

Development of Mathematics Learning Tools Based on Problem Posing Learning Models to Improve Mathematical Communication Ability and Learning Independence of Junior High School Students

Fitriyanti Fadilla¹, Sahat Saragih², KMS. M. Amin Fauzi³

^{1,2,3} Universitas Negeri Medan, Indonesia

fitriyantifadilla@gmail.com, animinarni10@gmail.com, aminunimed29@gmail.com

Abstract

This study aims to produce a valid, practical, and effective problem posing learning model-based learning tool for Class VIII students of SMP Nusantara Lubuk Pakam, to analyze the improvement of students' mathematical communication skills taught with learning tools developed based on the Problem Posing Learning model in SMP. Nusantara Lubuk Pakam, to analyze the achievement of student learning independence taught with learning tools developed based on the Problem Posing Learning model at SMP Nusantara Lubuk Pakam, as well as to analyze the answer process of SMP Nusantara Lubuk Pakam students in solving test questions of mathematical mathematical communication skills. The data were obtained through the validation sheet of teaching materials, observation sheets, student response questionnaires, mathematical communication skills test instruments and student learning independence questionnaires. This study uses the 4-D development model Thiagarajan, Semmel and Semmel by developing teaching materials with problem posing learning. Based on the validation results of the value of learning tools developed through the Problem Posing learning model, the validator team met the valid and practical criteria. The implementation of the learning tools developed through the Problem Posing learning model was in good criteria, namely 87.78% in trial II. Classical mastery of student learning has been achieved in the second trial by 90%. The achievement of learning objectives has been achieved in the second trial, which is 83.39%. Student responses to components and learning activities 94.11% have shown a positive response to the components of learning tools and learning activities developed.

Keywords

problem posing
learning;
mathematical
communication skills;
student learning
independence



I. Introduction

Mathematics is one of the subjects which is quite important in helping develop students' potential. This is in line with Suratno (2016) saying that mathematics plays a role in supporting human life, especially in the modern era. Mathematics is very closely related to human life. Observing this, the position of mathematics subjects in schools needs serious attention.

The Indonesian government has made various efforts to improve the quality of teaching and improve student mathematics learning outcomes, because mathematics is a very important science in every level of education pursued by every Indonesian citizen. The government's efforts are to develop curricula, provide training to teachers, complete

educational infrastructure and even improve teacher welfare. Along with the development of the internet, learning strategies have shifted and various information and communication technology-based learning strategies have emerged, from e-learning models, smart classroom technology, virtual classrooms, blended learning, etc. (Fitri & Zahari, 2019).

Through good mathematics education, students can indeed obtain various kinds of provisions in facing challenges in the global era. In the 2013 curriculum itself, the use of technology in learning became something that was highly recommended. The learning process in the 2013 curriculum requires students to participate actively and provide sufficient space for students' creativity, interests, and talents (Fitri, Syahputra, & Syahputra, 2019).

Communication skills are basically one of the learning outcomes that will be achieved in learning mathematics at any school level. Therefore mathematics learning must be focused on students' mathematical communication skills, so that students' mathematical abilities are achieved optimally. So that learning mathematics is not only transferring knowledge to students, but also helping students to form their own knowledge and empowering students to be able to solve the problems they face with mathematical communication.

Mathematical communication can be defined as a student's ability to convey something they know through dialogue events or mutual relationships that occur in the classroom environment, where message transfer occurs. The message that is transferred contains the mathematics material that students learn, for example in the form of concepts, formulas, or problem solving strategies. The parties involved in communication events in the classroom are teachers and students. The way of transferring the message can be oral communication or written communication.

According to Ansari (2016), it is important to build mathematical communication skills in students so that they can: (1) Model situations in written, oral, graphical, pictures, and algebraic ways; (2) Reflect and clarify thoughts about mathematical ideas in various situations; (3) Develop an understanding of mathematical ideas including the role of definition in mathematics; (4) Using reading, writing, and listening skills to interpret and evaluate mathematical ideas; (5) Assessing mathematical ideas with convincing reasons; (6) Understanding the value of notation and the role of mathematics in developing ideas.

