The Analysis of Students' Mathematical Critical Thinking Skills in Terms of Gender

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Abstract—**This study aims to analyze the students' mathematical critical thinking skills in the circle material. The method used in this study is descriptive. The technique of collecting data through a test of critical thinking skills consisting of 2 items of the essay. The research subjects were the VIII grade students' of SMP Negeri 3 Bandar Lampung, totaling 106 students consisting of 53 male students and 53 female students. The results showed that the percentage of male students' critical thinking skills indicators achievement was better than the female students. The results show that there is a need for innovation that can make learning effective in facilitating the critical thinking skills of male and female students**

Keyword: mathematical critical thinking skills

I. INTRODUCTION

Mathematics education is a crucial thing to improve the quality of human resources in order to improve the mathematical thinking skills very well. Eight core competencies in 21st-century education, namely; (1) communication skills, (2) critical and creative thinking skills, (3) inquiry/reasoning skills, (4) interpersonal skills, (5) multicultural/multilingual literacy, (6) problem solving, (7) information / digital literacy; and (8) technological skills [1]. Therefore, critical thinking skills is one of the eight abilities that are very important and must be developed by students in mathematics. The ability to think critically in mathematics is the ability to evaluate an argument. The argument in question is an argument relating to the mathematical problems / mathematical problems given [2]. Also, critical thinking as decision making is based on careful evaluation and consideration [3].

Within the scope of the school, critical thinking allows the students to discover the truth of information [4]. The ability to think critically is important to help the students develop their talents, practice concentration, and focus problems, and analytical thinking. So that critical thinking skills can facilitate them to improve their understanding of mathematics [5]. But the reality from the results of an interview with a mathematics teacher in one of the schools whose critical thinking skills are still low is SMP Negeri 3 Bandar Lampung. It is found that when the students are given a problem that is different from the sample problems that have been explained by the teacher, the students cannot analyze yet and evaluate the problem correctly. It happens because the students are accustomed to working on

routine problems that are normally given by the teacher, which results if students are given a different mathematical problem with the example problems, they can not solve the problems given correctly.

Other factors that influence the success of mathematics learning activities are the characteristics of the students, one of which can be influenced by gender (gender). Men and women have different abilities, among others: 1) women have higher verbal abilities than men, 2) men are superior in visual-spatial abilities than women, 3) men are superior in mathematical ability [6]. It is in line with Krutetski [7] explaining the differences between men and women in learning mathematics, namely (1) Men are superior in reasoning, women are superior in accuracy, precision, accurateness, and equality of thinking. (2) Men have better mathematical and mechanical skills than women; this difference is not evident at the elementary school level but becomes more apparent at higher levels. Based on the results of the study, there is no real difference in critical thinking skills between the boy and girl. This shows in the process of revealing the facts of the problems that exist for the process of resolution between female and male subjects tend to be the same [8].

Based on the explanation above, the researcher intends to conduct the research on students' mathematical critical thinking skills in terms of gender in the circle material based on indicators of critical thinking skills, namely interpretation, analysis, evaluation, and inference. Through this research, the researchers hope to get detailed information related to the mathematical critical thinking skills of male and female students in order to be able to practice the students' critical thinking skills.

II. EXPERIMENTAL METHODS

This research is a descriptive study with a qualitative approach that aims to analyze the students' critical thinking skills on circle material. The subjects in this study were students of VIII grade of SMP Negeri 3 Bandar Lampung, totaling 106 students selected by a simple random sampling technique. In this study, the data obtained from the results of students' critical thinking skills test consisted of 2 essay items related to circle material. The data were then analyzed using four indicators of critical thinking skills data obtained from each student's answer based on a rubric. Furthermore, it is

processed by determining the percentage of fulfillment of each indicator presented in a tabular form and making conclusions.

III. RESULTS AND DISCUSSION

A. Results

1) Percentage tests of the students' mathematical critical thinking skills

Percentage data on the students' mathematical critical thinking skills can be seen in Table 1.

