Effectiveness of the Problem-Based Learning Model Using LKPD in Mathematical Problem Solving

Qadriah Triatni Putri[1] , Farman[2*] , Marniati[3]
[1,2,3]Program Studi Pendidikan Matematika, FKIP, Universitas Sembilanbelas November Kolaka
qadriahtriatniputri2000 @gmail.com [1], farman.math@yahoo.co.id[*2], bungaitb@gmail.com[3]

Abstract

This research aimed to evaluate the effectiveness of Problem-Based Learning (PBL) assisted by LKPD on eighth-grade students' mathematical problem-solving (MPS) ability. The study used a true experimental design with a post-test only control group. The population consisted of eighth-grade students at MTs.S Nurul Iman Pomalaa during the 2021/2022 academic year. Cluster random sampling was used to select one class (Iman) as the experimental group and another class (Jujur) as the control group. Descriptive analysis revealed that the average MPS ability of the experimental group was higher than the control group. The inferential analysis confirmed that the data was normally distributed and homogeneous. Hypothesis testing showed that the PBL model assisted by LKPD was more effective than traditional learning methods in enhancing the MPS ability of the students at MTs.S Nurul Iman Pomalaa.

Keywords: *Mathematical Problem-Solving; Problem-Based Learning; LKPD.*

Abstrak

Penelitian dilakukan untuk menilai efektivitas model Problem-Based Learning (PBL) berbantuan LKPD terhadap kemampuan pemecahan masalah matematis siswa kelas VIII. Penelitian true eksperimen ini menggunakan post test only control group design. Populasi penelitiannya adalah seluruh siswa kelas VIII MTs.S Nurul Iman Pomalaa tahun pelajaran 2021/2022. Cluster random sampling digunakan untuk menetapkan satu kelas (Iman) sebagai kelompok eksperimen dan kelas lain (Jujur) sebagai kelompok kontrol. Analisis deskriptif menunjukkan bahwa rata-rata kemampuan pemecahan masalah matematis kelompok eksperimen lebih tinggi dibandingkan kelompok kontrol. Analisis inferensial memastikan bahwa data berdistribusi normal dan homogen. Uji hipotesis menunjukkan bahwa model PBL berbantuan LKPD lebih efektif daripada pembelajaran konvensional dalam meningkatkan kemampuan pemecahan masalah matematis siswa MTs.S Nurul Iman Pomalaa.

Kata Kunci: Pemecahan masalah matematis; Problem-Based Learning; LKPD.

*Correspondence:
Email: farman.math@yahoo.co.id

INTRODUCTION

Education has a vital role in everyday life. This can be obtained from reading, writing, arithmetic, and teaching the knowledge gained to others. Education gives students a clear, broad view, goals, and direction. The elements of education consist of input, process, and output. Input consists of individuals, groups, and educational actors. Meanwhile, the process is a planned effort to influence other people. Output is doing what is expected/behavior to achieve the desired goal (Zulkarmain, 2021). Formal education in schools involves teachers as educators and students as learners, which is realized through interaction in the learning process. This process can be realized if there is coordination between teachers, students, and the learning environment, where teachers must be the main priority and can act as facilitators who can guide students in the learning process. However, when teachers want to realize this process, students' interest in learning could be much higher, one of which is in mathematics lessons (Setianingsih et al., 2023).

Mathematics tends to be considered a difficult and boring subject for students because it is abstract and involves many formulas to solve problems (Leonard et al., 2022). These interests and views cause students to lack problem-solving abilities, so that students have low mathematical problem-solving (MPS) abilities (Laila et al., 2021; Rahayu & Aini, 2021). Therefore, teachers must be creative and innovative in teaching so students know that learning mathematics is not difficult (Yusri, 2018). Problem-solving ability is essential for students to learn (Agustami et al., 2021). Learning that emphasizes problem-solving can help teachers understand students' abilities in understanding problems, making problem-solving plans, carrying out problem-solving plans, and then checking the results of the solutions obtained. The stages of problem-solving are interrelated (Mariam et al., 2019). By understanding the stages of problem-solving, students will find it easier to solve questions, both easy and medium to more complex (Dewi et al., 2021). In this way, students will have investigation and problem-solving skills and become independent learners (Cahyani & Setyawati, 2017).

