignificant. That means the MCT ability of male students falls into a sufficient category, while female students fall into the lacking category. In arithmetic and geometry, male and female students have an average ratio of achievement that is almost the same, respectively 0.422619; 0.440497 for arithmetic, and 0.166667; 0.172619 for geometry. The next equation is in the fields of geometry and algebra, both male and female students both have less critical thinking achievement criteria, with an average achievement ratio of 0.169643 and 0.22619. In all problem areas (arithmetic, geometry, algebra), male and female students have shallow scores on two indicators, namely inference, and strategy.

4.2 Students 'Critical Mathematical Thinking Abilities Based on The Background

Here is a diagram that represents students' mathematical critical thinking abilities based on background.

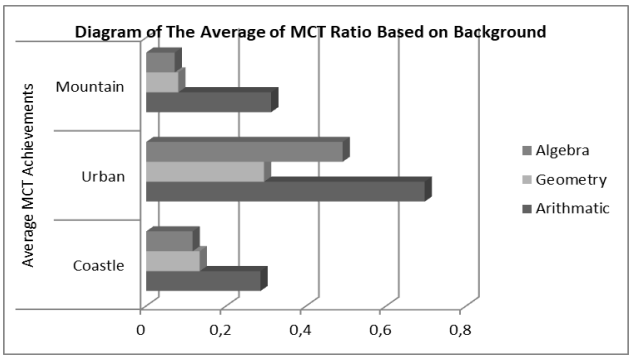


Figure 10. Diagram of The Average of MCT Ratio Based on Background

The diagram shows that students with urban community

backgrounds have the best MCT skills following students with coastal and mountain community backgrounds. It happens in all problem areas (arithmetic, geometry, algebra). The average ratio of the total mathematical critical thinking achievement of urban students is 0.494048, while coastal and mountain students are respectively 0.178582 and 0.154762. The figure includes the ability to think critically and mathematically students with an urban background on sufficient criteria, and others enter the criteria less. Geometry and algebra are two problem areas where all research subjects from the three backgrounds get low critical thinking achievement scores. Coastal students have an average critical thinking achievement ratio of 0.133929 and 0.116071 (insufficient) in the fields of geometry and algebra, and mountain students of 0.080357 and 0.071429 (insufficient).

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