Implementation of problem-based learning (PBL) model assisted by PAJURA media to improve learning outcomes of second-grade elementary school students

Dyah Ayu Lestari [1], Sugiarti [2], Nurina Manggiasih [3]
dyahayulestari.0731@gmail.com [1],
sugiarti@umm.ac.id [2],
manggiasihnurina@gmail.com [3],
Primary School Teacher Professional Education, Faculty of
Teacher Training and Education, University of Muhammadiyah
Malang

Abstract: The purpose of this research was to determine the improvement of students' learning outcomes by implementing the Problem-Based Learning (PBL) model assisted by PAJURA media in understanding the concepts of addition and subtraction operations on whole numbers. This study is classified as Classroom Action Research (CAR) comprising two cycles. The subjects are 27 second-grade students of SDN Mojorejo 1 Batu in the academic year 2022/2023. The data collection method in this research is through tests to gather students' learning outcomes data. The results of this study indicate that the implementation of the Problem-Based Learning (PBL) model assisted by PAJURA media can improve students' learning outcomes in understanding the concepts of addition and subtraction operations on whole numbers in grade 2. This improvement is evident in the student's learning outcomes. The initial data (pre-cycle) showed an average learning outcome of 67% with a mastery learning rate of 41%. After the implementation of the Problem-Based Learning (PBL) model assisted by PAJURA media in the first cycle, the average learning outcome increased to 79% with a mastery learning rate of 70%. Following the improvement in the second cycle, there was a further enhancement in the average learning outcome percentage, reaching 88%, with a mastery learning rate of 89%.

Keywords: Problem-Based Learning, Learning Media, Learning Outcomes

PRELIMINARY

A curriculum is a set of plans that serve as guidelines to regulate the goals, content, teaching materials, and teaching methods for providing quality education so that learning objectives can be achieved (Dahlia, 2022). The "Merdeka Belajar" (Freedom to Learn) concept is emphasized in the Independent Curriculum (Merdeka Curriculum) for students (Nugraha, 2022). The curriculum includes various subjects, one of which is mathematics. Mathematics plays a crucial role in daily life. It is a fundamental field of knowledge that

guides individuals to think logically, creatively, and systematically in solving problems (Arnidha et al., 2018).

Studying mathematics can help students prepare themselves to face changes and developments in various situations and acquire knowledge in different fields (Sriyanto as cited in Yanti, 2017). However, students often perceive learning mathematics as intimidating and tedious, leading to a lack of interest in studying it (Astuti et al., 2022). This perception may arise due to the presence of numbers, symbols, and formulas in mathematics. Additionally, during the teaching process, many teachers use conventional methods to deliver mathematics content, which may diminish students' enthusiasm for learning mathematics. The teacher is one of the important actors in attracting students' interest in learning through the selection of learning models, media, and teaching materials that are presented creatively and innovatively (Darmayoga, 2023).

However, it is still found that some teachers use conventional methods when teaching, which may limit the potential and mathematical abilities of students from developing to their fullest potential. Based on the initial observation during the pre-cycle phase of the addition and subtraction operations of whole numbers in Grade 2 at SDN Mojorejo 1, it was found that the majority of students did not achieve the minimum completeness criteria (KKM) set at 75. Out of 27 students, 15 students scored below 75. Based on the observation results during the teaching and learning process, several issues were identified, including 1) Students still confused with the concept of addition and subtraction of whole numbers through the teacher's lecture method, 2) Insufficient use of learning media, 3) Lack of utilization of concrete media in the learning process, 4) Some students were found playing and talking to their peers during the learning activities. These factors are suspected to contribute to the student's learning outcomes in Grade 2 being below the predetermined KKM.

