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# Student's Mathematical Reasoning Ability Viewed from Self-Confidence in Mathematical Modeling with Open-ended Approach Learning

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## Abstrak

The objectives of this study are (1) to examine the quality of learning with Open-ended Mathematical Modeling towards mathematical reasoning ability; (2) describe the achievement of mathematical reasoning abilities in terms of self-confidence. The research method used is a mix method with concurrent embedded design. The research subjects were students of 1st Public High School in Payung class Science of 11th grade. The quantitative research is true experimental research with Pretest-Posttest Control Group design. Quantitative data were tested with the z test, while qualitative data were analyzed descriptively. The results showed that (1) learning with Mathematical Modeling with Open-ended approach gave good quality; (2) students with low self-confidence can estimate the allegations and check the truth of the statement well but cannot draw conclusions logically, students with self-confidence are able to check the truth of the statement, provide an explanation of the picture and estimate the allegation but still make a little mistake in drawing conclusions logically, students with high self-confidence can check the truth, draw conclusions, estimate allegations very well, but make a few mistakes in giving explanations from images, the indicators of giving explanations from images are the most difficult indicators to be achieved by students in all categories of self-confidence.



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## INTRODUCTION

Education becomes an important component to measure the success of a country; therefore education in Indonesia is clearly regulated in the Constitution. As one part of education, mathematics should not be seen as the final result but also the process / activity of the formation of mathematics itself (Alawiyah, et al., 2018). Mathematics is useful for other fields of science, both as a theoretical basis and application of mathematics itself (Rosyana & Sari; Astuty et al., 2019).

Mathematical Reasoning Ability is one of the abilities that must be taught in mathematics learning (Kemendikbud, 2013; Kusumawardani, et al., 2018). Reasoning ability is the ability to make decisions based on facts and arguments that have been proven (Sumarmo, 2014; Satria, et al., 2018). Rohana (2015) suggested that reasoning ability is very useful for students in constructing and comparing ideas from various situations faced, so students can take the right decisions in solving problems in life. Through reasoning development exercises, students can see the problem and the adequacy of information to draw conclusions (Saleh., Et al: 2018). Indicators of reasoning ability in this study are drawing logical conclusions, checking the truth of statements, estimating guesses, giving and explaining images, tables and patterns (Sumarmo in Ayal, et al., 2016; Satriawan, 2017). In addition to hard skills, there is also a need for soft skills in every child, one of which is self-confidence.

According to Ficha (Haeruman., Et al, 2017) self-confidence is a self-belief in the abilities and strengths of students to be able to solve a given problem by means of a good and effective solution in accordance with the observed aspects.

Students' mathematical reasoning abilities and self-confidence in Indonesia are still relatively low; this is proven by the results of TIMMS (Rahmawati, 2016). The cognitive level achievement of Indonesian students' reasoning only reached 20% compared to the international scale reaching 45% while the achievement was only 23% compared to other countries which reached 32%. This also happened at 1st Public High School in Payung, based on the observations and interviews with teachers, students still had difficulty using their reasoning in modeling problems into mathematical form which is used to draw conclusions and make decisions. Students also have not been able to connect everyday problems with mathematical concepts.

Mathematical Modeling with open-ended approach learning is one of the innovative learning which is expected to develop mathematical reasoning abilities. In learning with Mathematical Modeling, students will be required to make choices based on the results of the exploration of concepts that have been obtained about how to approach problems mathematically, then what kind of assumptions must be made to determine how effective approaches are used to understand and make decisions about real world phenomenon ( Hernández, et al., 2017). Wherefore basically learning Mathematical Modeling is learning based on modeling activities, which is a cycle of activities modeling real world problems into the classroom. The model found was used as a solution to be returned to the real world (Santi, 2014; Erbaş, et al., 2014; Saxena, et al., 2016; Greefrath & Vorhölter, 2016).

