Jurnal Perspektif
Vol. 8 No. 2 Juli – November 2024
Page 250-262

Development of Mathematics Learning Tools Using Problem Based Learning Model to Improve Problem Solving Skills and Learning Motivation

Irma Yani Lidia Ulfa Nasution[1], Mulyono[2], Edy Surya[3]

[1,2,3] Postgraduate Mathematics Education Study Program, Medan State University

*yaniirma729@gmail.com

Received: 24 September 2024 ; Accepted: 30 Oktober 2024; Published: 01 November 2024

DOI: http://dx.doi.org/10.15575/jp.v8i2.306

Abstrak

Penelitian ini menguji validitas, kepraktisan, efikasi, dan motivasi model pembelajaran berbasis masalah pada salah SMP Negeri di Kabupaten Mandailing Natal untuk meningkatkan keterampilan pemecahan masalah siswa. Penelitian dan pengembangan digunakan dalam penyelidikan ini. Model pengembangan bersifat empat dimensi. Siswa Kelas VIII Connection berpartisipasi. Metodologi pembelajaran berbasis masalah menghasilkan produk perangkat pembelajaran dari penyelidikan ini. Setelah pemeriksaan, modifikasi, dan validasi oleh para profesional dan praktisi, produk ini cocok untuk siswa kelas VIII SPLDV. Penggunaan praktis teknologi pembelajaran berbasis masalah. Penerapan keterampilan pemecahan masalah pembelajaran dan motivasi belajar siswa memenuhi persyaratan praktis. Gadget pembelajaran berbasis masalah yang meningkatkan pemecahan masalah matematika dan motivasi siswa memenuhi persyaratan berhasil. Nilai rata-rata N-gain yang sederhana pada uji coba I dan uji coba II sebesar 0,40 dan 0,587 menunjukkan bahwa perangkat pembelajaran berbasis masalah meningkatkan pemecahan masalah matematika. Setelah menggunakan paradigma Pembelajaran Berbasis Masalah berbasis indikator, motivasi siswa meningkat pada uji coba I dan I.

Kata Kunci: Pembelajaran Berbasis Masalah, Kemampuan Pemecahan Masalah, Motivasis Siswa.

Abstract

This study tested the validity, practicality, efficacy, and motivation of the problem-based learning model at one of the State Junior High Schools in Mandailing Natal Regency to improve students' problem-solving skills. Research and development were used in this investigation. The development model is four-dimensional. Class VIII Connection students participated. The problem-based learning methodology produced a learning device product from this investigation. After examination, modification, and validation by professionals and practitioners, this product is suitable for class VIII SPLDV students. The practical use of problem-based learning technology. The application of learning problem-solving skills and students' learning motivation meet practical requirements. Problem-based learning gadgets that improve mathematical problem solving and student motivation meet successful requirements. The simple N-gain average value in trial I and trial II of 0.40 and 0.587 indicates that problem-based learning devices improve mathematical problem solving. After using the indicator-based Problem-Based Learning paradigm, student motivation increased in trials I and I.

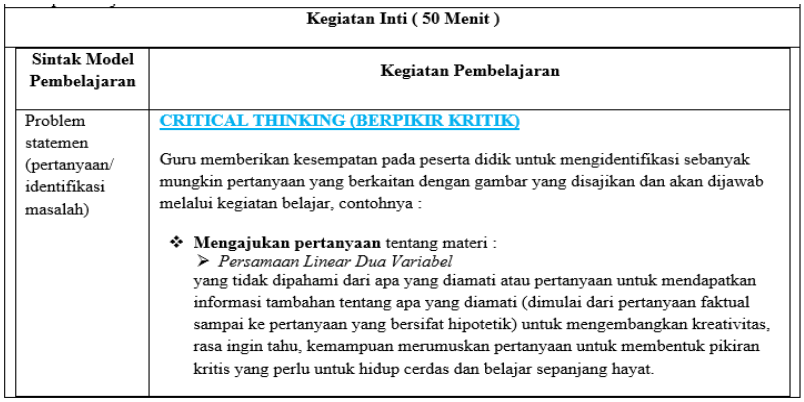
***Keywords**: Problem Based Learning, Problem Solving Ability, Student Learning Motivation.*

A. Introduction

Problem-solving skills are one of the mathematical skills that play an important role in everyday life. According to (Saragih, S., & Habeahan, 2014), problem solving is an important part of learning mathematics. Problem solving can build students' confidence in solving mathematical problems. In addition, students who have mathematical problem-solving skills are able to improve decision-making in everyday life. In line with Cooney's opinion in (Lailya. W.S & Fasha.E.F. 2021, 2021) that "having problem-solving skills helps students think analytically in making decisions in everyday life and helps improve critical thinking skills in dealing with new situations".

