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Scientific Learning with PJBL and PBL Models of Science Process Skills Student Learning Outcomes

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ABSTRACT

This study aims to determine 1. differences in student learning outcomes based on high and low science process skills. 2. interaction between project-based learning and problem-based learning models with science process skills on student learning outcomes. This research uses experimental research with a research design using a 2x2 factorial design. Sampling using purposive sampling. The sample of this research was 43 students of 8th grade of Islamic Junior High School. The instrument used is the treatment instrument namely lesson plans, worksheets. The data collection instrument was a test of learning outcomes in terms of knowledge and science process skills, an attitude aspect questionnaire and an observation sheet for skills learning outcomes. Data analysis using SPSS 16.0. The results of the study concluded that: 1. There were differences in learning outcomes in the aspects of knowledge, attitudes and skills between students who were given learning using project-based learning and problem-based learning models who had high and low science process skills. The scores of knowledges, attitudes and skills of students who were given project-based learning were 82.24 78.10 and 83.67 respectively, while students who were given problem-based learning were 80.00 72.59 and 80.64. 2. There is interaction between the project-based learning model and the problem-based learning model on student learning outcomes because the Anava Test also shows 3 aspects of learning outcomes have a p-value <0.05, which means there is interaction in the Project Based-Learning and Problem models -Based learning with science process skills to the results of learning aspects of knowledge, attitudes and skills.

1. INTRODUCTION

The quality of education is something that is always sought to be improved by changing the educational paradigm, including at the junior high school level. Scientific learning has the goal of improving students' thinking skills, and can form students sensitive to a problem so they are able to solve it, and can train students to communicate ideas or ideas in learning.

Education in schools must have the characteristics of complex knowledge with processes that are able to shape the intelligence, skills and attitudes of students according to their needs, so that students will become students who develop even better. The characteristics of science that can be applied to science learning include empirical, systematic, objective, analytical and verification. However, learning that does not go through a scientific process can cause students to not have direct experience of the theory that has been presented. So that science process skills in learning activities of the respiratory system material are very helpful in showing actual skills or abilities. Based on the results of observations that had been made before the research, namely the science process skills in schools so far were still relatively low which resulted in inadequacies in the learning process.

Science process skills are closely related to science learning which of course requires a model that is appropriate to the material of the respiratory system, such as the selection of *Project Based Learning* models and *Problem Based Learning*. Science process skills themselves are a learning approach that is used to develop the physical and psychological abilities of students even better, but these abilities are still simple and need stimulation in order to show their true identity (Omar, 2013).

Based on the observations and research that has been done, the *Project Based Learning* model can be suggested for educational practitioners, especially science learning as a consideration as an alternative to the *Project Based Learning* (PJBL) model that can be applied in class in order to increase student learning creativity to design a project and train students. critical thinking. The next alternative uses the *Problem Based Learning* (PBL) model because it has the characteristic of authentic investigation which can make students carry out objective investigations in the form of formulating problems, making hypotheses, collecting data, analyzing data, conducting experiments and drawing conclusions (Triyanto, 2007). So that the PBL and PjBL learning models are very suitable for use in developing students' science process skills in the learning process. Project-based learning can train students to use their attitudes, skills and knowledge to solve problems and adapt to unwanted circumstances in life (Chang et al, 2011).

Skills in the field of science include: observing, grouping, communicating, measuring, recognizing and using the relationship between time and space, making inferences, making operational definitions, developing hypotheses, controlling variables, analyzing data and conducting experiments (Omar, 2013). Science is a way of working, a way of thinking and solving problems, not just information about facts and concepts (Sudana, 2010). Project Based Learning is a learning model that focuses on the main concepts and principles of a discipline, involving students in problem solving activities. The PjBL model emphasizes learning activities that are relatively long duration, holistic-interdisciplinary, student-centered, and integrated with real-world practices and issues (Ngalimun, 2012), while the Problem Based Learning model is a learning model based on a problem and can be provide active learning conditions to students (Arends, 2008).

