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Students' Critical Thinking Ability: Description Based on Academic Level And Gender

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ABSTRACT

This research aims to describe students' critical thinking ability based on the level academic and gender. The populations of this study were 132 students participating in five classes of Calculus course. The research data obtained through technical tests and interview techniques.This study found that the high level of capability, both male students or female students already have the ability to generalize the ability to complete the data provided and do not yet have the ability to identify and justify the concept and analyze algorithms. At medium and low levels of capability, male students or female students show similar.

Keywords: critical thinking ability; level academic; gender

1. Introduction

Developments in science and technology very rapidly lead to rapidly changing life styles and global order. In the face of changing life styles and global order, there is often someone confronted with the readiness and ability to face changes. Therefore, in order to confront these changes, the ability to problem solving is necessary. To be able to do a good problem solving, then someone in desperate need critical thinking skills. Problem solving skills and critical thinking skills are part of the purpose of the study of mathematics.

In the Curriculum at secondary school (2006) is stated that after studying mathematics, students must have the following competencies:

a. Understand the concepts of mathematics, describes the relationship between concepts and apply concepts or logarithm, is flexible, accurate, efficient, and precise in troubleshooting.

b. Using the reasoning on the pattern and nature, perform mathematical manipulation in making generalizations, compile evidence, or explain mathematical ideas and statements.

c. Solve problems that include the ability to understand a problem, design a mathematical model, solve the model and interpret the obtained solution.

d. Communicate ideas with symbols, tables, diagrams, or the media to clarify the situation or problems.

e. Have respect for the usefulness of mathematics in life, which has the curiosity, attention and interest in studying mathematics, as well as a tenacious attitude and confidence in solving problems.

Critical thinking competency standards provides a framework for assesing students' critical thinking abilities (Butler,2005)

Mathematical abilities to be possessed by learners above, must also be owned by the student teachers who will teach math. Committee on the Undergraduate Program in mathematics (CUPM) (Karlimah, 2010) to provide six basic recommendations for the department, programs, and courses in mathematics. One recommendation stated that each course in mathematics should be an activity that will assist students in the development of analytical, critical reasoning, problem solving, and communication skills. Recommendations CUPM above

explains, the task of the institution in charge of educating student teachers who will teach mathematics, including female students prepare students to have the ability to think critically mathematically.

Aizikovitsh-Udi and Cheng (2015) state that critical thinking is a capability essential to contemporary life. Furthermore, the benefits of critical thinking are lifelong, supporting students in the regulation of their study skills, and subsequently empowering individuals to contribute creatively to their chosen profession.

Klurik and Rudnick (Sabandar, 2008) argues that included critical thinking in mathematics is thought that test, questioning, connecting, evaluating all aspects of the situation or a problem. Critical thinking that can arise when learning problems that triggered and followed by the question: "Resolving this problem in another way", "ask the question .... what if", "What's wrong", and "What would you do ".

Klurik and Rudnick has stated that the one belonging to the critical thinking are thought to question. A student will be able to think to question if they know what they want to ask. Firdaus, I.K, Md. Nor Bin Bakar, B (2015), critical thinking can be developed through a process of mathematics learning because the mathematics has a structure and strong and clear connectivity between its concepts to students who learn mathematics potential to be rational.

Critical thinking according to Johnson (2007) is a focused and clear process used in mental activities such as solving problems, making decisions,

persuade, analyze assumptions, and conduct scientific research. Similarly Ennis quoted Lipman (2003) argues aspects of critical thinking is the focus (focus), s good (reason), inference (conclusion), situation, clarity and overview (reviewing).

With critical thinking, students became more curious because of the encouragement of curiosity and a desire to obtain the truth. The habit of critical thinking will improve the mathematical ability of students, because the students are encouraged to perform various activities such as: face many challenges in learning, finding new things, and resolving the problems of non-routine. With critical thinking, students can understand the problem well, making plans solving problems, and making alternative settlement of the problem in a more practical, therefore, students who have the ability to think critically is expected to achieve a quality of a good solution of mathematical problems that need to be solved.

Based on the above statement can be concluded that critical thinking can create and train someone to do (doing the math) in the learning of mathematics. This indicates that the student or students no longer learn by rote, but learn math by doing or active. Therefore, critical thinking skills are essential to be developed.

