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Improving Problem Solving Skills through Problem Based Learning (PBL) for Students at SMAN 1 Jogorogo

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Abstract

The implementation of the "Merdeka" curriculum requires students to have high-level thinking skills such as problem-solving skills. However, in reality, this is in contrast to the students' ability in solving the real problem. The purpose of this study is to describe the effect of the Problem Based Learning (PBL) model in improving students' problem-solving skills. The Problem Based Learning is a learning model that syntaxes on the problem-solving process, so that students are able to provide solutions and familiarize themselves with the skills of problems analysis, collaboration, communication, creativity and critical thinking. Problem solving indicators that will be measured are connecting information/data to understand the problem, evaluating alternative problem solving presented, and making a design to solve the problem. This research is a Classroom Action Research (CAR) which took place in SMAN 1 Jogorogo with the subject of tenth grade (XA) students totaling 40 on the material of environmental change. The data were collected through observation, written test Daily Test (DT) and documentation which were then analyzed through comparing the average results of each indicator. The results showed that the initial data regarding the indicator of connecting information/data to understand the problem was 76.8%, increased in the first cycle to 82.2%, and in the second cycle to 86.25%. The indicator of evaluating alternative problem-solving initial data was 77.5%, increased in the first cycle to 85% and the second cycle to 87.5%. The indicator of making a design to solve the problem in the initial data was 80% and increased to 82.5% in the first cycle and 85% in the second cycle. From the various explanations above, it shows students' problem solving skills has increased as seen from the Daily Test (DT) scores.

Keywords: *Problem Based Learning (PBL), problem solving, Classroom Action Research (PTK). Environmental Change.*

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A. Introduction

The learning process has an important role in the development of education, especially in Indonesia. This is because the selection of models and methods in the learning process play a big role in developing students' abilities and can achieve effective learning goals. (Haryati & Wangid, 2023). Teachers/educators have mostly considered the characteristics of students and familiarized them with contextual-based learning in choosing learning models. In addition, teachers/educators should carry out the learning process in accordance with the applicable curriculum. Curriculum is one of the most important components in education (Praseto & Hamami, 2020). The current curriculum applied in Indonesia, *Merdeka* curriculum, focuses on diverse intracurricular content in order to deepen concepts and strengthen competencies as well as talents and interests (Suja'i, 2023). The *Merdeka* curriculum aims to implement the concept of independent learning to students. Teachers as educators have the freedom to develop their teaching tools based on the characteristics of students who are adjusted to their talents and interests. It is hoped that students will be able to take part in learning comfortably and without pressure.

Implementation of the *Merdeka* curriculum needs to be done in stages. This implementation refers to the Guidelines for Curriculum Implementation in the Context of Learning Recovery, and Decree of the Head of BSNP No. 008/H/KR/2022 of 2022 concerning Learning Outcomes in Early Childhood Education, Primary Education, and Secondary Education, in the *Merdeka* Curriculum (Cahyani et al., 2023). There are several suggested learning models used in *Merdeka* Curriculum such as Discovery Learning (DL), Problem Based Learning (PBL) and Project Based Learning (PjBL). The learning models aim to provide students with the habit of being able to solve problems through the learning process in class and as a means to develop their talents and interests while focusing on the learners (learner-centered). The material content implemented in the *Merdeka* curriculum is adapted to contextual learning, so that students are able to apply the knowledge gained in everyday life. One of them is in the field of biology.

Biology develops and is understood through scientific procedures that are implemented in practicum. Biology provides experiences to understand the concepts and processes of science (Agustanti, 2019). Therefore, biology is able to provide space for students to conduct experiment in building their own understanding according to the problems that exist (Ikhtiara dkk, 2022). One of the learning habits that can make students solve contextual-based problems is by choosing a Problem Based Learning (PBL) model.