The model that can be used to address the previously mentioned issues is Problem-Based Learning (PBL) with the assistance of the PAJURA (Papan Penjumlahan dan Pengurangan) learning media. Problem Based Learning (PBL) is an instructional model that presents authentic problems for students to solve by organizing their own knowledge, developing inquiry skills, practicing higher-order thinking skills (HOTS), and fostering confidence and independence (Arend as cited in Fariatun et al., 2022). The process of solving pre-determined real-life problems is the initial activity undertaken by students in

the learning process that implements the Problem Based Learning (PBL) model (Widyastuti et al., 2022). Problem-based learning provides students with the motivation to discover how to learn and collaborate in groups to solve existing problems. PBL also encourages students to explore problems based on the abilities and experiences they have acquired in previous learning activities (Handayani, 2017). This enables students to practice and develop higher-order thinking skills in problem-solving and become independent learners, leading to an improvement in their learning outcomes. There are five steps in the Problem-Based Learning (PBL) model (Puspitasari et al., 2022). The steps of PBL include: 1) Orienting students to the problem, 2) Organizing students, 3) Providing guidance through both individual and group sessions, 4) Presenting the results of their work and presentations, and 5) Analyzing and evaluating the problem-solving process undertaken.

In addition to applying a problem-based learning model, teachers can also use learning media to make it easier for students to understand the material being studied and the focus of students can increase. According to Daryanto in Astuti et al., (2022) stated that learning media is a tool used by the teacher as an intermediary for transferring knowledge during the learning process. Learning media used to convey mathematical material can make it easier for students to understand concepts that were originally abstract to become more concrete. PAJURA is one of the interesting learning media and can be used to train students' skills. Using PAJURA will provide real learning experiences for students because they directly use the media provided to solve the problems they face. After learning, students get meaningful learning so that learning does not only remember but also experience directly how to add and subtract numbers correctly.

Learning outcomes are the abilities possessed by students after experiencing the learning process (Sudjana in Nurmala, 2021). Students achieve learning outcomes based on the interactions they have with various factors of learning outcomes themselves (Octaviana et al., 2018). Based on this, it can be said that interactions with various factors carried out by students can lead to changes in behavior, whether it is overall or just in one aspect, which is the result of the learning process carried out.

Based on this background, the problem can be formulated as, whether the Problem-Based Learning (PBL) learning model assisted by Pajura media can improve

learning outcomes in class II.B students at SDN Mojorejo 01 Batu City in the 2022/2023 school year. The purpose of this study was to find out whether the application of the Problem-Based Learning (PBL) learning model assisted by PAJURA learning media can improve mathematics learning outcomes, especially in the material of addition and subtraction operations for whole number students in class II.B SDN Mojorejo in the first semester in the Academic Year 2022/2023. Based on research conducted by Taspiah (2021) with the title "Implementation of the Problem-Based Learning Model to Improve Mathematics Learning Outcomes for Elementary School Students" and Fariatun's Research (2022) with the title "Implementation of the Problem-Based Learning Model to Improve Learning Outcomes of Mathematics Lesson Content".Based on the previous research, it enables us to design the current study to address the issues that arise in the classroom.

METHOD

The research method employed in this study falls under the category of classroom action research, using 2 cycles. Classroom action research is a process conducted to address classroom issues through self-reflection activities by implementing planned and directed actions in real situations, followed by presenting the results based on the analysis of the effects of the implemented interventions (Wina Sanjaya as cited in Octaviana et al., 2018). There are 4 stages in each cycle of classroom action research, namely planning, acting, observing, and reflecting (Taspiah & Hasan, 2021).

This classroom action research was conducted on class II.B students at SDN Mojorejo 1 Batu City in the first semester of the 2022/2023 school year regarding the material of addition and subtraction in whole numbers where this year the independent curriculum began to be implemented. The number of students was 27 students consisting of 14 male students and 13 female students. CAR variables in this study consisted of independent variables, namely the Problem-Based Learning model and PAJURA media, while the dependent variable was in the form of changes in student learning outcomes.

The observation technique is used in this research during the data collection process. The research instrument used is a pre-test and post-test evaluation to determine the learning outcomes of the students. The analysis of the student's learning outcomes employs descriptive analysis using percentage techniques. In each cycle, there will be a

test of the student's learning outcomes. The difference in learning outcomes is used as an indicator of improvement, comparing the average scores obtained from the test in Cycle I and Cycle II.B.

Based on the evaluation tests conducted from the end of Cycle I to Cycle II, the following conclusions can be drawn, if the test results show an improvement compared to the previous cycle, it indicates that there has been an increase in learning outcomes. However, if the evaluation test results show a decline or become worse (decrease), then follow-up actions should be taken to improve the subsequent learning activities. Therefore, the objective of this research is to enhance the mathematics learning outcomes of second-grade students by implementing the Problem-Based Learning (PBL) model with the assistance of the PAJURA learning media. The success indicators are as follows: 1) Improvement in mathematics learning outcomes for second-grade students. 2) Achievement of learning outcomes by the students meeting the predetermined passing grade of 75%.