The ability to think critically examined based on the following indicators, namely:

a. The ability to identify and justify the concept, namely the ability to give a reason to the mastery of the concept;
b. The ability to generalize, namely the ability to supplement the data or information that supports

c. Ability to analyze the algorithm, namely the ability to evaluate or examine an algorithm.

2. Method

This research is descriptive qualitative study in which subjects are taken are students of the Faculty of Mathematics Education Teaching and Education Riau Islamic University second semester of academic year 2014/2015, amounting to as many as 132 students.

The validity of the data used in this study include the credibility (validity) and dependability (reliability). Furthermore, to obtain reliable research data (credibility), the technique used is the method of triangulation. Meanwhile, to keep reliability conducted by documenting all activities carried out in this study. Data collection tool in this research is a matter of critical thinking skills test and interview guide with students. Data collection instrument was obtained through technical tests and interview techniques.

Furthermore, the data that has been analyzed based on the following steps:

a. Written data analysis done by checking the truth of the answers given by the students to think critically about the ability of the test based on settlement instructions and answer key provided by the researcher. The next draw conclusions from the data collected and verify conclusions.

b. Analysis of data from interviews conducted with data reduction ie activities referring to the electoral process, concentration and transformation of raw data in the field. If there is invalid data, then the

data were collected separately and may be used for other adverse outcomes. The next draw conclusions from the data collected and verified this conclusion.

3. Results and Discussion

Collecting data in this study conducted in room A6.09 - A6.14 Campus FKIP UIR Pekanbaru on 11-13 May 2015 at 09:00 to 12:00 hours GMT. After the research subjects working on sheet instruments critical thinking mathematically, the researchers further classify students based on ability level and gender, then determined the average and the maximum value of each level of ability and gender. Here's a summary of critical thinking ability grouping students by ability levels and sex:

Table 1. Grouping Students of Critical Thinking Ability Based on Ability Level and Gender (Based Test)

Ability Level	Male	Mean	Maximum Value	Female	Mean	Maximum Value
High	1	9	9	10	7.5	10
Medium	10	5	6	89	4.99	6
Low	4	3	3	18	2.83	3
Summary	15	4.73		117	4.87	

Source: Data Processed Researchers

Based on the table 1 above, it is seen that there is a difference between the maximum value of male students and female in high-level capability, while the ability of medium and low level, between male students and female there is no difference maximum value. Furthermore, the high level of capability, there is only

one person male students or 6.67%, while female students are as many as 10 people or 8.55%, so there is a difference of 1.88%. While the medium ability level, there were 10 male students or 66.67%, while female students are as many as 89 people or 76.07%, so there is a difference of 9.4%. Furthermore, the low ability level, there are as many as 4 students or 26.67%, while female students are as many as 18 people or 15.38%. Overall, the high level of capability and being dominated by female students, while low ability level, dominated by male students.

For the average overall, between male students and female is not much different, namely, 4, 73 to the average value of male students and 4.78 for female students, but in this case, still shows female students overall has an average value higher.

After grouping, the researchers determined the subjects were selected based on skill level and gender. In this case, researchers took 3 students (male and female), each of which represents a capability level (high, medium, low). Once the interview process is complete, the researchers conducted an analysis of research data. Data analysis is done by exposing research subjects answer in writing and then continued by presenting the results of research interviews with the subject. Lastly researchers triangulate the results of the data that has been obtained.

Based on three indicators of critical thinking skills that researchers use in this study, which are: (1) the ability to identify and justify the concept, namely the ability to give a reason to the mastery of concepts; (2) the ability to generalize, namely the ability to supplement the data or information support; (3) the ability to

analyze the algorithm, namely the ability to evaluate or examine an algorithm. The following summary of the triangulation of data (data analysis and interviews written) subjects based on the level of ability and gender.

Table 2.Profile of Student Critical Thinking Ability in Solving Mathematics in Calculus II Course Based on The Level of Academic Ability and Gender (Based Interviews)