The description above states the importance of mathematical problem-solving skills for students, but what happens in the field is that most people view learning mathematics as the most difficult field of study. When people hear the word "mathematics" their brows immediately furrow. In their minds, they imagine complicated and difficult to solve numbers. In PISA 2018, this survey assessed 600,000 15-year-olds from 79 countries. Based on this survey, the reading literacy score of Indonesian students is 371. Meanwhile, for mathematics ability it is 379 and science ability 396. Indonesia is in the bottom 10. (IEA, 2016) showed that Indonesian students' achievement in mathematics was ranked 46th out of 51 countries with a score of 397.

Based on the results of an initial survey at Panyabungan State Junior High School on May 3, 2023, researchers asked about the creation of lesson implementation plans. Most teachers still use lesson implementation plans that have not been tested for validity that are circulating on the internet as examples of lesson implementation plans (Hendrikson R Panjaitan, 2023). Researchers conducted interviews related to the learning process, especially the creation of lesson implementation plans and student worksheets. The mathematics teacher at the school admitted to being directly involved in the preparation of the Learning Implementation Plan and Student Worksheets because the main obstacle in preparing the 2013 Curriculum Lesson plan was caused by several factors. One of them is the time needed to prepare the Learning Implementation Plans is quite long, and the lack of training in preparing the Lesson plan. In addition, teachers also experience obstacles in compiling learning indicators, determining learning models and methods, compiling teaching materials, and creating assessment instruments. This is in accordance with the results of researchers' observations of the Learning Implementation Plans compiled by mathematics teachers at Panyabungan State Junior High School, as seen in the picture below.



Kegiatan Inti (50 Menit)	
Sintak Model Pembelajaran	**Kegiatan Pembelajaran**
Problem statemen (pertanyaan/ identifikasi masalah)	**CRITICAL THINKING (BERPIKIR KRITIK)** Guru memberikan kesempatan pada peserta didik untuk mengidentifikasi sebanyak mungkin pertanyaan yang berkaitan dengan gambar yang disajikan dan akan dijawab melalui kegiatan belajar, contohnya : ❖ **Mengajukan pertanyaan** tentang materi : ➢ *Persamaan Linear Dua Variabel* yang tidak dipahami dari apa yang diamati atau pertanyaan untuk mendapatkan informasi tambahan tentang apa yang diamati (dimulai dari pertanyaan faktual sampai ke pertanyaan yang bersifat hipotetik) untuk mengembangkan kreativitas, rasa ingin tahu, kemampuan merumuskan pertanyaan untuk membentuk pikiran kritis yang perlu untuk hidup cerdas dan belajar sepanjang hayat.

Figure 1. Initial Survey Results on RPP

Based on the picture above, teachers are still confused about starting core activities in learning, teachers should have a way to stimulate such as literacy activities before entering core activities in learning. The picture above also explains that teachers teach only by referring to textbooks. To overcome this problem, an in-depth analysis is needed regarding the difficulties faced by teachers, especially at the lower elementary school level, in preparing lesson plans. This analysis aims to identify factors that may cause teachers not to prepare lesson plans before teaching. One sign of teacher difficulties in preparing learning tools is that many teachers still have difficulty in preparing lesson plans, especially in terms of developing teaching materials and preparing assessment rubrics. In addition, researchers observed learning in class, many students in the school still do not like mathematics, they say that mathematics is difficult to understand, too many formulas, and very boring (Kusumaningrum, S., & Djukri, 2016).

This view of students influences the low mathematical problem-solving abilities of students. This shows that the problem-solving abilities of students in the school are still very low. The low mathematical problem-solving abilities of students are also due to learning activities that are still centered on the teacher and the use of learning approaches that are still less relevant. There are also students who have difficulty in conveying ideas or concepts that they have in class during learning activities. This is because some students still have difficulty in understanding a problem stated in the question, so students have difficulty in interpreting the question (Risma, A, 2019). This happens because the learning process still uses conventional methods, namely the lecture method and is centered on the teacher. The following are the results of students' abilities when asked to work on a two-variable linear equation system problem, with the question "Mela and Sinta went to the market to buy fruits. Mela bought 4 kg of mangoes and 1 kg of apples for Rp16,000.00. While Sinta bought 6 kg of mangoes and 1 kg of apples for Rp20,000.00. How much do 5 kg of mangoes and 3 kg of apples cost?"