RESULTS

Completeness Analysis of Mathematics Learning Outcomes Cycle I

This classroom action research was conducted at SDN Mojorejo 1 Batu City. The research subjects were all 27 students in class II.B. The problem discussed in this study is whether the Problem-Based Learning (PBL) learning model assisted by Pajura media can improve learning outcomes in class II.B students at SDN Mojorejo 01 Batu City in the 2022/2023 school year on the material for addition and subtraction of whole numbers. The following is a presentation of research results in the form of student learning outcomes by applying the Problem-Based Learning (PBL) learning model to class II.B students at SDN Mojorejo 1 Batu.

1. Pre Cycle

At the initial stage, a formative test consisting of 10 fill-in-the-blank questions on the topic of addition and subtraction of whole numbers will be administered to the students as a pre-action in this research as follows.

No	KKM score	Frequency	Percentage	Information
Table 1 Pre-cycle results				

1	≥ 75	11	41 %	complete
2	≤ 75	16	59 %	Not Completed
Amount		27	100 %	
Maximum Score			85	
Minimum Score			40	
Average			67	

From Table 1, it can be observed that the initial condition of the students is relatively low, as 59% of the students scored below the Minimum Mastery Criteria (KKM), and the class average also indicates a score below the predetermined KKM.

2. Cycle 1

Data analysis after reflecting and improving in cycle 1 using the Problem-Based Learning (PBL) learning model assisted by PAJURA learning media as the learning media used by teachers to convey mathematics material has increased. The learning outcomes of students in cycle I can be seen in Table 2 below

Table 2. Distribution of Complete Mathematics Learning Outcomes Cycle I				
No	KKM score	Frequency	Percentage	Information
1	≥ 75	19	70 %	complete
2	≤ 75	8	30 %	Not Completed
Amount		27	100 %	
Maximum Score			100	
Minimum Score			50	
Average			79	

Table 2 shows an increase in student learning outcomes in cycle I. Of the 27 students who took part in the learning evaluation, there were 19 children (70%) who were declared complete or able to achieve KKM 75 and there were 8 (30%) students who did not complete or are still under KKM. Based on the table, the highest score obtained by a student is 100, and the lowest score is 50. Meanwhile, the class average has improved to 79.

3. Cycle 2

The data analysis after conducting reflection and improvements in cycle 2 using the Problem-Based Learning (PBL) learning model with PAJURA learning media,

which was increased in quantity to ensure each group received one PAJURA, resulted in an improvement in the learning outcomes of the students. The learning outcomes of the students in cycle II.B can be seen in the following Table 3.

| Table 3. Distribution of Completeness of Mathematics Learning Outcomes Cycle II.B				
No	KKM score	Frequency	Percentage	Information
1	≥ 75	24	89 %	complete
2	≤ 75	3	11 %	Not Completed
Amount		27	100 %	
Maximum Score			100	
Minimum Score			60	
Average			88	

Table 2 shows an improvement in the learning outcomes of the students in cycle II.B. Out of 27 students who participated in the learning evaluation, 24 students (89%) achieved the minimum completeness criteria (KKM) of 75, while 3 students (11%) did not meet the passing grade. The highest score obtained by a student was 100, and the lowest score was 60. The class average score also increased to 88.

Comparative Analysis

Based on the analysis results that have been carried out on student learning outcomes starting from the pre-cycle, cycle 1, and cycle II.B. The analysis process can use the data resulting from the number of learning outcomes starting from the pre-cycle, cycle 1, and cycle II.B. The following details the results of the analysis listed in Table 4.

