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The Influence of Problem Based Learning Model Accompanied by Multirepresentation based Physics Worksheets On Students' Learning Motivation

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ABSTRACT

This research examines the significant influence of using the problem-based learning model accompanied by multi-representation-based physics students worksheets on junior high school students' learning motivation. The study used a quasi-experiment with a nonequivalent control group research design. The research subjects were students in class VIII of SMP Katolik Santo Petrus Jember, even during the semester of the 2022/2023 academic year in May, with the number of respondents being 52 students divided into experimental and control classes. Data collection uses test techniques in the form of pretest-posttest and non-test in the form of questionnaire sheets accompanied by data analysis techniques in the form of normality test, independent sample t-test, and a right-tailed t-test. The research results show that the use of the problem-based learning model accompanied by multi-representation-based physics students worksheets has a significant influence on increasing junior high school students' learning motivation.

Keywords : Problem-Based Learning; Multirepresentation; Physics Students Worksheets; Learning Motivation

I. INTRODUCTION

Science subjects are the management of natural knowledge given to students by teachers regarding facts, principles, concepts, processes, and scientific attitudes in their discoveries. Additionally, science also leads to the development of competence and direct experience where students must be active in learning to relate to real life and can show their activeness during the learning process [1] . Activeness here is closely related to students' desire to carry out learning, or in other words, students' motivation to participate in education. Student learning motivation is one factor that makes students successful in learning. Students with high learning motivation will easily accept lessons, and the resulting learning attitudes will be more positive [2]. Apart from that, motivation plays an important role as a driver for achieving achievement; this is because each student will try to encourage their desires and determine the direction of their actions in order to achieve the desired goals [3]. However, in reality, students' learning motivation still needs to improve, mainly when science learning occurs [4].

The lack of student motivation to learn is caused by the teacher's inability to use interesting learning strategies during the learning process [5]. One example of a less interesting learning process is when teachers use teacher-centred learning methods, which tend to bore students and limit their understanding of the material being taught [6]. The problem of low student learning motivation is also because the material presented by the teacher is considered difficult and tedious, so students feel unenthusiastic in the learning activities provided [7].

In response to this problem, much research has been carried out, including explaining that using the problem-based learning model is more effective because it positions students as the main actors in overcoming problems designed by the teacher so that students will be active and innovative during learning [8]. [9] Also explain that the problem-based learning model has several appropriate and organized learning syntaxes, where students are more active than teachers, so that it will provide learning that is directed towards students (students-centered learning). Apart from that, other research explains that the problem-based learning model is relevant to classroom learning, especially for students who need teacher assistance solving the given problems [10]. The problem-based learning model gives the teacher the role of guiding students to solve problems related to the material provided. These problems include those related to students' daily activities so that students can solve problems individually and in groups which is determined at the beginning of learning by the teacher [11]. At the end of the problem-based learning process, students are expected to explain the results of their group discussions, allowing for the exchange of various ideas and answers between students; the teacher's job is supervising in the final session [12]. The problem-based learning model helps teachers and students as a whole and directs teachers and students to intellectual problem-solving with a scientific approach [13]. From this explanation, the problem-based learning model positions students as the main subject in the learning process, accompanied by the teacher as a facilitator to make students active in developing innovative, creative, and scientific attitudes.

Based on the results of previous research and existing correlations, the researcher proposed an idea to help students understand concepts more quickly and overcome difficulties during learning, namely by implementing a problem-based learning model accompanied by multi-representation-based physics students worksheets (LKPD). Physics student worksheets (LKPD) are teaching materials that contain summaries of material and instructions for completing assignments related to basic competencies that are used with the aim of helping and facilitating teachers in managing learning, as well as guiding students in work groups so that they can improve their skills so they can achieve learning goals [14]. Multirepresentation is the use of two or more representations displayed in verbal, pictorial, graphic and mathematical form to explain a concept [15]. Thus, multi-representation-based physics student worksheets (LKPD) provide a good correlation between teachers and students, which includes learning concepts in different forms. The meaning of this difference is that the LKPD is arranged systematically and contains four multi-representation formats, namely verbal representation, images, graphics, and mathematics [16]. So it can be concluded that the problem-based learning model accompanied by multirepresentation-based physics student worksheets (LKPD) is a learning approach in which students are faced with a problem described in an LKPD teaching material so that learning objectives can be achieved both towards mutual verbal, graphic, pictorial and mathematical representations and connected so that the information from each answer in the LKPD creates a perspective that suits each student's spatial abilities [17]. This will most likely increase students' learning motivation so that they can achieve the desired learning goals.

II. METHOD

The research used is quantitative research conducted in the even semester of the 2022/2023 academic year. The type of research used was a quasi-experiment accompanied by a nonequivalent control group design.