Level of Academic Ability	Gender	Indicators of Critical Thinking Ability		
		The ability to identify and justify the concept, namely the ability to give a reason to the mastery of concepts	**The ability to generalize, namely the ability to supplement the data or information that supports**	**The ability to analyze the algorithm, namely the ability to evaluate or examine an algorithm**
High	Male	Has been able to create a design sketch curves, equations of lines, and has been able to determine which areas will be counted in extent. But there is still one in determining the integral limit and determine which area should be reduced, so that the final answer is ot correct.	Has been able to provide answers correctly	Has been able to provide an evaluation correctly, but still wrong in giving corrections repair.
	Female	Is correct in making the design sketch curves, and has been able to determine which areas will be counted extent, and it is correct in	Is correct in giving an answer	Is correct in giving an evaluation of the selesaian presented, but still wrong in giving corrections

		giving the final settlement.		repair
Medium	Male	Has not been able to create a design sketch of the curve, sebingga not able to show which areas are to be counted extent, but right in determining the integral limit and determine which area should be reduced, but is still not correct in determining the final settlement	Has been able to provide complete data, but can not complete properly, that is wrong in integrating	Already provide evaluation correctly, but still wrong in giving corrections repair.
	Female	Try to make a design sketch of the curve, but still wrong, and it is still one in determining the integral limit and define the eventual settlement	Has been able to determine which concept will be used to complete the data provided, but still one in determining the eventual settlement.	Has been able to provide an evaluation of the settlement were given correctly, but still wrong in giving corrections repair.
Low	Male	Has not been able to create a design sketch of the curve, so it has not been able to show which areas are to be counted broad area. So it has not been able to provide the correct completion	Has not been able to determine the correct concept to complement the data provided, so that the expected final settlement has not been true.	Wrong in giving an evaluation of a given settlement.
	Female	Most subjects did not respond, because they do not understand the problems given.	Has been able to determine which concept will be used to complete the data provided, but still wrong in	Does not provide an evaluation of a given settlement.

			using concept, so it is still wrong in ving the final settlement	

Source: Data Processed Researchers

Based on the table above, it appears that the male students at the high ability level, only able to answer correctly to question no. 2, so that it can be said that the male students at the high ability level already has the ability to generalize the ability to complete the data provided and do not yet have the ability to identify and justify the concept and analyze algorithms. While female students at high ability levels, based on the table above, indicated that it has the ability to identify and justify the concept and the ability to generalize and not have the ability to analyze the algorithm.

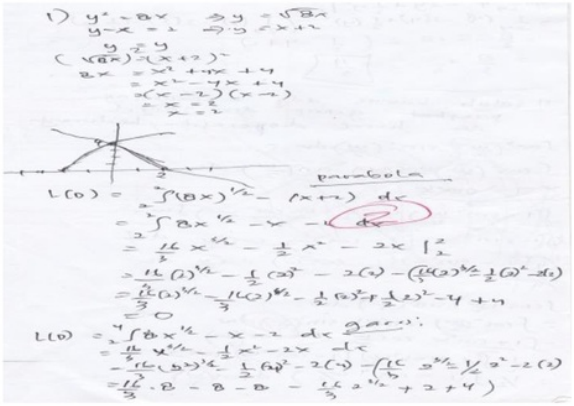
At the level of moderate ability, students men and women show similar symptoms, so the students indicated both men and women have not had the ability to identify and justify the concept, ability to generalize, as well as the ability to analyze the algorithm. Whereas at a low ability level, students men and women also showed similar symptoms, which do not yet have the ability to identify and justify the concept, ability to generalize, as well as the ability to analyze the algorithm. But according to our analysis, male students at a low level is slightly superior when compared to female students, which in a matter of no. 1, male students understand a given problem, while female students do not understand at all that indicated with no response to question no. 1.

Here are Excerpts of the results of student answers to questions critical

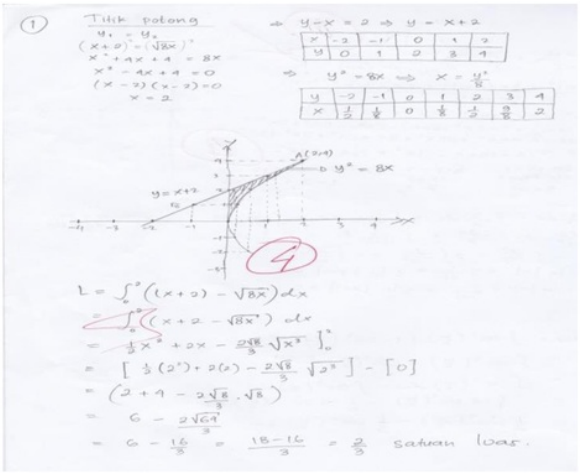
thinking mathematically based on the level of ability and gender.