Table 4. Data Analysis Summary							
No	Completeness	Pre Cycle		Cycle I		Cycle II.B	
		F	%	F	%	F	%
1	Complete	11	41	19	70	24	89
2	Not Completed	16	59	8	30	3	11
	Maximum Score	85		100		100	
	Minimum Score	40		50		60	
	Average	67		79		88	

Graph 1. Improvement of Student Learning Outcomes in Each Cycle
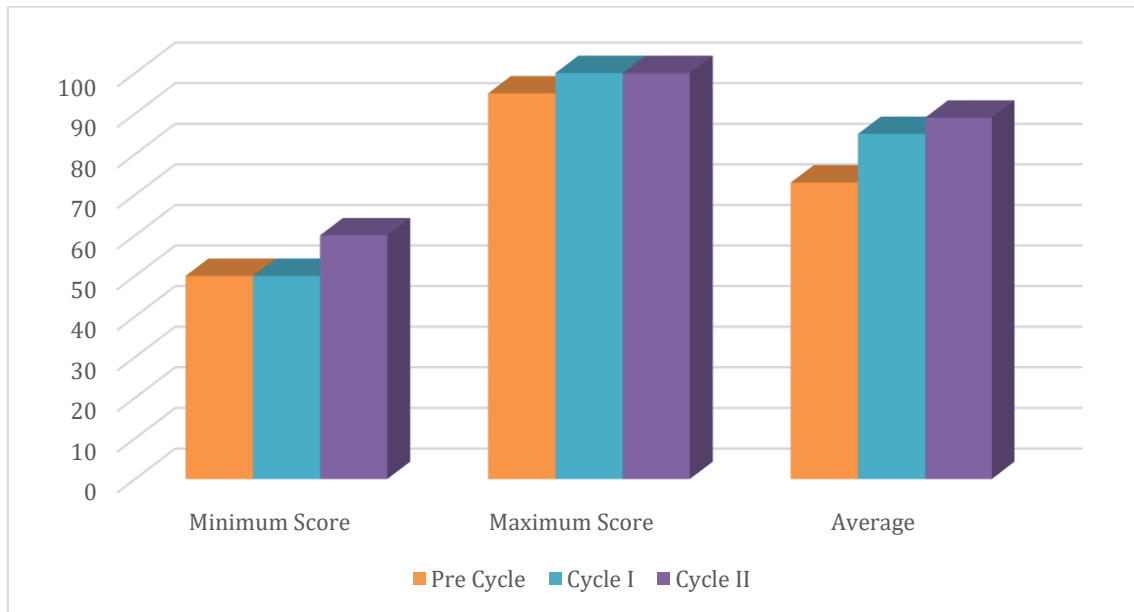
Based on the results of student evaluation tests starting from the pre-cycle, cycle 1, to cycle II.B showed an increase in learning outcomes. The increase in learning outcomes from pre-cycle to cycle I was 29%, which came from 41% to 70%. Furthermore, an increase also occurred from cycle I to cycle II.B by 19%, from 70% to 89%.

DISCUSSION

The learning activities carried out in this study were applying the Problem-Based Learning (PBL) learning model using the help of Addition and Subtraction Board learning media (PAJURA) which has the aim of improving student learning outcomes even more. Learning activities are carried out in cycle I and cycle II which have shown significant progress in the learning outcomes of class II-B students. The improvement shown can be said that the process of transferring knowledge carried out by students during the learning process is successful and students get meaningful experiences during the activity. This success is attributed to the application of the PBL model, which encouraged active thinking and problem-solving skills among the students, leading to a learner-centered approach in the teaching and learning process.

At the same time, this research is supported by the results of research conducted by (Indah in Firdaus et al., 2021) showed that the application of the PBL learning model has a good impact on student learning outcomes. Then the results of research from (Winarti & Noor Fatirul, 2020) revealed that the Problem-Based Learning model was able to

improve student achievement with the acquisition of a class average score of 76.84. Similar research results are shown by (Eismawati et al., 2019) stated that the increase in mathematics learning outcomes by applying the PBL learning model which was indicated by the number of students who completed the increase, as many as 22 students or 88%. Therefore, based on the findings from several research studies, it can be concluded that the implementation of the PBL model results in a significant improvement in students' mathematics learning outcomes, thus reinforcing the findings of this current research.

The implementation of the PBL model in learning activities can encourage students to be more active and develop critical thinking skills in solving encountered problems. The learning activities are designed to promote good cooperation among students within their group. Although in previous learning activities, students were hesitant and unable to fully participate, in subsequent learning activities, they became more active and focused, engaging in every learning activity conducted. Besides problem-solving skills, students are also trained to have confidence in expressing their opinions. They are encouraged to provide their input and accept feedback for the improvement of their work.

