Comparison of Metacognition Awareness of Male and Female Students Based on Mathematics Ability in Department of Mathematics Education of Halu Oleo University

La Misu[1,a)] and La Masi[2,b)]

[1]Department of Mathematics Education of Halu Oleo University, Kendari-Indonesia
[a)]lamisuhamid@yahoo.co.id
[2]Department of Mathematics Education of Halu Oleo University, Kendari-Indonesia
[b)]lamasimbahido1966@yahoo.co.id

Abstract. Awareness of metacognition is one of the mental processes that occur when a person knows what he thinks, including the knowledge possessed and the awareness to do something or realize the reason for it. The purpose of this research is (1) to describe how metacognition awareness of male and female students based on mathematics ability in Department of Mathematics Education of Halu Oleo University, and (2) to know the difference of metacognition awareness among male and female students based on mathematics ability in the Department of Mathematics Education of Halu Oleo University. The subject of this research is student of class of 2016 Department of Mathematics Education of Halu Oleo University Kendari, Indonesia. This research is an *ex post facto* research with data analysis using descriptive and inferential approach. Descriptive approach is used to describe the level of metacognitive awareness of male and female students based on mathematical ability, whereas the inferential approach is used to see the difference of metacognition awareness of male and female students based on the ability of mathematics. The result of this research are: (1) Level of awareness of metacognition of male students in Department of Mathematics Education of Halu Oleo University, generally at *Aware use* level (66.67%), while the level of awareness of metacognition of female students in Department of Mathematics Education of Halu Oleo University, *Aware use* (69.57%); (2) There is no significant difference between metacognition awareness of male students and female students based on mathematics ability in Department of Mathematics Education of Halu Oleo University, and (3) Awareness of female students metacognition better than metacognition awareness of female students in Department of Mathematics Education of Halu Oleo University.

Keywords: *Awareness of metacognition, math ability, male and female students*

I. INTRODUCTION

Gender differences in mathematics, referring to a person's non-biological nature, are associated with psychological features and social categories in mathematics learning. Experts have sought to explain the attributes that contribute to gender differences in learning and mathematical achievement. There are two different views pertaining to gender differences in mathematics learning: (a) reflecting the genetic roots of gender differences in mathematical abilities (Benbow & Stanley, 1983) and (b) expressing differences as the socialization of gender roles and/ or stereotyped threats (Spencer et al., 1999). The challenging study of the view of gender differences in mathematics is, because of the sex differences rooted in genetics in mathematical ability. Leder (2008) and Spencer et al. (1999) argue that the difference is due to the socialization of gender roles

and the threat of stereotypes of each sex. It is generally understood that the various factors that link gender differences in mathematics learning are enormous because they include: educational opportunities, teaching styles, influences and social values, the way men and women socialize places, social environments, student reactions to cultural contexts Which is faster in learning.

Based on the gender differences mentioned above, it allows for differences in metacognition awareness of male and female students, especially in understanding the concept of mathematics. This can be seen from the differences in the improvement of mathematics learning outcomes between male students and female students both in high school and after studying in the first semester at college. When viewed from the average score of national exams of high school mathematics (NE), for female students in Department Mathematics Education better than male students, the average female NE: 69.22 and the average male students NE: 59.68. While the average achievement index (AI) of the first semester, male students better than female students, the average male student AI: 3.12 and the average of female students AI: 3.04.

The facts above, in accordance with the opinion Taccasu (2008), that to improve metacognition skills required the awareness that must be owned by students at every step of his thinking. But every student has different abilities in dealing with mathematical problems. The student will be aware of his thinking process and evaluate himself / herself to the results of his thought process, so that it will minimize the student's mistake in solving the problem. Then Biryukov (2003), says that the concept of metacognition is a conjecture of one's thinking about his thinking which includes metacognitive knowledge (one's consciousness about what he knows), metacognitive skills (one's consciousness about something he does) and metacognitive experience (one's awareness of his cognitive ability). Furthermore, Wilson & Clarke (2004), states that metacognition is a student awareness of the thinking process, check back the process of thinking, and regulate the thinking process. In the learning process sometimes there is a concept error on the information obtained by the student, the information referred to by the lecturer is not like the information that is in the minds of students. Associated with this, metacognition can monitor the thinking stage of students in order to reflect the way of thinking and the results of thinking. Metacognition has an important role in the process of learning mathematics, especially understanding the concept.

Awareness of student metacognition as mentioned by Swartz & Perkins (1989), and NCREL (2007), that one's level of consciousness in the thinking process includes: (1) Level 1: *tacit use*, is the type of thinking in making a decision without thinking about the decision . The student only

tries or originates an answer in solving the problem, (2) Level 2: *aware use*, is a type of thinking that shows a person realizing "what" and "when" he is doing something. Students are aware of everything that is done in solving problems, (3) Level 3: *strategic use*, is a type of thinking that shows organize thinking by realizing specific strategies that improve the accuracy of thinking. Students are able to use and be aware of appropriate strategies for problem solving, and (4) level 4: *reflective use*, is a type of thinking that shows a person reflecting on his thinking by considering acquisition and how to improve it. Students are able to realize or correct mistakes made.