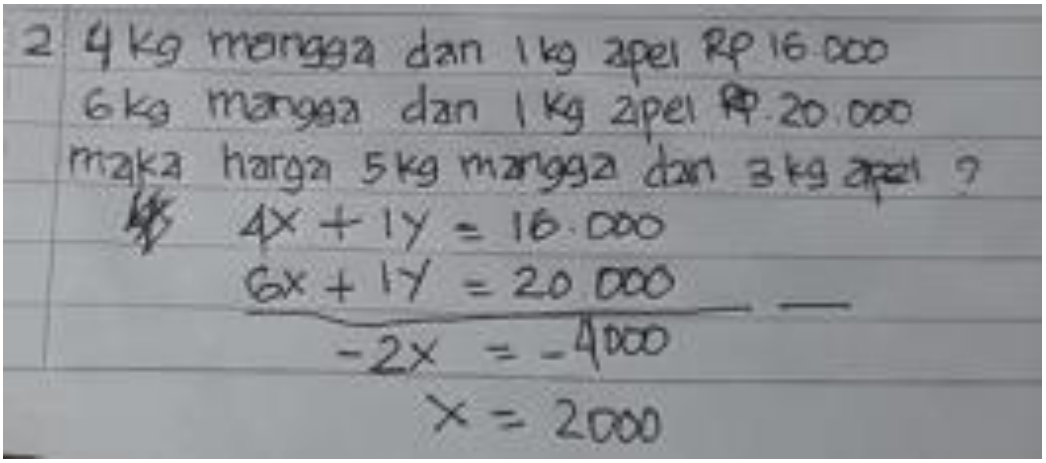


Figure 2. Results of the Initial Survey of Students' Problem Solving Ability

The picture above explains that students solve problems that do not match the problem-solving ability indicators consisting of problem identification, problem-solving plans, solving problems and re-checking. So it shows that students' problem-solving abilities are still low (Lubis, S.D., Surya, E., dan Minarni, 2015). The low ability to solve mathematical problems is due to several factors, one of which is internal factors including intelligence, emotional, intelligence, motivation, habits, interests, and so on. But researchers focus on student learning motivation. (Suharto., 2017) Motivation is a very important factor in the learning process in order to achieve the expected achievements. The problem that occurs regarding the motivation to learn mathematics as concluded by La'ia is that students' mathematics learning outcomes are low and still do not meet the Minimum Completion Criteria (KKM) standard, which is 60. From the results of the researcher's interview with the mathematics subject teacher, the cause of the low learning outcomes of class VII students at Panyabungan State Junior High School tends to be the internal factors (motivation) of students (Laia, 2019). Where, the lack of students' desire to compete with their classmates when the teacher gives assignments or exercises, and only waits for the results of friends who are able. When giving assignments, if there are no consequences of punishment and the assignments must be collected, then only a small number of students will do the assignments and will not even be responsible for the assignments given by the teacher.

Based on the problems above, to realize the goals of education in order to produce quality human resources, teachers must have innovation in classroom learning. Innovations that can be carried out by teachers are learning devices in the form of Learning Implementation Plans (RPP) and teaching materials in the form of student worksheets (LKPD). Based on several research results, there have not been many studies on the type of development of learning devices based on learning models, only a few were found, such as Merinda's research (Siregar, M. N. N. dan Aghni, 2021) entitled "Development of Problem Based Learning Devices (PBL) to Improve

Higher Order Thinking Skills (HOTS)" which focuses on developing LKPD (student worksheets) and RPP. So, researchers also want to do the same research but in a different place. This is because the problem that occurs at the research site is that teachers only use teacher-centered or conventional learning. Teachers rarely make learning innovations according to the needs of students in class (Mashuri, 2019).

