The effect of problem based learning (PBL) model accompanied multirepresentation based LKPD on learning outcomes

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A B S T R A C T

This study is useful to know the influence of learning models problem-based learning (PBL) accompanied multirepresentation based LKPD of science learning outcomes of Junior High School Class VIII. This is quasi-experimental study. Population wear class VIII students SMP Negeri 10 Jember. The research sample was determined using the method purposive sampling area namely class VIII G as many as 33students and class VIII H as many as 32 students. Learning tools in the form of (1) syllabus, (2) lesson plan, and (3) LKPD based on multirepresentation. The main data retrieval technique is test in the form of a description of 10 questions that lead to higher older thinking skill (HOTS) to see the result of congnitive learning carried out tests pretest, posttest, and the grid of the questions. Supporting data retrieval techniques are monitoring sheets, interviews, and documentation. The result of the research were normality test and homogeneity test approved so that the average score posttest different experimental and control class learning outcomes or learning models problem-based learning (PBL) accompanied multirepresentation based LKPD affect the learning outcomes of Junior Hight School science class VIII. The statement proves that learning using PBL learning model with multirepresentation based LKPD allows achieving learning science learning outcomes.

INTRODUCTION

Education in Indonesia is changing according to the times that contribute to progress and quality of human resources. The process of educational progress cannot be separated from the Learning Natural Science (Astuti, 2020). Learning Natural Science (IPA) is a learning process in gaining knowledge, skills, and behavioral transition of learners with educators in order to achieving goals desired namely mastering scientific concepts and understand the phenomenon of natural phenomena that occur (Rahmawati et al., 2018). The nature of science learning itself is defined as teaching that includes attitudes, processes, product and applications regarding the concept of science with a series of scientific methods in getting the truth in an informant. Science not only discusses a collection of concepts, principles or fact, but mastering these concepts through the process of discovery, so that the learning process of learners should further improve their Higher Order Thinking Skill (HOTS) *(Sari et al., 2022).*

In Science Learning, students are required to be able to apply the knowledge gained in activities every day and the need to have an active, creative, and innovative attitude (Kusnandar, 2019). The activeness of learners is supported by the role of teachers as facilitators in learning activities (Ridlo et al., 2020). If the learning activity is always dominated by the teacher and the use of the approach used does not involve student, then students will tend to depend on what the educator explained and result low learning outcomes (Gulo, 2022). Based on the result of PISA measurements on in 2018 aspects of literacy, mathematics, and science, from 78 participating countries Indonesia was set at the 70th position. This shows that Indonesia has a low quality of science (Fuadi et al., 2020). Low student learning outcomes due to difficulties in understanding the learning material, the lack of student activities in the learning process, and the learning atmosphere is less fun (Nabillah & Abadi, 2019). In addition, there has been no development of learning teaching materials according to subject matter based on basic competencies (Tyas et al., 2020).

The results of study is capabilities participants educated after gaining the experience of learning in the form of knowledge, attitudes, and skills. The result of the study is capabilities it is owned by the participating after receipts of learning experience during learning activities (Wahyuningsih, 2020: 65). Capabilities learning outcomes in various domains caused by the quality of learning obtained from capabilities learners in accepting learning experiences (Lisnamayanti et al., 2019). Learning outcomes realm cognitively focused against the development of brain skills and thinking learners. According to Bloom, the cognitive realm consists of six levels that include memory, mastery, application, analysis, synthesis, and evaluation (Zulqarnain et al., 2022). Learning outcomes on the ability of knowledge in the higher order thinking skill (HOTS), students need to be faced in solving problems that are able to activate students as the actors during learning and seek to optimize their intellectual abilities. HOTS is the ability of the realm of knowledge consisting of capabilities analyze, evaluate, and create (Permana & Utomo, 2021). One of the efforts to improve cognitive learning outcomes, especially higher order thinking skill is by using learning models Problem Based Learning (PBL) accompanied multirepresentation based LKPD. Learning activities using PBL model more effective uses learning materials in the form of student worksheets based on multirepresentation which contains a more concrete concept description (Nurfaida et al., 2020).

Learning models Problem Based Learning (PBL) is a problem based teaching method, learners work in groups and practice to find solutions, think analytically, able to determine and use appropriate learning materials (Hotimah, 2020). The process of using the PBL learning model begins form problems that are linked to the routine of life in general, thus being able to direct in organizing the problems that will be discussed in the learning process (Mahardika et al., 2017). PBL models are also able to maximize higher order thinking skill by designing problems in a real context (Velly, 2021). The identity of the PBL model is to raise problems, centered on interdisciplinary, cooperation, factual questions, and make real work (Satriawati et al., 2020).

The PBL Models is one of the learning models that help 21st century teaching activities (Suratno et al., 2020). 21st century learning reference center capabilities learners dig information from various sources, interpreting problems deep thinking and cooperation as well as collaborating and communication to solve problems (Muhtarom & Kurniasih, 2020). The PBL learning models has 5 steps is including orienting learners on problems, organizing learners to learn, guiding individual or group experience, developing and presenting work, analyzing and evaluating problem-solving processes (Widyaningrum et al., 2018) .