Problem Based Learning (PBL) is a learning model which syntaxes on the problem solving process that encourage students to provide solutions and familiarize themselves with problem analysis skills, ability to work collaboratively, communication skill, creativity skill and critical thinking (Critical thinking and Problem Solving) where these abilities must be possessed by students in the 21st Century (Ariyana et al., 2018)(Saputra, 2021). The Problem Based Learning (PBL) model provides a contextual learning experience as it is based on everyday problems that enable students to have new knowledge and problem-solving skills. This is in accordance with previous research which stated that Problem Based Learning (PBL) is able to improve problem solving skills as it is based on contextual problems that enable students to provide solutions through the stages of the scientific method (Pramudita et al., 2023).

Problem solving skills are students' skills in solving problems. Problem Based Learning is a learning model in which during the process of implementation, students are faced with a real problem that has been experienced by students (Ardianti et al., 2021). PBL aims to integrate real-world problems in society to learning, encourage students to solve problems so that they are able to work well together (Yuniarti et al., 2021). Besides that, Pramudita et al. (2023) added that PBL is able to improve problem solving skills with aspects of analyzing problems, planning problem solving, providing solutions, and correcting the solution steps. In order to know the problem-solving ability of students of XA SMAN 1 Jogorogo, the following results were obtained:

Table 1

Results of Daily Test 1 Based on Problem Solving skills of XA SMAN 1 Jogorogo

Average result (%)	Number of Students
77	40

Source: Archives of biology grades class XA SMAN 1 Jogorogo

Based on the results above, XA class students have an average class score of 77. This is still relatively low because most students do not reach the Minimum Completeness Criteria (KKM) score. Therefore, based on these results, it can be said that the students' problem-solving ability is still quite low. Therefore, further research is needed through the PBL learning model for students of XA SMAN 1 Jogorogo to improve their problem-solving ability.

B. Methods

The type of research used is Classroom Action Research (CAR). Kemmis (in Maliasih et al., 2017) explains that Classroom Action Research is something that must be done by teachers as educators with the main objective of solving problems in the classroom on an ongoing basis. This research describes the cause-and-effect of treatment, as well as describes what happens from the initial process of providing treatment to the impact of the treatment. Classroom Action Research (CAR) is aims to maximize the students' learning process as a reference for teachers in implementing learning that must be planned to make it easier for students to receive and understand the material (Sa'o et al., 2023). The stages of Classroom Action Research (CAR) according to Kurt Lewis consist of four stages; planning; action; observation and reflection (Akram et al., 2023).

The limit of the success of students' problem-solving ability can be seen by comparing the analysis questions between cycle I and cycle II. To determine the percentage of problem solving indicators achievement on daily test questions, the average of each indicator is used, namely according to Arikunto (2013) by using the formula:

$$\mathbf{P} = \frac{\boldsymbol{f}}{\mathbf{n}} \mathbf{X}\ \mathbf{100}\%$$

The target for students' problem-solving ability expected in this study is the category that reaches 80%. Problem solving indicators applied in the problem are connecting information/data to understand the problem, evaluating alternative problem solving presented, and making a design to solve the problem (Rini & Budijastuti, 2022). This research was conducted at SMAN 1 Jogorogo with XA class students totaling of 40 students as the research subjects. The methods and instruments used in data collection are observation sheets of learning observations during class action activities (Muallimin & Cahyadi, 2014), daily written tests to collect information in the form of students' knowledge (Winarno, 2013), documentation as a sign of Problem Based Learning (PBL) activities to measure problem solving skills.

