

**THE USE OF MIND MAPPING ASSISTED PROBLEM BASED LEARNING  
MODEL ON STUDENT LEARNING OUTCOMES IN SUBSTANCE PRESSURE  
MATERIALS****Eka Sari Hutasoit<sup>1)</sup>, Ridwan Abdullah Sani<sup>2)</sup>, dan Siti Aisyah<sup>3)</sup>**<sup>1)</sup>Department of Science Education Universitas Negeri Medan, Indonesia<sup>2)</sup>Department of Physic Education Universitas Negeri Medan, Indonesia<sup>3)</sup>Science Education Teacher, 17<sup>th</sup> Junior High School Medan, Indonesia

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Accepted: June 16<sup>th</sup>, 2022. Published: July 8<sup>th</sup>, 2022**Abstract**

This research aims to find out whether there was variation in students' procedural knowledge, the effectiveness of learning using a problem-based learning model assisted by mind mapping in improving the quality of students' learning, and their response to the model used. The implementation is at SMP Negeri 17 Medan. The population was all collages students of class VIII. The process of grouping samples was performed by way of random sampling method. The instructions decided on as studies subjects were class VIII-5 and VIII-6 with 32 college students. The type of research used was Quasi Experiment with a two-group pretest-posttest design. The method used in the statistics series procedure was the more than one preference take a look at device with a total of 20 questions. Through the results of the study, the average of pre-test score for the experimental class was 36.87 and 36.25 for control class and the average of post-test experimental class was 76.71 and control class was 60.46. This showed that there was a difference in procedural information among students who were taught the use of a trouble-based studying version and students who were taught the usage of conventional gaining knowledge of methods. The magnitude of the increase was 63% for the experimental class and 37% for the control class. Both are in the medium category and it was concluded that the problem-based learning model was effectively applied in the science learning process. Student responses to the model were on positive criteria where their response to the problem-based learning process was quite high with an average size of 85.39%.

**Keywords:** Problem Based Learning, Mind Mapping, Learning Outcomes, Substance Pressure

## Introduction

Science and technology is currently developing very rapidly. Living beings with all the conflicts in their activities, must be able to adapt and of course intelligence, creativity, and wisdom are needed to solve all problems so that they are not increasingly difficult to solve. Growing the fine of learning remains pursued and applied to enhance the great of education and coaching. Students will be more motivated in learning if the quality of education is improved. They will have a more positive attitude, master more types of information and skills, and have a more stable understanding of the content being studied (Suhadi, 2020).

Natural Sciences (IPA) is a field of science that is close to our lives. Science can play a role in doubling the knowledge of people's understanding regarding natural resource management, natural events related to the life around them and in every activity they do. Substance pressure is one of the science materials to show the relationship between force and area. The current learning process is one of the factors causing the decline in learning outcomes. The researcher interviewed a science subject educator at SMP 17 Medan, he said that the learning process at school was still conventional in general, namely providing learning materials, taking notes and answering questions in textbooks and questions made by the teacher, and in learning teachers play more and more active roles so that students tend to only be listeners which causes them to experience a decrease in their learning outcomes. The Minimum Completeness Criteria (KKM) which is a requirement for student learning completeness in science material at this junior high school is 70, but students still cannot achieve it optimally. The cause of this is due to several things, such as the curriculum used by schools, namely the 2013 revised 2017 curriculum, the lack of use of learning media, and students not being much involved in the learning process. When learning takes place online, student learning outcomes are lower and students' desire to learn is less because there are no teachers to supervise the learning process. Learning is carried out only by providing reading material to students and giving practice questions through google classroom and WhatsApp groups, causing less effective learning and students' understanding of a science material is not developed. With more attention in the learning process, it will certainly be easier to

achieve learning goals and objectives.

Suhadi said that from the numerous issues found in the getting to know procedure, it is necessary to discover new approaches of imposing the coaching and learning technique that invitations college students to be active inside the method. To make this happen, this is where the teacher's ability is tested in finding and designing learning activities how to run well, calmly and all active in it which will have a good influence in developing the competencies of students both in terms of cognitive, affective and psychomotor students have. Therefore, educators must decide on a good learning model and make learning objectives achieved and still able to bring students to understand the material. One model that can be applied to the implementation of coaching and studying activities is Problem Based Learning which is expected to be a model that brings students more enthusiasm and spurs students to be more focused, interested, excited, active, creative and motivated in the implementation of each learning activity in order to get learning outcomes. students who are good in science subjects. It's the same with Napitupulu (2019) one of the mastering models related to issues that can be implemented is the problem-based totally learning version (PBL). PBL is a learning model that puts the hassle as a reference to invite college students to discover, recognize and apprehend the content of the lesson cloth.