Based on the results of an interview with MTs.S mathematics teacher Nurul Iman Pomalaa on Monday, 22 November 2021, we can obtain information that students' problem-solving abilities at this school could be higher due to a weak foundation in mathematics. We can see this from the average semester test score for eighth-grade students, which is 35.71, which means the results are not in line with expectations, namely not reaching the KKM (Minimum Completeness Criteria), where the KKM value set by the school is 75. These results show low student learning outcomes because students' MPS abilities are low (Vikriyah, 2015). The study results also show that students' problem-solving abilities at the junior high school level still need to improve and be more optimal (Chairuddin & Farman, 2021). One of the causes of low MPS abilities is that teachers more often use direct learning models; in other words, teachers dominate learning so that students are less involved in the learning process, which causes students to be passive in exploring, studying, and processing existing information. Apart from that, there must be more teacher creativity in creating exciting learning media to increase student motivation. Learning media is very important so students can understand the material better because mathematics learning media feels more natural, and learning will be more varied (Deswita et al., 2016).

To develop students' MPS abilities, teachers can apply several appropriate learning models to stimulate indicators of MPS abilities (Chairuddin & Farman, 2022). One learning model that can facilitate problem-solving abilities is the Problem-Based Learning (PBL) model (Reski et al., 2019; Sumartini, 2018). This model involves presenting real-life problems to students, which motivates them to apply their existing knowledge and experiences to understand the problem and develop new knowledge and experiences (Chairuddin & Farman, 2019). The steps in PBL consist of problem orientation, organizing students, guiding, developing and presenting work results, and analysing and evaluating problem-solving. Through these steps, students are encouraged to learn independently, build their knowledge, and acquire skills (Andriana et al., 2021). The PBL model offers a greater potential for students to engage in active learning and to enhance their MPS abilities. This is because the model encourages students to engage in a series of activities, starting with the understanding of problems, formulating them, analyzing them, and presenting the results of their analysis.

On the other hand, several studies also use Student Worksheets (LKPD) in the learning process, which are helpful as teaching materials or media containing materials, summaries guides, or steps used for problem-solving activities. Using LKPD in this PBL model can improve students' mathematics abilities. Karima (2021) stated that the PBL model assisted by LKPD effectively increases students' self-efficacy and problem-solving abilities. Lestari (2019) concluded that the PBL model assisted by LKPD positively influenced students' critical thinking abilities and learning motivation. Lestari (2021) stated that the PBL model assisted by LKPD provides an increase in the MPS abilities of students.

This research is important because the PBL model using LKPD in mathematics lessons in several existing studies has yet to be used with MTs students. Nurul Iman Pomalaa, especially cube and block material. This research focuses on the effectiveness of the PBL model using LKPD. This research aims to determine the effectiveness of the PBL model using LKPD on the MPS abilities of eighth-grade students.

RESEARCH METHODS

This research employs a true experimental design with a post-test only control group, comprising two classes: the experimental class and the control class. The experimental class was treated with the application of the PBL model using LKPD, while the control class was not treated (direct learning). The population under study was comprised of all students in class VIII MTs.S Nurul Iman Pomalaa during the 2021/2022 academic year. The sampling technique used was a cluster random sampling technique. Before sampling data from the population, homogeneity was first tested and obtained from students' daily mathematics test scores. After the data was homogeneous, samples were taken using a lot system for the experimental and control classes. Class VIII Iman was obtained as the experimental (treatment) class using the PBL model and LKPD in the first lot for the experimental class. In the second lot for the control class, class VIII was obtained as the control class using the conventional learning model. This research has two variables: the MPS abilities of students taught using the PBL model using LKPD, and the MPS abilities of students taught using conventional learning models. Data regarding students' MPS abilities is collected through tests, teacher and student observation sheets, and documentation.

Data analysis techniques use descriptive analysis and inferential analysis. Descriptive analysis in this research analyses students' MPS abilities to describe research results. In this study, a descriptive analysis was employed to provide a description of the research data in the form of students' MPS abilities, with the mean, variance, and standard deviation. Meanwhile, inferential analysis is used to draw conclusions and generalize them to the population.

RESULTS AND DISCUSSION

The research was conducted at MTs.S Nurul Iman Pomalaa, with experimental and control classes being employed. In the experimental class, students were instructed using the PBL model with the aid of LKPD, whereas in the control class, students were taught using a conventional learning model (direct learning). The PBL model is a learning model that engages both teachers and students, with students assuming the role of problem solvers. LKPD is employed as a tool to facilitate students' comprehension of the material and to pique their interest in learning (Farman et al., 2021; Farman & Vivin, 2024). The teacher's role in PBL is to give problems and guide students in solving problems by formulating problems and then solving them together. Meanwhile, the conventional learning model is a learning model that teachers usually use. The materials used as the focus of the research are cubes and cuboids.

