The Effect of Project Based Learning (PBL) Strategies on Science Reasoning and Learning Outcomes

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Abstract: Effective learning is learning that involves students in the process of learning activities. Effective learning involves the active role of students both hearing, oral, visual, writing, and student attention in learning activities and can arouse student motivation in the learning process. This type of research used in this research is sent experimental (quassy experimental design). This study used two classes consisting of an experimental class and a control class. The experimental class was given treatment with a project based learning model. Meanwhile, the control class uses a learning model that is commonly used by teachers in schools. This study used a pretest-posttest control group design. For further researchers, there are suggestions as follows. 1) Pay attention to the steps of the project based learning model that have been adjusted to the characteristics of the elementary school students to be studied. 2) Understand each step of the project based learning model and its experiments so that learning runs effectively. 3) Understand each indicator of science process skills in accordance with the characteristics of elementary school students. 4) Paying attention to each student in carrying out science process skills that have been adjusted to the project based learning model 5) The researcher can then add to stage C6, which is evaluating, but also adjusted to the characteristics and initial knowledge of the student. 2) Understand each step of the project based learning model and its experiments so that learning runs effectively. 3) Understand each indicator of science process skills in accordance with the characteristics of elementary school students. 4) Paying attention to each student in implementing science process skills that have been adjusted to the project based learning model 5) The researcher can then add to stage C6, namely evaluating, but also adjusted to the characteristics and initial knowledge of the student. 2) Understand each step of the project based learning model and its experiments so that learning runs effectively. 3) Understand each indicator of science process skills in accordance with the characteristics of elementary school students. 4) Paying attention to each student in implementing science process skills that have been adjusted to the project based learning model 5) The researcher can then add to stage C6, namely evaluating, but also adjusted to the characteristics and initial knowledge of the student.

Keywords: PBL, Science skills, diabetes, Learning Outcomes

1. Introduction

Learning outcomes are a statement of the student's expected ability to master all or part of the competencies that have been taught. Learning outcomes indicate the achievement of the objectives of learning activities. In fact, student learning outcomes in science subjects have not reached the minimum completeness criteria because learning tends to still use a learning model that is not in accordance with the characteristics of the material presented. This makes it difficult for students to understand the material presented (Hamalik.2008).Science subjects are subjects that are considered complicated by most students, ranging from elementary to high school levels. Students rarely like science subjects with the discovery of problems such as students' thinking patterns only for memorizing and students who are less able to develop science concepts (Yance, 2013). Science is also related to how to find out about the occurrence of natural phenomena systematically, so that science is not only a collection of knowledge in the form of concepts, principles, or facts but science can also be a process of discovery. The use of the project aims to deepen learning. Students can use questions about a real topic. Other than that, the project also serves as a material for assessing student competence. In the project based learning model, there is the behavior of group members working together. It is intended that complex tasks that require investigation and project preparation can be done by students very well (Blumenfeld, 2000). When the teacher uses the project based learning model, it will encourage students to actively ask questions. convey ideas, listen to other people's ideas, reflect on ideas, and interact with others. Project based learning can make learning experienced by students more meaningful. Students can build knowledge based on their own experiences. and with direct learning experiences students can develop skills (Thomas. 2000). A person can be said to appreciate the process or activity that is being carried out if he makes direct observations (Rustaman, 2005). From these scientific activities. Science process skills can increase if students are directly involved in finding facts and concepts based on experiences gained from process skills and scientific attitudes (SoetardjoSoejitno, 1998). Based on the results of observations and interviews conducted by researchers, student learning outcomes at the elementary school level are still very concerning, especially in science subjects. The learning outcomes of science subjects show that of the 21 students there are 12 students who score below the KKM. The highest score was 88 and the lowest score was 45, with an average class score of 47%. There are some students who are not active in learning. In order to still use the lecture method and the absence of the use of media in delivering course material. This problem is the basis that there needs to be an improvement in student learning outcomes. Research conducted by (Koch. Chlosta. &Klandt, 2006). shows that 90% of students who take part in the learning process with the implementation of project based learning are confident and optimistic that they can implement project based learning in the world of work and can improve their academic achievement. Other than that. Research results from (Lasonen, Johanna. Vesterinen. &Pirkko. 2000) show that 78% of students believe that project-based learning can help equip students to prepare to enter the world of work, because students learn not only in theory but in practice in the field.

