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The Effect of Problem-Based Learning in Reducing the Misconceptions of Junior High School Learners on the Material of Substance Pressure

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Abstract
Various things experienced by science teachers (physics) in delivering material to students, especially the difficulty of absorbing and understanding the concepts conveyed by the teacher. This can be caused by the teacher's lack of understanding of the characteristics of the students themselves, and also the lack of concentration in following the learning material presented by the teacher starting from the introduction, core activities and closing so that the knowledge gained is only a piece of it. This study aims to determine the effect of problem-based learning on reducing students' misconceptions through students' learning outcomes on pressure material at state junior high school 7 Medan. This research is a pre-experimental design of one-group pretest-posttest type. The sampling technique used was purposive sampling considering that 8th-1 class is heterogeneous, consisting of different genders, religions, ethnicities, and races. The results showed that the indicator knew the concept 42%, did not understand 17.67%, and misconceptions 40.33%. After being given the problem-based learning action, knowing the concept increased by 34%, not understanding and misconceptions decreased to 8% and 25.66% respectively. Furthermore, t-test was conducted to determine the difference before and after treatment, obtained t-count = 26 with t-table = 2.04 at a significance level of 0.05, so Ha was accepted. The average value of <N-Gain> of 0.6 is classified as moderate which indicates that 60% of problem-based learning variables can improve concept understanding and reduce misconceptions on the material of substance pressure of state junior high school 7 Medan students.

Keywords: misconceptions; pressure; problem-based learning.

INTRODUCTION

Education is a means or bridge for humans to develop their potential through the learning process obtained. Education can also be defined as all learning experiences that take place in all environments and throughout life (long life education). To achieve educational goals, teachers play an important role in building character, creating an active, fun learning atmosphere, so that students can absorb and receive the knowledge conveyed by the teacher. Science (Physics), one of the subjects studied in junior high school, has various problems in learning, including the difficulty of students in absorbing and understanding the concepts conveyed by the teacher. One of the goals in physics subjects is to "bring learners to master physics concepts and be able to relate them to everyday life" (Saputri & Nurussaniah, 2015). "Physics learning emphasizes understanding concepts rather than memory"(Sholihat et al., 2017)

"In physics learning, students cannot always accept what is conveyed by the teacher because physics learning contains many scientific concepts, so sometimes the concepts understood by students are not in accordance with the concepts adopted by experts," (Sholihat et al., 2017). Based on this definition, the concept is the basic foundation for students to think

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but understanding concepts that are abstract and too complex will be difficult for students to accept in understanding a concept applied.

"The incompatibility of understanding that is often experienced by students is called misconception or allternative concept, where misconception is an obstacle for students to understand and master the material because misconception is said to be a mistake" (Sholihat et al., 2017). "Misconception as a naïve view and defining it as an idea incompatible with the now accepted scientific understanding" (Fakhruddin et al., 2012). Based on this definition, misconception is an understanding of students that is not in accordance with the understanding of experts which is an obstacle for students in understanding a material. "Misconception or misconception refers to a concept that is not in accordance with scientific understanding or understanding accepted by experts, for example students argue that when someone pushes a car and the car has not moved, there is no force acting on the car. The concept is wrong because even though the car is not moving, in the car there is a force caused by the push." (Nainggolan, 2016).

Many attempts to find out misconceptions have been made, but until now there are still difficulties in distinguishing between students who experience misconceptions and those who do not know the concept. The method used to identify student misconceptions uses diagnostic tests that can be used to find out students' strengths and weaknesses when learning something, so that the results can be used as a basis for providing follow-up (Rusilowati, 2015). One method that can be used in identifying misconceptions is the four-tier diagnostic test which has four levels of tests. The first level is a multiple-choice question with four deceivers and one answer key that students must choose. The second level is the student's level of confidence in choosing answers. The third level is the reason students answer questions. in the form of closed reasons. The fourth level is the level of confidence of students in giving reasons, (Sheftyawan et al., 2018). Using a four-tier diagnostic test has the advantage of distinguishing the confidence level of the answers and the confidence level of the reasons students choose so that they can dig deeper into the power of understanding, diagnose misconceptions that they experience more deeply, determine parts of the material that require more emphasis, and plan better learning to help reduce student misconceptions (Rusilowati, 2015). In diagnostic tests using techniques certainty of response index (CRI) to distinguish learners with lack of knowledge from misunderstandings (Hasan et al., 2014). The CRI technique is very easy to express misconceptions because there is a scale of respondents' confidence in answering the questions given (Saputri et al., 2016). CRI is useful for knowing the level of confidence of students in responding to the questions provided.