Student Worksheet (LKPD) namely one of the optional teaching materials to support students learning (Rizkika et al., 2020). Implementation of learning with multirepresentation based LKPD is different form LKPD in general. This is because the commonly used LKPD is dominated only by verbal representations, making it difficult for students in understand the material in other representations and cause students not interested in using LKPD (Antika et al., 2022). Multirepresentation based LKPD is a teaching material that includes several representation of concepts that make it easier for student to master representations that present a more concrete concept (Nurfaida et al., 2020). So that students able to manage information that is easily received by being given an illustration that is easily found in everyday life in the form of a more diverse representation. In the with Siahaan et al. 2020 explain that multirepresentation can be believed to minimize the difficulty of students in learning to concept of science. The three main functions in using multirepresentation based LKPD are complementary in the cognitive phase of learners, reducing the chances of other misinterpretations, creating a deeper mastery of concepts in learners (Putri et al., 2020).

The use of multirepresentation based LKPD on PBL models is able to encourage the activeness of learners, able to overcome differences in students ability to understand a science concept and reduce the difficulty of students in the learning process (Swiyadnya et al., 2021). Another advantage is that learners can solve problems by observing the phenomena that occur and help fins results of experimental data and prove hypotheses made (Hasanah et al., 2021).

METHODS AND MATERIALS

Place, Time, and Research Data Sources

The study was conducted at SMPN 10 Jember with the subject of the study being students of class VIII SMP academic year 2022/2023 odd semester who are studying the material additives and addictive substances. Components of learning activities using syllabus, lesson plans, and LKPD based multirepresentation.

Types and Design of Research

This is an experimental study (quasi experiment). This design uses a control group that does not entirely control the variables that have an impact on the implementation of the experiment. Experimental classes using models problem-based learning (PBL) accompanied multirepresentation based LKPD, the control class is a class that uses a direct instruction models.

The design of the study is pretest posttest nonequivalent control group desain and method used is purposive sampling area means the collection of samples

selected according to specific criteria to the object and purpose of the researcher. The research design is reviewed in **Table 1**.

Table 1. Research design pretest posttest nonequivalent control group design

Groups	Pretest	Treatments	Posttest
Experiment	O_1	X	O_2
Control	O_1	-	O_2

Description

O_1 : Prestest results

O_2 : Posttest results

X : Treatment

Research Procedure

Stages that are carried out in order to meet the research objectives include: 1) Preparing research such as completing research permits, preparing research instruments, consulting with supervisors and school authorities regarding the procedures carried out, 2) Carrying out observations and interviews at relevant schools, 3) Determining the research population, 4) Determine the research sample, 5) Carry out research samples pretest in order to see the learning outcomes, 6) Implement learning experiment class using PBL learning model and control class using direct instruction model that is often used by teachers, 7) Conduct posttest to determine the effect of learning models in the both classes, 8) Collect data obtained during the study, 9) Analyze the data obtained during the study, 10) Design the result and discuss the analysis of data obtained, 11) Conclude from the result of research that has been carried out.

Data Collection and Data Analysis

The main data retrieval technique is a test in the form of a description of 10 questions that lead to higher order thinking skill (HOTS) in order to calculate the learning outcomes of the cognitive realm, the test is carried out pretest and posttest as well as the grid of test questions. Supporting data retrieval techniques are observation sheets, interviews, and documentation.

The resulting data then in normality test using Shapiro-Wilk test to measure the information received normal distribution of sample data following the normal distribution. The next data in hypothesis test using Independent Sample t-Test to test the difference between experimental and control class average.

RESULTS AND DISCUSSIONS

Results

Learning to use the Problem Based Learning (PBL) model is carried out in the material of additive and addictive substances in class VIII in odd semesters. Learning activities is provided with student worksheet based multirepresentation listed the presence of verbal representation, images, tables, and graphs. Based on the research that has been carried out, obtained the average value of learning outcomes experimental class and control class. The average value is reviewed in Figure 1.
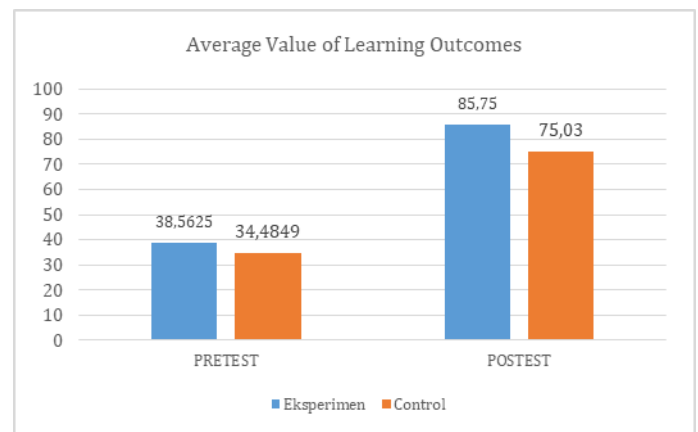
Figure 1. Data on the average value of student learning outcomes

Furthermore, the normality test analysis of the impact of PBL learning models on pretest and posttest learning outcomes of experimental and control class in reviewed more clearly in Table 2.