2.Significance of The Study

Marjan (2014)in his research stated that science learning is not taught in accordance with the nature of science. teachers still use conventional methods in the learning process so that the development of students' thinking skills cannot be honed. The same problem is also found in the skills possessed by students, especially science process skills. When the teacher asks students to make an observation and asks students to provide a hypothesis on a problem, there are still many students who do not understand what the teacher means and how to write a report on the results of their observations. The similarity with this research is how science

process skills are indispensable in science learning, so that the learning outcomes obtained by students get satisfactory results. Research conducted by Karamustafaoglu (2011). stated that the existence of a science-based laboratory allows students to build and solve problems, think critically, decide and find answers to their curiosity. rather than asking students to memorize science concepts. With laboratory activities. students can learn meaningfully. Science process skills build students to find the information they get in science learning. The difference with this study is the use of different models in learning. Karamustafaoglu uses a guided inquiry learning model as a step to help students solve problems. Research conducted by Oktadifani (2016) focuses on the implementation of the project based learning model in physics learning. In this study, it shows that students' teaching and learning activities increased to 85.09%. It can be concluded in the research that students' science process skills during the learning process were classified into very good criteria and student learning outcomes after learning physics using the project based learning model were better than student learning outcomes after learning physics using conventional models. Based on research that has been done previously, it is proven that to improve science process skills in science learning requires an innovative learning model. One of the innovative learning uses the project based learning model, because the project based learning model can encourage students to actively ask questions, listen to other people, and interact with other people. In the steps of project based learning, there are scientific process skills that are observed when a scientific product is made. Group rules, learning to be loyal to friends, learning does not depend on acceptance of the environment, learning to accept responsibility, learning to compete with others in sports, learning sports and the implication that teachers must design learning models that envision children to work or study in groups. and learn justice and democracy. This characteristic implies that teachers must design learning models that allow children to work or learn in groups. The teacher can ask students to form small groups of 4-5 people to study or complete a task in groups. In the steps of project based learning, there are scientific process skills that are observed when a scientific product is made. Group rules, learning to be loyal to friends, learning not depending on acceptance of the environment, learning to accept responsibility, learning to compete with others in a sporting manner, have the implication that teachers must design learning models that envision children to work or study in groups. and learn justice and democracy. This characteristic implies that teachers must design learning models that allow children to work or learn in groups. The teacher can ask students to form small groups of 4-5 people to study or complete a task in groups. In the steps of project based learning, there are scientific process skills that are observed when a scientific product is made. Group rules, learning to be loyal to friends, learning does not depend on acceptance of the environment, learning to accept responsibility, learning to compete with others in sports, learning sports and the implication that teachers must design learning models that envision children to work or study in groups. and learn justice and democracy. This characteristic implies that teachers must design learning models that allow children to work or learn in groups. The teacher can ask students to form small groups of 4-5 people to study or complete a task in groups.

3. Review of Related Studies

Project based learning is an innovative learning model and emphasizes contextual learning through complex activities. The focus of learning lies in the core principles and concepts of a scientific discipline, involves students in problem-solving investigations and meaningful task activities, provides opportunities for students to work autonomously in constructing their own knowledge, and in the end will produce tangible products (Thomas. 2000). According to the Buck Institute for Education, project based learning is a learning activity that involves students in problem solving and provides opportunities for students to construct their own knowledge and ultimately produce valuable student work products. Increase collaboration. the importance of group work in projects requires students to develop and practice communication skills. New

