

## The Implementation of Problem Based Learning with Mind Mapping to Improve The Student's Understanding of Concept

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### Abstract

The purpose of this research was, (1) to describe the implementation of PBL model with mind mapping to improve students' understanding of concept, and (2) to analyze the improvement of understanding of concept of the students after the implementation of PBL model with mind mapping. This type of research is mixed methods with sequential explanatory strategy. Samples of this research was the fourth grade students of SDN 5 Puyoh with 30 students. The first method applied in this research was quantitative method with one group pretest-posttest design, followed by the method of data collection techniques by using test in the form of multiple choice questions, as well as non-test which consists of interview, observation, and documentation. The results showed that (1) the implementation of PBL model with mind mapping had succeeded in increasing the understanding of concept of students with the achievement of three indicators: the average posttest student conceptual understanding reached the minimum mastery criteria, the increase of students' understanding of concept is in the category of at least moderate according to N-Gain test, the average score achieved by the N-gain test was 0.36 which is in the medium category, and the average score of the acquisition of the create of mind mapping is also in the minimum good category, the average score obtained is 22, (2) the learning conducted by using PBL and mind mapping can improve students' understanding of concept, the Sig value obtained is  $0.00 < 0.05$ , therefore, it can be concluded that there is an increased of understanding of concept of students after the implementation of PBL model with mind mapping.

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## INTRODUCTION

The learning of science became one of the subjects that have contributed greatly in developing the potential inside the student. Indriati (2012) suggests that science is knowledge gained through data collection by experimentation, observation and deduction to produce an explanation of a phenomenon that can be trusted. Juhji (2016) argues that science is rational and objective knowledge about the universe and everything in it.

The purpose of learning science is to develop an understanding of a wide variety of natural phenomena. Therefore, fostering the understanding of concept of students is very important. In order to the mastery of a concept by students towards learning it is not just a rote, but also able to apply the concepts that they have on other aspects.

Based on the results of discussion with the fourth grade teacher at SDN 5 Puyoh in Dawe Kudus, showed that in science teaching in terms of understanding the concept of students not in accordance with the learning goals. The fourth grade teacher stated that most teachers are still using the direct learning method or explain directly as a tradisional method that is often used. The method is used with assumption the material will not be complete if the teacher does not explain. Such circumstances more or less will disrupt the smooth learning for students, such as understanding the concept of the subject matter provided.

One of the students in the fourth grade of SDN 5 Puyoh suggested that he had difficulty in understanding learning, especially in science learning. According to him, the most interesting learning are those related to the arts, such as drawing or singing.

In line with the facts found in the research conducted by Widiawati (2015) which showed that the average value of science learning of students were considered low since students gain the science concepts without experiencing the meaningful process. Dwi et al. (2013) in her study stated that students regard teaching physics is a difficult learning resulting in lack of

understanding of the concept of students. Susilo (2012) states that in learning science, more teachers lectured and provided training or written assignments and laboratory work merely to take steps appropriate activities worksheet used but do not provide an opportunity for students to do experiment in accordance with the ideas and knowledge so that the learning process becomes less interesting and meaningful.

Abdillah (2017) suggests understanding the concepts and skills of the science process in schools can be effective if applying the appropriate learning model. This research deems it necessary to implement a learning model that provides a stimulus for students to enhance students' understanding of concept, the model of PBL by mind mapping. According Arends (2007), Problem Based Learning is a form of learning that has the essence of presenting a variety of problem situations authentic and meaningful to students. Nugraha (2017) suggests PBL is one of the innovative learning models applied to develop students' skills in solving problems.

Agraw (2017) suggests that PBL is an instructional method in which the relevant issue was introduced at the beginning of the instruction cycle and is used to provide context and motivation in learning. Application of PBL models in this study along with Mind Mapping as a form of facilities for students to be creative with drawing and coloring at the same time understand the concepts of learning. According to Vitulli & Giles (2016), mind mapping is a tool for teaching that can help teachers to introduce or bring together several words related to a topic or theme. Supriadi (2016) argues that mind mapping is a method of learning that can improve students understanding.

Adodo (2016) states that mind mapping is a representation of spatial concepts and linkages that are intended to represent the structure of human knowledge stored in their minds. Students are guided to create mind maps, they will find it easy to identify clearly and creatively what they have learned and what they want.