TABLE I.   PERCENTAGE TESTS OF THE STUDENTS' MATHEMATICAL CRITICAL THINKING SKILLS

Students' Score	Assessment Category	Male Percentage on question number 1	Male Percentage on question number.2	Female Percentage on question number 1	Female Percentage on question number 2
81-100	Very Good	69.18	62.25	66.03	60.38
61-80	Good	22.65	20.76	20.76	20.75
41-60	Enough	7.54	16.99	13.21	18.87
21-40	Less	0	0	0	0
0-20	Very Less	0	0	0	0
	Total	100	100	100	100

2) Percentage of The Students' Critical Thinking Skills Based on The Indicators Judging from Gender Differences
Data on the percentage of the students' critical thinking skills based on indicators can be seen in Table 2.

TABLE II.   PERCENTAGE OF THE STUDENTS' CRITICAL THINKING SKILLS BASED ON THE INDICATORS

Indicator	Male Percentage on question number 1	Female Percentage on question number 1	Male Percentage on question number 2	Female Percentage on question number 2	The average percentage of the fullness of male indicators	The average percentage of the fullness of female indicators	Category
Interpretation	66.03	64.15	65.46	58.49	63.20	61.32	Good
Analysis	58.49	52.83	64.15	50.94	62.26	51.89	Good
Evaluation	49.05	47.16	60.37	43.39	56.60	45.27	Enough
Inference	40.62	43.39	43.39	41.50	42.05	42.45	Enough

B. Discussions

Based on Table 2 shows the indicators of interpretation of male and female students, both this is seen based on the way students understand and express the meanings of various experiences, situations, and procedures or broader criteria. Based on the opinion that interpretation means being able to explain the problem at hand. Learners are also able to determine the information that can be used to solve problems [9].

Analysis Indicators on critical thinking skills show that the male and female students are categorized as well. It is seen based on the way students identify the relationship between statements, questions, concepts, or other forms of intended representation.

The ability to think critically on the evaluation indicators shows the results of sufficient categories of male and female students. It shows that the evaluation indicators need to be improved so the students can assess the credibility, statements, or other representations that provide explanations, including statements, descriptions, questions, or other forms of representation.

The ability to think critically on inference indicators is obtained by sufficient categories of male and female students. Critical thinking skills need to be improved so that students can identify and determine the elements needed to conclude by considering relevant information. Duron's argues that the stage of inference in critical thinking is focused on assessment and making conclusions based on information obtained [10].

The results obtained indicate that the mathematical critical thinking skills of male and female students are still relatively low in the indicators of evaluation and inference.

Analysis of critical thinking skills seen from Number 1
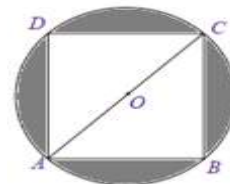
A circular garden. Inside the circle are plants that are not planted with square-shaped grass with a side of $7\sqrt{2}$ m. Determine the circumference of the field circle and the area of the field planted with grass.

Based on Table 1, it was found that male and female students who received very good categories for male students were 69.81%, and female students were 66.03%. In each indicator, male and female students can write the information that is known with a good completion strategy so that the indicators of interpretation, analysis, evaluation, and inference on male and female students are met.
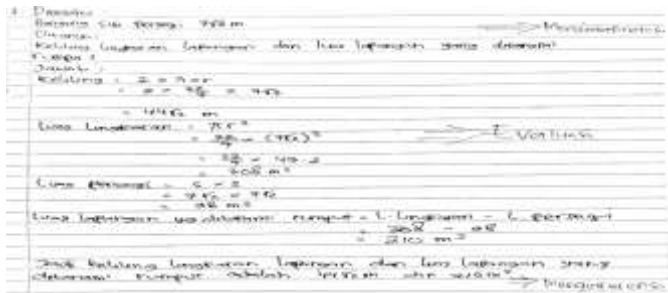

Fig. 1. One of the results of male students in either category

Figure 1 shows that the indicators of interpretation of male students can write out what is known and asked well. From the results identified that the ability of male students in the interpretation aspect is classified as good 66.03%. In the indicator analysis of male students classified as good 58.49%. However, some students are unable to connect known information with the strategies used because the students cannot find the diameter and radius of the given problem. In fact, the students assume that the known side is the radius of the circle, so students do not look for the radius of the circle. In the evaluation indicators, male students were considered quite 49.05%. From the results of the evaluation, male students can use the right strategy in solving problems, but they make mistakes in calculations. In the indicator aspect, the reference was obtained by quite a category of 39.62%. Some students can make conclusions exactly according to the context of the problem, but the calculation is not correct.
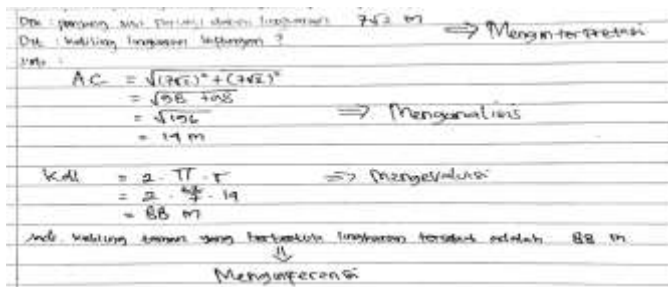