1. Excerpts Students answer to Question No. 1
   a. Students at High Level of Capabilities

   - Male student

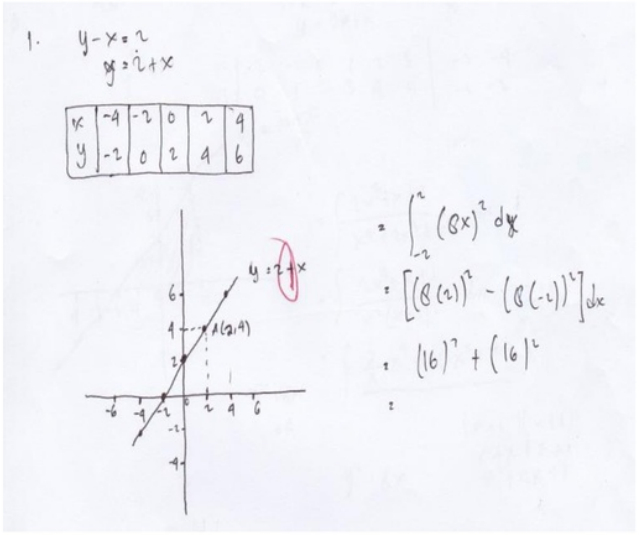


   - Female student

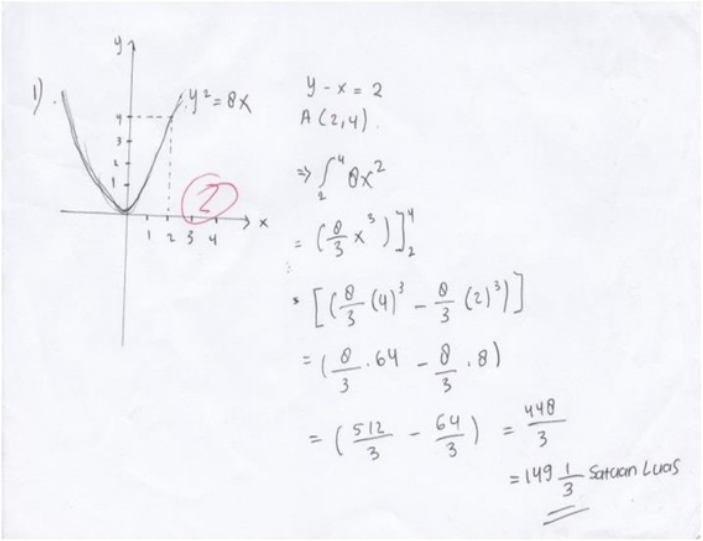


   b. Students at Medium Level of Capabilities

   - Male student

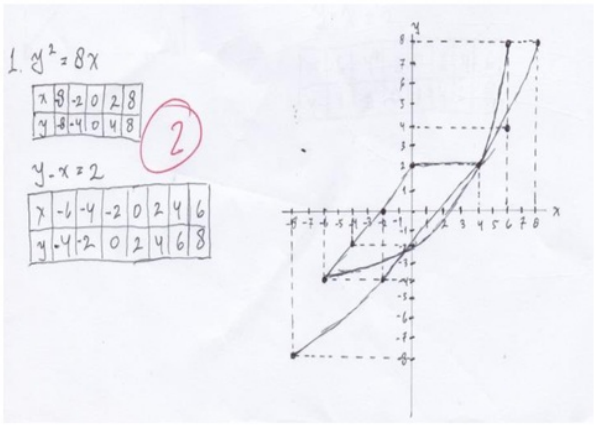


- Female student

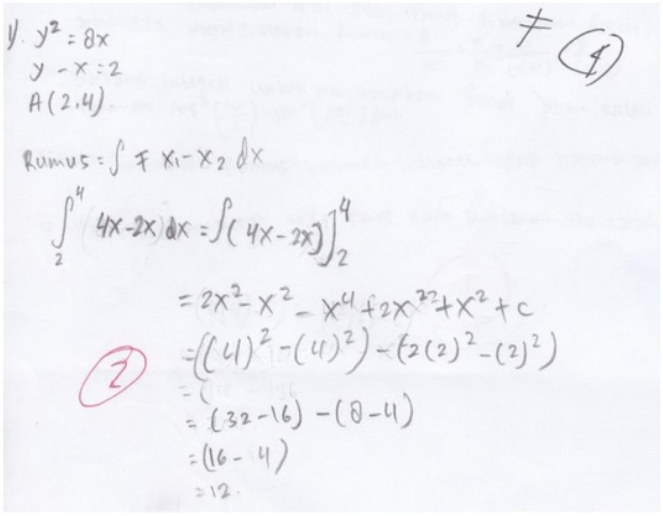


c. Students at Low Level of Capabilities

- Male Student



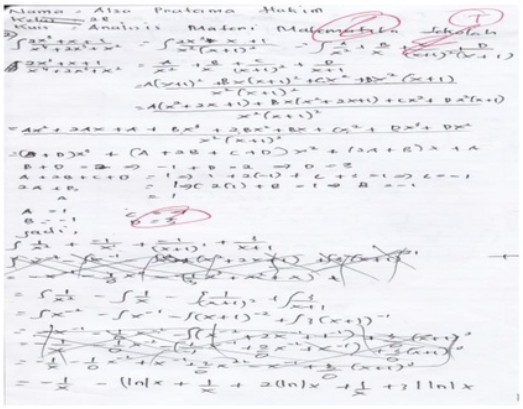
- Female student



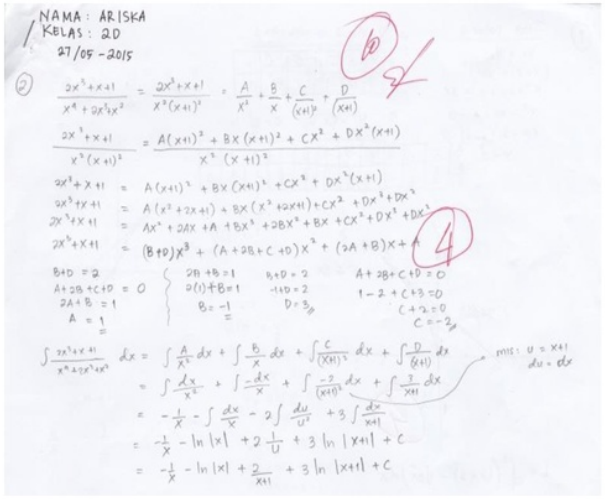
2. Excerpts Students answer to Question No. 2