Based on interviews with science subject teachers, information was obtained that the learning model used in teaching science, especially to 8^{th} students, varied depending on the subject matter presented, but on the substance pressure material the teacher used a conventional learning model with a lecture method and gave practice questions to students, and the learning results obtained were not satisfactory. Furthermore, the solution carried out by the teacher is to provide opportunities for students to rework the questions that have been tested before.

If this misconception is left unchecked, it is likely that other misconceptions will occur, and must be corrected so as not to affect the understanding and learning outcomes of students. One way to improve is to apply appropriate learning models to support learners' understanding of concepts. According to Tan (Rusman, 2014) Problem-based learning is the use of the full range of intelligence needed to confront real-world challenges, the ability to deal with everything new and the complexity that exists. Further (Silaban et al., 2022) the problem-based learning model is a learning model that uses real problems encountered in the environment as a basis for acquiring knowledge and concepts through the ability to think critically and solve problems. Problem-based learning is a learning model that involves real problems that are often encountered by students in real life, thus students can solve problems and find solutions to the problems faced.

This is in line with what was stated by (Barao et al., 2022), that in general, problem-based learning can be explained as a teaching model that is characterized by the existence of problems that are often found in the real world (real life) as materials to teach students in teaching, so that they are able to develop knowledge and critical thinking skills and solve problems.

In its implementation, problem-based learning follows five main steps: (Arends, 1997)(Fogarty, 1997)(Clarke, H. J., &; Agne, 1997) as shown in Table 1.

Table 1. Sintax for problem-based learning

Phase	Teacher Behavior
Phase 1 Orient students to the problem	Teachers goes over the objectives of the lesson, describes important logistical requirements, and motivate learners to engage in self-selected problem-solving activity.
Phase 2 Organize students for study	Teachers helps students define and organize study tasks related to the problem.
Phase 3 Assist independent and group investigation.	Teachers encourages students to gather appropriate information, carry out experiments, conduct experiments, and search for explanations and solutions.
Phase 4 Develop and present artifacts and exhibits	Teachers assists students in planning and preparing artifact such as reports, video, and models and helps them share their work with others.
Phase 5 Analyze and evaluate the problem-solving process	Teachers helps students to reflect on their investigations and the processes they used.

This research was only conducted in one class called the experimental class to see how problem-based learning Can reduce students' misconceptions on substance pressure material by using diagnostic tests four-tier. Based on the background, the purpose of the study was formulated to determine the influence problem-based learning towards reducing student misconceptions through student learning outcomes on pressure material at state junior high school 7 Medan.

METHODS

The method used was pre-experimental design type one-group pretest-posttest and purposive sampling technique. This research design was chosen because it only uses one group of research subjects as an experimental class. In this study, the situation before and after treatment of the experimental class will be compared. The design of this study is shown in Table 2.

Table 2. One Group Pretest-Posttest Design

Group	Pretest	Treatment	Posttest
Experiment	T1	X	T2

(Sugiyono, 2019, Tuckman et al., 2012)

The population in this study was all 8th learners of state junior high school 7 Medan, totaling 270 learners, consisting of 9 classes. The number of research samples was 30 people, namely 8th-1 which was drawn by purposive sampling techniques. The data collection tools used in pretests and posttest are multiple-choice form diagnostic tests on closed grounds.