and constructive cognitive theories emphasize that learning is a social phenomenon, and that students will learn more in a collaborative environment. Improve resource management skills, if implemented properly, students will learn and practice in project organizing, making time allocations and other resources such as equipment for completing tasks. Besides having advantages, project based learning also has disadvantages. Susanti (2008) based on experiences found in the field. the project based learning model has its drawbacks. Class conditions are a bit difficult to control and easily become scrambled during project implementation because of the freedom for students to give them opportunities to be noisy and for that we need teacher skills in good classroom mastery and management and even though the teacher has arranged a sufficient allocation of time. masilt alone requires more time to achieve learning outcomes. Project based learning is a cooperative learning model for students' ability to think freely and creatively. The implementation of project based learning is the involvement of students in understanding the realities of life from the concrete to the abstract. This reality of life will be a source of inspiration and creativity in analyzing and building a vision of life. Thomas (2000) argues that project based learning consists of the following activities. This stage is the first stage in project-based learning. At this stage the teacher gives problems related to the project that will be carried out by students. Giving problems given to students must encourage the concepts or principles contained in the subject matter. The teacher also provides a general explanation of the project implementation process to be implemented. At this initial stage it is very important because if at this initial stage it is successfully carried out, then the next stage will run well too. At this stage the teacher's role is very large to increase student motivation in carrying out projects. Identifying and Defining a Project. At this stage students work with groups and exchange ideas to identify problems that will be raised into projects to be completed. Students can write down the ideas they have related to the project. At this stage students are invited to formulate problems along with possible answers to the problems raised into a joint project. At this stage the teacher acts as a facilitator to facilitate students in identifying and defining projects. Students must plan all activities to be carried out carefully. The planning process made by students discusses student plans from initial activities to final project activities which include project preparation activities, namely. prepare tools and materials, supporting learning resources, rules during the project implementation of the data collection process and reporting format. Good planning will produce complete data and a good final product. The role of the teacher at this stage is to assist students in planning projects to be implemented. At this stage students get the widest possible opportunity to explore the phenomena that occur around students related to the project. Students can find various kinds of phenomena related to the project that is being implemented. The teacher acts as a student companion in carrying out the project. The project results reporting stage is useful for knowing the results of projects that have been implemented. Project reports are in the form of a written report in a standard format or by presenting the project results in certain media. Through this reporting activity. students can report various kinds of their findings while implementing the project and at the final stage in the project based learning is to evaluate the project results. Evaluation can be done by students and teachers themselves. At this stage it aims to evaluate and provide input about projects that have been implemented by students. Students can provide input on the advantages and disadvantages of the products that have been produced by students. So, it can be used as reflection material for students. There is a format that can be used by teachers and students to evaluate the products produced. Various investigations of an object carried out by humans to answer curiosity about a problem are developments that occur in the world of science. Knowledge or concepts will be hit after humans carry out an investigation. Requires the ability to think and reason well is the goal of a scientist to carry out the scientific method. This fact shows that science is a product of a method of thinking that requires precision, not a concept that just emerges (Hassard, 1992). The point of view of the

development of human intelligence can also be interpreted as scientific process skills. The process is a way or step to process information so that the scientific process will develop more complex in line with the development of intelligence possessed by humans. That human ability that continues to develop is what is called intellectual skills or science process skills (Hassard, 1992). Basic science process skills are the basic abilities that must be mastered to develop more complex or integrated science process skills (Sheeba, 2013). Basic science process skills have an important role in learning, namely building student knowledge, especially at the elementary school level, in the concept of science. Basic science process skills are interrelated with one another because more than one type of skill can be applied in a science activity (Funk and H. James, 1997). Integrated science process skills are skills in the problem solving process. Integrated means that students can combine various basic science process skills to learn an object.

Table 1 Types of Scientific Reasoning

Basic Process Skills	Integrated Process Skills
1. Observe Using the five senses to get information about an object or event	**1. Identifying Variables** Determine the variables that can influence the results of the experiment and keep the control variables constant if the variables being manipulated are independent variables
2. Communicate Describe an action, object, event orally or verbally	**2. Interpreting Data** Manage data and draw conclusions from these data
3. **Classify** Grouping objects or events based on certain properties or criteria	**3. Defining Operations** Explains how to measure a variable in an experiment
4. Measure Using standard and non-standard measurements and estimates to describe the dimensions of an object	**4. Formulating Hypotheses** Expresses expectations or predictions of the results of the experiment
5. Conclude Reveal a concept based on the data or information obtained	**5. Doing an Experiment** Testing variables using scientific stages
6. Predict Stating the results of an event based on a certain pattern or evidence	

Source: Hassard (1992).