However, the reality is that students' mathematical communication skills are still low. Low mathematical communication skills will make it difficult for students to digest the questions given, while students who have good communication skills will easily take steps to solve a problem. This can be seen from Sari's research (2015) which says that if most students are given questions that are not in accordance with the examples being taught, students will experience difficulties in solving the questions given, because they do not know where to start in order to solve the questions given. Likewise, the low level of communication skills makes it difficult for students to digest the questions given so that they cannot solve the problem. A student who has good communication skills will be able to easily take a step to solve a problem (Harahap, 2017).

Apart from cognitive abilities, affective abilities have also been in the spotlight in the world of education lately, where not only the cognitive realm but the affective domain have also been in the spotlight. One of the affective domains that is very important for students is independent learning. Mathematics is a universal science. Mathematics is also seen as the queen of science. (Irhamna, 2020).

II. Research Methods

The subjects in this study were Class VIII students of SMP Nusantara Lubuk Pakam for the 2019/2020 academic year and as the object in this study was the Problem Posing model learning device with the material of the flat-sided building (cubes and blocks) developed. The trial design that will be used in instrument development is the one group pretest-posttest design as follows:

Pretest	Treatment	Posttest
O ₁	X	O ₂

(Source: Sugiyono, 2012)

with:

O₁ = Pretest of mathematical communication skills and student learning independence.

X = learning treatment using the Problem Posing model learning tool
has been developed.

O₂ = Posttest students' mathematical communication skills and learning independence

This research is categorized into the types of development research (development research). This study uses the 4-D development model Thiagarajan, Semmel and Semmel (1974) by developing teaching materials with a realistic mathematical approach.

The development model was chosen because of the consideration of the development steps in the detailed 4-D development model but it was simple and easy to follow the development procedure. This development model is programmed with a systematic sequence of activities to solve learning problems tailored to the needs of students. The advantage of the 4-D development model is that it is the basis for developing learning tools because the implementation stages are divided in detail and systematically.

Thus, the product of this research is a valid, practical and effective problem-based teaching material. The development of these teaching materials is in the form of a learning implementation plan (RPP), student books (BS), student worksheets (LKPD) and research instruments in the form of a mathematical communication ability test and a student learning independence questionnaire.

III. Discussion

Based on the data obtained from the research results, it will be known whether the problem formulations raised in the previous section have been answered or not. The results of the data analysis showed: (1) the learning tools developed through the Problem Posing learning model were valid, practical, and effective, (2) there was an increase in students' mathematical communication skills after using the learning tools developed through the Problem Posing learning model, (3) there is an increase in student learning independence after using learning tools developed through the Problem Posing learning model, and (4) the type of student error in completing tests of mathematical communication skills.

3.1 The Validity of Learning Tools Developed Based on the Problem Posing Learning Model

Based on the research results that have been stated above, it shows that the learning tools developed through the Problem Posing learning model are declared valid or have a good degree of validity. This means that learning tools developed through the Problem Posing learning model can be used to measure students' communication skills and learning independence. The validation test of the learning device was carried out by 5 experts. The

aspects observed in the lesson plans, student books and LKPD are format, language and content aspects. Meanwhile, the observed aspects in the mathematical communication skills test and independent learning questionnaire were content and language aspects.

Overall, the average value of the student book validity from the format aspect was 4.35 with the valid category. This means that the lesson plans made are appropriate, from the clarity of the distribution of the material, the size and type of writing, the use of color and the emphasis on the writings deemed necessary. Whereas in the language aspect the overall average score is 4.10 in the valid category. This means that the sentences used in the RPP are in accordance with the rules for proper and correct use of Indonesian, are clear and easy to understand. In addition, in the content aspect, the average value of the students' book validity is 4.16 in the valid category. This means that the lesson plan has been prepared based on the conformity with the 2013 KI and KD curriculum and in accordance with the characteristics of the Problem Posing learning model learning.