Based on the above description, the research problem is (1) How is the description of metacognition awareness level of male and female students based on mathematics ability in Department of Mathematics Education of Halu Oleo University, and (2) Is there a significant difference between metacognition awareness of male students and female students based on mathematics ability in Department of Mathematics Education of Halu Oleo University.

II. METHOD

The subject of this research is student of class of 2016 Department of Mathematics Education of Halu Oleo University Kendari, Indonesia. There are 46 students of mathematics education consisting of 34 women and 12 men. This research is an *ex post facto* research with data analysis using descriptive and inferential approach. A descriptive approach is used to describe the level of metacognitive awareness of male and female students based on mathematical ability in the Department of Education of Halu Oleo University, whereas the inferential approach is used to see the difference of metacognition awareness of male and female students based on the mathematics ability in the Department of Education of Halu Oleo University.

Indicators to track the level or level of students' metacognitive awareness, following Lauren's adaptation (2009), as follows:

1. *Tacit use*: (a) *Indicators of planning*, namely: the student can not explain what is known, the student can not explain what is being asked, and students are not able to explain clearly the problem, (b) *Indicators of monitoring*, namely: the students showed no awareness of anything monitored and students are not aware of a mistake on the concept and the results obtained, and (c) *Indicators assessment*, namely: students do not evaluate or if an evaluation would seem confused or uncertainty of results.

2. *Aware use*: (a) *Indicators of planning*, namely: students having difficulty and confusion at the thought of the concept (formula) and how to count to be used, the student only explain some of what was written, and students understand the problem because it can speak clearly, (b) *Indicators monitoring*, namely: the students were confused because it can not continue with what will be done, the students aware of the misconception (formula) and how to calculate but can not fix it, and (c) *Indicators assessment*, namely: students do not evaluate or if an evaluation would look confused or vagueness of the results obtained and the students do an evaluation but are not sure of the results obtained.

3. *Strategic use*: (a) *Indicators of planning*, namely: students understand the problem because it can speak clearly, students do not have trouble and confusion to find a formula and calculation, and the student can explain most of what he writes, (b) *Indicators of monitoring*, namely: students realize misconceptions and how to calculate and students are able to give reasons to support his thinking, and (c) *Indicators assessment*, namely: students do not evaluate or if an evaluation would seem confused or vagueness of the results obtained and the students do the evaluation, but less convinced by the results obtainable.

4. *Reflective use:* (a) *Indicators of planning*, namely: students know the methods used to solve the problem, students are able to explain the strategies used to solve the problem, the students understand the problem well because it can identify important information in the matter, and students can explain what is written on the answer sheet (b) *Indicators of monitoring*, namely: students are able to apply the same strategy on other issues and students aware of the misconception that do and can fix it, and (c) *Indicators assessment*, namely: students evaluate each step made and believe the results which is obtained.

III. RESULTS AND DISCUSSION

In accordance with the above problems, the results of this study are reviewed from the results of descriptive analysis and inferential analysis. Descriptive analysis results include 2 categories, (1) Level of awareness of metacognition of male students in Department of Mathematics Education of Halu Oleo University, and (2) Level of metacognition awareness of female students in Department of Mathematics Education of Halu Oleo University. While the inferential analysis, is to

see the difference between metacognition awareness of male and female students based on the ability of mathematics in Department of Mathematics Education of Halu Oleo University.

1. Metacognition Awareness of male students in Department of Mathematics Education of Halu Oleo University

   The level of malak metacognition of male students in the Department of Mathematics Education Halu Oleo University as table 1 below.

   Table 1. Level of Awareness Metacognition of male students in the Department of Mathematics Education Halu Oleo University

No.	Metacognition Awareness Level	frequency	Percentage (%)
1	Level 1: *tacit use*	2	16.67
2	Level 2: *aware use*	8	66.67
3	Level 3: *strategic use*	1	8.33
4	Level 4: *reflective use*	1	8.33
	Total	12	100

Based on table 1 above, it is seen that the general level of Metacognition Awareness of male students in Department of Mathematics Education of Halu Oleo University is at the level of *aware use* use (66.67%), while the *strategic use* level is 8.33% and *reflective use* is 8.33%.

2. Metacognition Awareness of female students in Department of Mathematics Education of Halu Oleo University

   The level of metacognition of female students in Department of Mathematics Education of Halu Oleo University like the table 2 below.