Problem based learning is a model that provides a problem and then looks for how to solve the problem. The PBL model is a learning model in which students carry out innovative activities, are able to discuss, exchange ideas, and are able to use the information they get to solve problems that have been provided (Assegaff, 2016).

Based on research conducted by Pande Made Hendra Kesuma, et al with the title "The Influence of Mind Mapping-Assisted Problem Based Learning Models on Science Learning Outcomes" that the model with the help of a mind map influences students to be provoked and involved a lot when learning until they are able to develop their knowledge.

A similar study was also conducted by Liza Yolanda and Purwanto in the title "The Effect of Mind Mapping-Assisted Problem Based Learning Models on Student Learning Outcomes" where different learning will improve student learning outcomes.

Efriana Jon (2015) conducted a study

on "The Effectiveness of Using Mind Maps on Students' Biology Learning Achievement" where the results of the study explain that mind maps are very effectively used because they are able to increase the achievement of better grades and student achievement.

A similar study was also conducted by Ani Julita Br Sipayung with the title "The Influence of Problem Based Learning Models With Mind Mapping on Learning Outcomes of Motion System Materials in Humans" where in the activities she did, she found that there were positive changes produced by using the model on scholar studying consequences. Which can be visible within the classical completeness of the experimental elegance.

### Research Method

The form of research used is Quasi experiment. Quasi test is studies that ambitions to find the effect of something imposed on college students as studies subjects. This quasi-experimental research design is a two-group pretest-posttest layout. The design of this research can be seen in table 3.1 below:

**Table 1.** Research design

Class	Pre-test	Treatment	Post-test
Experiment	T1	X1	T2
Control	T1	X2	T2

(arikunto,2015)

Information:

T1 = pre-test (pre-test) for the experimental class and the control class

T2 = final test (post test) for the experimental class and the control class

X1 = teaching using Problem Based Learning learning model assisted by mind mapping

X2 = teaching using conventional learning

The groups that were used as the population in this study were students of class VIII SMP Negeri 17 Medan as a whole, which were divided into grades VIII-1 to grades VIII-9. The class that will be the experimental class with learning using the Problem Based Learning model assisted by Mind Mapping is class VIII-5 and the class that will be the control class by applying conventional learning is class VIII-6.

## Result and Discussion

### Research result

Based on the outcomes of the analysis check, it is said that the validation of the instrument accomplished via expert lecturers, subject teachers and students outside the research sample, the research instrument is feasible to use with necessary improvements. The number of questions that were validated were 30 questions and it was found that 20 questions met the validation requirements.

Primarily based at the consequences of the examiner, it confirmed that there were differences in college students' procedural expertise at the substance stress fabric within the pattern elegance used because the research class. This can be seen in the table of pretest-posttest results on the research sample in table 2 below.

**Table 2.** Pretest and posttest value data on the research sample

Component	pretest		Posttest	
	experi- ment	control	experi- ment	control
Number of students (n)	32	32	32	32
The highest score	65	50	90	80
Lowest Value	25	20	65	45
Average (mean)	36.87	36.25	76.71	60.46
Standard Deviation(s)	6.92	7.40	6.55	7.22

The value of the two sample classes has a significant difference before and after being given the experiment, where one class is treated with a problem-based learning model and the other class is treated with conventional learning. Hypothesis testing of the pretest data was used to determine the similarity of the students' initial abilities in the two sample groups. Seen in table 3.

From the table, it is found that the pretest data  $t_{count} < t_{table}$  is  $0.349 < 2.036$ , so  $H_0$  is accepted. It is concluded that the experimental class and the control class have the same initial ability.

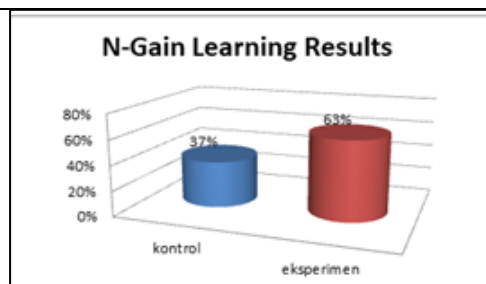
Hypothesis testing of posttest data in

this study was used to determine differences in student learning outcomes in the experimental and control classes. Seen in table 4.

