



# IMPLEMENTATION OF PROBLEM BASED LEARNING IN MATHEMATICS EDUCATION AT PRIMARY SCHOOLS WITH LIMITED TECHNOLOGY

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## Abstract

This study aims to describe how mathematics instruction is implemented in Grade IV at SDN Jajar 01, covering the stages of the opening, core, and closing activities. In addition, the study explores various challenges in the mathematics teaching process, particularly the limitations in using digital technology and concrete media. A qualitative approach was employed in this research, utilizing participatory observation and in-depth interviews to collect data from both teachers and students. The findings indicate that the learning process is conducted in a structured manner and integrates the Problem Based Learning (PBL) model with lectures and practice exercises. Although the use of digital technology remains limited, teachers continue to strive to maximize available media and create a communicative and reflective learning environment.

**Keywords:** Learning Activities, Mathematics

## 1. Introduction

Mathematics learning at the primary school level plays a crucial role in developing students' logical and structured thinking skills from an early age. At the concrete operational stage of cognitive development, students find it easier to understand mathematical concepts through direct experiences and visual representations rather than symbolic or abstract delivery. However, in practice, mathematics instruction still faces a number of complex challenges. Based on observations in Grade IV at SDN Jajar 01, the learning process remains dominated by lecture-based methods and worksheet (LKS) oriented exercises, with limited use of concrete media that align with students' characteristics. This situation has resulted in some students experiencing difficulties in understanding abstract concepts, such as unit conversions for length measurement.

This issue aligns with the findings of Astuti, Muslim, and Bramasta (2020), who stated that many teachers have not yet optimized mathematics instruction to meet the needs of primary school students. Teachers tend to employ one-way teaching methods that do not sufficiently encourage students' active participation in the learning process. In fact, meaningful learning activities that directly engage students can create deeper learning experiences (Astri Azani et al, 2024). Furthermore, concrete learning media are still rarely utilized to their full potential, even though they can help bridge abstract concepts, making them easier to understand. Constructivist learning theory emphasizes that knowledge cannot be directly transferred from teacher to student; rather, it must be constructed by the students themselves through direct experience and interaction with their social environment.

The urgency of this research lies in the importance of applying an instructional approach that can strengthen students' conceptual understanding of mathematics at a deeper level. The use of concrete media is considered an effective strategy to bridge students' knowledge from real-world experiences to abstract mathematical concepts (Fauziati, 2021). This approach aligns with Bruner's theory of representation, which posits that students comprehend concepts through three stages of representation: enactive (direct physical activity), iconic (images or visual representations), and symbolic

(abstractions). In this context, the Problem-Based Learning model, when combined with the use of concrete media, has been shown to improve students' learning achievement in mathematics (Rahmawati & Wahyudi, 2024). Therefore, this study is crucial for examining in greater depth how constructivist-based learning strategies can be effectively implemented in teaching unit conversion of length in Grade IV of primary school.

This study employed a qualitative approach to explore the implementation of mathematics instruction in Grade IV at SDN Jajar 01 on March 14, 2025. This approach was chosen as it is considered effective in providing an in-depth understanding of the phenomenon under investigation through the collection of descriptive data in the form of

## **2. Method**

words and actions (Sidiq & Choiri, 2019). The subjects of this research included the Grade IV teacher and students, with data collected through participatory observation and in-depth interviews. Participatory observation enabled the researcher to be directly involved in the learning process, while interviews were used to explore the perspectives of teachers and students more thoroughly. Instruments used in this study included observation guidelines, interview guides, and field notes to ensure the accuracy of the data.

The collected data were analyzed using the Miles and Huberman model, which consists of three stages: data reduction, data display, and conclusion drawing (Umrati & Wijaya, 2020). Data reduction was carried out to simplify raw data into relevant information, which was then presented in narrative or tabular form to facilitate interpretation. Conclusions were drawn by identifying patterns in the data and repeatedly verifying them to maintain the validity of the findings. The research also followed an action cycle consisting of planning, implementation, observation, and reflection as a strategy to ensure data validity and reliability (Haki et al, 2024). All stages were conducted simultaneously with data collection, in accordance with the characteristics of qualitative research.