The research instrument is in the form of a four tier diagnostic test and an observation sheet of students' activities during the learning process. Multiple choice questions with 4 answer options and 4 options for reasons for choosing answers and equipped with the certainty of response index (CRI) method on a scale of 1-6 to determine the level of learners misconceptions about substance pressure material and the percentage of learners who do not and already understand the concept or error. Meanwhile, the observation sheet was used to observe students' activities and responses during the problem-based learning process. Before the instrument was used on the research sample, a validity test was first carried out to 2 validators regarding material / content, construction, and language by giving a rating scale of 4 (valid), 3 (quite valid), 2 (less valid), and 1 (invalid) on each validated aspect. Furthermore, the questions were tested on students in 8th learners of state junior high school 13 Medan to determine the validity and reliability of the questions. Test validity using the product moment correlation formula:

$$r_{xy} = \frac{N\sum XY - \sum X \sum Y}{\sqrt{(N\sum X^2 - (\sum X)^2)(N\sum Y^2 - (\sum Y)^2)}} \quad \text{.......................................} (1)$$

Where, r_{xy}: correlation coefficient, X: item score, Y:total item score and N: number of subjects. Furthermore, the basis for making validity test decisions is if the value $r_{hitung} \geq r_{(N,\alpha=0,05)}$, then the question is valid otherwise if the value $r_{hitung} < r_{(N,\alpha=0,05)}$ the question is invalid (Arikunto, 2017). Test reliability using the KR-20 formula:

$$r_{11} = \left(\frac{n}{n-1}\right)\left(\frac{S^2 - \sum pq}{S^2}\right) \quad \text{..} (2)$$

Where, r_{11}= overall test reliability, n = items number items, s^2 = variance of item, p = proportion of subjects who answered the item correctly, proportion of subjects who answered the item incorrectly (q = 1- p), (Arikunto, 2017).

Furthermore, the basis for making decisions on the level of reliability of the questions is consulted in Table 3.

Table 3. Categories of Problem Reliability Level

Interval	Category
$0,80 < r_{11} \leq 1,00$	Very High
$0,60 < r_{11} \leq 0,8$	High
$0,40 < r_{11} \leq 0,6$	Medium
$0,20 < r_{11} \leq 0,4$	Low
$-1,00 < r_{11} \leq 0,20$	Very Low

(Brumbaugh & Guilford, 1956)

Quantitative analysis is carried out to determine the level of understanding of students' concepts which are divided into 3 categories, namely the percentage of the level of misconception of learners as the main analysis and 2 other categories, namely knowing concepts, not understanding. The percentage of the three categories can be obtained through the formula:

$$Psi = \frac{f_{si}}{N_{si}} x\ 100\% \quad ......(3)$$

Where, Psi: the percentage of the number of learners at each level of the category understanding the concept of each question item; fsi: the frequency of learners at each level of concept understanding category Nsi: the number of all learners who are the subject of research. Furthermore, the calculation results are consulted with Table 4.

Table 4. Misconception Level Categories

Percentage	Category
0%-30%	Low
31%-60%	Medium
61%-100%	Tall

(Sheftyawan et al., 2018)

Observation is used to collect data about student activities during learning, using data collection techniques with formula;

$$Np = \frac{R}{Sm} x\ 100 \quad ......(4)$$

Where; Np = the value sought or expected, R = the score during the observation, Sm = the maximum score.The stages of research carried out began with identifying problems, formulating problems, preparing research designs, making observations to see the school environment, getting information from the school about the situation and conditions of the school that would be used as a research site, informing the school about research activities, and asking permission from the school to conduct research at the school. Preparation of learning by determining the material, determining the sample, and compiling research instruments. The implementation of *four-tier* multiple *choice diagnostic test* pretest was conducted to determine the initial misconceptions of students in conventional learning. The pre-test results were first analyzed using the CRI technique before *problem-based learning* was conducted to improve students' learning outcomes. Furthermore, the change in students' misconceptions between formal learning during *problem-based learning* was tabulated as a percentage.

In accordance with the research hypothesis that there is an effect of *problem-based learning* in reducing the misconceptions of junior high school students on the material of substance pressure, it is necessary to conduct a prerequisite test, namely the normality and homogeneity test of the data. The data normality test used is Liliefor's test with the help of Microsoft Excel software calculations in the following order; Data $X_1, X_2, X3, \ldots, X_n$ is made into standard numbers $Z_1, Z_2, Z_3, \ldots, Z_n$ with the formula:

$$Z_i = \frac{X_i - \overline{X}}{s} \text{ for i = 1, 2, 3,} \quad ......(5)$$

Where; $\overline{X}$ = average value, and s = standard deviation. The proportion of z_1 z_2, ... z_n. is expressed in $S(z_i) = \frac{the\ number\ of\ z1, z2, \ldots zn\ that < zi}{n}$. Next, the difference $F(z_i)$-$S(z_i)$ is calculated by taking the absolute price. The largest value is referred to as $L_{hitung} = L_o$. Data requirements are normally distributed if $L_o < L_{tabel\ (\alpha = 0,05)}$. (Sudjana, 2017). Furthermore, the homogeneity test is carried out with the F-test formula;

$$F = \frac{\text{largest variance}}{\text{smallest variance}}, \quad \ldots\ldots(6)$$