Furthermore, the validity of the student book from the format aspect is 4.09 with the valid category. This means that the student's book has been made according to the size and type of writing, the use of color and the emphasis on the writings that are deemed necessary. Whereas in the language aspect the overall average score is 4.23 in the valid category. This means that the sentences used in the student book are in accordance with the rules for proper and correct use of Indonesian, are clear and easy to understand. In addition, in the content aspect, the average value of the students' book validity is 4.14 in the valid category. This means that student books have been prepared based on conformity with the 2013 KI and KD curriculum and in accordance with the characteristics of the Problem Posing learning model. This can be seen from the student books which are designed in the form of contextual problems related to students' daily lives. This contextual problem is a problem to explore students' knowledge and through the knowledge that students have, it will improve their thinking skills in solving problems.

Furthermore, the validation on LKPD obtained the overall average value of validity on the format aspect, namely 4.27 in the valid category. This means that the LKPD made is appropriate, both in terms of the size and type of writing, the use of color and the emphasis on the writings deemed necessary. Whereas in the language aspect the overall average score is 4.09 in the valid category. This means that the sentences used in the LKPD are in accordance with the rules for using the Indonesian language properly and correctly, are clear and easy to understand. In addition, in the content aspect, the average value of the students' book validity is 4.40 in the valid category. This means that the LKPD has been prepared based on the components in the LKPD consisting of the title, name, class, learning objectives and learning activities. The problems contained in the LKPD have also been made based on everyday life. In addition, the material and practice questions contained in the LKPD have also been adjusted to the learning objectives and cognitive abilities of students. And the pictures presented in the LKPD can also be said to help students understand.

Based on these findings, there are similarities, namely discussing the results of the validation of learning tools together. However, in Revita's findings, the aspects observed in the learning tools developed were not only content and language aspects, but those observed in didactic aspects, content aspects, language aspects, presentation aspects and time aspects. Based on this, to validate learning tools can also use didactic and time aspects. The more aspects that are observed to validate learning tools, the more quality a learning device is being developed.

3.2 The Practicality of the Learning Tools Developed Based on the Problem Posing Learning Model

Based on the research results, the learning tools developed through the Problem Posing learning model have met the practical criteria in terms of expert judgment and observations of the implementation of learning. Based on the results of expert assessments, the learning tools developed in the form of lesson plans, student books, LKPD, tests of mathematical communication skills and learning independence questionnaires are practical or can be used with a few revisions. Meanwhile, the results of the implementation of the learning tools in the second trial showed that the value of $k = 87.78$ was in good criteria.

These findings reinforce the findings of Peranginangin (2019) which found that the learning devices developed meet practical criteria in terms of the implementation of learning devices and are in good criteria.

It is natural if the results of the implementation of the learning tools developed are in good criteria. This is because the learning tools developed through the Problem Posing learning model help, facilitate, and provide benefits to students in understanding the material of flat-sided shapes (cubes and blocks). The learning process is presented by providing contextual problems to make students practice thinking skills in solving problems. Then the student books and LKPD that are presented with their activities can help students to develop their knowledge in solving problems. Thus, according to the description above, the learning tools developed through the Problem Posing learning model are practically used in the learning process.

Based on these findings, the learning tools developed using the Problem Posing learning model have met the practical criteria in terms of expert judgment and observations of the implementation of learning. This is because the tools developed are presented with contextual problems so that students can practice thinking skills in solving problems.

3.3 The Effectiveness of the Learning Tools Developed Based on the Problem Posing Learning Model

Based on the research results, the learning tools developed through the Problem Posing learning model have met the effective category in terms of (1) classical student learning completeness, (2) achievement of learning objectives, (3) student response, and (4) learning time. The aspects of each effective category above are described as follows:

a. Classical Student Learning Completeness

Based on the results of the posttest analysis of trial II, it was found that the students' mathematical communication skills had met the completeness criteria classically.