Science learning is a process related to finding out about objects and living things in the surrounding environment objectively. Science is a process of discovery that involves concepts, facts and principles (Depdiknas, 2006). Through science process skills, students are expected to gain new knowledge and be able to develop it. Process skills put forward in the growth and development of skills possessed by students. Science process skills can make students process information so that new things are found in the form of concepts, facts and the development of attitudes and values (Wibowo, 2012). Learning is a process of changing behavior as a result of interaction with the environment in order to meet the needs of life (Saiful, 2005).

Based on observations at Islamic Junior High School of Surakarta, it shows that teachers still use learning methods that communicate in one direction and do not involve science process skills, so that learning still prioritizes cognitive aspects, and does not consider much of the processes carried out by students. The aims of this study were: 1. To find out the differences in student learning outcomes at Islamic Junior High School of Surakarta based on high and low science process skills. 2. Knowing the interaction between *Project Based Learning* models and *Problem Based Learning* with science process skills on student learning outcomes at Islamic Junior High School of Surakarta.

2. MATERIALS AND METHODS

This study used an experimental method with the Project Based Learning model and problem based learning with a population of 43 grade 8 students at Islamic Junior High School of Surakarta for the 2021/2022 academic year. Sampling used purposive sampling, namely by direct selection carried out in class 8 A as the experimental class I and class 8 B as the experimental class II. The experimental class I used the project based learning method and the experimental class II used the

problem based learning method. Data collection methods: observation, documentation, and tests. The research design uses a 2x2 factorial design:

Table 2.1. Research design

Moderator Variable	Variabel Bebas	
	Model *Project Based Learning* (A1)	Model *Problem Based Learning* (A_2)
Higher Science Process Skills (B1)	A_1B_1	A_2B_1
Higher Science Process Skills (B2)	A_1B_2	A_2B_2

Keterangan :

A_1 : Model *Project Based Learning*
A_2 : Model *Problem Based Learning*
B_1 : Higher Science Process Skills
B_2 : Higher Science Process Skills

3. RESULTS AND DISCUSSION

The data that has been collected in this study include: 1) Science Process Skills, 2) Learning Outcomes include aspects of knowledge, attitudes and skills. Data obtained from class 8A as a class with a *Project based learning* model and class 8B with a Problem based learning model. The research data was taken during the learning activities (aspects of skills) and after teaching and learning activities (aspects of knowledge and attitudes). The purpose of this research itself is to determine differences in student learning outcomes based on high and low science process skills, and to determine interactions between *Project based learning and Problem based learning* models with science process skills on student learning outcomes.

Table 3.1 Average Student Learning Outcomes by Model *Project Based Learning* and *Problem Based Learning*

Learning model	Learning outcomes		
	Knowledge	Attitude	Skills
Project Based Learning	84,24	78,10	83,67
Problem Based Learning	80,00	72, 59	80,64

Based on the results of research that has been done on the knowledge aspect of the *project based learning* model 84.24 and the problem based learning model 80.00 while the results on the attitude aspect of the project based learning model are 78.10 and the *problem based learning* model is 72.59. The results on the skill aspect of the *project based learning* model were 83.67 and the problem based learning model was 80.64. So it can be seen that learning with project-based learning and problem-based learning models is not too different, because the use of project-based learning and problem-based learning models is something students are still new to. In addition, the direct involvement of students during learning activities also affects student learning outcomes.

Table 3.2 Average Learning Outcomes based on Science Process Skills

Science Process Skills	**Learning outcomes**		
	Knowledge	**Attitude**	**Skills**
High Science Process Skills	85,48	82,05	85,21
Low Science Process Skills	75,00	67,48	70,75

The mean of learning outcomes based on Science Process Skills contained in the aspect of student knowledge, obtained students with high science process skills, namely 85.48, while

students who had low science process skills, namely 75.00. For the results on the attitude aspect of science process skills the highest average is 82.05 and students who have low science process skills are 67.48. And the results on the skills aspect of students who have high science process skills are 85.21, then students who have low science process skills are 70.75. Based on the three aspects that have been carried out in this study, the learning outcomes of students who have high science process skills have a better average than students who have low science process skills, namely excelling in the aspects of knowledge, attitudes and skills.