Galbraith et al revealed that Mathematical Modeling is a means for teaching mathematics (in Erbaş et al., 2014). This is also in line with the opinion of Biembengut & Hein (2013) that Mathematical Modeling is a way of teaching mathematics that aims to provide students with a better understanding of mathematical concepts, train them to read, interpret, formulate and solve specific problems, as well as to arouse his critical and creative feelings. Steps in learning Mathematical Modeling according to Selvia, et al (2014) are (1) Presentation of themes; (2) Problem limitation; (3) Formulation of the problem; (4) Development of teaching materials; (5) Presentation of similar examples; (6) Formulation of mathematical models and solutions; (7) Interspersion and validation of solutions.

An open-ended approach is needed to open up insights or explore concepts that students already have. The Open-ended approach will give students the breadth to gain knowledge, experience, discover, recognize, and solve problems differently. The open-ended approach can be concluded that it's not only provides open problems for students to be solved but also must guarantee the openness of student activities in the learning process (Winardi & Wardono, 2017).

Based on the description above, the purpose of this study is to examine the quality of Mathematical Modeling learning with Open-ended approach to mathematical reasoning abilities and describe the achievement of mathematical reasoning abilities in terms of self-confidence.

**METHODE**

This research is a mixed method with embedded concurrent design. Quantitative research uses true experimental design with Pretest-Posttest Control Group. This research was conducted at Payung 1st Public High School; the population in this study was the mathematical reasoning ability of students of science class of 11th grade of the 1st Public High School 1, Payung in the school year of 2018/2019. The data in this study are the students' scores obtained from the results of students' mathematical reasoning tests namely the initial and final abilities, the student's response questionnaire, the results of observations of the implementation of learning and the results of the validation of learning tools and research instruments. There are two quantitative data analysis in this study namely prerequisite test analysis and research data analysis, individual and classical completeness, and average difference test and proportion difference. Normality test on initial and final capability data uses the Kolmogorov Smirnov test with testing criteria if $D_{value} < D_{table}$ then accept $H_0$, otherwise reject $H_0$. While the homogeneity test uses the F test with the criteria $F_{value} < F_{table}$ then accept $H_0$, otherwise reject $H_0$. The numbers of samples in this study were more than 30. Therefore the prerequisite test and the research hypothesis test used the z test. Test criterias are accept $H_0$ if $z_{value} < z_{table}$ and reject $H_0$ if $z_{value} \geq z_{table}$. The significant level in this study is α = 5%. The subjects of this research were obtained by using purposive sampling. Qualitative data analysis was tested descriptively.

**RESULT AND DISCUSSION**

The results of this study describe the quality of Open-ended Mathematical Modeling learning. Descriptions will be carried out based on three stages, namely the preparation, implementation and evaluation stages (Danielson, 2013).

The first stage is the preparation stage, at this stage is to measure the results of the validation of learning tools and research instruments by experts. The learning tools and research instruments in this study that were validated by experts were syllabus, lesson plans, worksheets, observation sheets and test questions on students' mathematical reasoning abilities. The average validation results for each Learning Implementation Plan, Student Worksheets, and Observation Sheets are 3.9 in the good category, for the average syllabus validation results are 3.8 also in the good category, and the average validation of mathematical reasoning ability test questions is 4 in the good category. So that the overall validation results of learning tools and research instruments are 3.9 in either category.

Based on the description of the results of the validation, it can be concluded that the results of the validation of the learning tools and research instruments are good, so they can be used as a research. In the test instrument, validation is not only done by experts but also empirical validation. Empirical validation is carried out to determine the level of validity, reliability and difficulty of the item in order to measure the desired mathematical reasoning ability.

The results of empirical validation show that the test items for the try out test to measure the ability of mathematical reasoning which consists of problem descriptions are: (1) all questions are valid, with details for questions number 1,2,3 and 4 the interpretation of validity is very good while numbers 5 and 6 interpretation of validity is good. It can be said that the matter of mathematical reasoning ability can measure the desired indicators in this study; (2) reliability seen from the results of r count, obtained $r_{11}$ = 0.78. This result shows that the reliability of the test questions is good, which means the mathematical reasoning ability questions that are made will give the same or consistent results even though given by different subjects, times and places; (3) the level of difficulty of the items, the difficulty index obtained for numbers 2,3 and 4 is 0.579, 0.658, and 0.421 which are interpreted to have a moderate level of difficulty, the difficulty index numbers 5 and 6 are 0.283 and 0.295 which are interpreted to have difficult levels of difficulty, while the item difficulty index number 1 is 0.812, which means easy difficulty level. The results of the difficulty index indicate that the level of difficulty of the questions varies. Based on the results of Empirical validation, all questions can be used to test mathematical reasoning abilities. In this study 5 questions out of 6 questions will be taken to maximize the student's work time. The test questions used are item number 1, 3, 4, 5 and 6.