Table 2. Normality test of pretest and posttest learning outcomes

	Class	Shapiro Wilk		
		Statistic	df	Sig.
Pretest value	Experiment	.971	32	.533
	Control	.960	32	.257
Posttest value	Experiment	.964	32	.354
	Control	.964	32	.327

Normality testing uses the Shapiro-Wilk test. The test was conducted using a significance scale of 0,05 is if the significance scale is greater than 0,05 then the data produced are normally distribution, if the significance scale is smaller than 0,05 then the data are not normally distribution. Based on Table 2 shows the Sig. value posttest

value for experimental class is 0,354 and control is class 0,327 then the test result normally for the posttest data are normal distribution because sig. (2-tailed) greater than 0,05. After the pretest and posttest data are said to be normally distributed, then the homogeneity value is analyzed. The homogeneity test was carried out with a significance scale of 0,05 using the Levene Test. Than, is if the sig. > 0,05 then the data is homogeneous and if the sig. < 0,05 the data is not homogeneous. The test results are reviewed in **Table 3.**

Table 3. Test of the independent sample t-test value of learning outcomes

Levene's Test for Equality of Variances			
		F	Sig
Learning Outcomes	Equal variances assumed	.519	.474
	Equal variances not assumed		

Based on **Table 3** found Sig. value Levene's Test for Equality of Variances obtained results of 0,0474. Homogeneity test results found a value greater than 0,05 so it said the data from both groups of learning outcomes are homogeneous, so use the row Equal variances assumed. Furthermore, hypothesis testing using test Independent Sample T-Test reviewed in Table 4.

Tabel 4. Hypothesis test independent sample t-test

Independent Samples Test							
t-test for Equality of Means							
						95% Confidence Interval of the Difference	
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Learning Outcomes	Equal variances assumed	7.52	63	.000	10.719	1.4252	7.8716	13.568
	Equal variances not assumed	7.51	61.8	.000	10.719	1.4276	7.8658	13.574

Hypothesis testing results above show that the test criteria obtained are the value sig. (2-tailed) is 0,000 means H_0 rejected and H_α received and the value is smaller than 0,05 there is a difference in the average score posttest experimental class and control class. This proves the application of learning model problem-based learning (PBL) accompanied by multirepresentation based LKPD has a significant influence on student learning outcomes.

DISCUSSIONS

The different learning outcomes of the experimental class and the control class are influenced by the teaching model used. According to Pratiwi (2022) than in teaching activities teachers are required to use innovative and varied learning models to improve student learning outcomes as a whole from the realm of cognitive, affective, and psychomotor. The use of PBL models accompanied multirepresentation based LKPD in learning, student learning outcomes increase and are more active when participating in learning. Learning using the PBL model is done by discussion with the group, so that learners feel challenged to solve problems, able to cultivate their curiosity and able to develop their knowledge. According to Burhana et al. (2018) PBL itself emphasizes authentic learning by solving problems through the process of investigation, discussion, gathering information, conducting experiments and observations, and making conclusions. The existence of such a process students will find a variety of solutions and actively involved in integrating the understanding and content of each matter. Agreed by Wardani (2020) said that the PBL model can enable students to be visible in the process of acquiring information and building student knowledge.

The advantages of the application of the PBL model are able to increase learning outcomes and presence of new knowledge. Reinforced by research result Kusnandar (2019) PBL learning model raises student knowledge learning outcomes. In accordance with research by Aslam et al. (2021) saying that there is a positive influence of PBL model with learning outcomes, it means that learning outcomes can be increased by applying PBL model. Research results by Reinsini et al. (2021) that problem based learning models positively impact students cognitive learning outcomes.

Learners easily explore using a combination of multirepresentation based LKPD with verbal representations, tables, graphs, and images and present events in daily activities. This is reinforced by the opinion Mahardika (2016: 546) namely the emergence of a variety of representations to support students explore the concept of material. In line with Anggraini et al. (2022) that multirepresentation based LKPD good effect on the ability of learnes knowledge and tend to assume easy to understand with the combination of various representations. Result of the study Nurzaman et al. (2018) said that the use of PBL model accompanied multirepresentation based LKPD is also useful in improving higher order thinking skill (HOTS), with one of the reasoning abilities. Students when given multirepresentation based LKPD will tend to deepen the subject matter through the representations presented, so

that they can focus on organizing data and information from basic knowledge to high level knowledge.

CONCLUSIONS

Learning by using the model Problem Based Learning (PBL) accompanied multirepresentation based LKPD is able to improve student learning outcomes. The learning process with PBL model accompanied multirepresentation based LKPD makes it easier for students to understand and manage information by presenting events in daily life and the presentation representation in the form of verbal, graphic, table, and pictures.

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Author's Contribution

All authors reviewed the results and contributed in full from the beginning to the final manuscript.

Conflict of Interest

All Authors have no conflict of interest and are able to work professionally.

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