The Influence of Learning Model and Learning Motivation Towards Mathematical Reasoning Abilities in Junior High School

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ABSTRACT
The purpose of this study was to determine the effect of learning models, learning motivation and interactive learning models, and learning motivation on mathematical reasoning abilities. This research was conducted by using an experimental method on the students' population of a private junior high school in Bogor Regency, by taking samples of class VIII students of Puspanegara and Bantarjati Junior High School. The samples were analyzed using two-way of Anova. The results of hypothesis testing obtained conclusions: 1). There was a significant effect of learning models on students' mathematical reasoning abilities. 2). There was a significant effect on student learning motivation towards students' mathematical reasoning abilities. 3). There was a significant effect of interactive learning models towards students' learning motivation on mathematical reasoning abilities. Therefore, it was suggested that teachers shall begin to apply various kinds of learning models and teachers shall be able to maintain high learning motivation for students to improve their mathematical reasoning abilities.

Keywords: Learning models, Learning motivation, Mathematical reasoning abilities

1. INTRODUCTION

The problem in mathematics education in Indonesia is the low level of students' achievement, especially in reasoning abilities towards mathematical problem-solving in schools. Meanwhile, mathematics learning in schools at this time, especially in junior high, is a very important basis, as a provision to keep up mathematics learning at the next level [1]. Another emerging problem is that there are complaints from society stating that the process of learning mathematics in schools still uses conventional or traditional approaches, in which a teacher actively teaches mathematics, and then gives examples and exercises [2]. On the other hand, students’ duty is like machines; they just listen, take notes, and do the exercises given by the teacher (teacher-centered).

In mathematics learning, teachers' delivery tends to be monotonous in Private Junior High Schools, almost without any variations. If students are asked about mathematics, they are going to give excuses stating that mathematics is difficult and they feel fear of being told to go forward and so on. Thus, it can cause symptoms of children’s mathematics phobia (fear) that afflicts most students. That phobia causes mathematics to become a subject that students fear and hate [3].

Various attempts to improve outcomes of mathematics learning have been carried out since the 2006 Curriculum, by education stakeholders, for example through education and training programs of mathematics subject teachers related to the use of teaching methods or strategies or models and techniques that are suitable and fun, both in Mathematics Teacher Working Group (MGMP) and in Mathematics Centre for the Development and Empowerment of Educators and Educational Personnel (PPPPTK). However, after the teachers return from education and training programs, they are back to teach in the old style of teaching method (teacher-centered). Those habits result specifically in mathematics learning of class VIII Junior High School students. The end-exam of Odd Semester shows that 30% of the total number of 420 students gets grades below the Minimum Mastery Criteria (KKM). KKM is the average ability level of students set by the school at least 75. The daily test scores are used to measure learning mastery of each indicator in Basic Competence (KD) of at least 75% and 25% of one class is below the KKM. As a consequence, the results achieved by students still have not shown significant improvement.
This result also shows that students’ reasoning ability is still low.

The reasoning is a thinking process to conclude in the form of knowledge [4]. Other opinions show that reasoning is a process or an activity of thinking to draw a conclusion or thought process to make a new statement that is true based on several statements whose truth has been proven or assumed previously [5]. Mathematical material and mathematical reasoning are two things that cannot be separated. Mathematical material is understood through reasoning and reasoning is understood and is practiced through mathematics learning. Thus, the mindset developed by mathematicians as described above indeed requires and involves critical, systematic, logical, and creative thinking [6].

Penalaran is the Indonesian translation of reasoning. The reasoning is one of the basic mathematical competencies in addition to understanding, communication, and problem-solving. The reasoning is also a mental process in the mind developing from several facts or principles [7].

In a teaching implementation and a learning process, teachers play an important role and cannot be replaced by any object because the continuity of a teaching and learning process is very closely related to various attitudes, such as feelings, motivation, teaching methods, and assessment/evaluation systems.

Based on that explanation above, the expectation of ideal reasoning ability and the reality in the field is still not satisfactory. Therefore, to make mathematics not only becoming a subject feared by students and to increase students’ mathematical reasoning ability in school, and then mathematics learning must be changed by using learning patterns/models that are easier and more fun, that are attractive. Besides, by using those learning patterns/models, students will be happier to face mathematics and will become more active in mathematics learning [3].