Then, the second stage is the implementation phase, the results of observations of the inability of learning conducted by subject teachers for 5 meetings. The average value of observations of the implementation of learning in the experimental class for 5 meetings is 4.74 which is in the very good category with details of the value is that at the first meeting a value of 4.5, then at the second meeting the value is 4.8, then at the meeting third was 4.5, the fourth meeting was 4.9 and at the last meeting that is the fifth meeting, the value was 5.

Based on observations obtained, it can be interpreted that the average value of the learning process is in the very good category which means that it is in accordance with the learning plan and is of good quality. In addition, at the implementation stage of learning assessment activities are not only seen from observations by observers but also from the results of the questionnaire responses given by students who take Mathematical Modeling approach with open-ended approach. Questionnaire student responses contain positive and negative statements towards learning Mathematical Modeling approached Open-ended. The questionnaire assessment by the students is completed by answering yes and no. A score of 1 applies if students answer yes to positive statements and also if students answer no to negative statements. Vice versa, it is also given a score of 0 if students answer no to positive statements and also if students answer yes to negative statements. Learning practicality would be said to be good if students gave an average response of more than 75%. The results of student responses in this study amounted to 90% of students giving positive responses to Open-ended Mathematical Modeling learning. So based on the results of observations of the feasibility of learning and positive responses given by students it can be concluded that the feasibility of learning Mathematical Modeling with open-ended approach is good.

The final stage is the third stage, the evaluation stage. This stage is carried out on the results of tests of mathematical reasoning ability, namely initial and final abilities. The initial ability test results are used to see the initial mathematical reasoning abilities of the two samples are the same. To determine the initial ability of the two samples is the same, the average similarity test from the results of the initial reasoning ability will be used. Before conducting the average similarity test, the initial mathematical reasoning ability data were tested with normality and homogeneity tests. Using the Kolmogorov Smirnov test is obtained $D_{value} = 0{,}105 < D_{table} = 0{,}165$ which can be concluded that the initial reasoning ability data is normally distributed. Then the homogeneity test is carried out, the homogeneity test results using the F test are obtained $F_{value} = 1{,}16 < F_{table} = 1{,}82$, which means the variance of the two samples is the same. Because the results of the initial ability of the two samples were normally distributed and homogeneous, the average similarity test results used the z test because n > 30. The results were obtained $z_{value} = 0{,}074$ and $z_{table} = 1{,}96$ obtained from the standard normal table list. So $z_{value} = 0{,}074 < z_{table} = 1{,}96$ which means accept $H_0$. It can be concluded that there is no difference in the initial ability of the two samples. This shows that the sample comes from the same condition or state.

The results of the final reasoning ability test are used to test the proposed research hypotheses. Before testing the research hypothesis, normality and homogeneity tests were carried out on the results of the final reasoning ability. The results of the normality test results of the final reasoning ability test using the Kolmogorov Smirnov test are obtained

$D_{value} = 0{,}079 < D_{table} = 0{,}165$ which can be concluded that posttest data is normally distributed, then homogeneity test is performed, for the homogeneity test F results are obtained is $F_{value} = 1{,}33$ while the posttest data can be concluded with normal distribution, then homogeneity test is used, for the homogeneity test F results are obtained $F_{table} = 1{,}82$ obtained from the distribution list f. The results show $F_{value} = 1{,}33 < F_{table} = 1{,}82$ which means the posttest data is homogeneous. The result data from the final mathematical reasoning ability test (Posttest) proved to be normally distributed and homogeneous will then be used to test 4 research hypotheses.