The learning process that the teacher has implemented is evaluated using a teacher observation sheet according to the syntax in each model. The results of the observation sheet are presented in Table 1 below:

Table 1. Results of Teacher Activity Observation Sheet

Meeting	Teacher Activeness	
	Experimental Class	Control Class
I	88.23%	81.25%
II	94.11%	87.5%
III	94.11%	93.75%
Average	92.15%	87.5%

Table 1 illustrates that the mean percentage value of teacher activity in the learning process utilising the PBL model with LKPD assistance is 92.15%. In contrast, the mean percentage value of teacher activity in the conventional learning model is 87.5%. Therefore, it can be concluded that teacher activity in the learning process using the PBL model is higher than in the learning process using conventional learning models.

Meanwhile, analysis of student observation sheets is carried out to determine student activity. The average results of student observations are presented in Table 2 below:

Table 2. Results of Student Activity Observation Sheet

Meeting	Student Activity	
	Experimental Class	Control Class
I	80%	71.66%
II	81.42%	74.28%
III	90%	82.85%
Average	83.80%	76.26%

Table 2 illustrates that students using the PBL model with LKPD assistance showed an average activity level of 83.80% during the learning process. In comparison, students using the conventional learning model had an average activity level of 76.26%. This indicates that student engagement is higher in the PBL model.

In general, the teachers' abilities to manage learning and student activities in both experimental and control classes were observed to be in the active category. This is by the observer's observations during three consecutive meetings. Encouragingly, both teacher and student activities increased from the initial to the final meeting. The average teacher activity in the experimental class was 92.15%, compared to 87.5% in the control class, while student activity percentages were 83.80% and 76.26%, respectively. Therefore, the teacher and student activities in the class that used the PBL model assisted by LKPD were more active than those in the conventional learning model.

Additionally, in terms of students' MPS abilities, the average score of PBL-learned students was 81.6229, with a variance of 135.8353 and a standard deviation of 11.6548. Meanwhile, the average MPS ability score for students taught using the conventional learning model (control class) was 72.0652, with a variance of 170.7551 and a standard deviation of 13.0673. The post-test recapitulation of students' MPS abilities is presented in the following table:

Table 3. Description of Students' MPS Abilities

Analysis	Experimental Class	Control Class
N	31	23
Average	81.6229	72.0652
Variance	135.8353	170.7551
Standard Deviation	11.6548	13.0673

Thus, the MPS ability of students taught using the PBL model assisted by LKPD is higher than the MPS ability of students taught using the conventional model. This aligns with research by Saragih et al. (2022) and Bay et al. (2024) that shows that the average value of the PBL model assisted by LKPD is higher than that of the conventional model. Thus, this shows a difference between the PBL model assisted by LKPD and the conventional learning model on the MPS abilities of class VIII students at MTs.S Nurul Iman Pomalaa. This is to the hypothesis that researchers have previously set. This difference may be due to the PBL syntax emphasising active problem-solving. The syntax of the PBL model is that the teacher divides students into several groups: the teacher gives the students a problem, the teacher guides the students in solving the problem, and then the students present the results of solving the problem given by the teacher. Meanwhile, the syntax in the conventional learning model (direct learning) is that the teacher explains the material, students listen, and then ask the teacher if there is something they do not understand. From these differences, applying the PBL model with the help of LKPD can make students participate more actively in learning and develop their problem-solving abilities in solving a given problem.

Furthermore, inferential analysis was carried out, which consisted of normality tests, homogeneity tests, and hypothesis tests. The data normality test was carried out using the Lilliefors test. Based on tests in the experimental class, the results obtained were $D_{hit} = 0.122$ and the D_L value for $n = 31$ and $\propto = 0.05$, namely 0.156. Because $D_{hit} < D_{tabel}$ ($0.145 < 0.156$), then H_0 is accepted, meaning the data is normally distributed. Likewise, the control class data was tested for normality with the same test and obtained $D_{hit} = 0.121$ and the D_L value for $n = 23$ and $\propto = 0.05$, namely 0.180. Because $D_{hit} < D_{tabel}$ ($0.078 < 0.180$), then H_0 is accepted, meaning the data is normally distributed. The homogeneity test was carried out using the Bartlett test. Based on the homogeneity analysis, the calculated chi-square (x^2) = 0.335 and table chi-square ($x^2{}_{table}$) = 3.841, it can be concluded that the data has the same or homogeneous variance. Finally, hypothesis testing was carried out using the Polled Variant t-test. Based on the hypothesis testing analysis results using the t test, tcount = 2.830 and ttable ($\alpha=0.05$; $dk = n_1+n_2-2=52$) = 1.6746. Because $t_{count} > t_{table}$ ($2.830 > 1.6746$), H_0 is rejected, meaning there is a significant difference in the average value between the experimental and control classes. Thus, there are differences in the use of the PBL and conventional learning models regarding students' MPS abilities.