a. Students at High Level of Capabilities

- Male Student

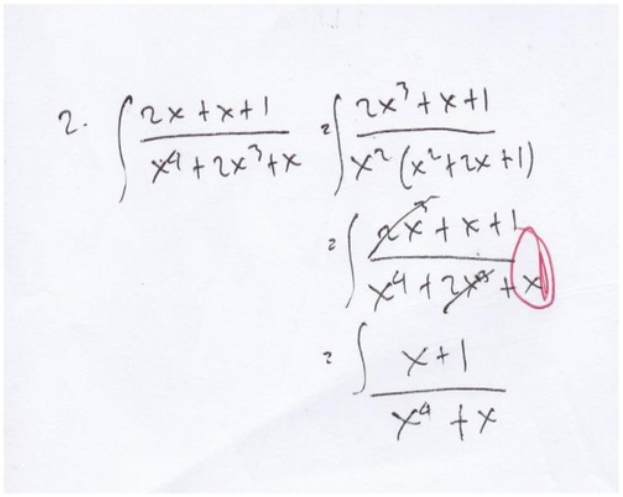


- Female Student

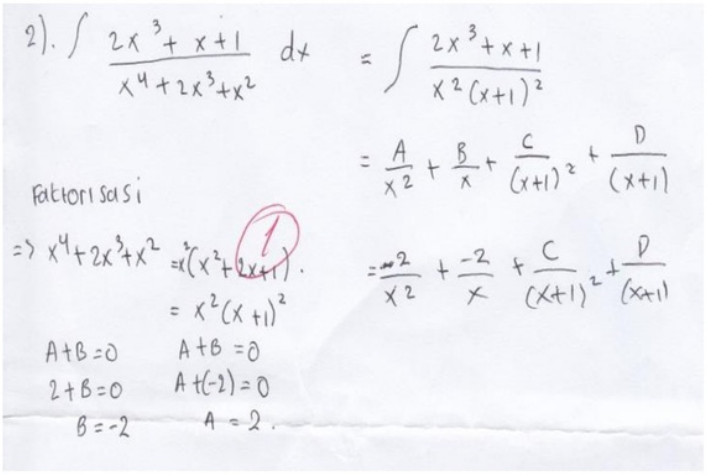


b. . Students at Medium Level of Capabilities

- Male student

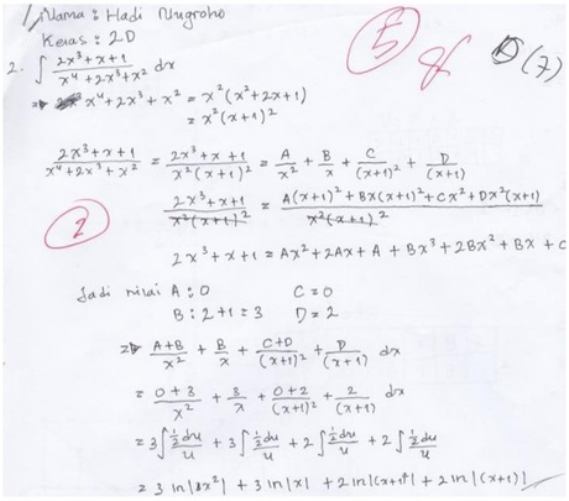