The first Hypothesis Test is testing the average mathematical reasoning ability of students in the experimental class exceeds the minimum completeness criteria that are 69. The first hypothesis test uses the z test, obtained $z_{value} = 6{,}742$ and $z_{table} = 1{,}65$ obtained from the list of standard normal tables. Because $z_{value} = 6{,}503 > z_{table} = 1{,}65$ then reject $H_0$ so that it can be concluded that the average mathematical reasoning ability of students in the experimental class exceeds the Minimum completeness Criteria.

The second hypothesis test is to test the proportion of students' mathematical reasoning abilities that exceed the minimum completeness criteria in the experimental class exceeding 75%. This hypothesis test uses the z test, obtained $z_{value} = 1{,}71$ and $z_{table} = 1{,}65$. Because $z_{value} = 1{,}71 > z_{tabel} = 1{,}65$, $H_0$ is rejected, meaning that the proportion of students' mathematical reasoning abilities that exceed the minimum completeness criteria in the experimental class exceeds 75%.

The third hypothesis in this study is to test the proportion of students' mathematical reasoning abilities that reach the minimum completeness criteria in the experimental class more than the proportion of students' mathematical reasoning abilities who reach the minimum completeness criteria in the control class. The third hypothesis test uses the z test, obtained $z_{value} = 1{,}75$ and $z_{table} = 1{,}65$. Because $z_{value} = 1{,}75 > z_{table} = 1{,}65$, $H_0$ is rejected. So it can be concluded that the proportion of mathematical reasoning abilities of students who reach the minimum completeness criteria in the experimental class is more than the proportion of mathematical reasoning abilities of students who reach the minimum completeness criteria in the control class.

The fourth hypothesis in this study is to test the average mathematical reasoning ability of students in the experimental class more than the average mathematical reasoning ability of students in the control class. This test uses the z test obtained $z_{value} = 2{,}85$ and $z_{table} = 1{,}65$. So $z_{value} = 2{,}85 > z_{table} = 1{,}65$, then $H_0$ is rejected. It was concluded that the average student mathematical reasoning ability in the experimental class was more than the average student reasoning ability in the control class.

The results of this study indicate that the quality of Mathematical Modeling with open-ended approach is good for developing students' reasoning abilities. Students who have good reasoning ability are proven to be able to get good grades too. This is in accordance with the research of Sanhadi (2015) that state reasoning ability has an effect on learning outcomes, the higher the mathematical reasoning ability of students the more learning outcomes. Likewise students who have low reasoning abilities get low grades too. In accordance with the statement of Tukaryanto et al., (2018) and Nurhajati (2014) that the low reasoning ability will result in low learning achievement.

In this study, one of the reasons for the development of mathematical reasoning abilities is the learning process. For example in the open-ended approach students are given Open-ended questions, students are free to use their reasoning ability to solve problems in various ways. As stated by Lestari, et al (2016) that the Open-ended approach by giving Open-ended questions will encourage the potential of students to carry out mathematical activities at higher levels of thinking. In line with the results of Irawan and Surya's research (2017) that through Open-ended learning will provide opportunities for students to express their opinions and ideas to improve their thinking skills so that they can think optimally. The results of this study are also in accordance with the results of Ruslan & Santoso (2013); Lestari et al (2016) that giving Open-ended questions will affect the ability of mathematical reasoning. Open-ended approach will also improve student learning outcomes (Chogo., Et al: 2017).

Self-confidence category is obtained from the questionnaire. Based on the results of the self-confidence questionnaire obtained 6 students with high self-confidence, 22 students with moderate self-confidence and 5 students with low self-confidence. The achievement of indicators of reasoning ability for each category of self-confidence is shown in Table 1 below:

**Table 1.** Achievement of mathematical reasoning abilities in terms of self-confidence

| Mathematical Reasoning Capability Indicator | Self-confidence Category | | |
|---|---|---|---|
| | Low % | Moderate % | High % |
| Draw a conclusion | 0 | 45 | 60 |
| Provides Explanation of Pictures | 17 | 9 | 40 |
| Estimate or guess | 50 | 73 | 80 |
| Check the truth statement | 50 | 64 | 80 |

Table 1 show that of the four indicators measured, indicators estimate or infer answers, provide explanations from pictures and indicators checking the veracity of statements can be achieved by each category of self-confidence. The most difficult indicator to achieve is the indicator giving an explanation of the picture. Indicators of drawing conclusions can only be reached by medium and high categories. Based on Table 1, each of the two subjects for each category of self-confidence was chosen to conduct in-depth interviews about mathematical reasoning abilities.