Fig. 2. One of the results of female students in the good category

Figure 2 shows that the indicators of interpretation of female students can write out what is known and asked well. The results identified that the ability of female students in aspects of interpretation is classified as good 64.15%. In the indicator analysis of female students, it was classified as quite 52.83%. But some students can connect information that is known with the strategies used. In fact, the students assume that the diameter is the same as the radius of the circle. In the evaluation indicators, female students were considered quite 47.16%. From the results of the female evaluation, students can use the right strategy in solving problems, but they make

mistakes in calculations. In the aspect of inference indicators, it is obtained a sufficient category of 43.39%. Some female students can make conclusions exactly according to the context of the questions, but the calculations are not correct.
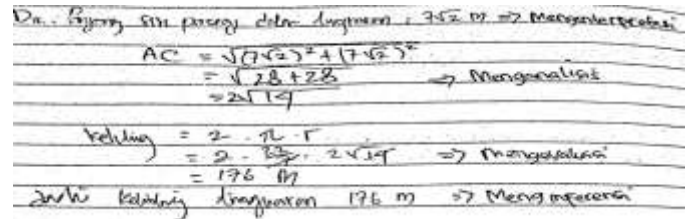

Fig. 3. One of the male student results in a sufficient category

Figure 3 shows that the interpretation indicators of male students can write the known but still not write what is asked. In the analysis indicator of male students can find the radius using the Pythagorean Theorem, but it is not appropriate in calculations. In the evaluation indicators of male students, they can use the right strategy in solving problems, but they still make mistakes in calculations. In the aspect of inference indicators, students cannot make conclusions correctly even though they are adjusted to the context of the questions because the students' calculations are not correct.
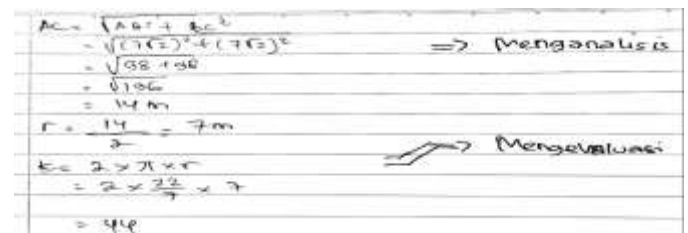

Fig. 4. One of the female student results in a sufficient category

Figure 4 shows that the indicators of interpretation of female students can not write what is known and asked well. In the analysis indicators, female students can find the radius using the Pythagorean Theorem correctly. In the evaluation indicators, female students make the mistake of not writing the unit area. In the aspect of indicators, the inference of female students cannot make the conclusions.

Analysis of students' critical thinking skills can be seen from number 2

Look at the following picture!
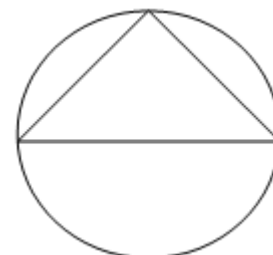
What is the circumference angle facing the diameter of the circle? Explain!

Based on Table 1, it was found that male and female students who received very good categories for male students were 62.25%, and female students were 60.38%. In each

indicator, male and female students can write the information that is known with a good completion strategy so that the indicators of interpretation, analysis, evaluation, and inference on male and female students are met.
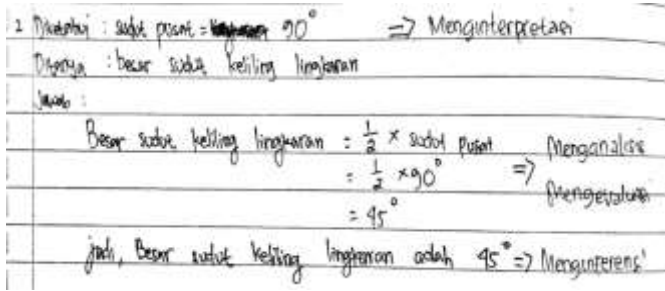