C. Result and Discussion

This study used 2 cycles consisting of planning, action, observation and reflection stages. After the completion of each cycle, students' abilities were measured through daily test

activities with problem solving-based questions. Cycle 1 consists of 2 meetings while cycle 2 consists of 1 meeting. The percentage results of students' improvement in problem-solving skills after being exposed to a Problem Based Learning (PBL) model are as follows:

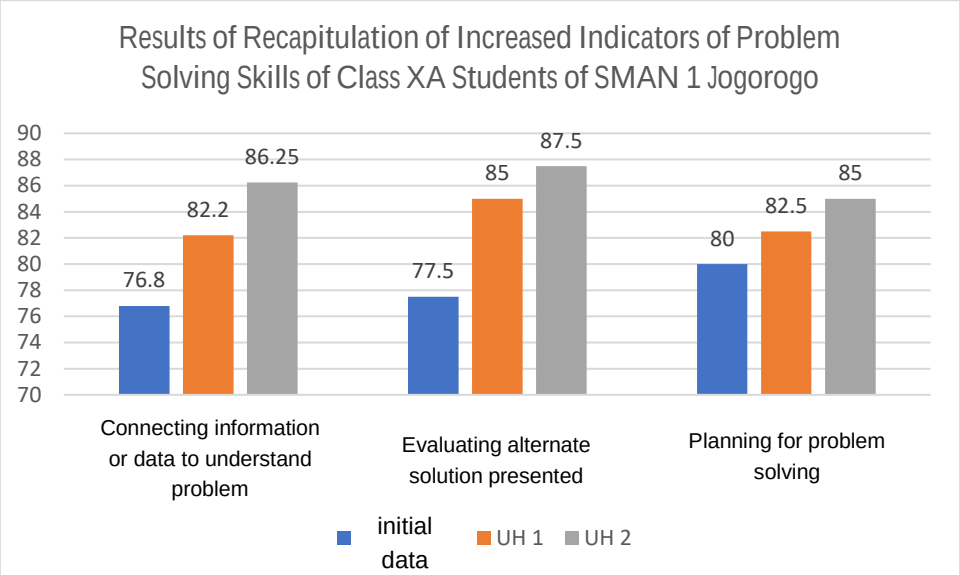

Figure 1. Results of Recapitulation of Improvement in Problem-Solving Skill Indicators of Class XA Students of SMAN 1 Jogorogo

Cycle 1

In the first meeting, students were still unable to optimally participate in learning, seen from the confusion in understanding the stages of the Problem Based Learning (PBL) syntax process which has a problem analysis process. This is because the previous learning process has not familiarized problem solving skills. The first cycle stages begin with learning plan. The basis of the initial data processed is the results of the previous daily test in which from these results, the learning plan for cycle 1 is that students are able to campaign for solutions to environmental change problems through making posters effectively. In this planning stage, the learning process is based on Problem Based Learning (PBL) with students being given cases of environmental change problems, namely some environmental pollution by displaying images of pollution cases. From these images, students are expected to provide appropriate and effective solutions tailored to the pollution that has been determined. The following is the lesson plan for meetings 1 and 2 using the Problem Based Learning (PBL) model:

Table 2. Problem Based Learning (PBL) Lesson Plan

First Meeting		
Syntax	Activities	Problem-solving indicators
Orienting students to the problem	Provided a video on environmental pollution. Provided triggering questions based on 2 pictures of polluted rivers.	Connecting information/data to understand the problem
Organizing students to learn	The students receive the Worksheet (LKPD) from the teacher. The Worksheet (LKPD) contains pictures of various examples of pollution, then learners are expected to analyze the causes, impacts and solutions by making a campaign / call to protect environment in the form of simple poster.	
Assisting independent and group investigations	Students conduct discussions to answer the problems in the Learner Worksheet (LKPD) through literature study.	
Developing and presenting artifacts	Make a poster design based on the results of the discussion.	Evaluate problem-solving alternatives presented.
Analyzing and evaluating the problem-solving process	Make a poster based on a case of environmental pollution and present it to the class.	Make a plan to solve the problem.
Second Meeting		
Syntax	Activities	Problem-solving indicators
Orienting students to the problem	Provided a video of water pollution and asked triggering questions about a picture of a polluted river.	Connecting information/data to understand the problem
Organizing students to learn	In groups, students discuss solutions to water pollution.	
Assisting independent and group investigations	Learners collecting relevant data/information related to the problem formulation of water pollution through appropriate literature.	