Good learning tools are implemented if supported by learning models. In this study, it is suspected that problem-based learning models can improve students' mathematical problem-solving abilities. (Masri, MF., 2018) stated that Problem-based learning is a series of activities that can be developed in line with learning targets in the implementation of the 2013 curriculum. This is in line with the characteristics of Problem-based learning as a generative learning strategy that leads to students as the center of the learning process so that it can foster or improve metacognitive thinking, a creative, collaborative soul, develop high assumption competencies, foster interpretation of meaning, foster or improve independence, provide problem solving, and create teamwork (Chamberlin and Moon, 2018) Meanwhile, Zakiya, Sunaryo and Amam stated that problem-based learning uses contextual problems in its learning process to motivate students to learn (Zakiah, L & Ika, 2019). Based on the description and problems above, the researcher is interested in studying or researching "Development of Learning Tools Through Problem Based Learning Model to Improve Problem Solving Skills and Student Learning Motivation at SMP Negeri 3 Penyabungan"

B. Research Method

This research is included in the type of research and development (Reserch & Development) so it is often abbreviated as R&D (Sugiyono, 2018). This research is a development research on teaching materials through the 4-D model by Thiagarajan. The research has developed learning devices with System Of Linear Equations In Two Variables material. This research was conducted in class VIII of Panyabungan State Junior High School in the 2023/2024 Academic Year with the material "Two Variable Linear Equation System". The subjects in this study were students of class VIII of Panyabungan State Junior High School in the 2023/2024 Academic Year in classes VIII A and VIII B. while the object in this study was a learning device based on the Problem Based Learning Model on SPLDV material. In this study, the researcher used the 4-D development model. Where in this study it was stated by Thiagarajan. (Sugiyono, 2015) that 4D development, which is an extension of Define, Design, Development and Dissemination.

C. Result and Discussion

Data analysis and research results obtained at each stage of development are presented as follows:

Define

Based on the results of observations of learning devices through the problem based learning model used by teachers during the learning process at Panyabungan State Junior High School, it shows that there are weaknesses in the learning devices through the problem based learning model used in the learning process in the classroom. Based on observations in the field, the implementation of learning devices is not yet appropriate. Because learning devices that are not appropriate are used in the teaching and learning process in the classroom, precisely in the system of linear equations in two variables material. At this stage in this development activity is to conduct an analysis of the needs for developing learning devices at Panyabungan State Junior High School by conducting interviews with mathematics teachers and 35 students. Based on the results of the interview, some information was obtained. In general, students in this class basically have a nature that is quite general about system of linear equations in two variables. However, learning motivation in class is very low so that it affects students' mathematical problem solving abilities. Student analysis is also done by interview or often known as interview is a dialogue activity conducted by researchers to obtain information from students. The results of interviews with students stated that they need the development of learning tools through problem based learning models so that learning is more active and effective and can improve mathematical problem solving skills and student learning motivation.

Design

Based on the defining stage analysis, problem-based learning gadgets are designed to boost students' problem-solving and learning motivation. Teaching resources foster active learning via discussion. Images make media appealing to pupils. Problem-based learning gadgets deliver media activities as phrases and communicative pictures. Thus, this media's design will appeal to pupils and aid learning. This design stage includes test preparation, media selection, format selection, and basic design. Following are the steps:

In the Student Worksheet, instructions are provided for the work, a place to write the group name, group members, and answers to each question. The Student Worksheet contains the process of solving mathematical problems which are questions in the student's book, so that the student's book and Student Worksheet in this study are inseparable parts. The Student Worksheet resulting from this stage is called draft I. For more details, the visual form of one of the Student Worksheet used by students is shown in Figure 3 below:

Figure 3 Student Worksheet Display

Development

The results of the definition and design stages produce an initial design of a learning device called draft I. After the learning device with a problem-based learning model is designed in the form of draft I, a validity test is carried out on experts and field trials. The validation results are in the form of validation values, corrections, criticisms, and suggestions which are used as a basis for revision and improvement. So that it produces a valid realistic mathematics approach-based mathematics learning device. The revision results are called draft II.

The following is a display of the student worksheet that was developed:

Table 1. Validation Results

No	Aspect	Average	Category
1	Learning Tool Plan	4,6	Valid
2	Student Worksheets	4,7	Valid
3	Mathematical Problem Solving Ability Test	4,5	Valid
4	Student Motivation	4,5	Valid

Table 1 shows that the RPP, Student Worksheets have a total "valid" average of 4.5. The data in this study were analyzed using descriptive statistical analysis. According to Sheskin (2004), descriptive statistics as an analysis tool for the purpose of describing data without drawing conclusions and making predictions. Common procedures used in descriptive statistics are in the form of tables, graphs, diagrams and calculations on the size of the central and dispersion of data.