## **3. Results and Discussion**

### **1.1. Result**

Although digital devices such as laptops and projectors have been provided and used at Grade IV SDN Jajar 01, their utilization remains limited due to several technical and situational factors. Teachers use them mainly to support visual explanations in order to make lessons more engaging; however, interactive digital media has not yet been directly implemented. On the other hand, the use of digital devices by students is still difficult to control, as there is a tendency for misuse when access is given. The following data was obtained through classroom observation and interviews with the homeroom teacher.

**Table 1. Implementation of Problem-Based Learning (PBL) Stages in Mathematics Instruction**

Stage	Observed Activities
<b>Opening Activity</b>	The teacher begins the lesson with greetings, a prayer, and attendance checking. A warm classroom atmosphere is created by asking students how they are doing. A preliminary activity (apersepsi) is conducted by linking the previous material (weight measurement) to the new topic (length measurement). The teacher clearly explains the learning objectives
<b>Main Activity</b>	The teacher poses a triggering question: "How many steps are there in length measurement?" and draws an unit staircase on the whiteboard. The material is visualized using a projection tool. Students work on problems on the board and in their worksheets (LKS), interspersed with chants as an ice-breaking activity.
<b>Closing Activity</b>	The teacher guides students to summarize the day's lesson, provides an evaluation and homework. The teacher says: "If you are still confused, feel free to ask me via WhatsApp, okay?" the session ends with a prayer led by a student.

**Table 2. Use of Learning Media**

Stage	Observed Activities
<b>Whiteboard</b>	Used to explain and draw the unit staircase as the main visual aid.
<b>Student Worksheets (LKS)</b>	Used for individual practice questions, which are then reviewed together.
<b>Concrete Media</b>	Not yet available. The teacher stated: "I want to make an unit staircase out of cardboard, but I haven't had the chance".
<b>Digital/Interactive Applications</b>	Not used in the lesson. The teacher stated: "Actually, it's possible, but when I tried using a phone, the students just opened YouTube instead".

**Table 3. Results of Grade IV Teacher Interview**

Stage	Observed Activities
<b>Learning Strategy</b>	"I get the students thinking first by asking questions before explaining the material, so they stay active. After the explanation, I give them exercises and ask them to solve them on the board."
<b>Use of Technology</b>	"If there's a screen or images, they're more enthusiastic. I usually use a projector to make the material clearer."
<b>Media-Related Challenges</b>	"I once tried using the school's phone, but the students ended up using it for unrelated things. So I limited it."
<b>Future Expectations</b>	"I hope to have more engaging tools, but still safe and appropriate for elementary school children."

The findings indicate that the teacher has implemented the Problem Based Learning (PBL) model in a structured manner in mathematics instruction. The learning process begins with a triggering question to encourage students 'critical thinking, followed by material explanation, practice exercises, and active student involvement through direct activities such as solving problems on the whiteboard. This strategy effectively enhances student engagement and promotes a deeper understanding of the concepts being taught.

Although technological tools such as projectors and laptops are available, the use of interactive digital media remains suboptimal due to technical and situational constraints. This suggests that problem-based learning can still be effectively carried out as long as it is supported by appropriate media and strategies. The teacher's efforts to create a

communicative and varied classroom atmosphere continue to support student participation. With proper management and the development of safe and purposeful media, the integration of technology in elementary mathematics instruction has the potential to be gradually improved in the future.

## **1.2. Discussion**

### **1.2.1. Stages of Learning Implementation**

Effective learning implementation should follow a systematic sequence, consisting of the opening activity, core activity, and closing activity. Each stage has a pedagogical function that complements the others and supports the achievement of learning objectives. According to Bruner's theory, this sequence is important so that students can activate prior knowledge, construct new understanding, and reflect on their learning process. In practice, the success of learning does not only depend on the content of the material but also on how the teacher manages these stages as a whole (Febiani Musyadad & Sari, 2024). Therefore, teachers need to thoroughly understand and carefully design each stage to optimally support students' competency development.