**Table 3.** Calculation of t test data pretest

Category	Class	Average	$t_{count}$	Table	Sig	Conclusion
Learning outcomes	Control	36.25	0.349	2.036	0.729	$H_0$ accepted
	Experiment	36.87				

Based on table 4, it is found that for posttest data  $t_{count} > t_{table}$ , namely learning outcomes data  $9,426 > 2,036$ . So it is able to be concluded that  $H_a$  is popular. it's far concluded that there is an average distinction in pupil getting to know effects among the control magnificence and the experimental elegance.



**Figure 1.** Gain Learning Results

**Table 4.** Calculation of t test data posttest

Category	Class	Average	$t_{count}$	Table	Sig	Conclusion
Learning outcomes	Control	60.00	9,426	2.036	0.00	$H_a$ accepted
	Experiment	76.09				

From the picture above, it can be seen

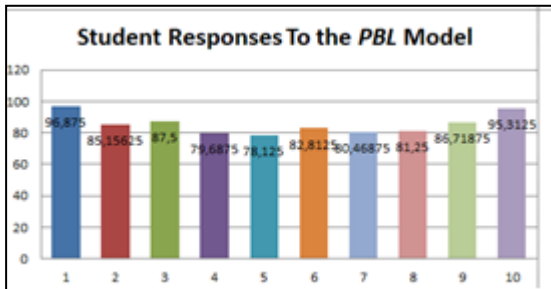
The calculation of N-gain is carried out to find out how effective the model is on the learning outcomes obtained by the two classes after the learning process is carried out. Shown in table 5.

**Table 5.** N-gain of experimental and control class

No	Class	gain	N-Gain (%)	Category
1	Control	0.37	37%	Currently
2	Experiment	0.63	63%	Currently

Based on table 5 above, it can be described the difference in the increase in learning outcomes (gain) for the experimental class and the control class through the diagram in Figure 1 below.

that the % increase in learning outcomes in the control class (37%) is lower than the increase in learning outcomes in the experimental class (63%). This is an indication that there is effectiveness in improving student learning outcomes in learning on substance stress material using a mind mapping-assisted problem-based learning model ( $H_a$  is accepted,  $H_0$  is rejected). The student response hypothesis test aims to find out how students respond to the problem-based learning model assisted by mind mapping. Student responses were analyzed through a questionnaire that was filled out after students took part in problem-based learning. Student response questionnaire data was obtained from one class that was used as the experimental class, totaling 32 students. It can be seen in Figure 2.



**Figure 2.** Student response to the PBL model

Figure 2 shows where the percentage of responses from SMP Negeri 17 Medan students to the problem-based learning model assisted by mind mapping on substance pressure material on each indicator has very good criteria, which indicates that the responses of SMP IPA Class VIII students to the application of the PBL learning model received a positive response from students. so that the problem-based learning model is good for use in the learning process.

### Discussion

The research was applied at SMP Negeri 17 Medan, especially in class VIII-5 and VIII-6 where the two classes were given different treatment, such as class VIII-5 which was the experimental class given the treatment of applying a mind mapping-assisted problem-based learning model and class VIII-6 as the control class was given treatment using conventional learning on the material pressure of substances.

Before conducting the research, the researcher first gave an initial test to the students in determining their initial ability on the material pressure of substances. The common pre-check within the manage elegance was 36.25 and the experimental elegance become 36.87. based totally on the consequences of the normality and homogeneity checks, the information confirmed that the 2 samples were generally distributed and had homogeneous versions.

Then the hypothesis is tested where  $t_{count} < t_{table}$  is  $0.349 < 2.036$  and it is concluded that the initial abilities of the two classes are the same before being given treatment. After that, the sample was given a different treatment. The experimental class uses a problem-based learning model with the aid of mind mapping and the control

class uses conventional learning.

The researcher applies a mind mapping-assisted problem-based learning model where before learning in class, the researcher first provides student direction so that the learning process can take place in a peaceful manner. Effective and meaningful. There are five phases of learning the problem-based learning model assisted by mind mapping. The first phase is to provide orientation about the problem to students. In this phase, the researcher prepares students to learn, conveys the topic of learning, provides an overview and explains what the learning process has achieved. Then the researcher invites students to learn actively using a new model that is using a problem-based learning model by presenting concrete problems in the form of videos to students. The researcher encouraged the students by asking "try to pay attention and you see what happens in the video?" Several students expressed their opinion on the problems contained in the video. This is in line with research by Arends (2008) who said the concept of teaching PBL offers a variety of quality problem conditions to students, with the function of being the foundation for student investigation. Then the researcher directed the students to discuss and analyze any physics concepts in the video and make the results of the discussion in the form of mind mapping. This is in line with research by Arends (2008) who said the concept of teaching PBL offers a variety of quality problem conditions to students, with the function of being the foundation for student investigation. Then the researcher directed the students to discuss and analyze any physics concepts in the video and make the results of the discussion in the form of mind mapping. This is in line with research by Arends (2008) who said the concept of teaching PBL offers a variety of quality problem conditions to students, with the function of being the foundation for student investigation.