Learning activities carried out in several cycles by applying the PBL model and PAJURA media have shown changes in the form of improvements in the results of previous evaluations. Indeed, during the pre-cycle implementation, the evaluation results of students were still below the KKM, but when implementing cycles I and II, students showed significant improvements. Based on the results of the pre-cycle evaluation, the average student gets a score of 67 with a completeness level of 41%. For this reason, reflection was carried out for improvement in the next learning activity in cycle I. After the implementation of the cycle I, students showed enthusiasm for learning, and being active in participating in learning increased more than before. Furthermore, students more frequently express their opinions, indicating improved focus on learning and understanding. As a result, the evaluation in Cycle I shows that the students obtained an average score of 79, with a level of mastery reaching 70%.

The learning activities in Cycle I differed from the previous ones as the students showed interest and increased focus due to the addition of PAJURA media in understanding addition and subtraction concepts. With this media, students were given the freedom to express diverse answers based on their findings. The activities continued with the verification of the answers, which motivated the students to know whether their

work was correct or needed improvement. The purpose of these activities was to provide students with ease in the process of knowledge transfer by eliciting their best answers to the questions.

After the reflection activities in Cycle I, the learning activities continued in Cycle II. At the end of the evaluation in Cycle II, it was evident that the student's learning outcomes had improved compared to the previous learning activities in Cycle I. This improvement was attributed to the addition of mini PAJURA learning media for each study group, which made the students more interested in participating in the learning process. Their increased interest directly contributed to a better understanding of the taught material. As shown in Table 4, the final evaluation scores in Cycle II indicated an average score of 88 and an achievement rate of 89%.

The learning activities have been successfully conducted by the teacher, and although there are still some aspects that need improvement, the results of the data analysis show a significant improvement. This is evidenced by the increase in the class average from 79 to 88 and the improvement in the students' learning outcomes from 70% to 89%. Furthermore, based on the observation data, it is evident that the students actively participated during the learning activities. The improvements made to address the shortcomings identified in the previous cycle have been implemented and resulted in better outcomes.

Based on the successful implementation of mathematics learning activities in grade 2 of SDN Mojorejo 1, Batu City, on the topic of addition and subtraction operations, using the Problem-Based Learning (PBL) model assisted by the PAJURA media, several advantages have been observed, as highlighted by Kambi in Handayani (2017), including: (1) Restore students' scientific attitudes, (2) Increase student motivation, and (3) Obtain meaningful learning.

CONCLUSION

Based on the results of the research and the discussions presented earlier, it can be concluded that the implementation of the Problem Based Learning (PBL) model assisted by the PAJURA media can improve the learning outcomes of students in the subject of mathematics, specifically in the topic of addition and subtraction operations, in grade 2 of SDN Mojorejo 1, Batu City. The improvement in learning outcomes occurred

gradually over the two cycles. In the Cycle I, the average score obtained was 79 with a mastery level of 70%, while in the Cycle II, there was an increase with an average score of 88 and a mastery level of 89%. This indicates that there was a difference in the learning outcomes of students when they were provided with the intervention in the form of the Problem-Based Learning (PBL) model assisted by the PAJURA media. Therefore, it can be concluded that the Problem-Based Learning (PBL) model assisted by the PAJURA media can enhance the learning outcomes of grade 2 students at SDN Mojorejo 1 in the subject of Mathematics.

REFERENCES

Arnidha, Y., Noerhasmalina, & Rekawati, D. (2018). Model Problem Based Learning (Pbl) Pada Pembelajaran Matematika. *JURNAL E-DuMath*, *4*(2), 46–51. https://doi.org/10.26638/je.755.2064

Astuti, D. F., Syam, N., & Hairuddin. (2022). Penerapan Model Problem Based Learning Menggunakan Media Stick Eskrim Untuk Meningkatkan Hasil Belajar Siswa Kelas 1 SD Negeri Selopukang. *Pinisi Journal PGSD*, *2*(2), 559–563.

