Metacognition, self-efficacy, and mathematics learning achievement: A study based on gender differences

A H Kaluge*
Universitas Katolik Widy Mandira, Jl. San Juan Penfui, Kupang, Indonesia

*agapituskaluge@gmail.com

Abstract. This research was conducted in 2018 in the 4th semester students of the mathematics education study program at the Catholic University of Widy Mandira Kupang. The aim was to determine the effect of metacognition and self-efficacy on mathematics learning achievement in terms of gender differences. The method used was multiple regression analysis. The results of this study indicated that both partially and simultaneously in male and female student groups all had a significant effect on mathematics learning achievement. The effect of metacognition and self-efficacy on mathematics learning achievement in female students was greater than that of male students. Of the two independent variables, self-efficacy had more influence on mathematics learning achievement than metacognition in both male students and female students. The results of this study indicated that male students' metacognition and self-efficacy need to be further improved. Self-efficacy needs to be given the most attention compared to metacognition in mathematics learning so that student mathematics learning achievements can be improved.

1. Introduction
The quality of education in a college is inseparable from the role and quality of its students. According to Law No. 20 of 2003, "Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation and state". There are two things that can affect student learning achievement, namely metacognition and self-efficacy (self-confidence). According to Collins [1] who has examined several students who have diverse mathematical abilities, the results show that self-efficacy is more appropriate for predicting achievement in mathematics compared to actual mathematical abilities.

Reality in the field shows that generally every student experiences a change in the way of learning while still as a student in school and after becoming a student in college. His demands are getting heavier with the existence of independent tasks that are not small. For this reason, every student is expected to have physical and spiritual readiness in facing lectures in college. One important factor needed in this readiness is the self-confidence factor.

Many studies have examined the effect of metacognition and self-efficacy on mathematics learning achievement. However, as far as the author's knowledge there has not been such a study that studies it in terms of gender differences. This is important considering that in mathematics learning there are often differences in learning achievement among male and female students.
In mathematics learning there are often several differences between male and female students. Female students generally sit in the front while male students in the back. Female students are more active in asking and answering than male students. Female students tend to be more serious and orderly to take lessons than male students. Female students usually arrive early and are rarely late for learning compared to male students.

Researchers once gave questions for students to do, then told them to check their work. There are students who examine it carefully, honestly and accept the results as they are. Some don't know where they are wrong and feel all right. Here it appears that their metacognitive abilities are inadequate. The author has given several reflective questions to students to answer honestly based on what they experience. From the answers there are generally they lack confidence and are afraid of working on the math problems given. This makes them lazy to learn and their achievements are low. There are those who have self-confidence but are less careful in answering questions. Some are careful but hesitant so you need a friend's opinion. But there are also those who are careful and confident so that the value is good. There are also those who are able to solve the questions given, but when the final semester exam cannot even work so that the mathematics learning achievement is low.

From the background above, the author wants to know whether there is a metacognitive influence and self-efficacy on student mathematics learning achievement seen from gender differences. This is important to study so that in the future these two factors need to be taken seriously in an effort to improve the mathematics learning achievement of students based on gender differences.

2. Method

2.1. Metacognition

Metacognition comes from the words "meta" and "cognition". According to Flavell [2] Metacognition is defined in simplest terms as "thinking about your own thinking. According to Anderson and Krathwohl [3], the addition of the word "meta" to the word cognition to reflect the idea that metacognition is "about" or "above" or "after" cognition. Thus literally metacognition is interpreted as cognition about cognition, knowledge of knowledge or thinking about thinking.

According to Laurens [4] metacognition is a person's awareness or knowledge of the processes and results of his thinking (cognition) and his ability to control and evaluate these cognitive processes. Metacognitive strategies consist of planning, monitoring and evaluating our own cognitive processes. According to Yarmayani [5] metacognition is very helpful for students in understanding the material being studied and solving problems faced. From several opinions above it can be concluded that metacognition is a person's awareness in monitoring and evaluating the process and results of his own thinking (cognition).

2.2. Self-efficacy

Bandura finds that self-efficacy, which is the belief in one's ability to master a situation and bring about favorable outcomes, is a crucial to adolescent achievement [6]. According to Stajkovic and Luthans [7], self-efficacy refers to individual beliefs about their ability to mobilize motivation, cognitive resources and actions needed to successfully carry out tasks in certain contexts. Greenberg and Baron [8] show there are two types of self-efficacy namely specific self-efficacy (SSE) and general self-efficacy or general self-efficacy (GSE). SSE and GSE both show confidence in an individual's ability to achieve the desired results, only SSE refers to specific and specific tasks while the GSE refers to general tasks. It also said that self-efficacy has three aspects, namely magnitude, strength, generally.