According to Hamalik (2008). learning outcomes are the abilities that students have after receiving their learning experience. Based on the opinions that have been described above, it can be concluded that learning outcomes are the abilities that students have after receiving lessons from the teacher. Changes in ability behavior in a person as a result of learning actions that include cognitive aspects, affective aspects, and psychomotor aspects. Next. stated by Susanto, 201b 2:13) that school is one of the factors that determines student learning outcomes. The higher the student's learning ability and the quality of teaching at school, the higher the student's learning outcomes. Thus, it is increasingly clear that learning outcomes are the result of a process in which a number of factors influence each other..

4. Objectives of The Study

The science learning process that takes place in the classroom does not fully emphasize the scientific process, there are no experiments that characterize science learning. The active learning in the process of learning science activities by focusing students on problems can encourage students to be actively involved in solving problems and students can find the concept of science. Students will have a learning experience if the learning process engages

students actively, The application of science process skills to the science learning process in the classroom needs to be presented with innovative learning.The purpose of using innovative learning models is so that students can practice using scientific skills actively and students can build knowledge that is Science learning is student-centered learning, students are directly involved in the process of finding and solving problems in the material properties of sound and its relation to the sense of hearing. Learning that involves students using a project based learning model can make students more active, effective, and can make it easier for teachers to explain the material properties of sound and its relation to the abstract sense of hearing and make it easier for students to understand the subject matter. Students can solve problems that occur using scientific knowledge so that students can develop science process skills and students can create a meaningful learning atmosphere and can achieve optimal learning goals. Learning process. the teacher engages students in working with groups to conduct experiments.

5.Population And Sample

The population in this study were students of class IV even semester MI MAMBAUL ULUM Malang City which consisted of three classes with a total of 70 students. There are 21 students for each class. The sample in this study were 2 classes. Researchers used class IV-C as the experimental class and NA class as the control class. The sampling technique used by the researcher was cluster random sampling. The control class and the experimental class were taken randomly. Each class has been assumed to have the same ability, because the class grouping has been determined by the school on the basis of knowledge and gender which have been distributed equally. The equivalence test of this study used a learning outcome test conducted by the three classes. When the researcher analyzes the test results, it can be seen that the results between the three classes have an equivalent value. The researcher took 2 classes which have almost the same equality. So that the two classes are what the researchers chose to serve as the experimental class and the control class.

5.1.Statistical Techniques Used in the Present Study

This type of research used in this study is a quassy experimental design. This study used two classes consisting of an experimental class and a control class. The experimental class was given treatment with a project based learning model. Meanwhile, the control class uses a learning model that is commonly used by teachers in schools. This study uses a pretest-posttest control group design.

5.2.Data Analysis and Interpretation

Table.2. Table 3.1 Research Design

Group	Prestest		Treatment	Posttest	
	Skills Process science	Learning outcomes		Science Ability	Result Study
Experiment	O1	O3	X	O2	O4
Control	O5	O7	-	O6	O8

Source: Creswwell (2010)

The level of implementation of the project based learning model after the stages were analyzed was carried out properly according to the procedure. The observation data on the implementation of the project based learning model for teacher and student activities are presented in tables 3 and 4

Table.3. Data on the Results of Teacher Activity Learning.

Learning 1 to 5					
1	2	3	4	5	Average
80%	83.3%	86.6%	88.3%	91.6%	85.96%

Interpretation of table-3.

In table 3, the average value of the results of the learning activities of the teacher is 85.96%. The average score can already be categorized as good enough, because it has exceeded 75%. The researcher has adjusted the learning with the lesson plan according to the project-based leanang learning model procedure that has been validated by the validator lecturer. So that. At each meeting it can be obtained that the average score increases

Table.4. Data on the results of student activity learning

Lessons 6 to 10					
1	2	3	4	5	Average
73.3%	76,6,3%	81.6%	83.3%	88.3%	80.6%

Interpretation of table-4.

In table 4, the average value of the results of the learning activities of the teacher is 80.6%. The average score can be categorized as quite good. because it has exceeded 75%. Researchers have adjusted learning with RPP according to the procedure of the project based learning model that has been validated by the validator lecturer. Students' enthusiasm in carrying out learning increases at each meeting.

Science learning outcomes data were measured using a multiple choice test instrument with the material properties of sound and its relationship to the sense of hearing. The instrument consisted of 30 validated multiple choice questions. then used for the pretest and posn'est learning outcomes of science content. The pretest is carried out before learning. pretest held at the first meeting. Meanwhile, the posttest was carried out at the last meeting after learning. Actual allocation used is 2x40 minutes. The description of the achievement of the average pretest and posttest results of learning science content in the experimental class and control class can be seen in table 5 as follows.