The average MPS abilities of students in the experimental and control classes increased significantly, so this learning model was effective. In other words, applying the PBL model using LKPD was proven effective in improving students' MPS abilities. This is consistent with the findings of Karima (2021) and Nadiya et al. (2023), which demonstrated that that students taught using the PBL model assisted by LKPD achieved significantly higher levels of MPS abilities than those taught using the conventional model.

In general, the PBL model assisted by LKPD has a positive effect on MPS abilities compared to conventional learning models (Gunawan et al., 2017; Saragih et al., 2022). Sitohang (2019) study shows that the use of the PBL model assisted by LKPD can increase students' MPS abilities by 46.6%. Several other studies have also attempted to develop PBL-based LKPD to improve students' MPS (Ali et al., 2022; Darmawan et al., 2024). Therefore, with these positive results, further studies can consider the PBL learning model assisted by LKPD to be used to facilitate other mathematical abilities. Researchers also use digital-based LKPD to make learning more enjoyable.

CONCLUSION

The mathematical problem-solving ability of students taught using the PBL learning model supported by LKPD is, on average 81.62. Meanwhile, the MPS ability of students taught using conventional learning models (direct learning) has an average of 72.06. Mathematics learning using the PBL learning model using LKPD is more effective than the conventional learning model, especially in teaching material on flat-sided geometric shapes in class VIII MTs. S Nurul Iman Pomalaa. In this way, teachers can apply this model to the same material or other material because the PBL learning model assisted by LKPD positively influences classroom learning.

REFERENCES

Agustami, Aprida, V., & Pramita, A. (2021). Analisis Kemampuan Pemecahan Masalah Matematis Siswa dalam Menyelesaikan Soal Materi Lingkaran. *Jurnal Prodi Pendidikan Matematika (JPMM), 3*(1).

Ali, D., Nurhanurawati, N., & Noer, S. H. (2022). Pengembangan LKPD Berbasis Poblem Based Learning dengan Pendekatan Kontekstual untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, *11*(2), Article 2. https://doi.org/10.24127/ajpm.v11i2.4760

Andriana, R., Muliana, M., & Listiana, Y. (2021). Pengaruh Model Pembelajaran Berbasis Masalah dalam Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa SMP Negeri 2 Dewantara. *Jurnal Pendidikan Matematika Malikussaleh*, *1*(1). https://doi.org/10.29103/jpmm.v1i1.4305

Ariandi, Y. (2016). Analisis Kemampuan Pemecahan Masalah Berdasarkan Aktivitas Belajar Pada Model Pembelajaran PBL. *Seminar Nasional Matematika X Universitas Negeri Semarang*. Seminar Nasional Matematika X Universitas Negeri Semarang, Semarang.

Bay, R. L., Kurniati, N., Lu'luilmaknun, U., & Azmi, S. (2024). Efektivitas Model Problem Based Learning (PBL) Berbantuan Lembar Kerja Peserta Didik Interaktif untuk Meningkatkan Kemampuan Pemecahan Masalah Matematika Siswa Kelas VII SMPN 23 Mataram Tahun Ajaran 2023/2024. *Pendas : Jurnal Ilmiah Pendidikan Dasar*, *9*(2), Article 2. https://doi.org/10.23969/jp.v9i2.13997

Cahyani, H., & Setyawati, R. W. (2016). Pentingnya Peningkatan Kemampuan Pemecahan Masalah melalui PBL untuk Mempersiapkan Generasi Unggul Menghadapi MEA. *Seminar Nasional Matematika X Universitas Negeri Semarang 2016*, 10.

Cahyani, H., & Setyawati, R. W. (2017). Pentingnya Peningkatan Kemampuan Pemecahan Masalah melalui PBL untuk Mempersiapkan Generasi Unggul Menghadapi MEA. *PRISMA, Prosiding Seminar Nasional Matematika*, 151–160.