Developing and presenting artifacts	Create an interesting explanation diagram based on the pollution case provided. Make a simple water purification plan / design for water pollution solutions.	Evaluate problem-solving alternatives presented.
Analyzing and evaluating the problem-solving process	Analyze and evaluate the water purifier charts and designs that have been made based on feedback from other groups and the teacher.	Make a plan to solve the problem.

Based on the table above, the implementation of learning has been adjusted to the syntax of Problem Based Learning (PBL) and problem-solving indicators. The 1st and 2nd meetings discussed the problem of environmental pollution in environmental change material. Giving cases in the form of pictures and videos aims to make students interested so that they pay attention to the learning process. The challenge of PBL is to find contextual problems and provide facilities for students to be able to build their own understanding and create solutions based on predetermined problems. If the teacher is not able to provide a stimulus for students to think, then the implementation of learning will not go well and the learning objectives will not be achieved. Teachers as facilitators need to provide fun learning activities. Therefore, this Classroom Action Research (CAR) activity needs the collaboration of many teachers and educational practitioners as it is better done collaboratively (Murtafiah et al., 2023).

The next stage is action. Action is to carry out the planning of the learning process. In this action stage, the teacher is assisted by an observer to observe the learning process. The observer's results are the basis for evaluating future activities. In cycle 1, two meetings were held, this is because the first meeting was used as a stabilization and habituation of students to the syntax of Problem Based Learning (PBL). This is meant to help students to understand the flow and make sure they were not confused by the activities in order to achieve learning objectives. The daily test activities were not given in the first meeting as it was meant to help students understand the material. The daily test was given in the second meeting. Based on the results of the daily test, the problem-solving indicator of connecting information / data to understand the problem has reached 82.2%, the indicator of evaluating alternative problem solving presented has reached 85% and the indicator of making a design to solve the problem has reached 82.5%. The data has increased compared to the initial data, but because it is still in the range of Minimum Completeness Criteria (KKM) standards, the researchers conducted the follow-up

research to find out the problem-solving skills of XA SMAN 1 Jogorogo students in the second cycle.

The next stage is observation and reflection. The results of observing the learning process as a whole show that students are active and able to follow the activities well. It can be seen that mutual communication between teachers and students has been created. Learning assignments have also been completed according to the deadline. The results of observation and reflection and the follow-up plan are as follows:

Table 3. Observation and Reflection Results and Follow-up Plan for Cycle 2

Observation Results	Reflection	Follow-up Plan
The students feel bored with the initial group members.	This is because the groups are based on old data which made students feel bored to conduct discussions.	Create new groups based on the ability level and learning style of the learners and adjusted to the students' characteristics.
Students still have difficulty in understanding the purpose of the activities in the problem analysis-based Learner Worksheet (LKPD).	This is because students are less accustomed to understanding problems, so it is difficult to find problems that have been determined. Since it is difficult to understand the problem, it will also be difficult to provide solutions.	Provide additional information or material on the Learner Worksheet (LKPD) to make it easier for students to understand the problem.
Students only make an image product which shows that they do not maximize their abilities, especially in evaluating the products they make.	This is because understanding the material does not involve all senses where students do not maximize their existing abilities in evaluating and designing problem solutions.	Make experimental or practicum-based learning activities so that students are able to maximize their sensory abilities in understanding the material.

A good learning process needs to pay attention to the characteristics of students, especially in problem-solving-based learning. Analysis in solving problems needs to be done by reviewing some literature, so that it is appropriate in understanding the causes of the problem to provide solutions (Argusni & Sylvia, 2019). In solving problems, it is necessary to connect the students' previous the knowledge. Therefore, good teamwork is needed which needs to be considered in the division of groups. Habituation of learners to improve problem solving skills needs to consider their initial knowledge. This is important as a basis for them to understand the

existing problems so that they can provide the right solution. The problem chosen as a stimulus for students needs to be written on the Learner Worksheet (LKPD) and packaged with effective sentences to help students to understand the problem easily and prevent ambiguous meanings.