With the test criteria as listed in Table 5.

Table 5. Homogeneity Test Criteria

Sig	Criterion
$F_{calculate} \geq F_{table}$	Inhomogeneous
$F_{calculate} < F_{table}$	Homogeneous

The research hypothesis test was carried out with parametric statistics t-test if the data was normally distributed, namely by comparing the two average scores. as follows.

Formulate a statistical hypothesis from the null hypothesis and the alternative hypothesis.

Determine the value of $_{thitung}$ with the formula

$$t = \frac{Md}{\sqrt{\frac{\sum x^2 d}{N(N-1)}}} \quad \ldots\ldots(7)$$

Where; Md: mean of deviation (d) between pretest and posttest, xd: difference of deviation with mean deviation, N: number of subjects, and db = (N-1). Hypothesis testing criteria, $t_{hitung} < t_{tabel}$ then H_0 is accepted and H_1 is rejected otherwise if $t_{hitung} > t_{tabel}$ then H_0 rejected dan H_1 accepted. (Sudijono, 2018) (Arikunto, 2017: 263)

$$t = \frac{Md}{\sqrt{\frac{\sum x^2 d}{N(N-1)}}} \quad \ldots\ldots (8)$$

Where, Md: mean of deviation (d) between pretes and postes, xd: difference of deviation with mean deviation, N: number of subjects, and db = (N-1). Hypothesis testing criteria, if $t_{count} < t_{table}$ then H_0 is accepted and H_1 is rejected otherwise if $t_{count} > t_{table}$ then H_0 is rejected and H_1 is accepted. (Sudijono, 2018; Arikunto, 2017). To determine the effectiveness of problem-based learning by administering a four-tier diagnostic test, the normality test of Gain <N-Gain> was conducted by (Hake, 2002) with the formula

$$\langle N\text{-Gain}\rangle = \frac{(\text{post-test score}) - (\text{pre-test score})}{\text{maximum score} - (\text{pre-test score})} \quad \ldots\ldots (9)$$

With the acquisition score criteria as shown in Table 6 .

Table 6. Score Acquisition Category Criteria

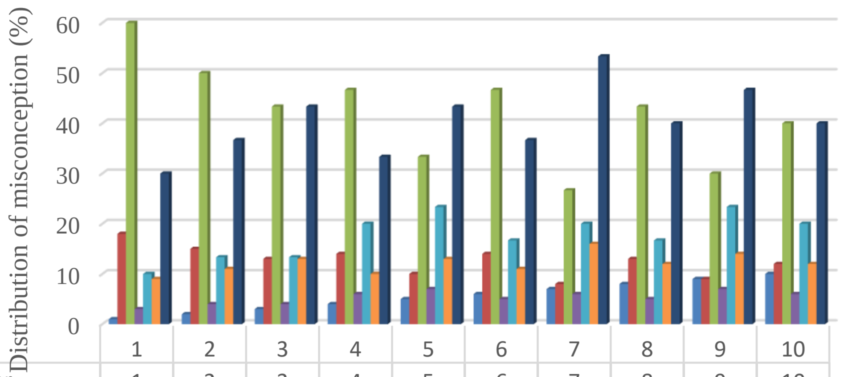
Gain Value Category	Criteria
g > 0,70	High
0,30 ≤ g ≤ 0,70	Medium
g < 0,30	Low

(Ramdhani et al., 2020: 164)

RESULTS AND DISCUSSION

Based on the content validity test conducted by two validators, namely physics education lecturers and science teachers at state junior high school 7 Medan, an average score of 3,765 was classified as valid. Furthermore, from the results of Tier 1 and Tier 3 test trials on students at state junior high school 13 Medan, the average correlation coefficient was obtained 0.4040 and 0.3713 with r_{table} = 0.361, meaning that r_{count} > r_{table} is classified as valid, as well as the reliability coefficient 0.79 and 0.75 respectively is high.