Interesting description of the effectiveness of problem-based learning devices

In this study, the level of student mastery is reviewed from the ability to solve mathematical problems using a mathematical problem solving ability test that has been developed. The description of the results of students' mathematical problem solving abilities in trial II is shown in Table 2. below.

Table 2. Description of the Results of Students' Mathematical Problem Solving Understanding Ability

Information	*Mathematical Problem Solving Ability Pretest*	Posttest of Mathematical Problem Solving Ability
Highest Score	80	100
Lowest Score	50	65
Average	64,2	84,0

Based on Table 2, it shows that the average mathematical problem solving ability of students in the pretest results is 64.2 and the posttests are 84.0. If categorized based on the level of student mastery, then the level of mastery of students' mathematical problem solving abilities in the pretest and posttest results of trial II can be seen in the following Table 3.

Table 3. Level of Mastery of Students' Mathematical Problem Solving Skills Based on Pretest and Posttest Results

No	Value Interval	*Pretest*		*Posttest*		Category
		Number of Students	Percentage	Number of Students	Percentage	
1	$0 \leq$ MPSAS < 45	0	0%	0	0%	Very Poor
2	$45 \leq$ MPSAS < 65	8	40%	0	0%	Poor
3	$65 \leq$ MPSAS < 75	9	45%	3	15%	Enough
4	$75 \leq$ MPSAS < 90	3	15%	9	45%	Good
5	$90 \leq$ MPSAS ≤ 100	0	0%	8	40%	Very Good
		20	100%	20	100%	

From Table 3. it is obtained that, in the pretest there were students who obtained the less category as many as 8 students (40%), those who obtained the sufficient category as many as 9 students (45%), those who obtained the good category as many as 3 students (15%), and there were no students who obtained the very good category (0%). However, in the posttest, the results showed that there were no students who obtained the less category, those who obtained the sufficient category as many as 3 students (15%), those who obtained the good category as many as 9 students (45%), and those who obtained the very good category as many as 8 students (40%).

The improvement of students' mathematical problem-solving ability in trial I will be seen through the N-Gain from the results of the pre-test and post-test of students' mathematical problem-solving ability in trial II. The recapitulation of the improvement of students' mathematical problem-solving ability by using learning devices with problem-based learning models developed in trial II is shown in Table 4. below.

Table 4. Summary of N-Gain Results of Students' Mathematical Problem Solving Ability in Trial II

Range	Improvement Category	Number of Students	Percentage
$g \geq 0,7$	High	7	35%
$0,3 \leq g < 0,7$	Medium	12	60%
$g < 0,3$	Low	1	5%

Based on Table 4 above, it can be seen that 7 students got an N-Gain score in the range > 0.7. For students who experienced an increase in students' mathematical problem solving abilities with the "Medium" category or got an N-Gain score of $0.3 < g \leq 0.7$, there were 12 students and 1 student who got an N-Gain score $g \leq 0.3$ with the "Low" category. The average gain in trial I was 0.58, which is in the medium category. So, it can be concluded that there is an increase in students' mathematical problem solving abilities after implementing learning using learning devices with the problem based learning model.

Student Motivation

In trial II, the student motivation scale was also given. Similar to trial I, the motivation scale was also given after students finished the mathematical problem-solving ability test. This motivation scale is still the same as the motivation scale given in trial I which consists of 30 statement items, each statement item is arranged according to the motivation indicators that have been determined by the researcher in Chapter III. Each motivation indicator contains positive statements and negative statements that are randomly distributed on the motivation scale. Based on the results of trial II, the average student motivation score is obtained in table 5 below.

No	Indicator	Average Score	Category
1	Pleasure	88,0 %	Very Good
2	Student Interest	85,0 %	Very Good
3	Student Attention in Learning	85,4 %	Very Good
4	Student Engagement	86,6 %	Very Good

Based on Table 5, it is obtained that indicator 1 (Feeling of Joy) is the indicator with the highest percentage, which is 88%, while indicator 2 (Student Interest) is the indicator with the lowest percentage, which is 85%. Then, if viewed based on the achievement of the motivation category, there is only 1 category, which is the very good category.