Cycle 2

In cycle 2, the third meeting produced data on the increase of each problem-solving indicator, namely connecting information / data to understand the problem has reached 86.25%, the indicator of evaluating alternative problem solving presented has reached 87.5% and the indicator of making a design to solve the problem has reached 85%. Based on these results, it can be seen that there is an increase in problem solving skills. This indicates that the habituation of Problem Based Learning (PBL) is able to improve problem solving skills. The results of the data are inseparable from the learning activities that have been conducted. Based on the results of observation and reflection, the learning plan stage is carried out again at the third meeting using the Problem Based Learning (PBL) learning model with practicum activities to make simple water purifiers. The different groups based on the ability of students is created to ensure that the activities are well managed. The reasons for choosing water purification practicum are:

1. Making a water purifier that is done in groups, familiarizes students in managing problems.
2. Making a water purifier requires a lot of senses and analysis to make a device that can purify water.

Based on contextual problems commonly experienced by students related to cloudy water in the bathroom, students are expected to be able to carry it out (Afifullah, 2019). The following is the lesson planning for meetings 1 and 2 using the Problem Based Learning (PBL) model:

Table 4. Problem Based Learning (PBL) Lesson Plan

Third Meeting		
Syntax	Activities	Problem-solving indicators
Orienting students to the problem	The students observe a video on clean water management. The students observe a picture of water management at PDAM.	Connecting information/data to understand the problem

Organizing students to learn	- Students get into groups and receive Learner Worksheets (LKPD) from the teacher. The Learner Worksheet (LKPD) contains the work steps to make a simple water purifier and the reflection after conducting the practicum.	
Assisting independent and group investigations	Learners in groups conduct a simple water purification practicum	
Developing and presenting artifacts	The students present a simple water purifier that is ready to be assessed by the teacher. (creative) The students who succeed in making the water purifier are seen to be able to change the murky water into clear water and are asked to present how to make it to other groups that have not succeeded.	Evaluate presented problem-solving alternatives.
Analyzing and evaluating the problem-solving process	- The students analyze and evaluate simple water purifiers that cannot purify water.	Make a plan to solve the problem.

Based on the results of the third meeting, an increase in problem solving indicators was obtained. It can be seen from the scores of students after working on problem solving-based test questions with three indicators, namely connecting information / data to understand the problem, evaluating alternative problem solving presented, making a design to solve the problem (Rini & Budijastuti, 2022). This is inseparable from the problem-based learning process to make sure that students are accustomed to analyzing problems and being able to answer questions correctly. The practicum-based learning process is concrete so that it provides a good experience for students to build their knowledge (Nisa, 2017). Practicum is an activity that is able to multiply the students' activities to gain new knowledge that can last longer in the memory (Mahzani & Nurma, 2023).

Water purification practicum as a mean for students to increase experience and problem-solving skills, because students are expected to analyze problems and provide appropriate solutions. Providing this solution needs evaluation activities so that the product created by the students can be used according to its function. This is because during the

experiment of making water purification devices, several groups failed in making it work which can be seen from the purified water which is still cloudy. From these new problems, students are asked to re-experiment to encourage them to think of the solutions so that the tools they have made can function well.

D. Conclusion

Based on the results of the research, Problem Based Learning (PBL) is able to improve problem solving skills, especially in the biology material of environmental change to students of XA SMAN 1 Jogorogo. This can be seen by analyzing 3 indicators of problem solving, namely connecting information / data to understand the problem, evaluating alternative solutions to problems presented, and making a design to solve the problem. The three indicators have increased in every cycle. Analysis of the 3 indicators is included in learning activities and Daily Test (DT) of Biology material on environmental changes. The suggestion of this research is it should be applied to a wider range of materials and other subjects, so that the opportunity for students to familiarize themselves with problem solving skills becomes wider.

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