The selection of the right learning model is one of the keys so that students become more active. There are so many choices of learning models in cooperative learning. Cooperative learning or what some people call mutual learning is a learning system that allows students to work together with other students in structured tasks. Cooperative learning will only run when a group or team has been formed, where students work in a directive way to achieve the goals that have been determined before and they do it in a group consists of just 4-6 students [8].

Based on the explanation above, the researchers want to improve the ability of mathematical reasoning to obtain better learning outcomes, in the Pythagorean material by comparing Discovery Learning (DL) learning model and Numbered Heads Together (NHT). The intended mathematical reasoning ability is not only in learning cognition but also in learning motivation.

2. METHOD

This research was conducted in a private junior high school in Bogor Regency and was carried out in the first semester of the 2017/2018 school year. The population in this study were private junior high school students in Bogor Regency, which was restricted (research sample by using random sampling technique) to VIII grade students of Puspanegara and Bantarjati Junior High School, 40 students each.

This study was a quasi-experimental research. The method used in this study was an experimental method, with a 2 x 2 factorial design treatment by level. Research design could be shown in Table 1.

| Students’ Learning Motivation | Learning Methods   | Σ B |
|------------------------------|--------------------|-----|
|                              | Discovery Learning |     |
|                             | (A₁)              | A₁B₁ Σ B₁ |
|                             | NHT (A₂)          | A₂B₂ Σ B₂ |
|                             | Σ K               | Σ K₁ Σ K₂ Σ Total |

The sampling technique was done by using a random sampling approach by taking representatives from each of the existing geographical areas. The author took 50% of students in high learning motivation in an experimental design could be shown in Table 1.

The technique of data collection for mathematical reasoning ability was executed by giving evaluations through written tests, in a form of essay questions. Measurement of students’ mathematical reasoning abilities was done by using 8-items essay test instruments. Besides, it was necessary to analyze the data to test the research hypothesis. The steps in data analysis were as follows: 1) to describe the data for each variable, 2) to test the data analysis requirements for normality and homogeneity of the test, and 3) test the hypothesis with analysis of variance (ANOVA).

3. RESULTS AND DISCUSSION

This research consists of two factors which are the cooperative learning model factor (A) and learning motivation (B), each factor is divided into two sub-factors. The first sub-factor of the cooperative learning model factor is the Discovery Learning model (A₁) and

Table 1. Research Design
Numbered Heads Together learning model (A2). Mathematical learning motivation contains high mathematics learning motivation sub-factor (B1) and low mathematics learning motivation (B2).

Research data in the form of students’ Mathematical Reasoning Ability (Y) as a result of the research treatment of cooperative learning model factors is called Learning Model (A), as well as students’ mathematics learning motivation (B). The data are analyzed by using descriptive statistical techniques to measure the central tendency and the tendency towards dissemination of data from each treatment group.

Application treatment in Discovery Learning model (A1) is carried out in SMP Puspanegara with the data sample are 40 students and Numbered Heads Together (NHT) learning model (A2) is carried out in SMP Bantarjati with the data sample are also 40 students. The implementation of the application of both the Discovery Learning model and NHT model is reflected by learning steps contained in Learning Implementation Plan (RPP) and are accompanied by the observation sheet (the observation made by the observer on any learning process).

The Discovery Learning in this study [9], translated back into its implementation, which is (1), to open the students’ thought with the stimulus question, to conclude the reading with trying to find a concept that leads to problem-solving preparation; (2) to identify many problems by linking material that is relevant to learning materials, then to give students’ alleged to self-completion; (3) to collect information (find it by their own), the relevant reasons to prove whether the temporary answer is true or false; (4) to process data and information that has been obtained by students through observation, and they are interpreted; (5) to prove whether the default answer is true or false; (6) to draw the conclusion that can be used as a general principle and it applies to all event or the same problem, by taking into account of the verification result. The 1-6 step can be the implementation control of learning observation by the observer. The results in this research show that steps 1-6 are given a checkmark by the observer. It means that researchers have implemented learning with Discovery Learning in the learning process.

That also applies to NHT learning stages in this research which includes: 1) numbering (divide students into groups consisting of 4-5 students and each student are labeled by number); 2) asking questions (researchers give questions); 3) thinking together and answering (students unite their opinion with group discussion then researchers call a student with a certain number and then the appropriate number of student raises his/her hand and then tries to answer). This stage becomes a control for the observer in stating that the researchers have implemented the NHT learning model because steps 1-3 are applied and are marked with a checklist on all the numbers[10], [11].