Then the researcher directed the students to discuss and analyze any physics concepts in the video and make the results of the discussion in the form of mind mapping. Then proceed with the second phase, namely organizing students to learn. In this phase, the researcher organizes students to form



discussions to define the problems they have found and conduct investigations with various literatures as references to find solutions to the problems that have been presented. Wulandari (2016) states that the PBL model makes students more creative in their opinions, participates in working on designs and discussions, has reciprocal relationships with groupmates who are also very good at processing problems.

Next the third phase, assisting individual and group investigations. Here, the researcher provides LKPD that displays problems in the form of events that are related to the material being taught. Researchers help students investigate problems together with their group friends so that they can exchange opinions. For example, Fitriyani's research (2019) where the PBL model can increase students' collaboration skills with learning activities carried out in groups by providing LKPD so that students do assignments by collaborating with each other and discussing between groups. Also, by Heldianty (2020) The problem presented is proven through experimental activities that require each student in the group to participate. Each group presents its arguments regarding the solution to the problem and then discusses it in finding the answer. Next, give a percentage of the answers obtained and it is hoped that the active involvement of all students during the learning process can improve student learning outcomes, especially cognitive learning outcomes.

Next the fourth phase, developing and presenting the work. Students pour out the results of the examination obtained in the form of a mind map which will then be presented. Mind mapping made by students varies according to the creative level they have and how they understand the learning material as in Efwinda's research (2016) explaining that with the help of mind maps it will be one way for students to pour the information they already have and they need, thus helping him in understanding the material. After students are ready to make a mind map, they present their results to the front of the class. The fifth section is reading and evaluating the problem-solving system.

Here the researcher gives the students the flexibility in their own groups to

present the findings they get in understanding the material being taught. Researchers also provide an assessment of the results of each group's presentation, and guide students to find the core of the material being studied by reviewing the information collected in processing problem solutions in line with learning objectives.

In short, the consequences of the study show that there are variations within the procedural expertise of college students who are taught the usage of a problem based totally getting to know version and people taught using traditional getting to know. After being given a pretest to students, it was concluded that the initial abilities of the sample were the same before being given treatment. Then the posttest was given with the average value of the experimental class 76.71 and the average value of the control class 60.46. The calculation results are in line with what Novita (2020) did, where previously the sample class got an average pre-test result of 49.3 which increased with an average post-test to 79.2.

By testing when the posttest was given after different treatments, the data obtained for both samples were normal and the variants were homogeneous. Based on the results of the independent sample t test, the results of the hypothesis are obtained, namely Sig ( $\alpha$ ) < 0.05 (0.00 < 0.05) and based on statistical statistics, it can be obtained that the student gaining knowledge of consequences within the experimental class are extra than the gaining knowledge of effects of the manage elegance students (reject  $H_0$ , receive  $H_a$ ), it means that there may be a distinction in average mastering outcomes between the manipulate magnificence and the experimental class which concludes that there's a distinction in procedural understanding among students who're taught the use of the problem based totally learning model and students who're taught using traditional getting to know.

Based on the N-gain test, the percentage of N-gain student learning outcomes in the experimental class was 63% in the medium category and in the control class was 37% in the medium category, which is in line with Novita's research (2020) N-gain gains are 0.28 low category and experimental class 0.63 medium

category. The use of problem-based learning models with the help of mind mapping taught to the experimental class makes students more interested in carrying out learning activities, where researchers bring students to be able to express their thoughts, whose findings will later be poured out by describing what they have obtained in a more comprehensive form. interesting.

The KKM value for science learning set by the school is 70. Previously, both classes were given a pretest first and the data was tested using SPSS assistance, where the pretest data obtained  $t_{count} < t_{table}$  i.e.  $0.349 < 2.036$  with  $H_0$  accepted (the initial ability of the two classes was the same before given treatment) and for posttest data  $t_{count} > t_{table}$ , namely learning outcomes data  $9,426 > 2,036$  so  $H_a$  is accepted (student gaining knowledge of results within the experimental elegance are greater than getting to know outcomes inside the manage magnificence) In other words, there are variations in pupil studying effects between the experimental class and the control magnificence.