Project based learning is able to train students to use their attitudes, knowledge and skills to solve problems and be able to adapt to unwanted or unwanted circumstances in life (Chang et al, 2011). *Project Based Learning* has several characteristics by using science process skills such as students being able to make decisions about a framework, being able to pose a problem or challenge to students, being able to design processes to determine solutions to problems, being able to be collaboratively responsible for accessing and managing information to solve a problem, an evaluation is carried out continuously, can reflect on the activities that have been carried out (Daryanto, 2014).

Science process skills have a characteristic in the form of a learning process that can provide learning experiences to students, so that students have many skills such as: physical skills, psychological skills, and social skills. Teacher competence is needed in the application of process skills so that students' teaching and learning activities can have comprehensive capabilities (Epon, 2013).

Based on the results of the Test of Between Effects, the calculated F value = 0.087 with p-value = 0.048 then H0 is accepted, which means that there is interaction in the Project Based Learning and Problem Based Learning models with science process skills on learning outcomes aspects of knowledge, attitudes and skills influencing learning outcomes good student. In the research that has been carried out, it has produced several findings, including: project-based learning and problem-based learning models in terms of science process skills can affect student learning outcomes, namely learning that is not too much different, because it includes new things that students know and are able to affect student learning outcomes. Project based learning and problem based learning models are able to facilitate students in solving a problem and finding their own concepts about respiratory system material in grade 8 in everyday life. For students when they find something new that is fun for students, so that it can cause students' learning motivation to increase so students don't feel bored in participating in learning activities. The real environment can provide important stimulation for students in learning and exploring and discovering something new for themselves (Ristanto, 2010).

The results of research that has been done there is an interaction between project based learning and problem based learning with Science Process Skills on learning outcomes. Through hypothesis testing, a p-value <0.05 is obtained, which means that there is an interaction between project-based learning and problem-based learning with science process skills on learning outcomes in knowledge, attitudes and skills aspects. As in research, the project-based learning model for students is more fun in determining methods and performance, so high creativity is required, whereas in the problem-based learning model students still receive guidance from the teacher in solving problems.

Science process skills (KPS) can be developed using two models, namely project based learning and problem based learning in terms of student learning outcomes through written and oral tests. The development of KPS (Science Process Skills) can be carried out with practical activities in learning such as material on the respiratory system in humans. The division of KPS (Science Process Skills) consists of ten stages including: observing (observation), interpreting, making classifications, making estimates, communicating, making temporary conjectures, making plans, conducting experiments, applying concepts, making questions and concluding (Nuryani, 2005).

KPS (Science Process Skills) students will be more involved and interact so that students who have high science process skills will try to understand concepts quickly. In the project based learning model students are more free in determining how and how to perform, students are

required to have high creativity, whereas in the problem based learning model students still receive guidance from the teacher in solving the problem. However, the two models have similar characteristics and characteristics in the application of KPS (Science Process Skills) which are used for learning outcomes, namely the teacher as a facilitator, student-centered learning, training students to think critically in solving a problem, and training students to seek various sources of information.

Based on the factors described above, that the *project based learning* and *problem based learning* models affect the teaching and learning process of students, there are 2 factors that can influence, namely internal factors and external factors. Internal factors are factors that exist within the individual, while external factors are factors that exist outside the individual (Slameto, 2010). If in the learning process students do not fulfill these factors properly, it will also affect the learning outcomes achieved by students. Therefore, to achieve learning outcomes, teachers must also pay attention to these factors so that learning outcomes can be achieved. In this study, the material used is the respiratory system in humans, including:

3.1. Structure and Function of the Respiratory Tract

The respiratory tract is divided into two parts, namely the upper respiratory tract and the lower respiratory tract. The upper respiratory tract includes the nostrils, nasal cavities, pharynx and larynx. The lower respiratory tract consists of the trachea, bronchi, bronchioles and lungs (Young, 2007).