Research conducted by Rahma et al. (2016), showed that the implementation of

science learning can increase learning motivation and students' understanding of concept. Isnaini (2016) in her research found that learning strategy of Mind Map gives a good influence on students' understanding of concept of the experimental class compared to the control classes using conventional methods. In addition, the learning strategy of Mind Map provide an activity for students become more active. Students not only listening to the explanation of teachers, but also explore their understanding by creating a Mind Map.

Research conducted by Haji (2015), showed that the application of PBL teaching model effectively increases independent learning and students' understanding of concept. Meanwhile, Ma'rifah et al. (2016) in her research showed that there is a difference between the student's mastery of concepts before and after learning through Dual Safeguard Web-Based Interactive (DWBI) strategy with PBL model in the subject matter of temperature and heat. Research conducted by Rahmawati and Asri Budiningsih (2014) obtained result that students who take science lesson by using mind mapping has the ability of understanding the concept higher than students who learn by using lecture and presentation.

Based on several studies that have been put forward, the research found a gap in the form of limitation in the previous studies. There are no studies that found specifically apply PBL model and mind mapping for teaching the material of force and motion in order to measure the students' understanding of concept. Therefore, we wanted to implement the model of PBL and mind mapping on the subject matter of force and motion to determine whether the results remain consistently increase understanding of concept or even with a load of material of force and motion as well as apply the model of PBL and mind mapping will get diminishing or inconsistencies with the previous studies.

A PBL model with mind mapping was implemented on the subject matter of motion and force due to the scores obtained by the students that was still low. We tried to compare the scores of each of the subject materials of science learning

and it was concluded the scores acquires by students on the subject material of force and motion were lower than other subject materials. In addition, students can perform experiments related to force and motion through PBL learning step, and then summarize it in the form of mind mapping.

The implementation of PBL learning model with mind mapping on the subject matter of force and motion was done in grade IV SD N 5 Puyoh with the total number of students of 30 children. The learning of PBL models here was in accordance to Arends (2007), which establishes five phases or steps in the learning of PBL models which include (1) orienting students on the issue, (2) organizing the students to learn, (3) assisting with the investigation independently and in groups, (4) developing and presenting work, and (5) analyzing and evaluating problem-solving process. While the steps of making mind mapping in this study refers to Tony Buzan (2007) which includes (1) starting with the main topic in the middle of writing a paper, (2) using illustrations, symbols, codes on the overall map of the mind, (3) selecting the keywords in each branch, (4) identifying any word/image must stand alone on any line/branch, (5) the branches are made to be associated with the main topic in the middle of the paper. The main branch line thicker and becomes thinner as getting away from the main branch, (6) creating a line/branch as long as the words, (7) using colors in a mind map at least three colors according to favourite, (8) developing a form of mind maps to suit the students' style or creativity respectively, and (9) reserving space for the addition of the next theme.

## METHODS

This study uses *mixed methods* which is designed in the form of sequential explanatory. The quantitative methods design applied in this research was pre-experimental design, with one group pretest-posttest design. Qualitative methods applied in this research was descriptive qualitative design done in order to understand the phenomena that arise in the implementation of science learning by using Problem Based

Learning model with mind mapping. Quantitative methods was designed to obtain data on the implementation of PBL model with mind mapping and found an increased understanding of concept of students in science learning material force and motion, while the qualitative method in was conducted in order to obtain data on the overview of the implementation of the model of PBL with mind mapping.

The population in this study were all of the fourth grade students of SDN in Diponegoro's group Dawe Kudus in academic year 2017/2018. The sampling techniques conducted by the researchers was done by using a purposive sampling technique based on several considerations in order to obtain research samples of SDN 5 Puyoh, and therefore obtained the total sample of 30 students.

The learning process begins with observing the activities of a janitor in the school environment, researchers give a stimulus to the students about what the janitor (oriented students on the issue). The learning process continued with students in groups according to their group, students read instructional materials relating to the material influence the style of an object, students observe the example shown researcher associated force that causes objects to move into silence, the students were asked to cite examples of the influence of the force against an object (organizing students to learn). Continued learning with students conduct experiments related to the influence of the style of an object, experiments were conducted in groups by following the steps experiment in student activity sheets (individual and group guided inquiry).

Learning continued with students to discuss with members of the group related to the results of the experiments have been carried out, the students make mind mapping with guidance from researchers in summarizing the results of the experiments have been done, then the students present the results of experiments the influence of the style of an object by using mind mapping, while the other group given the opportunity to ask questions and provide feedback to the groups who appear (develop and present the results of the

work). Learning continued with the students express their opinions based on the understanding that has been obtained during the learning activities take place, the students together with researchers identify how students perform experiments related to the influence of the style of an object, then the students along together researchers identified how the students in making mind mapping to summarize the results related experiments influence of the force of an object (to analyze and evaluate the process of solving the problem).