Recapitulation results of the descriptive statistical calculations score in students’ mathematical reasoning abilities are shown in Table 2. It can be concluded that the average mathematical reasoning abilities of students, who use the cooperative learning model of Discovery Learning (DL), are higher than students who are taught by the cooperative learning model of Numbered Heads Together (NHT) (74.63> 59,90). Thus, the use of the cooperative learning model of Discovery Learning (DL) is proven to improve students’ mathematical reasoning abilities.

Meanwhile, the average score of students with high mathematics learning motivation is higher than the students who have low mathematics learning motivation (73,15> 61,38). Therefore, the motivation to learn mathematics should be a factor taken into account in the mathematical reasoning abilities.

Table 2. Statistical Description of the Research Result

| Learning Motivation (B) | Learning Model (A) | Numbered Heads Together (A2) | Total |
|------------------------|---------------------|-------------------------------|-------|
| High (B₁)              |                     |                               |       |
| n = 20                 | n = 20              | n = 40                        |       |
| \(\bar{X} = 84.20\)    | \(\bar{X} = 62.10\) | \(\bar{X} = 73.15\)           |       |
| s = 9.070              | s = 11.698          | s = 15.231                    |       |
| Low (B₂)               |                     |                               |       |
| n = 20                 | n = 20              | n = 40                        |       |
| \(\bar{X} = 65.05\)    | \(\bar{X} = 57.70\) | \(\bar{X} = 61.38\)           |       |
| s = 12.593             | s = 12.658          | s = 13.006                    |       |
| Total                  |                     |                               |       |
| \(\bar{X} = 74.63\)    | \(\bar{X} = 59.90\) | \(\bar{X} = 67.26\)           |       |
| s = 14.539             | s = 12.234          | s = 15.269                    |       |

Table 2 may be scrutinized again by measuring the students’ ability in using mathematical reasoning descriptive test instrument which consists of 8 questions given to all respondents.

Respondent groups of the experimental class consisting of 40 students, who are taught by the cooperative learning model of Discovery Learning (DL), get the highest score of 97 and the lowest score of 49. From a statistical calculation, it is obtained an average score of 74.63; a median of 75.50; a modus of 66.00, and a deviation standard of 14.593. The same measurements on the control class group consisting of 40 students, who are taught by the cooperative learning model of Numbered Heads Together (NHT) show the highest score of 83 and the lowest score of 34. From the statistical calculations, it is obtained an average score of 59.90; a median of 61.50; a modus of 66.00, and a deviation standard of 12.234.

In a respondent group with a high learning motivation consisting of 40 students, the measurement results of mathematical reasoning show that the highest score is 97 and the lowest score is 37. From a statistical calculation, it is obtained an average score of 73.15; a median of 74.00; a modus of 71.00, and a deviation standard of 15.231. The measurement results on a respondent group with low learning motivation consisting of 40 students show that the highest score is 97 and the lowest is 34. From a statistical calculation, it is obtained an average score of 61.38; a median of 60.00; a modus of 66.00, and a deviation standard of 13.006.

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A respondent group of cooperative learning model of Discovery Learning with high learning motivation consisting of 20 students shows that the highest score is 97 and the lowest score is 66. From a statistical calculation, it is obtained an average score of 84.20; a median of 66.00; a modus of 91.00, and a deviation standard of 11.698. Meanwhile, a respondent group of cooperative learning model of Discovery Learning with low learning motivation consisting of 20 students shows that the highest score is 97 and the lowest score is 49. From a statistical calculation, it is obtained an average score of 65.05; a median of 63.00; a modus of 57.00, and a deviation standard of 12.593.

The measurement of a respondent group of cooperative learning model of Numbered Heads Together (NHT) with high learning motivation consisting of 20 students shows that the highest score is 83 and the lowest score is 37. From a statistical calculation, it is obtained an average score of 62.10; a median of 63.00; a modus of 66.00, and a deviation standard of 11.698. Meanwhile, a respondent group of cooperative learning model of Numbered Heads Together (NHT) with low learning motivation consisting of 20 students shows that the highest score is 83 and the lowest score is 34. From the statistical calculations, it is obtained an average score of 57.70; a median of 58.50; a modus of 65.05; and a deviation standard of 12.658.

After fulfilling the assumption that the data are in a normal distribution and a homogenous variance, it can proceed with the research hypothesis testing. The research hypothesis uses analysis of variance (ANOVA). Here is a summary of the data analysis results.