In the category of high self-confidence, subjects E-12 and E-22 were chosen. Test and interview results show that subjects E-22 can reach all indicators of mathematical reasoning ability. In the indicator giving an explanation of the picture, the subject E-22 can solve the problem correctly using its own way, while the E-12 subject can provide an explanation of the picture but is not quite right in the final solution of the problem. Subject E-22 in completing indicators estimates the allegations using its own way by utilizing the concept of number patterns, while subject E-12 applies the material that has been studied. For indicators to draw conclusions and check the validity of statements, both subjects have the same completion pattern, using the concept of material that has been studied.

In the category of self-confidence, the subjects E-19 and E-25 were selected. The achievement of indicators in this category varies. Subject E-25 achieves all the indicators measured, while subject E-19 can only reach indicators estimating answers, checking the veracity of statements and giving explanations from pictures. Constraints appear on the indicators giving conclusions, based on interviews results that Subject E-19 can find out what is known and asked but Subject E-19 incorrectly uses material concepts for problem solving so the process of searching for answers obtained by Subject E-19 is not right. The reasoning pattern with indicators provides an explanation in the picture by Subjects E-25 and E-19 the same as the reasoning pattern of subjects E-22 at high self-confidence, as well as the reasoning pattern of indicators estimating the allegations. Subject E-19 has the same pattern of reasoning as subject E-12 in the indicator estimating conjecture that is using the concept of the material obtained. The reasoning pattern with indicators checking the truth of the statements of the two subjects has a difference in completion; Subject E-25 uses the manual method or its own method while the subject E-19 utilizes the formula that has been studied.

At the indicator of low self-confidence selected subjects E-02 and E-09. Subject E-09 can reach indicators estimating the allegations, checking the truth of the statement and giving an explanation of the picture, while Subject E-02 can only reach the indicator estimating the allegations and checking the truth of the statement. The reasoning pattern of the indicators checking the truth of the statements of the two Subjects is the same. Both of them utilize the formula that has been learned. In the estimation indicator estimation, Subject E-09 uses a row pattern while Subject E-02 uses the concept of material that has been obtained. Subject E-09 can reach the indicator giving an explanation of the picture and has the same settlement pattern as the reasoning pattern of Subject E-22, Subject E-25 and Subject E-19. On the indicators drawing conclusions the two subjects of low self-confidence cannot solve the problem correctly. Based on the results of the interview, Subject E-02 thinks using the basic formula of the material instead of the application formula, while Subject E-09 replies that it cannot understand the problem and also cannot remember which concept to use.

## CONCLUSION

Based on the results and discussion, it can be concluded that (1) Mathematical Modeling learning with open-ended approach can be said to be of good quality, indicated by the results of the validation of learning tools and research instruments that will be used in good categories, the process of implementing Mathematical Modeling with open-ended approach is very good and more than 75% of students gave positive responses, the average mathematical reasoning ability of students in the experimental class reached the minimum completeness criteria individually and classically, the average and proportion of mathematical reasoning abilities in the experimental class was more than the average mathematical reasoning ability of students in the control class ; (2) students with low self-confidence category can estimate the allegations and check the truth of the statement well but cannot draw conclusions logically, students with self-confidence are being able to check the truth of the statement, provide an explanation of the picture and estimate the allegation but still make a little mistake in drawing conclusions logically, students with high self-confidence can check the truth, draw conclusions, estimate allegations very well, but make a little mistake in giving an explanation of the picture.