-Female student

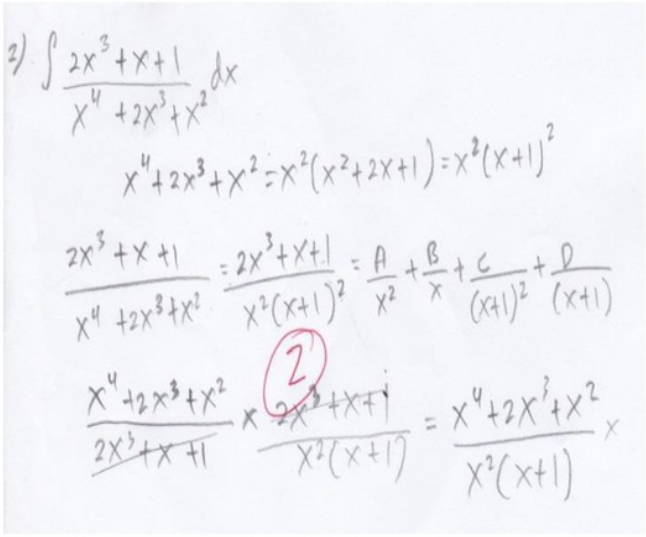


c. . Students at Low Level of Capabilities

- Male Student



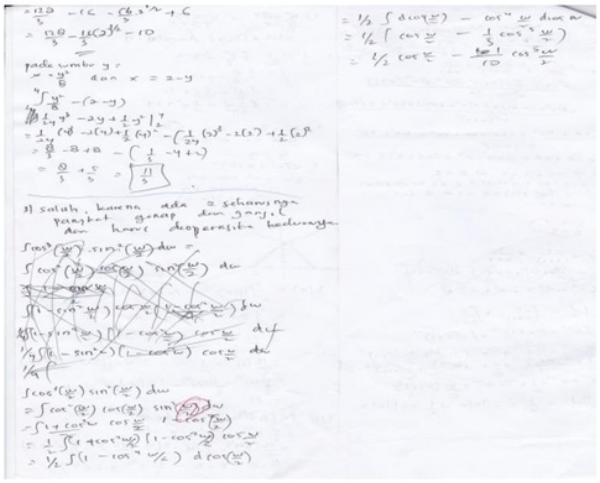
- Female student



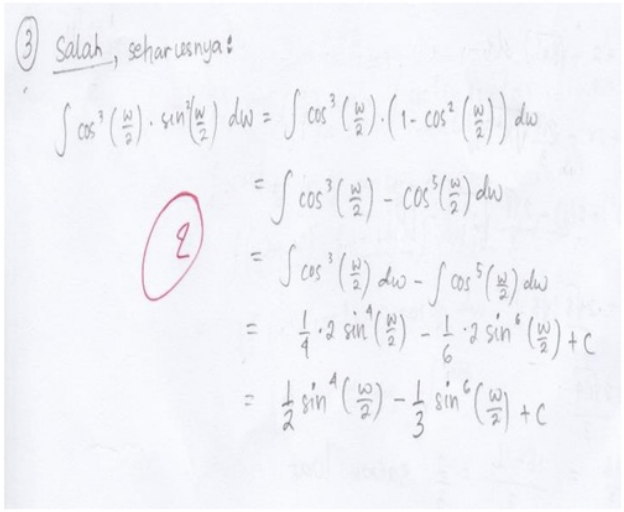
3. Excerpts Students answer to Question No. 3