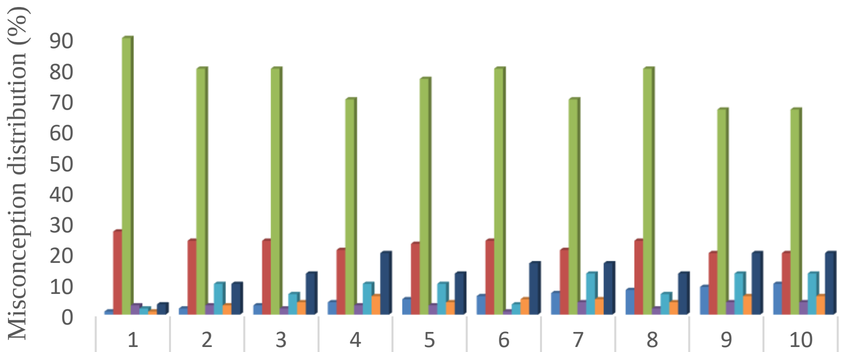
Research that has been conducted, obtained the percentage of students' misconceptions on substance pressure material. In addition, the percentage of students' understanding is also obtained, both students who know the concept, do not understand and students who experience misconceptions. The percentage of misconceptions that have been analyzed is divided into several parts, namely that for the entire research sample of 30 people, analysis is carried out on each *four-tier* item to see the percentage distribution of misconceptions on each item. The results of the percentage of misconceptions before *problem-based learning is* conducted as shown in Figure 1.



Question Number	1	2	3	4	5	6	7	8	9	10
Category Percentage TK Σ	18	15	13	14	10	14	8	13	9	12
Category Percentage TK %	60	50	43,33	46,67	33,33	46,67	26,67	43,33	30	40
Category Percentage TP Σ	3	4	4	6	7	5	6	5	7	6
Category Percentage TP %	10	13,33	13,33	20	23,33	16,67	20	16,67	23,33	20
Category Percentage M Σ	9	11	13	10	13	11	16	12	14	12
Category Percentage M %	30	36,67	43,33	33,33	43,33	36,67	53,33	40	46,67	40

Figure 1. Histogram of the Level of Misconception of All Learners on Each Question Item before the application of PBL

Based on Figure 1, it shows that the percentage of physics misconceptions of all students on the material of substance pressure in at state junior high school 7 Medan for each item is the highest value found in item number 7 by 53.33%, and the lowest in item number 1 by 30%. The highest percentage of knowing the concept (TK) is highest in item number 1 by 60%, while the lowest percentage of TK is in item number 7 by 26.67%. Based on the results of data analysis, it was concluded that the level of misconception (M) was 40.33% in the moderate category, did not understand (TP) was 17.67% in the low category, and knew the concept (TK) was 42% in the moderate category. Furthermore, an analysis was carried out on each item of the *four-tier* question to see the percentage distribution of misconceptions that had been experienced by all students on each item. The percentage of misconceptions that have been analyzed is shown in Figure 2.



	1	2	3	4	5	6	7	8	9	10
Question Number	1	2	3	4	5	6	7	8	9	10
Category Percentage TK Σ	27	24	24	21	23	24	21	24	20	20
Category Percentage TK %	90	80	80	70	76,67	80	70	80	66,67	66,67
Category Percentage TP Σ	3	3	2	3	3	1	4	2	4	4
Category Percentage TP %	2	10	6,67	10	10	3,33	13,33	6,67	13,33	13,33
Category Percentage M Σ	1	3	4	6	4	5	5	4	6	6
Category Percentage M %	3,33	10	13,33	20	13,33	16,67	16,67	13,33	20	20

Figure 2. Histogram of the level of misconception of all students in each Question Point after PBL implementation

Figure 2 shows the percentage of physics misconceptions on the material of substance pressure in 8th state junior high school 7 Medan for each item. Of the 10 *four-tier* items, *the* highest percentage of misconceptions was obtained in items number 4, 9, and 10 by 20%, and the lowest was number 1 by 3.33%. The highest percentage of conceptual knowledge (TK) was found in item number 1 by 90%, while the lowest percentage of TK was found in items number 4, 9, and 10 by 66.67%. The distribution of misconceptions obtained is as follows, misconceptions (M) 14.67% low category, do not understand (TP) 9.67% low category, and know the concept (TK) 76% high category.