Table 1. Classical Completeness Levels of Mathematical Communication Skills in Trial II

Category	<i>Pretest</i>		<i>Posttest</i>	
	Number of Student	Classical Completeness Percentage	Number of Student	Classical Completeness Percentage
Able	4	13%	27	90%
Unable	26	87%	3	10%
Total	30	100%	30	100%

Based on the data in Table 1 above, it shows that the classical completeness of students' mathematical communication skills at the pretest was 13% while in the posttest it was 90%. In accordance with the completeness criteria of classical student learning outcomes, namely at least 85% of students who take the mathematics communication skills test are able to achieve a score of ≥ 75 . Thus, the posttest results of mathematical communication skills have met completeness classically because they obtained a completeness percentage of 90%. It is a natural thing if students' mathematical communication skills meet the criteria of classical learning completeness. This is because the communication skills test given can measure students' mathematical communication skills. Where the tests developed are in accordance with the indicators of mathematical communication skills, then the tests that are presented also contain contextual problems that are used to be solved by students during the learning process using learning tools based on the Problem Posing learning model. Based on this, the learning device developed with the Problem Posing learning model fulfills the effective category in terms of classical student learning completeness.

b. Achievement of Learning Objectives

Based on the results of the analysis of mathematical communication skills in the second trial, the first learning goal achievement in section (a) was 87.50%, the first learning goal achievement in part (b) was 80.00%, the second learning goal achievement was part (a) is 83.75%, the achievement of the second learning goal in part (b) is 81.25%, the achievement of the third learning goal is 81.25%, the achievement of the fourth learning goal in part (a) is 88, 33%, and the achievement of the fourth learning goal in part (b) is 81.67%. This means that the achievement of the learning objectives in the second trial has been achieved. The achievement of learning objectives by using learning tools developed through the Problem Posing learning model because the learning device in the form of student books is designed in the form of contextual problems related to students' daily lives. This contextual problem is a problem to explore students' knowledge and through the knowledge that students have, it will improve their thinking skills in solving problems.

Likewise with the LKPD which was developed in accordance with the characteristics of the Problem Posing learning model. LKPD is designed in the form of contextual problems related to students' daily lives. Giving the problem is useful for exploring students' knowledge in solving problems. The LKPD presented consists of questions that are in accordance with the indicators of mathematical communication skills. These questions are useful for improving students' thinking skills in solving problems. Meanwhile, the test of mathematical communication skills consists of contextual problems related to everyday life. The questions on the test are in accordance with the indicators of mathematical communication skills. Based on this, the learning tools developed with the Problem Posing learning model meet the effective category in terms of the achievement of learning objectives.

c. Student Response

Based on the results of the analysis of student response data in the second trial, it was concluded that students had a positive response to the components and learning activities. The learning process will be effective if students are actively involved (Nasution, 2020). The positive response of students cannot be separated from the learning conditioning with the Problem Posing learning model, including: the problems posed by students originate from contextual problems, namely problems that are close to the student's real world or can be reached by students' imaginations to demonstrate the usefulness of mathematics in student life through Mathematical communication Student responses in the second trial met the established criteria. This indicates that the application of learning tools developed with the Problem Posing learning model can foster students' motivation and interest in learning in implementing learning. This is also in line with the results of research conducted by Lestari, et al. (2018) that student responses of 94.07% have shown a positive response to the components of the learning material and learning activities developed. Based on this, it can be concluded that the learning tools developed with the Problem Posing learning model meet the effective category in terms of student responses.

d. Learning Time

Based on the achievement of the learning time carried out during the second trial, the length of learning time using the Problem Posing learning model is the same as the usual length of time for learning that is carried out this salam, which is four meetings. Thus, the learning time used is in accordance with the learning time achievement criteria, namely the achievement of the learning time used is the same as the usual learning time carried out so far, so it is concluded that the achievement of learning time in Trial II has been achieved.

e. Improving Students' Mathematical Communication Ability Based on Learning Tools Based on the Problem Posing Pursuit Model