Fig. 5.   One of the results of male students in either category

Figure 5 shows that on the interpretation indicators, male students can write down what is known and asked but is not quite right. From the results identified that the ability of male students in the interpretation aspect is classified as good 65.46%. In the indicator analysis of male students classified as good 64.15%. However, some students can connect information that is known with the strategies used because of what is known to be wrong is the central angle of the circle which should be 180°, but the students write the center angle of 90°. In the evaluation indicators of male students classified as good 60.37%. From the results of the evaluation, male students can use the right strategy in solving problems, but at the analysis stage, they make mistakes, so the calculation results are not right. In the aspect of inference indicators, it is obtained a sufficient category of 43.39%. Students can make conclusions exactly according to the context of the problem, but the calculation is not correct.
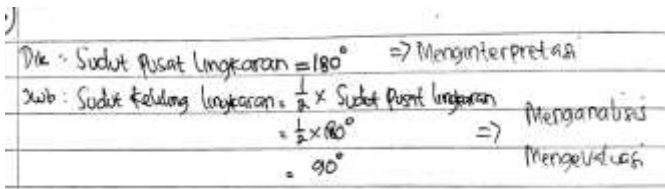

Fig. 6.   One of the results of female students in either category

Figure 6 shows that the interpretation indicators of female students can only write those that are known precisely. From the results identified that the ability of female students in the interpretation aspect is classified as good 58.49%. In the analysis indicator of female students classified as good 50.94%. The students can connect information that is known with the strategies used. In the evaluation indicators, female students were classified as quite 43.39%. From the results of the evaluation, female students can use the right strategy in solving problems, so the calculation results are correct. In the aspect of inference indicators, it is obtained a sufficient category of 41.50%. But some students don't make conclusions.
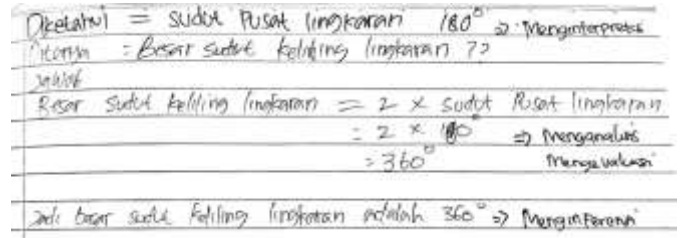

Fig. 7.   One of the male student results in a sufficient category

Figure 7 shows that on the interpretation indicators, male students can write down what is known and asked correctly. In the analysis and evaluation indicators, students use an incorrect formula because they assume that the circumference of a circle is two times the angle of the center of the circle so that the resulting calculation is incorrect. At the inference stage, male students make mistakes in the analysis and evaluation aspects so as to make inaccurate conclusions.
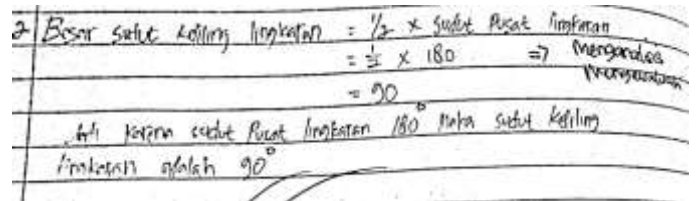

Fig. 8.   One of the female student results in a sufficient category

Figure 8 shows that the indicators of interpretation and inference some female students can not write what is known and asked well and do not make conclusions. In the analysis and evaluation indicators, female students can use strategies correctly and calculations correctly.

IV. CONCLUSIONS

The results showed that the indicators of achievement of students' critical mathematical thinking skills as a whole were still low, namely below 53%. The percentage of indicators of achieving mathematical critical thinking skills of male students is better than female students. The results of the mathematical critical thinking skills of male and female students are interpretation indicators (63.20% and 61.32%), analysis indicators (62.26% and 51.89%), evaluation indicators (56.60% and 45.27%), and inference indicators (42.05% and 42.45%).

Based on the results of the analysis, it was concluded that the mathematical critical thinking ability of male and female students was different. It can be seen from the way students interpret, analyze, evaluate, and conclude the problems given to students. So in Maccoby's and Jacklin's opinion that the math skills of male students are superior to female students.

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