Data collection techniques was done by using test and non-test. The instruments applied as the data collection technique used were a pretest and posttest in the form of multiple choice, observation sheet of learning process, interview, and documentation. Data analysis techniques used in this research was the analysis of quantitative data and qualitative data. Quantitative data analysis techniques include (1) The average mastery of test, (2) test of an improved understanding of concept, and (3) N-gain test. Qualitative data analysis techniques was done by using interactive model consists of three main components, namely data reduction, data presentation, and conclusion.

## RESULTS AND DISCUSSION

The results of study is presented in the form of a description of the PBL model implementation with mind mapping in the subject matter of science teaching of force and motion as well as the results of an the increased understanding of concept of the students after following the learning process conducted by using PBL with mind mapping.

### **The Description of The Implementation of Problem Based Learning Model with Mind Mapping**

Problem Based Learning's model with mind mapping, based on the result of observation showed that students were enthusiastically participated in the learning, they were very pleased when asked to perform experiments regarding the material of force and motion,

students were also enthusiastic when asked to make mind mapping to provide color and images according to their favourite.

The first phase of the PBL model learning step is to orient students on their problems. In this stage, students were faced with a problem related to the activities of janitor. Based on the result of observation on the student, most of the students were competences in focusing themselves to the problem and answering the questions given by the teacher. Students were very enthusiastic in answering questions related to the relationship of force and motion with the activities carried out by the janitor.

The second stage is to organize students to learn. In this stage, the students were accepting the division of the group as heterogeneous, although there were some students who are protesting on the division of the group done by the researcher, but then finally, the students could cooperate with the researcher. When students were asked to cite examples of the influence of the force of an object, the students looked active in the learning although there were some students who were giving less precise answer.

The third stage is to guide individual and group investigation. In this stage, the students conducted experiments related to the influence of the force on an object. Based on the result of observation, students were excited to try the practice-related events of the influence of force on an object by using the tools and materials that have been provided by the researcher. Students seemed to be able to work in groups and took turns in doing the experiment, so that all students in the group know what have to do.

The fourth stage is to develop and present the results of experiment. In this stage, students created a mind mapping in order to summarize the results of experiments that have been done, then the students performed the results in front of the classroom. Based on the result of observation, students were very enthusiastic when making mind mapping with interesting pictures and colors. Students in one of the group were working together in making mind mapping, and they even scrambling to provide color and image. After that, the students present the results of an

artificial mind mapping by the group in front of the class. There were some students who like to give responses and asked to the group that perform in front of the class, but there were also students who did not give any response or ask some questions to the group.

The last stage of PBL model learning step is to analyze and evaluate the problem solving process. In this stage, teacher together with students were discussing about the material that consider still difficult and identifying the students' performance in conducting experiments and in producing mind mapping. Based on the result of observation, the students seemed pay attention and listened carefully to the researcher's explanation on the students' performance in conducting experiments and making mind mapping. There were some students who asked for something related to the researcher's explanation.

We were exploring the individual cases related to students whose posttest scores were significantly increased higher than the score of pretest, as well as students whose pretest scores were better than the posttest. Those students were S-6 and S-24. S-6 obtained score 35 in the pretest, and then significantly increased after the posttest into 90. Whereas, S-24 obtained score 85 in the pretest and then decreased into 60 after the posttest. After finding the data, then the researcher conducted further analysis on the result of observation of the students' activity of S-6 and S-24 during the learning process.

The result of observations showed that S-6 was seriously following the learning process conducted by the researcher, S-6 always follows the direction in learning, competence in carrying out the study, and enthusiastically in group discussions. In the other hand, S-24, is a student who have special character that is still accompanied by his parents during the learning process, he considered felt uncomfortable when participating in the learning process and often ask for help from his parents to help him to deal with the tasks assigned by the researcher.

Besides conducting observations, the researcher also conducted interviews toward S-6 and S-24 to determine the constraints that they

face as well as their impressions after attending the learning in order that their results can be included in the specific criteria of individual cases in this study.