Chairuddin, C., & Farman, F. (2019). Comparison of The Effectiveness of Scientific Approach and Problem-Solving Approach in Problem-Based Learning in Class IX of SMP Negeri 3 Pangsid. *JME (Journal of Mathematics Education)*, *4*(2), Article 2. https://doi.org/10.31327/jomedu.v4i2.1010

Chairuddin, C., & Farman, F. (2021). Mathematical Problem Solving Ability in Cooperative Learning Type Student Teams Achievement Division (STAD). *JME (Journal of Mathematics Education)*, *6*(2). https://doi.org/10.31327/jme.v6i2.1669

Chairuddin, C., & Farman, F. (2022). The Comparison of Students' Mathematical Problem Solving Ability through Students Teams Achievement Division (STAD) and Problem Based Learning (PBL). *AL-ISHLAH: Jurnal Pendidikan*, *14*(3), 3349–3360. https://doi.org/10.35445/alishlah.v14i3.1634

Darmawan, O. M., Syofni, & Sakur. (2024). Pengembangan LKPD Berbasis Model Problem Based Learning pada Materi Perbandingan untuk memfasilitasi Kemampuan Pemecahan Masalah Matematis Siswa. *Jurnal Absis*, *6*(2). https://journal.upp.ac.id/index.php/absis/article/view/2322

Deswita, H., Setyono, T., & Afri, L. E. (2016). Pengembangan Media Pembelajaran Matematika dengan Menggunakan Macromedia Flash Pada Materi Bangun Ruang Kelas VIII Sekolah Menengah Pertama. *Jurnal Mahasiswa Prodi Matematika UPP*, *2*(1), 109913.

Dewi, N. A., Irham, M., & Wibowo, S. E. (2021). Pengaruh Penerapan Pembelajaran Kooperatif Tipe STAD Terhadap Kemampuan Pemecahan Masalah Matematika. *GANEC SWARA*, *15*(1). https://doi.org/10.35327/gara.v15i1.186

Farman, F., Hali, F., & Rawal, M. (2021). Development of E-LKPD Using Live Worksheets for Online Mathematics Learning during Covid-19. *JME*

(Journal of Mathematics Education), *6*(1), Article 1. https://doi.org/10.31327/jme.v6i1.1626

Farman, F., & Vivin, M. (2024). Developing Student Worksheets Based on Problem Posing Approach to Improve Students' Reasoning Ability. *RANGE: Jurnal Pendidikan Matematika*, *5*(2), Article 2. https://doi.org/10.32938/jpm.Vol5.Iss2.5842

Gunawan, I. W. A., I Made Tegeh, S. P., & I Made Suarjana, M. P. (2017). Pengaruh Model Pembelajaran PBL Berbantuan Media LKS Terhadap Kemampuan Pemecahan Masalah Matematika Siswa Kelas V SD Gugus V Kecamatan Abang. *MIMBAR PGSD Undiksha*, *5*(2). https://doi.org/10.23887/jjpgsd.v5i2.10812

Karima, U. N. (2021). *Efektivitas Model Pembelajaran Problem Based Learning Berbantuan LKPD Terhadap Self Efficacy dan Kemampuan Pemecahan Masalah Materi Pokok Keliling dan Luas Lingkaran Pada Peserta Didik Kelas VIII SMP Negeri 20 Semarang—Walisongo Repository* [Universitas Islam Negeri Walisongo]. https://eprints.walisongo.ac.id/id/eprint/16580/

Laila, Z., Aima, Z., & Yunita, A. (2021). Analisis Kemampuan Pemecahan Masalah Matematis Ditinjau Dari Minat Belajar Siswa. *Jurnal Horizon Pendidikan*, *1*(3). https://doi.org/10.22202/horizon.v1i3.5257

Leonard, L., Suhendri, H., Hasbullah, H., Mevianti, A., & Puteri, N. C. (2022). Identifikasi Materi Yang Dianggap Sulit untuk Pelajaran Matematika Pada Jenjang SMP Kelas 8. *Jurnal Lebesgue : Jurnal Ilmiah Pendidikan Matematika, Matematika dan Statistika*, *3*(3), 560–567. https://doi.org/10.46306/lb.v3i3.167

Lestari, N. P. S. (2021). *Penerapan Model PBL Berbantuan LKS Terstruktur Terhadap Kemampuan Pemecahan Masalah Matematika Siswa Kelas VIID SMP Negeri 1 Sukasada* [Undergraduate, Universitas Pendidikan Ganesha]. https://doi.org/10/1313011106-COVER.pdf