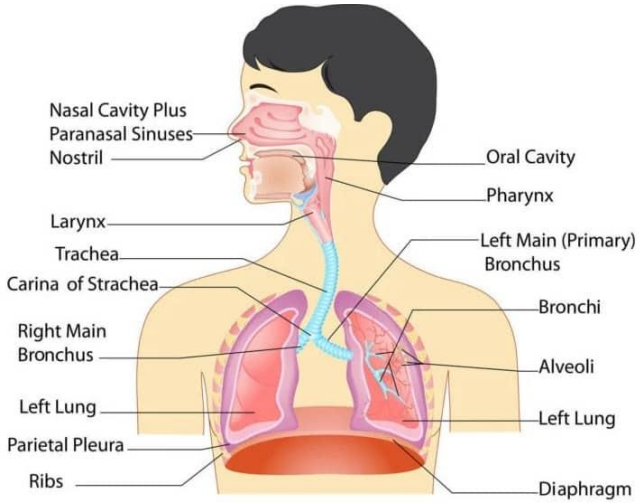

Figure 1. Respiratory Tract
Source: Mulyani (2013)

3.2.Breathing Mechanism

The process of breathing is divided into two, namely inspiration (inhale) and expiration (exhale). The respiratory center is very sensitive to excess CO2 levels in the blood and deficiencies in the blood (Syaifuddin, 2006).

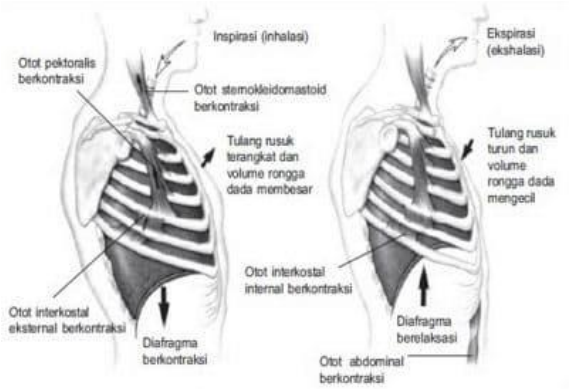

Figure 8. Breathing Mechanism
Source: Britannica (2006)

Chest breathing occurs when the muscles between the outer ribs contract or contract, the ribs lift up so that causes the chest cavity to expand which causes the air pressure in the chest to decrease so that air enters the body (Mulyani, 2013).

3.3. Gas Exchange Process

The process of exchanging oxygen and carbon dioxide occurs in the lungs, especially in the alveoli because the walls of the alveoli are attached to blood capillaries.

3.3.1. Oxygen Transport

3.3.2. Transport Carbon Dioxide

3.4. Breathing Speed and Control

3.4.1. Control By Nerves

The respiratory center is an automatic center within the medulla oblongata that transmits efferent impulses to the respiratory muscles.

3.4.2. Chemical Control

This chemical factor is the main factor in controlling and regulating the frequency, speed, and depth of respiratory movements. The respiratory center in the marrow is very sensitive to chemical reactions.

3.5. Breathing Air Volume and Capacity

The volume of air in the lungs and the rate at which it is exchanged inspiration and expiration can be measured through a spirometer (Setiadi, 2007).

3.5.1. Volumes

3.5.2. Capacity

3.6. Abnormalities, Disorders and Diseases of the Respiratory System

Setiadi (2007) in his book describes several abnormalities in the respiratory system:

3.6.1. Hypoxia (anoxia)

3.6.2. Hypercapnia

3.6.3. Hypocapnia

3.6.4. Asphyxia (suffocation)

3.6.5. Dyspnea

4. CONCLUTIONS

There are differences in learning outcomes in the aspects of knowledge, attitudes and skills between students who are given learning with project-based learning models and problem-based learning who have high and low science process skills. _ Scores of knowledge, attitudes and skills provided by students _ Project based learning respectively 8 2, 24 78, 10 and 8 3, 6 7 while students given problem based learning 80.00 72.59 and 8 0.64 . There is an interaction between the project-based learning model and the problem-based learning model on student learning outcomes because the ANOVA test also shows 3 aspects of learning outcomes have a p-value <0.05, which means H0 is rejected.

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