Based on the results of the analysis of the students' mathematical communication skills test in the first trial, it was found that the average pretest and posttest results were 47.43 and 79.44, respectively. This means that the pretest results in the first trial did not

meet the specified completeness, namely 75, but the posttest results in the first trial met the specified completeness, namely 75. Meanwhile, in the second trial stage it was found that the average pretest and posttest results were 47, 43 and 82.83. This means that there is an increase in students' mathematical communication skills before and after using learning tools based on the Problem Posing learning model. When compared to trial I with trial II shows that the average posttest result of trial I is 79.44, increasing to 82.83 in trial II. This means that students' mathematical communication skills using learning tools based on the Problem Posing learning model increased in the second trial. If viewed from the increase in students' mathematical communication skills based on the N-Gain calculation, that in the first trial and second trial, there was an increase from 0.58 to 0.66. The results of the N-Gain calculation on mathematical communication skills can be seen in Table 2 below:

Table 2. Summary of N-Gain Results of Mathematical Communication Ability Trial II

<i>N-Gain</i>	Interpretation	Number of Student
$g > 0,7$	Tinggi	9
$0,3 < g \leq 0,7$	Sedang	18
$g \leq 0,3$	Rendah	3

Based on Table 2 it can be seen that students who got an N-Gain score in the range $g > 0.7$ there were 9 students who experienced an increase in the high category, for students who got an N-Gain score in the range $0.3 < g \leq 0.7$ there were There were 18 students who experienced an increase in the medium category, and students who got N-Gain scores in the range $g \leq 0.3$ there were 3 students who experienced an increase in the low category. So the average obtained in the second trial is $0.66 \approx 0.7$ in the medium category. This shows that the students' mathematical communication skills using learning tools based on the Problem Posing learning model have increased in the second trial.

There is an increase in students' mathematical communication skills because the learning tools applied have met the criteria for good quality learning tools. With the good of learning tools developed using the Problem Posing learning model, the students' mathematical communication skills will increase. The increase in students' mathematical communication skills is due to the learning process using learning tools based on the Problem Posing learning model beginning with providing information, so that students can find out information before further learning students are given the opportunity to pose problems from the information provided.

This is in line with Ausubel's (Trianto, 2011) theory that meaningful learning is a process of linking new information to relevant concepts contained in a person's cognitive structure. George Polya (Schoenfeld, 2013) also said that good learning is learning that provides opportunities for students to ask something, which in this case is a problem related to learning and students are required to create ideas. In other words, knowledge will be meaningful to students if the learning process begins with providing information in advance and builds students to create ideas from the information provided. Regarding the Problem Posing Learning Model and students' mathematical communication skills, the results of research conducted by Lestari, et al. (2018) suggest that the problem posing learning model can train students' mathematical communication skills. This happens when students discuss a given problem with their group members. Harahap (2019) also said that students who received learning through the Problem Posing Learning Model had significantly better mathematical communication skills when compared to students who received ordinary learning. Based on this, it can be concluded that learning tools using the Problem Posing learning model can improve students' mathematical communication skills.

f. Increasing Student Learning Independence by Using Learning Tools Based on Problem Posing Learning Models

Based on the results of the questionnaire data analysis of student learning independence in the first trial, it was found that 2 students (6.67%) had learning independence with a very high category and 16 students (53.33%) had learning independence with a high category. The results of the student learning independence questionnaire can be seen in Table 3 below:

Table 3. Student Learning Independence in Trial II

Category	Number of Student	Percentage (%)
Very High	5	16,67
High	15	50,00
Low	7	23,33
Very Low	3	10,00
Total	30	100

Based on Table 3, it shows that students who get the very high category are 5 students out of 30 students (16.67%), while those who get the high category are 15 students out of 30 students (50.00%), for the low category are 7 students out of 30 students (23.33%) and for the very low category as many as 3 out of 30 students (10.00%). When compared to trial I with trial II, it shows that the average result of the student's learning independence score of 90.80 increases to 95.03 in the second trial. This means that the independent learning of students using learning tools based on the Problem Posing learning model increased in the second trial.