Observations were conducted 3 times which aimed to observe students' *learning* activities during *problem-based learning*. The results of the observations obtained by the observer were that students' activities experienced a positive increase. The average activity of students in the experimental class at meeting I and meeting II was 66.83 and 71.17 respectively. At the 3rd meeting, researcher continued to motivate so that there was an increase in activity with an average of 76.67. Based on the results of observations, it shows that there is an effect of increasing student learning outcomes. At each meeting always follows the steps of the learning process that has been previously determined, namely that all learning devices have been prepared in advance.

Based on the normality test summary of the calculation results using the Lilliefors test data *pretest* and *posttest* presented in Table 7.

Table 7. Summary of Normality Test Calculations

Data	L_{count}	L_{table}	Conclusion
Experimental pre-test	0.133	0.61	Normal
Experimental post-test	0.142	0.61	Normal

Table 7 shows that the pretest and posttest data are normally distributed. This can be seen from the price of $L_{calculate<}$ L_{table} which indicates that the data is normally distributed. Based on the homogeneity test which aims to find out whether the data has homogeneous variance or not, which states that the sample used can represent the entire population. Through the F-test with α = 0.05 obtained Fcalculate price and F_{table} for data pretest and posttest each sample is presented in Table 8.

Table 8. Summary of Homogeneity Test Calculations

Data	Variance	$F_{calculate}$	F_{tabel}	Conclusion
Pre-test experiment	154.48	1.46	1.86	Homogeneous
Post-test experiment	105.74			

From Table 8 it is known that the sample of the experimental class come from a homogeneous population. This can be seen from the price of F_{count} < F_{tabel} indicating that the sample come from a homogeneous population. In this study, the type of hypothesis test used is a one tail t-test because the sample used is only one class which aims to see the similarity of the initial learning abilities of learners in the experimental class. The average and results of the pretest and posttest of learners in the experimental class were 42.00 and 76.67, respectively. Summary of one-party t-test results in the experimental class obtained results as in Table 9.

Table 9. Summary of Calculation of Hypothesis Test of Pretest-Posttest Data Experiment Class

Data	$\bar{X}$	t_{count}	t_{table}	Conclusion
Pre-test	42	25,623	1,699	Ha accepted (there is an effect)
Post-test	76,67			

Based on Table 9 it is obtained that t_{count} > t_{tabel} , namely (25.623> 1.699) with a significant level of significance (α)= 0.05; so Ha is accepted which concludes that there is an effect of problem-based learning in reducing learners' misconceptions. The effectiveness of problem-based learning in reducing misconceptions used the <N-Gain> test, namely by calculating the difference between pretest and posttest scores as presented in Table 10.

Table 10. Test <N-Gain> Class Pretes-Postes

No	Score		Posttest-Pretest	Maximum Score (100)-Pretest	N-Gain Score	N-Gain Score (Percent)
	Pretest	Posttest				
1	20	60	40	80	0.500	50.000
2	40	70	30	60	0.500	50.000
3	40	80	40	60	0.667	66.667
4	30	60	30	70	0.429	42.857
5	30	70	40	70	0.571	57.143
6	60	80	20	40	0.500	50.000
7	60	90	30	40	0.750	75.000
8	50	80	30	50	0.600	60.000
9	50	90	40	50	0.800	80.000