Disseminate

The development of learning devices has reached the final stage where the learning devices have received positive assessments from experts and through development tests. After the valid, practical and effective criteria are met in the second trial, the final device (Final Draft) is

obtained. The next step is to carry out limited distribution in the form of distributing the final device to the MGMP forum at SMP Negeri 3 Penyabungan which is marked by the submission of the developed learning device to the MGMP forum with the hope that mathematics teachers who are members of the forum can apply the learning device in subsequent learning in order to improve students' mathematical problem solving abilities.

Discussion

Based on the results of trial I and trial II, the problem-based learning device developed has met the effective category in terms of: (1) classical student learning completeness; (2) increasing mathematical problem-solving ability; (3) achievement of learning motivation and (4) student response. The following will present a discussion for each indicator in measuring and seeing the effectiveness of the learning device with problem-based learning.

Based on the results of the posttest analysis previously stated that in trial I the percentage of classical completeness of mathematical problem-solving ability was 70% while in trial II the percentage of classical completeness of mathematical problem-solving ability was 85%. When viewed from the results of classical student learning completeness of students' mathematical problem-solving ability, the completeness obtained from the results of trial I has not met the criteria for classical completeness while in trial II it has met the criteria for classical completeness.

The results of the study above indicate that classical student learning completeness with the developed learning device meets the criteria for effectiveness. This is because by implementing the problem-based learning model learning device, students are actively involved in solving problems. This is supported by the results of research by (Sihombing, Nova A dan Fauzi, 2017) which concluded that the learning device developed based on problem-based learning meets the effective criteria indicated by the individual and classical learning completeness of students being met.

Based on the results of the research and support from previous research above, it can be seen that the problem-based learning model learning device developed can help students achieve classical learning completeness. Thus, it can be concluded that the problem-based learning model learning device is able to help students achieve classical learning completeness. Based on the results of the analysis of data from trial I and trial II, it was obtained that the average percentage of student responses in each trial was positive. This means that students gave a positive response to the components of the problem-based learning model learning device developed. The student responses given in each trial have reached the predetermined criteria category, namely ≥ 80%. This shows that the learning device through problem-based learning that was developed has met the effective criteria in terms of student responses. In line with

Cognitivistic Learning Theory, (Siswanto & Ratiningsih, 2020) said that activeness can be in the form of seeking experience, seeking information, solving problems, observing the environment, practicing something to achieve a certain goal. Cognitive psychologists believe that previous knowledge can determine the success of learning new information/knowledge. Thus, the actions/responses taken by students to stimuli in the form of teaching as activities can be categorized into two things, namely positive responses to learning (listening, reading, writing, discussing/asking) or negative responses (other irrelevant actions). A positive response indicates that students are willing to follow the learning process.

D. Consclusion

The results of this study are a product of learning devices through the problem based learning model. This product is feasible and valid for use in learning for class VIII students with SPLDV subjects through assessment, revision and validation from several experts and practitioners. This conclusion is drawn based on the results of the analysis of experts and practitioners consisting of RPP experts with a value of 4.6 meaning valid, LKPD material experts with an average value of 4.4 meaning valid. The learning device through the problem based learning model used is practical. This can be seen based on the results of the calculation of the implementation of problem-solving ability learning in trial I 80% implementation of learning, in trial II 87%. On student learning motivation in trial I 83% in trial II 86%. Learning devices based on problem-based learning model learning in improving mathematical problem-solving abilities and student motivation meet practical criteria. Learning devices based on problem based learning model learning in improving mathematical problem solving ability and student motivation meet the effective criteria, namely 1) Classical completeness reaches 85%, which has met the completeness criteria, namely ≥ 85% of students achieve KKM. 2) increasing the ability to understand mathematical problem solving. and 3) achievement of motivation and (4) student responses in each trial are positive. The increase in the ability to understand mathematical problem solving using learning devices based on the problem based learning model that has been developed can be seen from the average N-gain value in trial I and trial II, respectively, of 0.40 and 0.587, which are in the moderate category. There is an increase in student motivation in trial I and trial II after learning based on the Problem Based Learning model that has been developed based on indicators.

References

Chamberlin and Moon. (2018). How Does the Problem Based Learning Approach Compare..to..the..Model-Eliciting..Activities..Approach..in..Mathematics? In *University of Wyoming Sidney M. Moon*. University of Wyoming Sidney M. Moon, Purdue University.

