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THE EFFECT OF APPLYING PROBLEM BASED LEARNING MODELS TO STUDENTS' SCIENTIFIC LITERACY

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Abstract

This research aims to examine the effect of applying Problem Based Learning models to students' Scientific Literacy. Using a quasi-experimental design with research subjects for grade IV students in 5 excellent primary schools in Magelang Regency, amounting to 90 students. The results obtained are SDN 1 (control) pretest 36.6, posttest 46.2, on SDN 2 (experimental) pretest 42.3, posttest 67.8, on SDN 3 (experimental) pretest 37.6, posttest 69, 8, at SDN 4 (experimental) pretest 41.5, posttest 78.2 and at SDN 5 (experimental) pretest 35.5, posttest 77.5. While the control class hypothesis test and the experimental class that uses the independent sample t-test get a sig (2-tailed) value of 0.00 where this number <0.05, which means there is a significant influence. With these results it is hoped that Problem Based Learning can become one of the mainstays of learning models that can be used by teachers to strengthen the potential of students' scientific literacy while simultaneously carrying out the learning process scientifically.

Keywords: *Poblem Based Learning, Scientific Literacy*

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INTRODUCTION

Unprecedented advancements in the ages call for adjustments in various areas of life, one of which is education. It is hoped that this adjustment will enable the active, creative, and innovative learning process of producing competent graduates by the age of development. In the industry 4.0 era, one of the essential abilities is scientific ability. Referring to the resulting study of Trend on International Mathematics & Science Study (TIMSS) of 2015, Indonesian students' science results go to 45 countries. In addition to the results of the country's student science skills, the data from World's Most Literate Nation (WMLN) released on March 9, 2016, showed Indonesia to be in 60th place in 61 countries. The WMLN study focuses on the extent to the scientific (Scientific Literacy) of a country, and this serves as an overview of the reason for the Indonesian student's achievement of science on TIMSS.

The student's achievements were closely linked with scientific literacy. Toharudin (2011) explains that scientific literacy is one's ability to understand, communicate, verbally or in writing, and apply scientific knowledge in problem-solving to a high attitude and sensitivity toward oneself and its environment in making decisions based on facts theories, concepts, and laws of science.

In detail, a person who has the essential scientific foresight is 1). Understands the basic scientific facts and their meaning; 2) inquire, seek, and answer questions that spring from curiosity about daily experiences; 3) describing, explaining, and predicting natural phenomena; 4). Conscious of defending the newspaper on science and engaging in a social discussion on the conclusion's validity; 5). Identify scientific issues outside national and local decisions and commit explicit actions against them; 6) evaluate the quality of scientific information based on the source and manner of its production; 7) assign and assess the arguments based on evidence and apply the arguments correctly (Al-Rsa 'i, 2013).

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One of the adjustments made by the Indonesian government to meet the demands of today's development is the application of the 2013 curriculum, which has been particularly broad with the use of a scientific approach. Curriculum 2013's technical guide said the scientific approach is the learning that encourages the child to do scientific skills (department of commerce, 2013). Further in the implementation, teacher training materials of curriculum 2013 (2013) is described as learning the process of using a scientific approach is intended to give learners an understanding of, understanding materials using a scientific approach, that information may come from anywhere, at any time, not dependent on teacher information. Implementation of the scientific approach of observing, menus, gathering information or experiments, associated and communicating. One of the learning models that embrace this approach is the problem of based learning. Trianto (2010) states that learning based on problems is an interaction between stimulus and response, a relationship between two-way learning and the environment. The environment provides input of help and problems while the brain nerves interpret them effectively so that problems it faces can be observed, investigated, assessed, and analyzed to seek solutions. Holil (2008) states that the PBL in scientific learning is one of the most exciting studies because 1). PBL invites the students to finish the case or problem that is related to science; 2). Increase the interest in discussions between students and encourage learning activities; 3) help students build their knowledge of the world around them and to help lay the foundation of their early knowledge before moving on to more complex knowledge.