Table 3. Summary of Results of ANOVA

| Source          | Type III Sums of Squares | df | Mean Square | F     | Sig.  |
|-----------------|--------------------------|----|-------------|-------|-------|
| Corrected Model | 8197.337                 | 3  | 2732.446    | 20.319| .000  |
| Intercept       | 361939.51                | 1  | 361939.51   | 2691.487| .000  |
| A                | 4336.513                 | 1  | 4336.513    | 32.248| .000  |
| B                | 2773.013                 | 1  | 2773.013    | 20.621| .000  |
| A * B            | 1087.813                 | 1  | 1087.813    | 8.089 | .006  |
| Error           | 10220.150               | 76 | 134.476     |       |       |
| Total           | 380357.00               | 80 |            |       |       |
| Corrected Total | 184174.487              | 79 |            |       |       |

\[ R^2 = .445 \] (Adjusted \( R^2 \) = .423)

Based on the calculations from Table 3, it can be explained that the sig. for the learning model is 0.000 < 0.05 with \( F_{\text{calculation}} = 32.248 \). Therefore, \( H_0 \) is rejected and \( H_1 \) is accepted, so that it can be concluded there is a significant influence on the teaching model of mathematical reasoning abilities. Meanwhile, sig. for students' motivation is 0.000 < 0.05 with \( F_{\text{calculation}} = 20.621 \). Thus, \( H_0 \) is rejected and \( H_1 \) accepted so that it can be concluded that there is significant influence from student motivation towards students' mathematical reasoning abilities. Besides, sig. of learning with students' learning motivation is 0.043 > 0.05. Therefore, it can be concluded that there is a significant influence between interactive learning models and learning motivation toward students' mathematical reasoning abilities. Based on these results, then further tests are required.

Further tests are done to determine the different effects in each group. Further tests used are the Tukey test. Testing by Tukey test is usually used if the data analysis is done by comparing two sample groups that are the same [12]. Tukey test results are summarized in Table 4.

Table 4. Tukey Test Results Mathematical Reasoning Abilities

| (I) Post Hoc  | (J) Post Hoc  | Mean Difference (IJ) | Std. Error | Sig.  |
|---------------|---------------|----------------------|------------|-------|
| A: B_1        | A: B_2        | 19.15*               | 3.667      | .000  |
| A: B_3        | A: B_4        | 22.10*               | 3.667      | .000  |
| A: B_5        | 26.50*        | 3.667                | .000       |       |
| A: B_6        | -19.15*       | 3.667                | .000       |       |
| A: B_7        | -4.40         | 3.667                | .000       |       |
| A: B_8        | -2.95         | 3.667                | .000       |       |
| A: B_9        | 7.35          | 3.667                | .195       |       |
| A: B_10       | -22.10*       | 3.667                | .000       |       |
| A: B_11       | -4.40         | 3.667                | .000       |       |
| A: B_12       | -26.50*       | 3.667                | .000       |       |
| A: B_13       | -7.35         | 3.667                | .195       |       |
| A: B_14       | -4.40         | 3.667                | .000       |       |

Based on the Tukey test, it is acquired mean difference that is shown in Table 4 at 19.15, which indicates that the difference between the average group A:B_1 and A:B_2 is 19.15. This difference in the sense is that the difference value is quite large. It is judged from a 0.000 significance value that is less than 0.05, namely the level of guilt. These results illustrate that mathematical reasoning skills of cooperative learning model group of Discovery Learning, which is high learning motivation, and cooperative learning model group of Discovery Learning, which is low learning motivation, have significant differences. Implementation of Discovery Learning cooperative learning model with a high level of learning motivation gives a significant impact on mathematical reasoning abilities.

Furthermore, the cooperative learning model group of Discovery Learning with high learning motivation and cooperative learning model group of Numbered Heads Together (NHT) with high learning motivation have significant differences. It is clear that they have high learning motivation, cooperative learning model of Discovery Learning provides higher results of mathematical reasoning abilities with an average difference of 22.10 compared with the cooperative learning model of Numbered Heads Together (NHT). From Table 4, it is shown that the mean difference between the groups A:B_1 and A:B_2 is 22.10, while the significance value of 0.000 is smaller than the level of guilt, which is 0.05. It means that mathematical reasoning abilities in the cooperative learning model group of Discovery Learning with high learning motivation and in the cooperative learning model group of Numbered Heads...
Together (NHT) with high learning motivation has significant differences. From Table 4, it appears that the mean difference of 26.50 showing the average difference between groups A1B1 and A2B2 is 26.50. The difference’s value is tremendous. It is similar to the significance value, which is 0.000 less than 0.05 so that it can be interpreted that the mathematical reasoning abilities in cooperative learning model group of Learning Discovery with high learning motivation and cooperative learning model group of Numbered Heads Together (NHT) with low learning motivation have significant differences.