Based on interviews with both students, obtained script of the interview as follows:

- R : "What obstacles or difficulties that you encounter in the learning we've done 4 times this meeting?"  
 S-6 : "There is no difficulty Mom, but sometimes the explanation is too fast "  
 S-24 : "Difficult to do the worksheet"  
 R : "Do you find any difficulty in working on the given test?"  
 S-6 : "It's just the same as the task given at first time you come here, Mom, so it's easy in learning."  
 S-24 : "You see a lot of Mom, not the same"  
 R : "How do you feel learning with me?"  
 S-6 : "Its fun, Mom, Please come here again yes Mom"

Based on the result of interviews with both students, it can be concluded that the scores of S-6 in the posttest were significantly increased compared to the scores of pretest since she was seriously following the learning process, and she followed all directions given by the researcher, and competence in doing both individuals and groups task, Whereas, S-24 who felt not comfortable in following the learning process because he is still accompanied by his parents in the classroom, made him cannot freely and seriously follow the whole process of learning, moreover, in conducting posttest, he claimed that he was not seriously doing it.

**The Analysis of Successful of The Implementation of Problem Based Learning Model with Mind Mapping**

Hypothesis testing was done to determine the successful of the implementation of PBL models with mind mapping consists of three indicators of success, namely (1) the average posttest students in solving understanding of the concept has reached minimal mastery criteria, (2) the increase of understanding of concept of pretest-posttest results in the category of at least moderate according to the test of N-Gain, and

(3) the acquisition of the creating score an average of mind mapping are in either category.

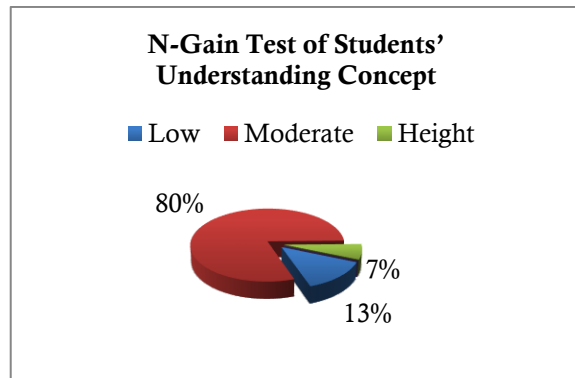
On average posttest students in solving conceptual understanding reached minimal mastery criteria is 70 calculated using the test one sample t-test results are presented in Table 1.

**Table 1.** The Result of One Sample t-Test of The Students' Understanding Concept

	t	df	Sig. (2-tailed)
Test value = 70	3.166	29	.004

Results obtained Sig 0.04 < 0.05, which means that H<sub>0</sub> is rejected, meaning that the average posttest students in solving conceptual understanding reached minimal mastery criteria. These results prove that the implementation of PBL model with mind mapping successfully on the first indicator.

Indicators of successful implementation of PBL models with mind mapping second is an increased understanding of the students' concept pretest-posttest results in the category of at least moderate according to test N-Gain. N-Gain Results are presented in Figure 1.



**Figure 1.** The Results N-Gain Test

Figure 1 shows that the obtained scores on tests of understanding the concept of the lower categories by 13%, moderate by 80%, and a height of 7%. The results of test calculations normalized gain in multiple-choice tests to measure students' understanding of the concept of the results obtained by g = 0.36 at the level of the index or the gain medium. This shows that the indicators of a successful implementation of

PBL with mind mapping are both said to be accomplished or successful.

The strength in this study was the manufacture of mind mapping done by students. By making mind mapping, made the students become more creative and enthusiastic in participating in the learning process. Following are the results of students' worksheet in making mind mapping of the influence of force on object in Figure 2.

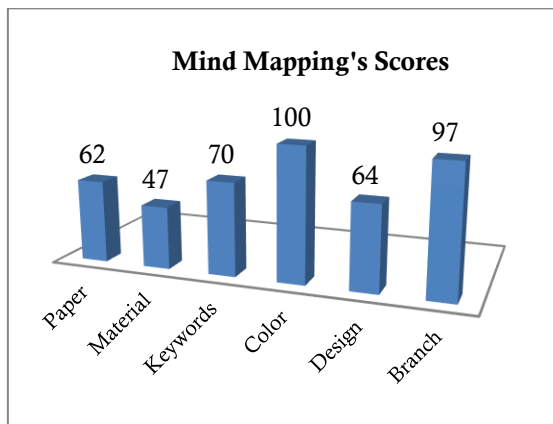


Figure 2. Result of Student's Work

The criteria of ideal indicator that must be achieved by students were (1) the use of paper (plain and landscape-oriented), (2) the depth of material (indicating the inclusion of a lot of content and the development of ideas), (3) keywords (effective keywords), (4) color (using more than one color), (5) designs (images stand out and clarify ideas), (6) branches (curved and spread in all directions).