No	Score		Posttest-Pretest	Maximum Score (100)-Pretest	N-Gain Score	N-Gain Score (Percent)
	Pretest	Posttest				
10	40	80	40	60	0.667	66.667
11	50	80	30	50	0.600	60.000
12	20	70	50	80	0.625	62.500
13	40	80	40	60	0.667	66.667
14	30	60	30	70	0.429	42.857
15	40	90	50	60	0.833	83.333
16	50	80	30	50	0.600	60.000
17	40	80	40	60	0.667	66.667
18	30	70	40	70	0.571	57.143
19	50	90	40	50	0.800	80.000
20	60	90	30	40	0.750	75.000
21	50	80	30	50	0.600	60.000
22	60	90	30	40	0.750	75.000
23	40	80	40	60	0.667	66.667
24	30	60	30	70	0.429	42.857
25	20	60	40	80	0.500	50.000
26	40	70	30	60	0.500	50.000
27	60	90	30	40	0.750	75.000
28	50	80	30	50	0.600	60.000
29	50	70	20	50	0.400	40.000
30	30	70	40	70	0.571	57.143
			Average		0.610	60.972
		Category				Medium

To determine the relationship between students' activities in problem-based learning (variable X) and posttest scores (variable Y), a liniers regression test was conducted using Microsoft Excel software as shown in Table 11.

Table 11. Results analysis of student activity (X) with posttest score (Y)

	Coeffi cients.	Standard Error	t-test	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	1,37	2,83	0,49	0,63	-4,42	7,17	-4,42	7,17
X-Variable	1,05	0,04	26,86	0,00	0,97	1,13	0,97	1,13

Based on Table 10, the regression equation is obtained as follows: Y = 1.37 + 1.05X, which indicates that each time the activity of students on problem-based learning will be able to increase the posttest value (learning outcomes) by 1.05 times.

Based on the results of data analysis, it shows that there is an effect of increasing the learning outcomes of learners 8th state junior high school 7 Medan with the implementation of *problem-based learning four-tier* questions, with the same initial ability of students. Based on the results of the one-tail t-test hypothesis, it is found that problem-based learning in reducing students' misconceptions can affect learners' learning on substance pressure material.

Observation of learning activities with *problem-based learning is* classified in the active category. Based on the *post-test* scores and the value of student activity, a regression test can be done to see the relationship of each variable, and a linear relationship is obtained between learning and learning outcomes of students in 8^{th} state junior high school 7 Medan.

Through the results of the study, it can be shown that there is an effect of *problem-based learning* on substance pressure material in reducing students' misconceptions which can be seen from the post-test scores of students who increase. Problem-based learning has a positive impact, among others, students have thinking skills in solving problems, the physics learning process is more effective, makes students active and motivates students to learn.

This discussion is supported by the existence of relevant previous research conducted by (Sholihat et al., 2017) showed that the *problem-based learning* (PBL) model was effective in remediating students' misconceptions on vibration at state junior high school 2 Sungai Raya. Specifically, the conclusions in this study are that (1) the average percentage reduction in the number of misconceptions of each student in the control class was obtained by 14.38%, while in the experimental class the average percentage reduction in the number of misconceptions of each student was obtained by 51.99%.; (2) there is a significant difference between the use of *problem-based learning* and conventional learning in remediating students' misconceptions on vibration.

Further (Nainggolan et al., 2023) found that that 9.1% of the learners population had a comprehensive understanding of the principles of mechanics. In contrast, 19.2% of learners showed a lack of understanding in this area. In addition, 26.2% of students only partially understood the ideas, while 41.4% of students showed misconceptions. Lastly, a small percentage of learners, 4.1%, could not be categorized due to lack of data. Based on the results of the survey study conducted on some students, it is known that many elements play a role in the development of learners' misconceptions regarding the field of physics. There are several factors that contribute to the challenges learners face in learning mechanics, particularly the study of physics concepts. These factors include learners' lack of interest in the subject matter, learners' perception that the mechanics material taught in physics class is not interesting, and the assumption that physics subject matter is difficult to understand and remember. In addition, learners tend to engage in physics learning mainly just before exams or tests, rarely dedicating time to solve physics problems or exercises at home. In addition, learners often express feelings of boredom when learning physics.

CONCLUSION

Based on the data analysis, it can be concluded that problem-based learning has an effect on reducing students' misconceptions through students' learning outcomes on pressure at at state junior high school 7 Medan. The results of this study are also expected to be a consideration or reference for physics teachers in designing the learning process so as to minimize the misconceptions experienced by each student. For further researchers with diagnostic tests, they should try to do it on other subjects and make observations on the causes of these misconceptions.

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