Meanwhile, mathematical reasoning abilities in the cooperative learning model group of Discovery Learning with low learning motivation and in the cooperative learning model group of Numbered Heads Together (NHT) with high learning motivation have significant differences. It is based on the 0.852 significance value which is greater than 0.05 and the mean difference is only 2.95 (it can be seen in Table 4, which is in group A1B1 and A2B2).

The data shown in Table 4 explains that the mean difference between A1B1 and A2B2 groups is 7.35. It means that the difference between the average is 7.35 (the difference value is quite small). Meanwhile, the significant value of 0195 is greater than 0.05. It means that the mathematical reasoning abilities in the cooperative learning model group of Discovery Learning with low learning motivation and in the cooperative learning model group of Numbered Heads Together (NHT) with low learning motivation have significant differences.

It can be seen from Table 4 that the mean difference between the average group of A1B1 and A2B2 is 4.40. The difference value is quite small. With a significant value 0.629> 0.05, it may be implied that the mathematical reasoning abilities in cooperative learning model group of Numbered Heads Together (NHT) with high learning motivation and cooperative learning model group of Numbered Heads Together (NHT) with low learning motivation have significant differences.

Results of analysis and research interpreted deeper that the cooperative learning model significantly affect students’ mathematical reasoning abilities. Results of analysis and research interpreted deeper that the cooperative learning model significantly affect students’ mathematical reasoning abilities. Therefore, if the process of learning uses a model that emphasizes learning activities and students also have high learning motivation towards mathematics, the interactive models of cooperative learning and learning motivation will affect students’ mathematical reasoning abilities. This is supported by the result of the research that shows the F-test value for interactive learning model and student motivation is 8089 and sig = 0.006> 0.05. That is why interactive models of cooperative learning and students’ motivation significantly affect students’ mathematical reasoning abilities.

From the further results of the Tukey test, it is found that students’ mathematical reasoning abilities differ significantly from those of students who are taught by a combination treatment of cooperative learning model of Discovery Learning (DL) and in high learning motivation when it is compared with a group of students who are taught by a combination of other treatments (cooperative learning model of Discovery Learning (DL) with low learning motivation and a group of students taught by cooperative learning model of Numbered Heads Together (NHT) as well as with high learning motivation and low learning motivation). Therefore, it can be interpreted that the students’ mathematical reasoning abilities can be improved by the cooperative learning model of Discovery Learning (DL) which is supported by the students’ high learning. This can be proved from the average value of 84.20 which is much different than the average value of the other treatment groups.

This research finally provides feedback that the learning model of Discovery Learning results better in students’ mathematical reasoning abilities when it is compared with the learning model of Numbered Heads Together (NHT). Model Discovery Learning Model is
more recommended to be applied to achieve high mathematical reasoning abilities of students [15], [16].

Another factor to consider is the high motivation that correlates to produce high mathematical reasoning capabilities when it is combined with the learning model of Discovery Learning [17].

However, it should be considered concerning students’ characteristics because there is a tendency that the Discovery Learning model is suitable for students who have high learning independence [18].

There is also a need to develop other variables to study its continuation. As it is related to the selection of instructional strategies associated with mathematical reasoning abilities. It can also lift the variable aspects of communication from students. Since there are already research references from Romiszowski in Angkowo and Kosash said to be “as the carriers on messages, from some transmitting source (which may be a human being or inanimate object) to the receiver of the message (which in our case is the learner)” [19], or learning models with different dependent variables, such as the understanding of mathematical concepts [20]. It is fixed by reference to the existing research.

4. CONCLUSION

Based on the data obtained, the hypothesis test results, and discussion of the research results, it can be concluded: 1) There is a significant influence on the teaching model of mathematical reasoning abilities of students. 2) There is a significant influence on students' motivation toward students' mathematical reasoning abilities. 3) There is a significant interactive effects model of learning and student motivation towards mathematical reasoning abilities.

REFERENCES

[1] F Mulyatna and W Nofiansyah, “Error patterns in determining combined probability functions from continuous random variables,” J. Phys. Conf. Ser., vol. 1188, no. 1, 2019.