Lestari, W. T. (2019). *Pengaruh Model Problem Based Learning (PBL) Berbantuan Lembar Kegiatan Peserta Didik (LKPD) Terhadap Kemampuan Berpikir Kritis Ditinjau Dari Motivasi Belajar Peserta Didik Kelas X IPS SMA Diponegoro Tumpang* [Diploma, Universitas Negeri Malang]. http://repository.um.ac.id/89882/

Mariam, S., Rohaeti, E. E., & Sariningsih, R. (2019). Analisis Kemampuan Pemecahan Masalah Matematis Siswa Madrasah Aliyah Pada Materi Pola Bilangan. *Journal on Education*, *1*(2), Article 2. https://doi.org/10.31004/joe.v1i2.40

Nadiya, E. S., Utami, C., & Husna, N. (2023). Model Problem Based Learning (PBL) Berbantuan Lembar Kerja Siswa (LKS) untuk Meningkatkan Kemampuan Penalaran dan Pemecahan Masalah Matematis Siswa. *JUMLAHKU: Jurnal Matematika Ilmiah STKIP Muhammadiyah Kuningan*, *9*(1), 21–39. https://doi.org/10.33222/jumlahku.v9i1.2820

Rahayu, I. F., & Aini, I. N. (2021). Analisis Kemampuan Pemecahan Masalah Matematis Siswa SMP Pada Materi Bilangan Bulat. *MAJU*, *8*(2), 60–66.

Reski, R., Hutapea, N., & Saragih, S. (2019). Peranan Model Problem Based Learning (PBL) terhadap Kemampuan Pemecahan Masalah Matematis dan Kemandirian Belajar Siswa. *JURING (Journal for Research in Mathematics Learning)*, *2*(1). https://doi.org/10.24014/juring.v2i1.5360

Saragih, E. M., Astuti, D., Silaen, N. E., Afriadi, A., Ray, S. A., & Sartika, M. (2022). Pengaruh Model Problem Based Learning (PBL) Berbantuan LKPD Terhadap Kemampuan Pemecahan Masalah Matematis Siswa Kelas VII SMP N 1 Kisaran. *Seminar Nasional Multi Disiplin Ilmu Universitas Asahan*. http://jurnal.una.ac.id/index.php/semnasmudi/article/view/3058

Setianingsih, N., Sukamto, & Huda, C. (2023). Meningkatkan Minat Belajar Peserta Didik dengan Model Pembelajaran Problem Based Learning Pada Materi Matematika Kelas IV SD. *Jurnal Citra Pendidikan*, *3*(4), 1279–1287. https://doi.org/10.38048/jcp.v3i4.2233

Sitohang, M. (2019). *Penerapan Model Problem Based Learning Berbantuan LKPD untuk Meningkatkan Kemampuan Pemecahan Masalah Matematika Peserta Didik Pada Materi Sistem Persamaan Linear Tiga Variabel (SPLTV) Kelas X SMA Negeri 1 Onan Runggu T. P. 2018/2019* [Thesis, Universitas HKBP Nommensen]. https://repository.uhn.ac.id/handle/123456789/2711

Sumartini, T. S. (2018). Peningkatan Kemampuan Pemecahan Masalah Matematis Siswa melalui Pembelajaran Berbasis Masalah. *Mosharafa: Jurnal Pendidikan Matematika*, *5*(2), 148–158. https://doi.org/10.31980/mosharafa.v5i2.270

Vikriyah, N. (2015). *Peningkatan Kemampuan Pemecahan Masalah Matematika Melalui Model Problem Based Learning (PBL) Pada Pokok Bahasan Trigonometri (PTK di kelas X SMA Muhammadiyah 1 Surakarta Tahun Ajaran 2014/2015)* [Thesis, Universitas Muhammadiyah Surakarta]. https://eprints.ums.ac.id/32907/

Yusri, A. Y. (2018). Pengaruh Model Pembelajaran Problem Based Learning Terhadap Kemampuan Pemecahan Masalah Matematika Siswa Kelas VII di SMP Negeri Pangkajene. *Mosharafa: Jurnal Pendidikan Matematika*, *7*(1). https://doi.org/10.31980/mosharafa.v7i1.341

Zulkarmain, L. (2021). Analisis Mutu (Input Proses Output) Pendidikan di Lembaga Pendidikan MTs Assalam Kota Mataram Nusa Tenggara Barat. *MANAZHIM : Jurnal Manajemen dan Ilmu Pendidikan*, *3*(1). https://ejournal.stitpn.ac.id/index.php/manazhim/article/view/946