a. Students at High Level of Capabilities

- Male student

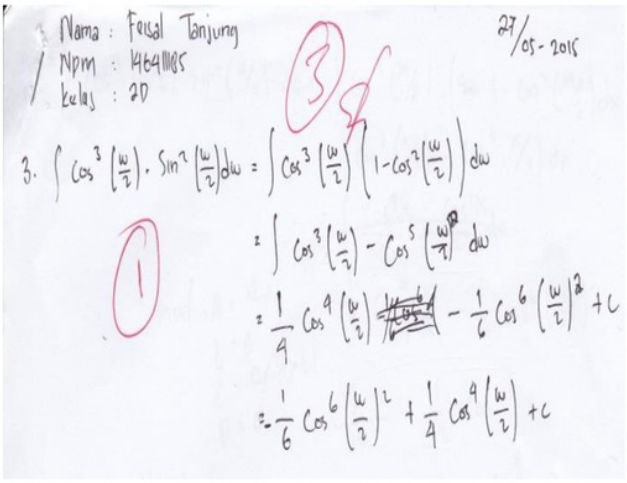


- Female student

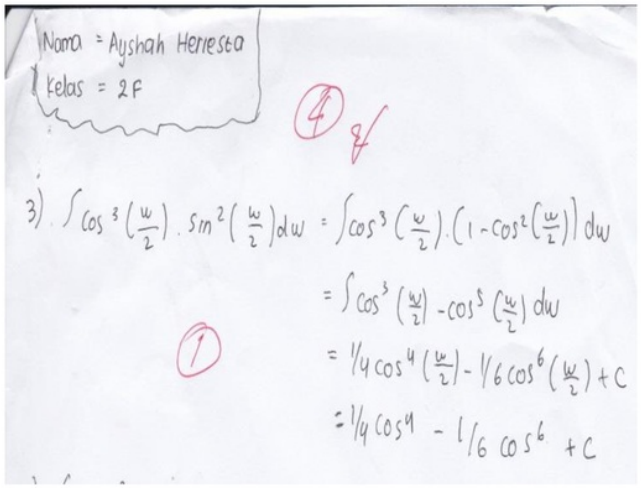


b. Students at Medium Level of Capabilities

- Male student

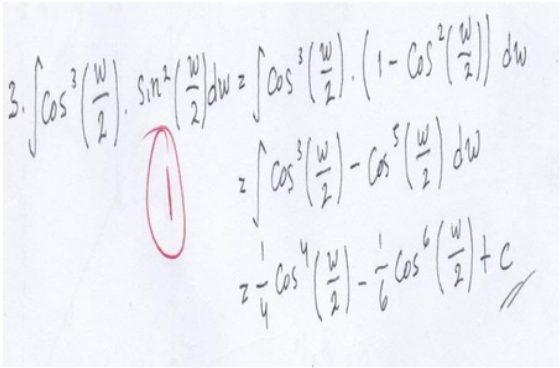


- Female student

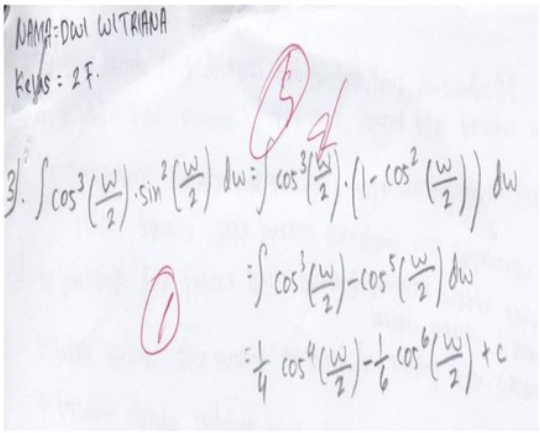


c. Students at Low Level of Capabilities

- Male student



- Female student



According the test results of students based gender above, it can be delivered that critical thinking skills are better than female students' critical thinking skills male student for each academic level.

4. Conclusion

At high ability level, male students already have the ability to generalize the ability to complete the data provided and do not yet have the ability to identify and justify the concept and analyze algorithms. While female students in already

has the ability to identify and justify the concept and the ability to generalize and not have the ability to analyze the algorithm. At the level of moderate ability, students male and female show similar symptoms, which do not yet have the ability to identify and justify the concept, ability to generalize, as well as the ability to analyze the algorithm. Whereas at a low ability level, students male and female also showed similar symptoms, which do not yet have the ability to identify and justify the concept, ability to generalize, as well as the ability to analyze the algorithm.

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