## REFERENCE

Alawiyah, A., Waluya, S. B., & Prasetyo, A. P. B. 2018. Didactical Situations of Students ' Mathematical Reasoning Based on the Learning Obstacle on Quadrilateral Areas. *Unnes Journal of Mathematics Education Research*, *7*(1), 196–203.

Anwar, N. T., Waluya, S. B., & Supriyadi. 2018. Abilities of Mathematical Literacy Based on Self-Confidence in Problem Based Learning with DAPIC Problem-Solving Process. *Unnes Journal of Mathematics Education*, *7*(2), 152–160.

Astuty, E. S. W., Waluya, S. B., & Sugianto. 2019. Mathematical Reasoning Ability Based on Self Regulated Learning by Using The Learning of Reciprocal Teaching With RME Approach. *Unnes Journal of Mathematics Education Research*, *8*(1), 49–56.

Ayal, C. S., Kusuma, Y. S., Sabandar, J., & Dahlan, J. A. .2016. "The Enhancement of Mathematical Reasoning Ability of Junior High School Students by Applying Mind Mapping Strategy". *Journal of Education and Practice*, *7*(25): 50–58.

Biembengut, M. S., & Hein, N. 2013. "Mathematical Modeling : Implications for Teaching". *Modeling Students' Mathematical Modeling Competencies, ICMT 13*: 481–490.

Chogo, C. N., Githua, B. N., & Changeiywo, J. M. 2017. Effect Of Open Ended Teaching Learning Approach On Secondary School Students' Mathematics Achievement In Learning Three Dimensional Geometry. *International Journal Of Scientific & Technology Research*, *6*(12), 273–277.

Danielson C. 2013. *The framework for teaching evaluation instrument*.Virginia: Association for Supervision and Curiculum Development

Erbaş, A.K., KertiL, M., Çetinkaya, B., Çakiroğlu, E., Alacaci, C., & Baş, S. 2014. "Mathematical Modeling in Mathematics Education: Basic Concepts and Approaches". *Educational Sciences: Theory & Practice*, 14(4):1621-1627

Greefrath, G., & Vorhölter, K. 2016. *Teaching and Learning Mathematical Modelling : Approaches and Developments from German Speaking Countries*. (13th ed.). Springer International Publishing AG Switzerland.

Haeruman, L. D., Rahayu, W., & Ambarwati, L. 2017. "Pengaruh Model Discovery Learning Terhadap Peningkatan Kemampuan Berpikir

Kritis Matematis dan Self Confidence ditinjau dari Kemampuan Awal Matematis Siswa SMA Di Bogor Timur". *JPPM*, *10*(2): 157–168.

Hernández, M.L., Levy R., Felton-Koestler, M. D., & Zbiek, R.M. 2017. "Mathematical Modeling In The High School Curriculum". *Mathematics Teacher*, 110 (5): 336-342.

Irawan, A., & Surya, E. 2017. "Application of the Open Ended Approach to Mathematics Learning in the Sub-subject of Rectangular". *International Journal of Sciences*, *33*(3), 270–279.

Junaedi, I., & Asikin, M. (2012). Pengembangan pembelajaran matematika humanistik untuk meningkatkan kemahiran matematis. *Unnes Journal of Mathematics Education Research*, *1*(2):115–120.

Kemendikbud. 2013. *Permendikbud No. 65 tentang Standar Proses Pendidikan Dasar dan Menengah.* Jakarta: Kementerian Pendidikan dan Kebudayaan.

Kusumawardani, D. R., Isnarto, & Junaedi, I. 2018. Mathematical Reasoning Based on Belief in PBL with Dyadic Interaction Approach. *Unnes Journal of Mathematics Education Research*, 7(1), 48–53.

Leong, K. E. 2013. Mathematical Modelling In The Malaysian Secondary. *Learning Science and Mathematics*, *1*(8):66-74.

Lestari, N., Hartono, Y., & Porwoko. 2016. "Pengaruh Pendekatan *Open-Ended* Terhadap Penalaran Matematika Siswa Sekolah Menengah Pertama Palembang". *Jurnal Pendidikan Matematika*, *10*(1), 81–95.