Literation may still be a little alien to some societies. Although some people have often heard of literacy, it still has a minimal definition of reading and writing or being free of illiteracy. It is a bit of a concern when communities in education still have a large misconception of what literacy is. Emphasis (2017) initially explained that literacy is the ability to use language and pictures in rich, varied forms to read, write, listen, speak, see, present, and think critically about ideas. Deboer (2000) explained that scientific insights are the primary goal all scientific learners hope to have to react to the phenomena in the environment. More broadly, Chiapetta & Koballa (2010) states that the dimensions or aspects of scientific literacy (the scientific theme) follow the natural science: 1) science as a way of thinking; 2) science as a way of investigating; 3) science as a body of knowledge; 4) science and its interaction with technology and society. National Science Teacher Association (NSTA) (1971) explains that a person who has good scientific connections is capable of employing scientific concepts, process skills, and the values of science in his dealings with others and the environment, as well as understanding the interconnected relationships between science, technology, and other social and economic development. According to Laherto (2010: 163), increasing students' Scientific Literacy is one of the principal purposes of global education. Based on this, we might conclude that scientific innovations are a component of the ability of a person to understand, communicate, and apply the scientific codes to deal with the phenomenon of daily life.

One very close study model to implementing the scientific approach is Problem Based Learning (PBL). Cheong (2008) explained that in a PBL approach, students faced situations that led them to problems to solve. Students learn how to solve the problem. They analyze problems, gather information, generalize and evaluate solutions to find the right solution, and present the solution already reached. According to Arends (2008), a well-troubled situation should meet five essential criteria. First, the situation must be authentic, and the problem must be attributed to the actual learning experience. Second, the problem is presented so unclearly that it creates a mystery or a riddle. Third, it should be meaningful and consistent with the level of intellectual development. Fourth, the problem should be broad enough to allow teachers to fulfill its instructional purposes and still within physic limits for their subjects in terms of time, space and resource limitation. Fifth, a good problem should benefit from a group's efforts rather than stand in the way.

Savin (2003) said being an effective facilitator is more than asking open-air questions, giving beautiful body gestures, and providing a comfortable and fun class atmosphere. However, it is more. The facilitator's position is to ensure that teamwork goes well and that the learning goal can be accomplished. Facilitators are tasked with developing team culture, giving challenges to students, and improving student thought levels. The teacher's job as a learning process controller is (1) to guard and control the learning process, (2) to instruct and convince learners when the learning course is at a dead-end, (3) to check students initial knowledge to fit the context of the problem at hand, (4) to control and organize small groups so that learning does not become monotonous. Cheong (2008) explained three PBL processes in the class: early meetings, the self-reliant learning stage, and the final meeting. At the initial meeting, students were given a problem that was a safety match for the study. Students analyzed the problem from their field corner and tried to explain it with their initial knowledge. At the self-reliant learning stage, students clarify and identify the problem, suggest an idea, and determine what they need to master to manage the problem. Students compiled an action plan to find, evaluate, synthesize, application of the necessary information to solve the problem. At the stages of independent learning, stay under the teacher's guidance. At the last meeting, students share and repeat their information and confirm that the problem has indeed been solved. Students look back on how they solve problems and generalize solutions it finds for different conditions.

METHOD

The kind of research used in this research is a quasi-experiment. Creswell (2012) states that experimental experimentation studies only testing an idea (practice/procedure) to determine whether it affects results or variables, while Sugiono (2009) adds quasi-experiment is a method that has control groups but cannot fully function to control outside variables that affect the implementation of experiments. McMillan & Schumacher (2010) explained that there are two sample classes of experiment classes and control classes in this design. Each sample class was given a different treatment and was given pre-test and post-test at the same time. In the experiment, classes were given problem-based learning models, and control classes were given conventional learning.