Dahlia. (2022). Penerapan Model Pembelajaran Problem Based Learning untuk Meningkatkan Hasil Berlajar Matematika Topik Bilangan Cacah. *Pedagogia: Jurnal Ilmiah Pendidikan*, *14*(2), 59–64. https://doi.org/10.55215/pedagogia.v14i2.6611

Darmayoga, I. W. (2023). Penerapan MetodePembelajaranExperiental Learning Berbantu Media Audiovisual Untuk Meningkatkan Hasil Belajar Siswa. *Edukasi: Jurnal Pendidikan Dasar*, *4*(1), 1–10.

Eismawati, E., Koeswanti, H. D., & Radia, E. H. (2019). Peningkatan Hasil Belajar Matematika Melalui Model Pembelajaran Problem Based Learning (PBL) Siswa Kelas 4 SD. *Jurnal Mercumatika: Jurnal Penelitian Matematika Dan Pendidikan Matematika*, *3*(2), 71–78. https://doi.org/10.31764/justek.v1i1.416

Fariatun, M., Achmad, W. K. S., & Mus, I. (2022). Penerapan Model Problem Based Learning Untuk Meningkatkan Hasil Belajar Muatan Pelajaran Matematika. *Pinisi Journal PGSD*, *2*(2), 696–706. https://doi.org/10.56916/ejip.v1i1.7

Firdaus, A., Asikin, M., Waluya, B., & Zaenuri, Z. (2021). Problem Based Learning (PBL) Untuk Meningkatkan Kemampuan Matematika Siswa. *QALAMUNA: Jurnal Pendidikan, Sosial, Dan Agama*, *13*(2), 187–200. https://doi.org/10.37680/qalamuna.v13i2.871

Handayani, E. (2017). Penerapan Model Problem Based Learning untuk Meningkatkan Kemampuan Memahami Perkalian Bilangan. *Briliant: Jurnal Riset Dan Konseptual*, *2*(3), 319–327. https://doi.org/10.28926/briliant.v2i3.75

Nugraha, T. S. (2022). Kurikulum Merdeka untuk Pemulihan Krisis Pembelajaran. *Jurnal

UPI, *19*(2), 251–262.

Nurmala. (2021). Penerapan Model Pembelajaran Problem Based Learning (PBL) untuk Meningkatkan Hasil Belajar Siswa Pada Mata Pelajaran Matematika Kelas III SDN Mangkura 4 Kota Makassar. In *Eprints.Uad.Ac.Id*. http://eprints.uad.ac.id/5284/1/Deany R. Rosalina 130005049 Perpus PGSD Kls A.docx

Octaviana, A., Nuryani, P., & Robandi, B. (2018). Penerapan Model Problem Based Learning (PBL) untuk Meningkatkan Hasil Belajar Matematika siswa Kelas III Sekolah Dasar. *Jurnal Pendidikan Guru Sekolah Dasar*, *3*(3), 12–20.

Puspitasari, I. A., Azainil, & Basir, A. (2022). Penggunaan Media Pembelajaran Dalam Model Pembelajaran Problem Based Learning Pada Mata Pelajaran Matematika. *Prosiding Seminar Nasional Pendidikan Matematika, Universitas Mulawarman*, *2*, 75–92.

Taspiah, S., & Hasan, K. (2021). Penerapan Model Pembelajaran Problem Based Learning Meningkatkan Hasil Belajar Matematika Siswa SD. *Pinisi Journal PGSD*, *1*(2), 643–649. https://doi.org/10.23887/jippg.v4i2.35695

Widyastuti, E., Sahabuddin, E. S., & Latif, R. A. (2022). Upaya Meningkatkan Hasil Belajar Matematika Melalui Model Pembelajaran Problem Based Learning (PBL) Pada Siswa Kelas II SD. *Pinisi Journal Pendidikan Guru*, *2*(1), 115–122.

Winarti, T., & Noor Fatirul, A. (2020). Model Pembelajaran Problem Based Learning, Inkuiri Terbimbing, dan Learing Creativity Berpengaruh Terhadap Prestasi Belajar Matematika. *Jp2*, *3*(3), 387–396.

Yanti, A. H. (2017). Penerapan Model Problem Based Learning (PBL) Terhadap Kemampuan Komunikasi dan Kemampuan Pemecahan Masalah Matematika Siswa Sekolah Menengah Pertama Lubuklinggau. *Jurnal Pendidikan Matematika Raflesia*, *2*(2), 118–129.