The sample was given different treatment during the implementation of learning. During the implementation of learning in the control class, students did not conduct an investigation. They only listen to the teacher's explanation of the substance pressure material, then copy it into a notebook and work on the questions. Furthermore, the students and the teacher answered the questions that had been done and gave an assessment of the results obtained by the students. In this class, the average pre-test was 36.25 and the post-test average was 60.46, which made the N-Gain test results on learning outcomes 37%. Furthermore, in the experimental class, the value is tested with a gain test where the calculation of the experimental class gain (VIII-5) with a pretest average of 36.87 and a posttest average of 76, 71 obtained an n-gain percentage value of 63% where it was seen that there was an increase in learning outcomes in the medium category, it was proven that the score was at  $30 < gain < 70$ . When viewed from the results of the student gains of the two sample classes, the experimental class increased by a difference of 26% higher than control class when given different learning. Similarly, the research by

Dewi (2020) with the results which concluded that there was a clear distinction in technological know-how understanding competence among the organization that used the PBL version with the help of mind maps and the organization of users of traditional getting to know.

Therefore, it is able to be concluded that the trouble primarily based learning (PBL) version is successfully carried out to science gaining knowledge of for class VIII SMP Negeri 17 Medan as defined in Siregar's research (2016) that effectiveness is the ability to carry out the right part or prepare something well, summarizing the selection the right means also have the right model so that learning objectives can be achieved, Jon (2015) there is effectiveness in student learning outcomes in learning by applying mind maps. Student response data obtained from student response questionnaires, given after finishing giving treatment with a problem-based learning model. It is known that the average percentage of responses obtained for learning with the problem-based learning model that is implemented is 85.39% which explains when the learning process using the PBL model is finished students feel more understanding of the material pressure of substances. In addition, students are stimulated to find and solve initial problems together through group work and finally they feel happy and do not feel monotonous during learning. As researched by Simanjuntak (2018) which states that stimuli given to students will produce feedback from them, where different actions will produce different responses, also Cerling's research (2020) Problem Based Learning model can help students understand active lessons in learning this is because the learning atmosphere is more active because the syntax of problem-based learning models produces motivation that arises both from within and from outside students. As in research Lubis (2020) except, trouble-based totally learning models can provide opportunities for students to discover, accumulate, and examine records to resolve troubles, so that scholars can assume critically, analytically, systematically, and logically in finding opportunity problemsolving. college students, in this

case, are energetic and enthusiastic to paintings with friends inside the organization in solving problems which have been given by the researcher.

Student responses are also related to students' knowledge and understanding of the given model, coupled with their mind mapping as a tool for students to understand the material. It is proven by the acquisition of student learning scores whose average completeness is 76.71 above the KKM value after being taught using a problem-based learning model assisted by mind mapping, such as research from Hardiyanti (2017) which states that more than half of students strongly agree and are interested in the problem-based model learning.

Because students are happy, interested and more involved in learning, that explains the good application of the PBL model to students where students respond with very good criteria. Because the learning model obtains positive response criteria from students, the learning model is feasible to be applied in teaching and learning activities at SMP Negeri 17 Medan. According to Ariani's research (2016) on learning activities, namely applying the Problem Based Learning model, students are happy because the application involves students participating in the learning process and their active level increases every meeting they get a positive response, and by Sugiantoro (2020) student responses In general, it is included in the positive criteria with a fairly high achievement of the PBL model.

### Conclusion

1. There are differences in the procedural knowledge of students who are taught with problem-based learning models and students who are taught using conventional learning. It is shown from the results of the t-test of posttest data with significant differences, where the value of  $t_{count} > t_{table}$ , namely data on learning outcomes  $9,426 > 2,036$  with a significant level of 0.05, namely rejecting  $H_0$ , accepting  $H_a$ , which means that there is an average difference in student learning outcomes between sample groups.

2. The learning effectiveness of the problem-based learning model assisted by mind mapping to improve student learning outcomes is in the medium category. The results of the calculation are carried out using n-gain where the increase in learning outcomes is 63% in the experimental class, while in the control class with conventional learning the increase in learning outcomes is 37%. So it was concluded that the problem based learning model assisted by mind mapping was effective in improving student learning outcomes compared to conventional learning in science learning about substance pressure in class VIII SMP Negeri 17 Medan.

3. Student responses to the problem-based learning model have very good criteria, which are equal to 85.39% where this confirms that the learning model gets a positive response so that the problem based learning learning model is well applied in the learning process.

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