Table 1. The research design is nonequivalent control group design

Class	Pretest	Treatment	Posttest
Experimental	O	X	O
Control	O	-	O

(Source: Ref [18])

This research was conducted from May 16, 2023, to May 30, 2023, at SMP Katolik Santo Petrus Jember. The research population was all students in class VIII of SMP Katolik Santo Petrus Jember with a sample of two classes, namely class VIII A as an experimental class using a problem-based learning model accompanied by a multi-representation-based physics students worksheets (LKPD). In contrast, class VIII B, as a control class, used a learning model commonly used by school teachers (discovery learning). However, each class receives the same material in their treatment: vibrations, waves, and sounds in everyday life. Data collection techniques use questionnaires/non-test sheets. This non-test technique contains questions totaling 30 points containing positive and negative statements following the following learning motivation criteria:

Table 2. The learning motivation criteria

Levels (%)	Description
$84 < x \leq 100$	Very High
$68 < x \leq 84$	High
$52 < x \leq 68$	Moderate
$36 < x \leq 52$	Low
$20 < x \leq 36$	Very Low

After conducting the research, analysis of learning motivation data was taken using a Likert scale with the formula:

$$N = \frac{S}{SM} \times 100\ \% \qquad (1)$$

Information :
N : Final score obtained
S : Score obtained
SM : Score maximum

Then, after obtaining student learning motivation data from the experimental and control classes, a statistical test was carried out to test the significance of the influence of the problem-based learning model accompanied by multi-representation-based physics students worksheets (LKPD). The test steps use a normality test with a significance level of 5% [19]: 1). Sig. (significance) > 0.05 is said to be normally distributed. So, the following data analysis applied was the independent sample t-test. 2). Sig. (significance) < 0.05 is said to be non-normally distributed. So, the following data analysis applied the Mann-Whitney test. If the data is said to be normal, then an independent sample t-test is carried out with the hypothesis:
H_0 : There is no significant difference in the score or average value of the results and learning motivation of the pretest-posttest experimental and control classes.
Ha : There is a significant difference in the score or average value of the results and learning motivation of the pretest-posttest experimental and control classes.

The criteria for using decisions [20]: 1). p (Sig.) > 0,05 H_0 is accepted and H_a is rejected, meaning there is no significant difference in scores or outcome values and student learning motivation from both the experimental class and the control class. 2). p (sig.) < 0,05 H_0 is rejected and H_a is accepted, meaning that there is a significant difference in scores or outcome values and student learning motivation from both the experimental class and the control class. Next, a right-tailed t-test is carried out; the hypothesis is as follows:
$H_0 = R1 \leq R2$, where the average score of the experimental class is not superior to the control class.
$H_a = R1 \geq R2$, where the average score of the experimental class is superior to the control class.

By paying attention to the right-sided t-test criteria as follows: 1). (H_0) the null or nil hypothesis is accepted, then (H_a) is rejected if $t_{count} < t_{table}$ and 2). (H_0) the null or nil hypothesis is rejected, then (H_a) the alternative hypotehesis is accepted if $t_{count} > t_{table}$.

III. RESULTS AND DISCUSSION

This research aims to examine the influence of the problem-based learning model accompanied by multi-representation-based physics students worksheets (LKPD) on junior high school students' learning motivation. The data obtained in this research is in the form of learning motivation scores obtained from a questionnaire sheet; the questionnaire contains an assessment scale with a score range of 1 – 5, which is then interpreted using a Likert scale. The learning motivation data obtained is as follows:

Table 3. Data on learning motivatuon for experimental class and control class

Class	Experimental Class	Control Class
The Number of Students	26	26
Highest Score	88,67	84
Lowest Score	59,33	51,33
Average	74,66	67,26
Standard Deviation	7,11	8,15

Table 3 shows that the average learning motivation score for the experimental class is higher than that of the control class. The average score for learning motivation in the experimental class reached 74.66, while in the control class, it only reached 67.26. Meanwhile, the average learning motivation score for each indicator found can be seen in the following table:

Table 4. Average learning motivation score for each indicator

Learning Motivation Indicators	Experimental Class	Control Class
There are exciting activities in learning	19,83	18,57
Resilient in facing difficulties	22,17	18,23
Quickly bored with routine tasks	18	17,17
Can defend his opinion	17,67	16,33
There is encouragement and a need to learn	19,37	17,13

Table 4 shows that the experimental class has a higher average learning motivation score for each indicator than the control class. Each hand of learning motivation for each type shows variations or varying results. The results of the learning motivation indicator in the experimental class showed that the highest indicator was "resilient in facing difficulties," with a score of 22.17. In contrast, the lowest score was the indicator "can defend his opinion," with a score of 17.67. The hand of learning motivation in the control class shows the highest indicator, "there are exciting activities in learning," with a score of 18.57. In contrast, the lowest score is the indicator, "there is encouragement and a need to learn," with a score of 17.13.