   Table 2. Level of Awareness Metacognition of female students in the Department of Mathematics Education Halu Oleo University

No.	Metacognition Awareness Level	frequency	Percentage (%)
1	Level 1: *tacit use*	5	14.71
2	Level 2: *aware use*	24	70.58
3	Level 3: *strategic use*	5	14.71
4	level 4 : *reflective use*	0	0
	Total	34	100.00

Based on table 2 above, it is seen that generally the level of Metacognition Awareness of female students in Department of Mathematics Education of Halu Oleo University is at the level of *aware use* (70.58%), while the *strategic use* level is 14.71% and no female students are in *reflective*

use level . This is according to the result of the research of La Misu (2017), that Generally (53,9%) Level of Awareness of Metacognition student of Mathematics Education Department of Halu Oleo University is at level 1 (*tacit use*), and small part (12,7%) is at level 4 (*reflective use).*

3. Differences Awareness Metacognition between male students and female students in Department of Mathematics Education of Halu Oleo University

The difference of metacognition betweens between male students and female students in Department of Mathematics Education of Halu Oleo University can be seen in the summary of t-test calculation in table 3 below.

Tabel 3. Summary of t-test calculations to see differences in metacognition awareness among male students and female students in Department of Mathematics Education University of Halu Oleo

Class	$\overline{X}$	N	variance	t-count	t(0.05; 44)	Explanation
Male students	44.59	12	217.15	0.225	1.68	Accept H0, means there is no difference
Female student	45.54	34	136.04			

Based on table 3 above, it is seen that there is no significant difference in metacognition awareness between male students and female students in Department of Mathematics Education of Halu Oleo University. Because the average metacognition awareness of female students is greater than that of male students, the metacognition awareness of female students is better than that of male students in Department of Mathematics Education of Halu Oleo University.

The results of this study indicate that the awareness of metacognition of mathematics education students both men and women alike are at the stage of problem solving process, and feel confused in determining how to get answers. Confusion shows that there is metacognition activity (metacognition experience) that leads to one indicator in Aware Use level. Students who occupy this level have different awareness in recognizing the problem, but they can give reasons why they do such thinking. For example a student is confused but can finish it but other students stop and not optimal in the process of finding results. To obtain optimal results requires interaction between metacognitive knowledge and metacognitive experience, meaning that not enough people only have metacognitive knowledge, it takes experience or metacognitive skills in solving a problem. Uncontrolled metacognitive knowledge can lead to

mistakes, as Marcell and Venman (2006) suggest that metacognitive knowledge of our learning can be false or true and this selfknowledge may be changing.

IV. CONCLUSION

Based on the results of research and discussion above, it can be concluded that:

1. Level of Awareness Metacognition of male students in Department of Mathematics Education of Halu Oleo University, generally at the level of *aware use* (66.67%), while *reflective use* level is only 8.33%;
2. Level of Awareness Metacognition of female students in Department of Mathematics Education of Halu Oleo University, generally at the level of *aware use* (70.58%), and no female students are at the level of *reflective use*.
3. There is no significant difference between students' metacognition awareness of men and women based on mathematics ability in Department of Mathematics Education of Halu Oleo University.
4. Based on the average metacognition awareness of students seen that the awareness of female students metacognition better than the metacognition awareness of male students in the Department of Mathematics Education.

REFERENCES

[1] Benbow, C.P., & Stanley, J.C. (1983). Sex differences in mathematical reasoning ability: More facts. Science, 222, 1029–1031.

[2] Biryukov, P. (2003), *Metacognitive Aspect of Solving Combinatorics Problems.* [Online]. http://www.cimt.pymouth.ac.uk/journal/biryukov.pdf

[3] La Misu, 2017, Study on Metacognition Awareness of Students First Semester Mathematics Education Department Halu Oleo University, *Journal of Science Education Phenomenon* UIN Walisongo Semarang, October 2016 Edition, Volume 7 Number 2.

[4] Laurens,Theresia, 2009, *Metacognition level students*, Dissertation, Surabaya State University.

[5] Leder, G. C. (2008), "Equity: The case for and against gender". Paper presented at *the 11th International Congress on Mathematical Education*, 6-13 July, 2008, Monterrey, Mexico.

[6] NCREL (2007), *Metacognition*, available: http://info@ncrel.org. Accessed March 9, 2007.

[7] Spencer, S.J., Steele, C.M., & Quinn, D.M. (1999), "Steereotype theart and women's math performance", *Journal of Experimental Sosial Psichology*, 35, 4-28.

[8] Swartz, Robert J. and Perkins, D. N, (1989), *Teaching Thinking: Issues and Approaches*. Revised Edition. The Practitioners' Guide to Teaching Thinking Series.

[9] Taccasu, Project (2008), *Metacognition*, (Online) .Http://www.careers.hku.hk/taccasu/ref / metacogn.htm,. Accessed on April 30, 2012.

[10] Wilson, Jeni dan Clark, David. (2004), Toward the Modelling of Mathematical Metacognition. Mathematics Education Research Journal, 2004, Vol. 16, No. 2, 25-48, University of Melbourne.