Based on observations at SDN Jajar 01, the opening activity began with greetings, a group prayer, and attendance checking. Following this, the teacher asked about the students' well-being and created a comfortable atmosphere as an initial step in establishing a conducive classroom environment. The activity continued with an apperception stage, where the teacher connected the day's material with the previous lesson on weight measurement. The teacher then introduced that the focus of the day would be on length measurement and explained the learning objectives to be achieved. This stage indicates that the teacher applied an opening approach that was not only administrative but also reflective and communicative. Such opening activities are crucial, as they not only mark the technical beginning of the lesson but also influence students' mental and emotional readiness to learn (Wang et al, 2024). When the teacher greets and interacts warmly, it helps create a safe and pleasant atmosphere, forming the foundation for active student engagement. The use of apperception also assists students in connecting prior knowledge with new information, making learning more relevant and easier to grasp (Bagus Rusman, 2022). Explaining the learning objectives provides a clear direction and sets expectations for what students should achieve during the lesson. With a well-structured and communicative opening, the learning process begins not just formally but also addresses students' psychological preparedness.

The core stage was carried out by applying the Problem Based Learning (PBL) model combined with lecture, question-and-answer, and assignment methods. The teacher began with a prompting question such as, "How many steps are there in length measurement?" to stimulate students' thinking. The teacher then drew a measurement staircase on the board and asked students to name the units from kilometers to millimeters. After the explanation, the teacher gave practice questions and asked two students to solve them on the board. In the middle of the core activities, the teacher inserted an ice breaking session in the form of a cheer to keep students motivated and prevent boredom during the lesson. Next, students worked on questions in their worksheets and exchanged answers for peer correction. The core stage is the heart of the learning process, as this is when concepts are actively learned and thinking skills are developed (Mega Swara et al, 2024). The use of a problem-based approach allows students to build understanding through exploration and meaningful problem-solving. The prompting questions provided by the teacher help direct students' focus and activate critical thinking from the outset. The visualization of the concept using a measurement staircase is particularly helpful for understanding abstract material, while the exercises provide opportunities for students to apply the knowledge gained. The variation of activities and the inclusion of ice-breaking sessions play an important role in maintaining an engaging atmosphere and preventing boredom that could hinder the learning process (Hartini et al, 2025).

In the closing activity, the teacher guided students in summarizing the day's lesson and provided evaluation questions as a tool to assess their understanding. The teacher also assigned homework as additional practice. As a form of reflection, the teacher asked students about their impressions of the day's learning and offered motivation to encourage continued academic improvement. Students who still experienced difficulties were given the opportunity to ask questions outside of class through communication platforms such as WhatsApp. The session concluded with a group prayer led by one of the students and a farewell greeting from the teacher. This shows that the teacher concluded the lesson not only in a formal manner but also with an emotional approach that motivated the students. This stage not only marks the end of the learning activity but also provides students with the opportunity to reflect on what they have learned. Summarizing the lesson together reinforces understanding and helps students recall the core material in a structured way. Simple evaluations offer insight into how well the learning objectives have been achieved, while homework assignments strengthen understanding through continued practice (Zolfaghari et al, 2025). The teacher's reflective questions open space for openness and closeness, making students feel personally valued and cared for. Ending the lesson with emotional elements such as motivation and a shared prayer strengthens social bonds and enhances students' enthusiasm for learning beyond the classroom (Azizah & Wardani, 2024).

### **1.2.2. Use of Learning Media**

In the context of mathematics education, learning media play a crucial role as a bridge between abstract concepts and concrete experiences that students can comprehend (Dhea Nanda Lazuardi et al, 2024). Mathematics often involves symbols, numbers, and procedures that are not always easy to grasp especially for elementary school students who are still in the concrete operational stage of cognitive development. Therefore, learning media serve as tools that make these concepts more tangible, visual, and directly perceivable through students' senses (Asy'arie et al, 2025).