Hendrikson R Panjaitan. (2023). Analisis Kemampuan Berpikir Kreatif Siswa Melalui Penerapan Model Problem Based Learning Di Smp Jendral Sudirman. *JOURNAL PREVALENT MULTIDISCIPLINARY, 1 No 3*, 23.

IEA. (2016). TIMSS International Results In Mathematics. *Online*. https://timssandpirls.bc.edu/timss2003i/userguide.html

Kusumaningrum, S., & Djukri, D. (2016). Pengembangan perangkat pembelajaran model project based learning (PjBL) untuk meningkatkan keterampilan proses sains dan kreativitas. *Jurnal Inovasi Pendidikan, 2(2),* 241.

Laia, H. (2019). Hubungan Motivasi Berprestasi Terhadap Hasil Belajar Matematika Pada Materi Pokok Operasi Hitung Bentuk Aljabar Terhadap Siswa Kelas VII SMPN 1 Telukdalam Tahun Pembelajaran 2018/2019. *Jurnal Education and Development Institut Pendidikan Tapanuli Selatan, 7(4).*

Lailya. W.S & Fasha.E.F. 2021. (2021). Analisis Kemampuan Pemecahan Masalah Pada Soal Tipe Higher Order Thinking Skills (Hots) Ditinjau Dari Self- Efficacy Siswa. *Dialektika P. Matematika, 8. No 1.*(ISSN: 2089 – 4821), 488-500.

Lubis, S.D., Surya, E., dan Minarni, A. (2015). Peningkatan Kemampuan Pemecahan Masalah Matematik Dan Kemandirian Belajar Siswa SMP Melalui Model Pembelajaran Berbasis Masalah. *Jurnal PARADIKMA, Vol 8. No*, 99–105.

Mashuri, S. (2019). Problem-based learning dalam pembelajaran matematika: Upaya guru untuk meningkatkan minat dan prestasi belajar siswa. *Pythagoras: Jurnal Pendidikan Matematika, 14. No. 2*.

Masri, MF., dkk. (2018). Pengaruh Metode Pembelajaran Berbasis Masalah terhadap Self-Efficacy dan Kemampuan Pemecahan Masalah Matematis ditinjau dari Kemampuan Awal Matematika Siswa SMA. *JPPM., 11 (1),* 116–126.

Risma, A, and & H. I. (2019). Kemampuan Pemecahan Masalah Matematika Dalam Menyelesaikan Soal Cerita Berdasarkan Langkah Polya. *Prosiding Seminar NasionalPascasarjana Unnes Seminar Nasional Pascasarjana, 3 (4).*

Saragih, S., & Habeahan, W. (2014). The Improving of Probem Solving Ability and Students' Creativity Mathematical by Using Problem Based Learning in SMP Negeri 2 Siantar. *Journal of Education and Practice, Vol. 5. No*, 123-132.

Sihombing, Nova A dan Fauzi, A. (2017). Perbedaan Kemampuan Komunikasi Matematis Siswa yang Diajar dengan Menggunakan Model Pembelajaran Kooperatif Tipe Think Pair Share dengan Tipe Think Talk Write pada Materi Kubus dan Balok di Kelas VIII SMPN 27 Medan. *Jurnal Inspiratif, 3 No2*.

Siregar, M. N. N. dan Aghni, R. I. (2021). Pengembangan Perangkat Pembelajaran Berbasis Problem Based Learning (PBL) untuk Meningkatkan Higher Order Thinking Skill

(HOTS). *JPAK, 9(2),* 292–301.

Siswanto, R. D., & Ratiningsih, R. P. (2020). Korelasi kemampuan berpikir kritis dan kreatif matematis dengan kemampuan pemecahan masalah matematis materi bangun ruang. *ANARGYA: Jurnal Ilmiah Pendidikan Matematika*, *3*(2), 96–103.

Sugiyono. (2015). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Alfabeta.

Sugiyono. (2018). *Metodologi Penelitian Pendidikan (Pendidikan Kuantitatif, Kualitatif dan R&D)*. Alfabeta.

Suharto. (2017). Peningkatan Motivasi dan Hasil Belajar Siswa pada Pembelajaran Lingkaran dengan Metode Penemuan Terbimbing. *Cakrawala, Jurnal Pendidikan.*, *11(2)*, 91–99.

Zakiah, L & Ika, L. (2019). *Berpikir Kritis Dalam Konteks Pembelajaran*. Erzatama Karya Abadi.