After obtaining the average learning motivation score for each experimental and control class, a statistical test was carried out to determine the significance value to examine the influence of the problem-based learning model accompanied by multi-representation-based physics students worksheets (LKPD) on junior high school students' learning motivation. The first statistical test used is the normality test; here are the calculation results:

Table 5. Test of normality of learning motivation

Tests of Normality							
		Kolmogorov-Smirnov			Shapiro-Wilk		
	Class	Statistic	df	Sig.	Statistic	df	Sig.
Learning Motivation	Experimental Class	.107	26	.200*	.983	26	.937
	Control Class	.146	26	.164	.971	26	.655

Based on Table 5, the normality test for learning motivation using the Kolmogorov-Smirnov test showed that a significance score for the experimental class was 0.200, while for the control class, it was 0.164. Thus, the learning motivation score concludes that the significance is more significant than 0.05 (Sig. > 0.05). So, the learning motivation score on the normality test can be said to be normally distributed, so the next stage is to carry out a second test or t-test in the form of an independent sample t-test statistical test which has the aim of showing a significant comparison of the average student learning motivation scores between the two classes. The results of the independent sample t-test calculation of student learning motivation can be presented as follows:

Table 6. Independent sample t-test of learning motivation

Independent Sample test							
		Levene's Test for Equality of Variances		t-test for Equality of Means			
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference
Learning Motivation	Equal variances assumed	.323	.572	3.487	50	.001	7.400
	Equal variances not assumed			3.487	49.089	.001	7.400

The independent sample t-test output in Table 6 states Sig. (2-tailed) guided by the independent sample t-test decision, a data value of 0.001 was obtained, which means the significance value is smaller than 0.05 (0.001 < 0.05), so it can be said that H_0 is rejected while H_a is accepted. From this, it was explained and obtained that there was a significant difference in the average student learning motivation scores between the experimental and control classes. Next, a hypothesis test was carried out in the form of a a right-tailed t-test to compare the average learning motivation scores in which class was better and superior between the experimental and control classes. The results obtained for learning motivation in the right-tailed t-test can be seen in Table 7 as follows:

Table 7. Right-tailed t-test of learning motivation

Class	Average	t_{count}	t_{table}	Description
Experimental	74,66	3.487	1,675	H_a is accepted
Control	67,26			H_0 is rejected

Data obtained from the right-tailed t-test Table 7 shows count with a value of 3.487, while the table has a value of 1.675. So that the value of t_{count}> t_{table} and paying attention to the decision criteria of the right-tailed t-test, then H_0 is rejected. At the same time, H_a is accepted, meaning that the experimental class has a better average score for learning motivation than the control class. Based on this, the problem-based learning model accompanied by multi-representation-based physics students worksheets students (LKPD) significantly affects junior high school students' learning motivation.

After data analysis, research results were obtained, which showed that the problem-based learning model accompanied by multi-representation-based physics student worksheets (LKPD) had a significant influence on junior high school students' learning motivation. The PBL model used in the experimental class makes students the centre of learning activities (student centre learning) who are active in solving problems from the teacher during the learning process. Through this active involvement, students can stimulate understanding and remember the essence of the teaching material studied [21]. This is also in line with the results of previous research, which stated that the problem-based learning model succeeded in making students improve their creative thinking abilities and become more imaginative, introducing innovative thinking, and encouraging them to increase their self-confidence in learning, one of which is students' learning motivation [22]. Apart from that, in using this problem-based model, teachers are able to deepen their knowledge about how to teach, which makes the teacher not only focus on teaching skills but also focus on other teaching skills that are more innovative and interesting [23].

The application of the problem-based learning model during the research was also accompanied by a multi-representation-based Physics Student Worksheet (LKPD), namely a student worksheet that contains several representations such as verbal, mathematical, pictures and graphs with the aim that when using them, students can provide ways to solve problems and understand context or physics concept being studied. During the learning process, it was proven with good results that the problem-based learning model accompanied by multi-representation-based Physics Student Worksheets (LKPD) made experimental class students more active and enthusiastic compared to the control class whose learning used the model usually used by teachers (discovery learning). This is also in line with previous research that the role of multi-representation-based Physics Student Worksheets (LKPD) on learning motivation is to stimulate students to be creative in arranging ideas into LKS so that they can establish connections between the questions given. Teachers and answers produced by students [24]. On the other hand, the use of multi-representation-based Physics Student Worksheets (LKPD) also supports students' conceptual understanding of various aspects of multi-representation. The point is that through worksheets, students can be motivated and more easily understand and complete the learning process, especially if they are accompanied by verbal, mathematical, pictorial and graphic representations that are relevant to the material being discussed [25].

IV. CONCLUSION

Based on the results of the research, it can be concluded that applying the problem-based learning model accompanied by multi-representation-based physics students worksheets (LKPD) significantly influences the learning motivation of class VIII middle school students at SMP Katolik Santo Petrus Jember so that the application and use of the problem-based learning model can be used as an alternative to support increasing the learning motivation of junior high school students in achieving the expected goals.

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