[2] J. Jäder, J. Sidenvall, and L. Sumpter, “Students’ Mathematical Reasoning and Beliefs in Non-routine Task Solving,” Int. J. Sci. Math. Educ., vol. 15, Feb. 2016.

[3] J. Sidenvall, J. Lithner, and J. Jäder, “Students’ reasoning in mathematics textbook task-solving,” Int. J. Math. Educ. Sci. Technol., vol. 46, no. 4, pp. 533–552, May 2015.

[4] Junjun S. Suriasmumtrini, “Filsafat Ilmu Sebuah Pengantar,” in Filsafat Ilmu Sebuah Pengantar, Jakarta: Pustaka Sinar Harapan, 2009, p. 42.

[5] F. Shadiq, “Pemecahan Masalah, Penalaran dan Komunikasi,” in Diklat Instruktur/Pengembang Matematika SMA Tingkat Dasar, Yogyakarta, 2004.

[6] M. Norqvist, “Cognitive Abilities and Mathematical Reasoning in Practice and Test Situations,” in Proceedings of the 42nd Conference of the International Group for the Psychology of Mathematics Education, 2018, pp. 419–426.

[7] Sukirwan, Durhim, and T. Herman, “Analysis of students’ mathematical reasoning,” J. Phys. Conf. Ser., vol. 948, p. 12036, 2018.

[8] A. Lea, Cooperative Learning. Jakarta: Gramedia, 2002.

[9] S. Mawaddah and R. Maryanti, “KEMAMPUAN PEMAHAMAN KONSEP MATEMATIS SISWA SMP DALAM PEMBELAJARAN MENGGUNAKAN MODEL PENEMUAN TERBIMBING (DISCOVERY LEARNING),” EDU-MAT J. Pendidik. Mat., vol. 4, no. 1, pp. 76–85, 2016.

[10] N. H. Alie, “Penggunaan Model Pembelajaran Kooperatif Tipe NHT Untuk Meningkatkan Hasil Belajar Siswa Kelas X2 SMA Neg . 3 Gorontalo Pada Materi Jarak Pada Bangun Ruang,” J. ENTROPI Inov. Penelitian, Pendidik. dan Pembelajaran Sains, vol. 7, no. 1, pp. 583–592, 2013.

[11] A. Amin and S. P. Suardiman, “PERBEDAAN PRESTASI BELAJAR MATEMATIKA SISWA DITINJAU DARI GAYA BELAJAR DAN MODEL PEMBELAJARAN,” J. Prima Edukasi, vol. 4, no. 1, pp. 12–19, 2016.

[12] S. U. Sajimana, “Pengaruh Pembelajaran Matematika Realistik Terhadap Hasil Belajar Matematika Ditinjau Dari Motivasi Belajar,” J. Ilm. Factor Exacta, vol. 1, no. 1, 2008.

[13] E. Mulyasa, Kurikulum Tingkat Satuan Pendidikan. Bandung: Remaja Rosdakarya, 2008.

[14] T. Nunes et al., “The contribution of logical reasoning to the learning of mathematics in primary school,” Br. J. Dev. Psychol., vol. 25, no. 1, pp. 147–166, Mar. 2007.

[15] M. Alex and M. O lubusuyi, "Guided-discovery Learning Strategy and Senior School Students Performance in Mathematics in Ejigbo, Nigeria," J. Educ. Pract., vol. 4, no. 12, 2013.

[16] T. Martaid, N. Bukit, and E. M. Ginting, “The Effect of Discovery Learning Model on Student Students’ Critical Thinking and Cognitive Ability in Junior High School,” IOSR J. Res. Method Educ., vol. 7, no. 6, pp. 1–8, 2017.

[17] B. A. Adegoke, “Modelling the Relationship between Mathematical Reasoning Ability and
[18] U. Supraptinah, Budiyono, and S. Subanti, "EKSPERIMENTASI MODEL PEMBELAJARAN DISCOVERY LEARNING, PROBLEM BASED LEARNING, DAN THINK-TALK-WRITE DENGAN PENDEKATAN," *J. Elektron. Pembelajaran Mat.*, vol. 3, no. 10, pp. 1138–1149, 2015.

[19] R. Angkowo and A. Kosasih, *Optimalisasi Media Pembelajaran*. Jakarta: PT Grasindo, 2007.

[20] H. Soinbala and F. Mulyatna, “PENERAPAN STRATEGI PEMBELAJARAN METAKOGNITIF,” *Fermat J. Pendidik. Mat.*, vol. 2, no. 1, pp. 46–56, 2019.