According to Maulana [9], self-efficacy is a person's belief in the extent to which he is able to do tasks, achieve goals, and plan actions to achieve a goal. One strategy for changing the source of self-efficacy expectations is to increase when observing the success of others, and vice versa, self-efficacy will decrease if you observe the failure of others. More details can be seen in table 1 below.
Table 1. Strategies for Changing the Source of Efficacy Expectations.

| Source          | Induction Method                                      |
|-----------------|-------------------------------------------------------|
| Performance     | Participant modelling                               |
| Experience      | Performance                                            |
|                 | desensitization                                      |
|                 | Performance exposure                                 |
|                 | Self-instructed                                       |
| Vicarius        | Living modeling                                      |
| Experience      | Symbolic modeling                                    |
| Social          | Suggestion                                            |
| Persuasion      | Exhorstation                                         |
|                 | Self instruction                                      |
|                 | Interpretive treatment                               |
| Emotion Generator| Attribution                                          |
|                 | Relaxation biofeedback                               |
|                 | Symbolic desensitization                             |
|                 | Symbolic exposure                                    |

Imitating a model having achievement
Eliminating the bad influence of past achievements
Highlighting the success that has been achieved
Training yourself to do your best
Observing real model
Observing symbolic models, film, comic or story
Influencing using words based on faith
Urget advice, warning or coercion
Governing yourself
New Interpretation improves old interpretation
Changing attribution, the person in charge of an emotional event
Relaxing
Eliminating emotional attitudes with symbolic modeling
Emerging emotions symbolically

Source: Psikologi Kepribadian [10].

From some of the opinions above, it can be concluded that self-efficacy is a person's self-confidence in his ability to master situations such as doing learning tasks or given questions so as to achieve the expected goals.

2.3. Students’ learning achievement
The word "achievement" comes from the Dutch language "prestatie" which means a person's success or achievement in carrying out activities. Thus achievement is the result of an activity carried out. According to the online version of the Large Indonesian Language Dictionary [11], learning achievement is the mastery of knowledge or skills developed through subjects, usually indicated by the value of the test or the number of values given by the teacher. Arifin [12] states that learning achievement is the ability, skill and attitude in solving a problem. According to Hamalik [13] mathematics learning achievement is the level of student mastery of mathematics subject matter that has been obtained from the results of learning tests expressed in the form of scores. From some of the opinions above, it can be concluded that mathematics learning achievement is the level of mastery of one's mathematical knowledge after getting a math lesson.

Some research results relevant to this research can be presented here as follows. The results of the study from Ardhaniantyas [14], namely that there is a significant relationship between metacognitive learning achievement. The results of the study from Fajriani [15], namely metacognition has a significant effect on mathematics learning outcomes with a value of p = 0.000 <0.05 with the magnitude of influence is 0.331 or 33.1%, and learning achievement of mathematics with mediators of learning creativity. The results of Ilhamsyah's [16] study are self-efficacy that has a positive and significant effect on mathematics learning achievement both directly and indirectly and metacognition which has a positive and significant effect on mathematics learning achievement both directly and indirectly. The results of research by Andriana [17] are that there is an effect of self-efficacy on the ability to solve mathematical problems.

Based on the literature review and some relevant research results above, the researcher formulated the hypothesis as follows. 1. There is an influence of metacognition on student learning achievement. 2. There is the effect of self-efficacy on student learning achievement. 3. There is an influence of metacognition and self-efficacy on student mathematics learning achievement.
3. Research method

3.1. Research type
This research is a quantitative research with multiple linear regression analysis method. The purpose of this study was to determine the effect of metacognitive and self-efficacy on student mathematics learning achievement in terms of gender differences.

3.2. Research location
This research was conducted at the Mathematics Education Study Program of the Catholic University of Widya Mandira Kupang.

3.3. Research sample and population
The population in this study consisted of two, namely a population of male students totaling 33 people and a population of female students totaling 33 people. Given the relatively small number of population, the sample in this study is all students in both populations (saturated samples) whose extraction uses census techniques.

3.4. Research variable
The independent variables in this study are Metacognition (X1) and Self-efficacy (X2). While the dependent variable is Mathematics Learning Achievement (Y). The metacognition instrument is a questionnaire consisting of 30 items with 4 answer choices. The self-efficacy instrument is also in the form of a questionnaire consisting of 26 items with 3 answer choices. Mathematics learning achievement instruments in the form of multiple choice tests of 30 items.

This research was conducted in April 2018 in the fourth semester of the 2017/2018 academic year in the mathematics education study program at the Catholic University of Widya Mandira Kupang.

3.5. Techniques of data gathering
Data was collected using 3 instruments, namely 2 questionnaires and 1 test. The two questionnaires were metacognition questionnaires and self-efficacy questionnaires were given to students to be filled out honestly while supervised by researchers. While the learning achievement test material was taken from the Graph Theory subject in the fourth semester.