By using the Problem Posing learning model-based learning during the learning process, students are involved in posing their own problems, thus enabling them to be more responsible and build their own understanding of the problem independently. The same thing was stated by Sundayana (2016) which states that the independent learning process is a method that involves students in action which includes several steps, and produces results both visible and invisible. This process is called independence learning.

With regard to learning independence and mathematics learning achievement, research conducted by Rendi Andreawan (2012) obtained results, namely that students with the high learning independence category had better mathematics learning achievement than the moderate and low learning independence categories. Then students with moderate learning independence have better mathematics learning achievement than students with low learning independence. Based on this, it can be concluded that the learning tools developed with the Problem Posing learning model can increase students' learning independence.

g. Student Errors in Completing the Mathematical Communication Ability Test Using Learning Tools Based on Problem Posing Learning Models

Based on the results of the students' answers, it can be seen that students made several types of errors, namely: (1) misconceptions, consisting of (a) errors in stating ideas or situations from the contextual problem given using their own words in writing; (2) operating errors, consisting of (a) errors in stating situations from a given contextual problem in the form of a mathematical model in the form of symbols or mathematical equations and (b) errors in using operating rules or calculations in solving contextual problems; and (3) principle errors, consisting of (a) errors in determining the final answer to the questions and (b) errors in drawing conclusions.

Based on the results of students' answers in the first trial, it was found that the dominant answer errors made by students in completing the mathematical communication skills test were concept errors, operation errors and principle errors, while in the second trial it was an operation error. The solutions to overcome the student's answer errors are:

(1) emphasizing the understanding of each sub-material on social arithmetic material, (2) providing various practice questions about social arithmetic material which are then discussed with the teacher, (3) providing various advanced exercises (4) remind students to be more careful in solving each problem and to look back at the results that have been obtained.

IV. Conclusion

The Based on the results of data analysis and discussion in this study, the following conclusions are stated:

1. Teaching Materials The learning tools developed through the Problem Posing learning model have met the valid criteria. This is based on the learning device declared valid by the validator team.
2. The learning tools developed through the Problem Posing learning model have met practical criteria. This is based on:
 - a. The learning device was declared practical by the validator team.
 - b. The implementation of the learning tools developed through the Problem Posing learning model was in good criteria, namely 87.78% in trial II.
3. The learning tools developed through the Problem Posing learning model have met the criteria for being effective. This is based on:
 - a. Classical mastery of student learning has been achieved in the second trial by 90%.
 - b. The achievement of learning objectives has been achieved in the second trial, which is 83.39%.
 - c. Student responses to components and learning activities 94.11% have shown a positive response to the components of learning tools and learning activities developed.
 - d. The learning time used does not exceed ordinary learning.
4. Increasing students' mathematical communication skills by using learning tools developed through the Problem Posing learning model on the flat-sided shape (cubes and blocks) material increases in the second trial with an average of 82.64 and an N-gain value of 0.7 are in the medium category.
5. Increasing students' learning independence using learning tools developed through the Problem Posing learning model in flat-sided spaces (cubes and blocks) increased in trial II with an average of 95.03.
6. In the student answer process, the types of errors that are often made by students in completing tests of mathematical communication skills in the first trial are concept and procedure errors, while in the second trial the most common errors are calculation operations.

