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Implementation of the Problem Based Learning (PBL) Model in Science Learning on the Material of Changes in the State of Objects in MI/SD

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Abstract

This article discusses the implementation of the Problem Based Learning (PBL) model in science learning, specifically on the topic of changes in the states of matter in elementary schools. PBL is a student centered learning model that presents learners with real-world problems to be analyzed and solved through discussion, investigation, and the presentation of results. The topic of changes in the states of matter is highly relevant to be taught using PBL because it can be easily observed in daily life, such as melting, freezing, evaporating, condensing, and sublimating. The implementation of PBL has been proven to enhance students' activeness, conceptual understanding, critical thinking skills, and collaborative abilities. This article describes the concept of PBL, steps for its implementation, examples of learning activities, and the benefits and challenges of applying it in science instruction.

Keywords: problem based learning, changes in form of objects, science education

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INTRODUCTION

Learning is a process designed to help students effectively optimize their cognitive and social-emotional potential, thereby achieving desired behavioral changes. Natural Science is a body of knowledge characterized by something objective and tangible regarding the universe and its environment. Science and technology learning has an impact on improving the quality of learning, thus improving the quality of learning and enabling students to become accustomed to critical, creative, and logical thinking.

The problem at the elementary school level is that many students do not understand the explanations given by educators. Learning activities always use the lecture method which causes students to be less proactive and often make mistakes when doing homework. This low student learning outcomes are caused by the inaccurate learning model used, students listen more and do not examine the problems faced in the learning material. One way to overcome this problem is to use an interesting, appropriate, and effective model during the learning process. And an appropriate and relevant model in learning is the problem-based learning model (PBL). With the problem-based learning model (PBL) means that the learning process is achieved by understanding and solving problems. *Problem Based Learning* (PBL) is one effective model to achieve this goal because it encourages students to analyze real problems, seek information, build hypotheses, and present solutions (Huda, 2019).

Therefore, this article designs a suitable learning method to address the identified problems, namely by implementing the *Problem Based Learning* (PBL) model. PBL is defined as a learning model that applies real-life problem contexts as a first step in

integrating and gathering new knowledge. Based on the problem, students are encouraged to study the problem based on their prior knowledge and experiences, thus generating new knowledge and experiences from prior knowledge. PBL is a learning model that provides an active and innovative learning environment for students, thus influencing and increasing student learning outcomes.

Jacobsen et.al. (2009, p. 249) The *problem-solving model* is an appropriate means of providing structured problem-solving experiences to students. Problem-solving is a problem-based teaching where teachers help students experience direct experience in learning to solve problems actively in groups. The steps of problem-solving include students being guided by the teacher to identify the problem, define the problem, choose the appropriate strategy, implement the agreed-upon strategy through discussion, and evaluate the results of the problem-solving. The teacher's primary role is to give students responsibility for solving a problem. Teachers help provide concrete experiences such as practicums or investigations, depending on the problem posed. Teachers play an indirect role by asking questions whose answers guide students to process the knowledge needed to solve the problem.

The implemented PBL model needs to be integrated with strategies that refer to the progress of the times. In line with (Rahmadi, 2019, p. 66) today's era requires teachers not only to have knowledge of the material and how to teach it. The syntax of the problem-based learning model is Directing students to problems, Organizing student learning, Guiding individual and group research, Developing and presenting work results, and Analyzing and evaluating the problem-solving process (Miftah., 2013). Teachers must be able to improve learning outcomes using appropriate learning approaches and models, especially problem-based learning (PBL).

METHOD

This article was compiled through a literature review *conducted* by examining various theoretical sources and scientific publications relevant to the theme of problem-based learning. The analysis process was carried out systematically by mapping the main concepts regarding *Problem Based Learning* (PBL), their relationship to the characteristics of science learning in elementary schools, and identifying implementation strategies that can be applied by teachers in learning practices. The literature sources used include scientific journals, textbooks, and academic works that discuss the PBL model and constructivist learning approaches. Through this review, a comprehensive theoretical basis was obtained to explain the urgency and potential of implementing PBL on the material of changes in the state of matter in science learning.

RESULTS AND DISCUSSION

Problem-Based Learning is a student-centered learning model that places problems as the initial step in the learning process (Savery, 2015). In PBL, students are required to identify problems, collect data, analyze information, and develop solutions. This model is believed to improve students' critical thinking skills, creativity, and independent learning (Arends, 2017). PBL positions the teacher as a facilitator who provides guidance when needed, rather than as the sole source of information.

The topic of changes in state of matter is so closely related to everyday life that it's easy to relate it to concrete, problematic situations. Phenomena such as melting ice, boiling water, morning dew, or sublimation of camphor are examples of events that can be used as problem-solving triggers for students. According to Sari and Rahmawati

(2020), problem-based science learning helps students understand concepts more deeply because they experience the problem-solving process directly through observation and simple experiments.

Implementing PBL in this material can be done through several stages. First, the teacher presents an initial problem, for example, "Why do ice cubes melt faster in open spaces?" or "Why do windowpanes fog up in the morning?" Second, students discuss to identify what they need to know. Third, students conduct investigations, such as experiments melting ice under various conditions or observing the processes of evaporation and condensation. Fourth, students develop solutions or explanations based on their observations. Finally, students present their findings and discuss them with other groups. This model allows students to actively and meaningfully discover the concept of changes in state of matter (Munawaroh, 2018).

Table 1. Stages of Problem-Based Learning Model

Stage	Teacher Behavior
Stage 1 **Student orientation to problems**	The teacher explains the learning objectives, motivates students to engage in the problem-solving activities of their choice.
Stage 2 **Organizing students for learning**	The teacher helps students define and organize learning tasks related to the problem.
Stage 3 **Guiding the investigation**	The teacher encourages students to conclude appropriate information, conduct experiments to get explanations for problem solving.
Stage 4 **Develop and present work results**	Teachers help students plan and prepare their work.
Stage 5 **Analyze and evaluate the problem solving process**	Teachers help students to reflect or evaluate their investigations and the processes they carry out.

(Source: Ibrahim and Nur, 2000)

The implementation of PBL offers several benefits, including improved conceptual understanding, critical thinking skills, collaboration, and communication skills (Utami and Widodo, 2021). In the context of changes in the state of matter, students can understand the relationship between heat, energy, and changes in the physical form of objects through direct experience gained from experiments. This makes learning more engaging and less rote.

Despite its effectiveness, PBL implementation also presents challenges. Teachers need more time to design appropriate problems and prepare investigation activities. Furthermore, if students are not accustomed to independent learning, they may require more intensive guidance (Kurniasih, 2018). Limited resources and learning time can also impact the effectiveness of PBL implementation. However, these challenges can be overcome through careful planning and the use of simple problems relevant to students' lives.

CONCLUSION

The application of Problem-Based Learning (PBL) in science learning on the topic of changes in state of matter is an effective strategy for improving students' conceptual

understanding and scientific thinking skills. Through the process of investigation and problem-solving, students not only gain knowledge but also develop collaborative, communication, and critical thinking skills. Despite several technical challenges, PBL can still be implemented optimally through proper planning and the selection of problems close to everyday life. Thus, the PBL model is highly suitable for use as a learning approach to improve the quality of science learning in elementary schools.

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