Figure 2 showed the results of the students' work in accordance to the ideal indicator 1 the student meets the ideal criteria that is using plain paper landscape, in the indicators 2 students have written a lot of content and develop ideas though still less, the indicator 3 students have written an effective keyword, the indicator 4 students have used more than one color, indicator 5 students have made design or image, but not related to the idea, the latest indicator, students have made the arching branches and spread in all directions. The results of student worksheet were not entirely meet the criteria of an ideal indicator in making mind mapping of the influence of force on an object. This happened since students were taking

too much time in making mind mapping so that there was not enough time to finish it.

The third successful indicators of the implementation of PBL model with mind mapping is the result of scores of in making mind mapping that was in the category of minimum good. The result of scores obtained in each indicator aspect of making mind mapping for 4 meetings are presented in Figure 3.



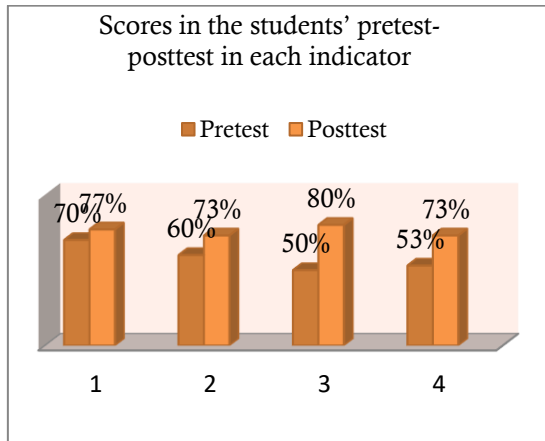
Figure 3. Mind Mapping's Scores

Based on the above picture, it can be seen that the indicator 1 (paper selection) obtained score of 62 from the 5 groups participated in the learning during 4 meetings, indicator 2 (the depth of material) obtained score 47, indicator 3 (keywords) obtained score of 70, indicator 4 (color) obtained score of 100 or a maximum score, indicator 5 (design) obtained score of 64, and the last indicator (branch) obtained score of 97. The average score obtained from the 4 meetings in 5 groups was 22 or included in the category of very good. This is proved that the implementation of PBL model with mind mapping was successfully done in the third indicator

### The Analysis of Improvement of Understanding Concept Training After The Implementation of PBL with Mind Mapping

The understanding of concept in this study measure the four indicators, namely (1) to restate a concept, (2) to classify objects according to certain properties, (3) to provides an example and not an example of a concept, and (4) to present the concept in various forms of representation.

The following Figure 4 presented the graphs of the increased scores in the students' pretest-posttest in each indicator of the understanding of concept.



**Figure 4.** Scores in the Students' Pretest-Posttest in Each Indicator

Based on the graph in Figure 4, it can be seen that there is an increase from pretest to posttest related to the understanding of concept of the student. Indicator 1 (restated a concept), students who answered correctly in the pretest obtained percentage of 70% and increased to 77% in the posttest. Indicator 2 (classify objects according to certain properties) showed that students who answered correctly in the pretest obtained percentage 60% and increases to 73% in the posttest. Indicator 3 (give an example and not an example) showed that students who answered correctly in the pretest obtained percentage of 50% and increased to 80% in the posttest. The last indicator (present draft) showed that students who answered correctly in the pretest obtained percentage of 53 % and increased to 73% in the posttest.

The following Table 4 presented the tendency of pretest-posttest results of students' understanding of concept.

Improved understanding of the concept of student pretest-posttest known to use pairs test or paired sample t-test too. Table 5 below presents the calculation results of paired sample t-test using IBM SPSS version 21.

**Table 5.** The Result of Calculation of Paired Sample t-Test

	t	df	Sig. (2-tailed)
Paired t pretest-posttest	-6.967	29	.000

Based on the data obtained, it is was obtained Sig value of  $0.00 < 0.05$ , therefore, it can be concluded that there is an increased of understanding of concept of students from the pretest to posttest.

## CONCLUSION

Based on the research that has been described, then presented the following conclusions (1) the implementation of PBL with mind mapping had successfully improving the students' understanding of concepts. This is proved by the achievement of the three indicators, namely (a) the average value of posttest of understanding of concept of students which reach the minimum mastery criteria, (b) the result of pretest-posttest on the increased understanding of concept of students based on N-Gain test is in the category of minimal medium, and (c) the average score of the acquisition of the mind mapping manufacture was consider in very good category, and (2) the learning conducted by the model of PBL with mind mapping can improve the students' understanding of concept.

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