References

- Ansari, B. (2016). *Komunikasi Matematik : Konsep dan Aplikasi*. Banda Aceh: Pena.
- Astuti. (2016). Pengaruh Pendekatan Problem Posing dengan Model Pembelajaran Kooperatif Tipe STAD terhadap Kemampuan Komunikasi Matematis Siswa Kelas XII SMA Negeri 1 Salo Kabupaten Kampar, *Jurnal PAUD Tambusai*. Volume 1 Nomor 1.
- Brown, S. I. & Walter, M.I. (2005). *The Art of Problem Posing* (Third ed). New Jersey: Lawrence Erlbaum Associates Publishers.
- Fauzi, M. A. (2011). Peningkatan Kemampuan Koneksi Matematis dan Kemandirian Belajar Siswa dengan Pendekatan Pembelajaran Metakognitif Di Sekolah Menengah

- Pertama. Proceeding Building the Nation Character through Humanistic Mathematics Education. Department of Mathematics Education. Yogyakarta State University, pp. 109-122.
- Fitri, S., & Zahari, C.L. (2019). The implementation of blended learning to improve understanding of mathematics, The Sixth Seminar Nasional Pendidikan Matematika Universitas Ahmad Dahlan 2018: IOP Conf. Series: Journal of Physics: Conf. Series 1188 (2019) 012109, 2018, doi:10.1088/1742-6596/1188/1/012109.
- Fitri, S., Syahputra, E., & Syahputra, H. (2019). "Blended Learning Rotation Model of Cognitive Conflict Strategy to Improve Mathematical Resilience in High School Students", International Journal of Scientific & Technology Research, vol.1, no. 1.
- Harahap, Y. H. (2017). Pengembangan Bahan Ajar Untuk Meningkatkan Kemampuan Komunikasi Matematis Siswa Smp Negeri 2 Padangsidempuan Melalui Model Pembelajaran Kontekstual. Masters Thesis, UNIMED.
- Harahap, Y. H. (2019). Pengembangan Bahan Ajar Untuk Meningkatkan Kemampuan Komunikasi Matematis Siswa Smp Negeri 2 Padangsidempuan Melalui Model Pembelajaran Kontekstual. Masters Thesis, UNIMED.
- Irhamna, Amry, Z., and Syahputra. (2020). Contribution of Mathematical Anxiety, Learning Motivation and Self-Confidence to Student's Mathematical Problem Solving. Budapest International Research and Critics in Linguistics and Education (BirLE) Journal Vol 3 (4): 1759-1772.
- Kusumaningrum. S. (2015). Pengembangan Perangkat Pembelajaran Berbasis Pendekatan Saintifik dengan Model Pembelajaran PjBL untuk Meningkatkan Keterampilan Proses Sains dan Kreativitas Siswa Kelas X. Tesis. Yogyakarta: Program Pascasarjana UNY.
- Lestari, A. B., Saragih, S., Hasratuddin. (2018). Developing Learning Materials Based on Realistic Mathematics Education with Malay Culture Context to Improve Mathematical Communication Ability and Self-Efficacy of Students in SMPN 2 Talawi. American Journal of Educational Research. Volume 6, No. 11.
- Nasution, Y.S., Syahputra, E., and Mulyono. (2020). The Development of Learning Instrument Using Problem Based Learning Model to Improve Critical Thinking of Junior High School Students. Budapest International Research and Critics in Linguistics and Education (BirLE) Journal Volume 3 (3): 1501-1508.
- Olayinka, A. B. (2016). Effects of Instructional Materials on Secondary Schools Students' Academic Achievement in Social Studies in Ekiti State, Nigeria. World Journal of Education. Vol. 6 No. 1.
- Pittalis, Christou, Mousoulides, Marios Pittalis & Pitta-Pantazi. (2004). A Structural Model For Problem Posing. Proceeding Of The 28th Conference of the International Group for The Psychology of Mathematics Educations, 2004. 4, 49-56.
- Pratama, S., Minarni, A., Saragih, S. (2017). Development of Learning Devices Based on Realistic Approach Integrated Context Malay Deli Culture To Improve Ability of Understand Mathematical Concepts and Students' Self-Regulated Learning At SMP Negeri 5 Medan. IOSR Journal of Mathematics (IOSR-JM). Volume 13, Issue 6.
- Revita, R. (2017). Validitas Perangkat Pembelajaran Matematika Berbasis Penemuan Terbimbing. Suska Journal of Mathematics Education. Vol. 3, No. 1, Hal. 15 – 26.
- Rosli, R., Mary, M. C., dan Robert, M. C. (2014). The Effects of Problem Posing on Student Mathematical Learning: A Meta-Analysis. International Education Studies. Vol.7, No. 13; 2014.
- Rusmono. (2012). Strategi Pembelajaran dengan Problem Based Learning itu Perlu: untuk meningkatkan Profesionalitas Guru. Bogor: Ghalia Indonesia.