Nurhajati. 2014. Pengaruh Penerapan Pendekatan Konstruktivisme Dengan Model Pembelajaran Kooperatif Berbantuan Program Cabri 3D Terhadap Kemampuan Penalaran Dan Koneksi Matematis Siswa SMA Di Kota Tasikmalaya. *Jurnal Pendidikan Dan Keguruan*, *1*(1): 1–10.

Rahmawati. 2016. *Seminar hasil TIMMS 2015.* Dalam https://puspendik.kemdikbud.go.id/seminar/upload/Hasil%20Seminar%20Puspendik%202016/Rahmawati-Seminar%20Hasil%20TIMSS%202015.pdf . Diakses tanggal 20 Agustus 2018.

Rohana. 2015. "The Enhancement of Student's Teacher Mathematical Reasoning Ability through Reflective Learning". *Journal of Education and Practice*, *6*(20): 108–115.

Rosyana, T., Sari, I. P. 2015. "Penerapan Aktivitas Quick On The Draw Melalui Pendekatan Thinking Aloud Pair Problem Solving untuk Meningkatkan Kemampuan Komunikasi dan Penalaran Matematis Siswa MA". *Jurnal Ilmiah UPT P2M STKIP Siliwangi*. 2(2), 192-202.

Ruslan, A. S, & Santoso, B. 2013. "Pengaruh Pemberian Soal Open-Ended Terhadap Kemampuan Penalaran Matematis Siswa". *Kreano*, *4*(2): 138-150.

Saleh, M., Prahmana, R. C. I., Isa, M., & Murni. 2018. "Improving the Reasoning Ability of Elementary School Student through the Indonesian Realistic Mathematics Education". *Journal on Mathematics Education*, *9*(1): 41–54.

Sanhadi, K. C. D. 2015. "Pengaruh Kemampuan Penalaran dan Self Efficacy terhadap hasil belajar matematika siswa kelas VIII". *Seminar Nasional Matematika Dan Pendidikan Matematika UNY*. 341-350.

Santi, E. E. 2014. "Pembelajaran Matematika Melalui Pemodelan". *Seminar Nasional Kedua Pendidikan Berkemajuan Dan Menggembirakan*: 493–498.

Satria, O. A., Waluya, S. B., & Siswanto, B. 2018. Model Discovery Learning Bernuansa Hypnoteaching untuk Meningkatkan Kemampuan Mathematical Reasoning dan Rasa Ingin Tahu Siswa. *PRISMA*, 1, 669–676.

Satriawan, R. 2017. Keefektifan Model Search, Solve, Create, and Share Ditinjau dari Prestasi, Penalaran Matematis, dan Motivasi Belajar. *Jurnal Riset Pendidikan Matematika*, *4*(1), 87–99.Saxena, R., Shrivastava, K. & Bhardwaj, R. 2016. "Teaching Mathematical Modeling in Mathematics Education". *Journal of Education and Practice,* 7(11): 34-44.

Selvia, F. R., Darmawijoyo, & Yusuf, M. 2014. "Penerapan Pembelajaran Pemodelan Matematika Menggunakan Pendekatan Konstruktivisme Terhadap Kemampuan

Pemecahan Masalah Untuk Siswa Kelas VIII SMP". *Jurnal Pendidikan Matematika, 3*(1): 66-74.

Sumarmo, U. 2014. "Berfikir dan Disposisi Matematika Serta Pembelajarannya. In Jurusan Matematika FPMIPA". *Kumpulan Makalah*. Bandung: Universitas Pendidikan Indonesia.

Tukaryanto, Hendikawati, P., & Nugroho, S. 2018. Peningkatan Kemampuan Penalaran Matematik dan Percaya Diri Siswa Kelas X Melalui Model Discovery Learning. *Prosiding Seminar Nasional Matematika*, (1): 656–662.

Winardi & Wardono. 2017. Analisis Kemampuan Literasi Matematika melalui Model Missouri Mathematics Project dengan Pendekatan Open-Ended. *Unnes Journal of Mathematics Education Research,* 6(1), 130-138.