3.6. Data analysis
Data analysis techniques used are multiple regression analysis techniques with $\alpha = 5\%$. The process of data analysis using the SPSS program ver. 22.0. Before testing the hypothesis, it is preceded by a prerequisite test, namely the normality test, linearity test, and multicollinear test. Multiple regression analysis was conducted to test the research hypothesis. Here there are two tests carried out, namely the t test to test the effect partially and the F test to test the effect of simultaneous independent variables on the dependent variable.

4. Results

4.1. The prerequisite test
The prerequisite test results show that the distribution of data from the three variables is normally distributed. The test results also show that each independent variable has a linear relationship with the dependent variable. Furthermore, the results of the multicollinear test show that the two independent variables are low correlated or not multicollinear.

4.2. T test result

4.2.1. Males. The results of the t test show that the sig value (X1) = 0.047 <0.05. This shows that there is a significant effect of metacognition on mathematics learning achievement. The results of the t test
show that the sig value (X2) = 0.026 <0.05. This shows that there is a significant effect of self-efficacy on mathematics learning achievement.

4.2.2. Females. The results of the t test show that the sig value (X1) = 0.003 <0.05. This shows that there is a significant effect of metacognition on mathematics learning achievement. The results of the t test show that the sig value (X2) = 0.000 <0.05. This shows that there is a significant effect of self-efficacy on mathematics learning achievement.

4.3. F test result

4.3.1. Males. The results of the F test indicate that the sig value = 0.003 <0.05. This shows that there is a significant effect of metacognition and self-efficacy on mathematics learning achievement.

4.3.2. Females. The results of the F test indicate that the sig value = 0.000 <0.05. This shows that there is a significant effect of metacognition and self-efficacy on mathematics learning achievement.

4.4. Coefficient of determination

4.4.1. Male students. Adjusted R Square value of 0.271 shows that the magnitude of the influence of metacognition and self-efficacy together on student mathematics learning achievement is 27.1%.

4.4.2. Females students. Adjusted R Square value of 0.489 shows that the magnitude of the influence of metacognition and self-efficacy together on student mathematics learning achievement is 48.9%.

4.5. Multiple regression equation

4.5.1. Male Students. The regression equation is \( Y = 5.339 + 0.213X_1 + 0.547X_2 \).

4.5.2. Female students. The regression equation is \( Y = 4.004 + 0.347X_1 + 0.822X_2 \).

4.6. Discussion

From the results of the above research, it appears that in the group of male students and female student groups all showed a significant effect of metacognition and self-efficacy both simultaneously and partially on mathematics learning achievement. This means that the higher the metacognition and self-efficacy, the higher the learning achievement of mathematics.

The results of this study are in line with the results of Waskitoningtyas [18] study that students who have good metacognition skills tend to be able to solve the problems they face well through mobilizing their awareness and thinking arrangements. It was also said that in solving contextual mathematical problems, students are required to be able to mobilize their awareness and arrangement of thinking (metacognition), so that it can be said that students will experience training to mobilize their metacognitive abilities. So by getting used to involving students in solving contextual mathematical problems, there will be a process of improving students' metacognitive abilities. Thus it can be said that a student will be able to solve mathematical problems if he has awareness in monitoring and evaluating the processes and results of his own thinking in solving these mathematical problems.

The results of this study also support the results of research by Andriana [17], namely that there is an effect of self-efficacy on mathematical problem solving abilities. This shows that a student will be able to solve mathematical problems if he has confidence that he is able to solve these mathematical problems.

Judging from gender differences, the results of this study indicate that in female students the influence of metacognition and self-efficacy on mathematics learning achievement is greater than that of male students. This shows that female students have metacognition and self-efficacy above male students. The results of this study also show that in both male and female students, self-efficacy is far
more influential on mathematics learning achievement than metacognition. Thus self-efficacy needs to get the main attention in mathematics learning in addition to metacognition so that the presentation of mathematics learning can be improved.

To realize this, students need to be more trained to learn to interact between them through working on assignments given by lecturers in groups, avoiding students from various pressures from lecturers or the campus environment which can cause them to become stressed, scared, lazy to learn, and desperate. The students need to be constantly motivated so that they are more confident, find their identity, and in the end can be more confident with their own abilities. So that when they graduate, all their learning achievements can be good and can increase their self-confidence to continue learning to a higher level.

5. Conclusion
From the results of the above research it can be concluded that there is a significant effect of metacognitive and self-efficacy both simultaneously and partially on mathematics learning achievement. The effect of metacognition and self-efficacy on mathematics learning achievement in female students was 48.9%. While the influence of metacognition and self-efficacy on mathematics learning achievement in male students was 27.1%. The effect of self-efficacy on mathematics learning achievement is greater than metacognition because the regression coefficient of self-efficacy is greater than the regression coefficient of metacognition.

Based on the above conclusions, it is suggested that male students’ metacognition and self-efficacy need to be considered more than female students. In addition, self-efficacy needs to be given greater attention than metacognition in mathematics learning so that student mathematics learning achievements can be improved.

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