- Sari, D. N. (2015). Peningkatan Kemampuan Pemecahan Masalah Dan Komunikasi Matematik Siswa Melalui Penerapan Strategi Pembelajaran Think Talk Write Dengan Berbantuan Software Autograph. Tesis tidak diterbitkan. Medan: Program Pascasarjana Unimed.
- Schoenfeld, A. H. (2013). Reflections on Problem Solving Theory and Practice. *The Mathematics Enthusiast*, 10(1,2), 9 – 32
- Sengul, S dan Katranci, Y. (2014). Free problem posing cases of prospective mathematics teachers: Difficulties and solutions. *ScienceDirect. Elsevier: Turkey*.
- Siswono, T. Y. E. (1999). Metode Pemberian Tugas Pengajuan Soal (Problem Posing) dalam Pembelajaran Matematika Pokok Bahasan Perbandingan di MTs Rungkut Surabaya. Tesis. PPs IKIP Surabaya.
- Sugiyono. (2012). Metode Penelitian Kuantitatif Kualitatif dan R&D. Alfabeta: Bandung.
- Sundayana, Rostina. (2016). Kaitan Antara Gaya Belajar, Kemandirian Belajar, dan Kemampuan Pemecahan Masalah Siswa SMP dalam Pelajaran Matematika. *Jurnal Ilmiah Program Studi Matematika STKIP Garut*, 8 (1): 31- 40.
- Suratno, T. (2016). Didaktik dan Didactical Design Research. Dalam Suryadi, D., Mulyana, E., Suratno, T., Kusnia Dewi, D.A. & Maudy, S.Y. (eds.). (2016). *Monograf Didactical Design Research*. Bandung: Rizki Press
- Thalhah, S. Z. (2014). Peningkatan Kemampuan Komunikasi Matematika Melalui Pembelajaran Dengan Pendekatan Problem Posing Pada Siswa Kelas X-6 Man Pinrang. *MaPan : Jurnal Matematika dan Pembelajaran*. Vol. 2. No.1, p-ISSN: 2354-6883 ; e-ISSN: 2581-172X.
- Thalhah, S. Z. (2014). Peningkatan Kemampuan Komunikasi Matematika Melalui Pembelajaran Dengan Pendekatan Problem Posing Pada Siswa Kelas X-6 Man Pinrang. *MaPan : Jurnal Matematika dan Pembelajaran*. Vol. 2. No.1, p-ISSN: 2354-6883 ; e-ISSN: 2581-172X.
- Thiagarajan, S. S, D. S & Semmel, M. I. (1974). *Instructional Development for Training Teachers of Exceptional Children: A sourcebook*. Indiana: Indiana University.
- Trianto. 2012. *Mendesain Model Pembelajaran Inovatif-Progresif*. Jakarta: Kencana.
- Utami, D. (2014). Perbandingan Antara Pembelajaran Matematika Dengan Problem Posing Tipe Pre-Solution Dan Tipe Withinsolution Dalam Peningkatankemampuan Koneksi Matematis Dan Kemandirian Belajar Siswa SMP. Tesis tidak diterbitkan. Bandung: Program Pascasarjana UPI.
- Yandari, dkk. (2018). Self-Regulated Learning In Designing Explorative Learning Tools Among Mathematics Pre-Service Teachers Through Explorative Module. *SHS Web of Conferences*. Volume 42
- Zimmerman, J.B. (1989). A Social Cognitive View of Self-Regulated Academic Learning. *Journal of Educational Psychology*. Vol. 81, Issue 3.