Table.5. Average Value of Science Learning Outcomes

	Prestest	Posttest	Enhancement
Experiment	63.33	85.52	21.19
Control	58.09	72.23	12.14

Interpretation of table-5

Based on table 5, it can be seen that the average value of learning outcomes in science content by students in the experimental class with a project based learning model is higher than the average value of learning outcomes in the control class. The posttest value of the learning outcomes of the experimental class science content learning has an average of 85.52 and the control class has an average value of 72.23. It can be concluded that the increase in the average score of the test scores for learning outcomes in science content interpreting the given project-based learning model has an effect on learning outcomes for science content.

Results of Data Normality

The normality test was carried out on the pretest and posttest data on the learning outcomes of science content in the experimental class and the control class. The nonnality test in this study used the Kohnogorov-Smirnov assisted by SPSS 20.The results of the normality test for the sience load can be seen in table 6 as follows

Table.6. Data Normality Test Results

Learning outcomes		Kolmogorov	
		Df	Sig
Pretest	Experimental Class	21	.157
	Control Class	21	.093
Posttest	Experimental Class	21	.125
	Control Class	21	.129

In table 6, the significance value of the science learning outcomes of the experimental class pretest is .157 and the posttest is, 093. The significance value on the learning outcomes test is greater than $\alpha = 0.05$, so it can be concluded that the data is normal distributed. In the control class, the significance value of learning outcomes for science content for the pretest was .125 and for the posttest was .129. The significance value on the learning outcomes test is greater than $\alpha = 0.05$, so it can be concluded that the data are normaly distributed. Science learning outcomes data from the experimental class and the control class are normaly distributed. then the prerequisite test is fulfilled.

To find out the difference between the experimental class and the control class, the ANCOVA (Analysis of Covarians) hypothesis test was carried out using the SPSS 25 program to test the hypothesis of the learning outcomes of science content after being treated using a project based learning model compared to conventional learning in the control class from the students' pretest scores. . The results of the calculation of science process skills showed that the average value in the experimental class in the first meeting was 8.9 while at the fifth meeting it was 16.95. The increase in the value obtained in the experimental class was 8.05. Meanwhile, the results of the calculation of science process skills showed that the average value in the first meeting control class was 6.7, while at the pregnancy meeting it was 9.71. The increase in the value obtained in the control class is 3.15. From the results of the two data, it can be concluded that there is a significant effect of the application of the project based learning model on science process skills compared to conventional learning models. Students are more active and enthusiastic in carrying out learning when the teacher invites students to do experiments

6.Conclusion

Based on the results of the research and analysis that has been described, the following conclusions can be drawn, namely that there is a significant effect of the application of the project based leaning model on science process skills among students in class IV in Malang. In the experimental class there was an increase of 8.05. At the first meeting an average of 8.9 was obtained and at the last meeting an average of 16.95 was obtained. Whereas in the control class using the conventional model there was an increase of 3.15. At the first meeting it was obtained an average of 6.7 and at the last meeting an average of 9.71 was obtained. The suggestions given to teachers in applying the project-bosed learning model are as follows. 1) the project based learning model is good for further learning, because it is proven by the increasing results

of science process skills and learning outcomes in science subjects. 2) The steps of the project based learning model should be adjusted to the characteristics of elementary school students. 3) Tools and materials should be prepared one day before learning takes place and can ask students to prepare simple and environmentally friendly tools and materials. 4) More attention is paid to the time allocation in this study, so that learning is in accordance with the original purpose and does not interfere with other subjects. For further researchers, there are suggestions as follows. 1) Pay attention to the steps of the project based learning model that have been adjusted to the characteristics of the elementary school students to be studied. 2) Understand each step of the project based learning model and its experiments so that learning runs effectively. 3) Understand each indicator of science process skills in accordance with the characteristics of elementary school students. 4) Paying attention to each student in implementing science process skills that have been adjusted to the project based learning model 5) The researcher can then add to stage C6, namely evaluating, but also adjusted to the characteristics and initial knowledge of the student.

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