Based on observations in Grade IV at SDN Jajar 01, the learning media used were still quite simple namely the chalkboard and student worksheets (LKS). The teacher made an effort to visualize the measurement staircase on the board as an iconic form of media to support student understanding. This initiative shows that the teacher attempted to present the material in a visual and accessible way. Although no physical concrete media were used, the teacher was still able to make the lesson engaging through active interaction and clear communication.

The use of concrete media such as measuring tools, cardboard-made measurement staircases, or other handmade teaching aids could be valuable options to enrich students' learning experiences. The use of concrete media has the potential to increase student interest and enthusiasm, especially for those with visual or kinesthetic learning styles (Tegeh et al, 2020). With more varied media support, the learning process can become more interactive, enjoyable, and tailored to the developmental needs of elementary school students (Dwanda Putra et al, 2023).

### **1.2.3. Challenges in Teaching Mathematics in the Digital Era**

The challenges of teaching mathematics in the digital era lie not only in the content being taught but also in the readiness to utilize technology as a learning aid (Tampubolon et al, 2022). Today's digital technology holds great potential to support the visualization of abstract mathematical concepts, increase student engagement, and enrich learning resources. However, real conditions in the field show that its use is still not optimal in many primary schools. One of the reasons is the situational challenge that arises when digital devices are used directly by students for example, the tendency to access entertainment content unrelated to the lesson. This prompts teachers to be more cautious and to prefer methods and media that are easier to control during the learning process.

Based on observations, devices such as laptops and projectors are available in the classroom and are occasionally used by teachers to display visual materials to support student understanding. However, this use has not yet become a routine part of daily instruction. Digital applications or interactive internet-based media are also underutilized due to concerns about students misusing the devices. Therefore, teachers rely more on conventional media such as the chalkboard and simple teaching aids that remain pedagogically relevant.

Implementation of Problem Based Learning (PBL) is an appropriate strategy to address the challenges of teaching mathematics in primary schools with limited access to technology. PBL encourages students to actively think, discuss, and solve real life problems without relying on digital tools. Teachers can design contextual problem scenarios and facilitate exploration and conclusion-making using simple media that still effectively support learning objectives.

Teachers play a central role in determining the direction and strategies of instruction, including how technology is utilized as an effective medium (Adiyono et al, 2024). While there are various interactive applications, such as measurement simulations or animations of unit conversions that can enhance student understanding, their use remains limited due to concerns over students' device usage control. Under these circumstances, there is a need for policies that support the safe use of technology and for learning environments that instill disciplined and purposeful use of devices (Haris et al, 2024).

Limitations in facilities and infrastructure are also a real challenge in implementing digital technology in schools (Urfa et al, 2024). Not all schools have sufficient access to essential devices, such as stable internet connections or supportive educational applications. This situation directly affects the extent to which technology can be integrated into teaching and learning activities, especially in mathematics instruction that often requires interactive visual media (Habibi et al, 2024). Nonetheless, teachers continue to do their best by making use of available resources, such as using pictures or manual teaching aids in place of digital media. With the right support from various stakeholders, these infrastructural limitations can gradually be addressed, making mathematics learning more engaging, effective, and relevant to current developments (Abiyyu & Efendi, 2024).

#### 4. Conclusion

Mathematics learning in Grade IV at SDN Jajar 01 has been effectively implemented using the Problem Based Learning (PBL) model in a structured way, encompassing the stages of introduction, core activities, and closure. The teacher encourages critical thinking through stimulating questions, provides clear explanations, and engages students in interactive tasks. Although there are limitations in the availability and use of learning media, the teacher utilizes visual aids and simple tools to support understanding. Digital devices like laptops and projectors are used occasionally, but interactive digital media remain underutilized due to technical and classroom management challenges.

To further enhance the effectiveness of mathematics learning, it is recommended that schools provide greater support for the integration of digital media by ensuring access to stable technology and implementing guidelines for proper device use. Teachers can also be given training to maximize the use of digital tools that align with pbl strategies. Additionally, incorporating a wider variety of learning media both conventional and digital can help address different learning styles and increase student engagement, especially in schools with limited resources.

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