This research design uses a non-equivalent control group design, which corresponds to the pre-test and post-test control group design (Sugiono, 2015). In this study, a random sampling was chosen. Experiment groups are given learning with a Problem Based Learning (PBL), whereas control groups are given learning by a typical teaching method by teachers with lecturing.

The research is located in the elementary school in the city of Magelang. The sampling technique with random sampling and to determine the number using the Slovin formula. The data-gathering technique in this study is a test. The test form used is a non-objective description or bentuk uraian non-objektif (BUNO) in Indonesian. The non-objective form of exposition requires students to remember and organize (describing & blending) unique ideas or things that have been learned by presenting or expressing those ideas in written descriptions so that the finder makes possible an element of subjectivity (Arifin, 2012). The validity of the instrument test uses expert judgment, while reliability tests are made by trying on the classes that have been studying the material. Reliability testing uses a 24.0 SPSS for Windows program using the basic formula of the Alpha Cronbach formula. The hypothesis uses the independent test t-test to test the impact and the t-test for pathogens to discern the shape of the impact.

RESULTS AND DISCUSSION

The identification of a testing device was a matter of BUNO

The instrument used is a type of BUNO, where the issue prepared for validity test of 20 questions is tested on 40 students on 5th grades whose notes have studied the test lesson material. As for the results is:

Table 1. The Result of Validity Test

Number	Question Number	Sig (2-tailed)	Description
1	1	0,95	Valid
2	2	0,814	Valid
3	3	-0,11	Invalid
4	4	-0,58	Invalid
5	5	-0,634	Invalid
6	6	-0,352	Invalid
7	7	0,923	Valid
8	8	-0,226	Invalid
9	9	0,159	Valid
10	10	0,865	Valid
11	11	0,124	Valid
12	12	0,985	Valid
13	13	0,589	Valid
14	14	0,961	Valid
15	15	0,59	Valid
16	16	0,814	Valid
17	17	-0,106	Invalid
18	18	0,899	Valid
19	19	0,572	Valid
20	20	0,572	Valid

Based on these results, 14 valid problem items and 6 invalid ones are found. Next, 14 valid question items are reliably tested using the alpha Cronbach test. The result is:

Table 2. The Result of Reliability Test

Number	Alpha Cronbach's Score	Description
1	0,14	Reliable
2	0,308	Reliable
7	0,091	Reliable
9	0,320	Reliable
10	0,138	Reliable
11	0,269	Reliable
12	0,368	Reliable
13	0,312	Reliable
14	0,202	Reliable
15	0,262	Reliable
16	0,145	Reliable
18	0,232	Reliable
19	0,109	Reliable
20	0,200	Reliable

From the 14 issues tested for reliability, there are 14 issues reliable, then selected 10 issues that will be the question item on the study's instrument according to the numbers 1, 2, 7, 9, 10, 11, 12, 13, 14, 15.

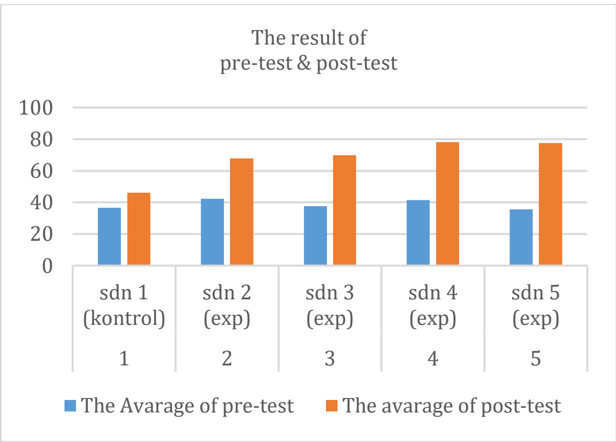
Result

After pre-tests and post-tests had been made, according to the individual criteria of each school, the results were found is:

Table 3. The Avarage of Pre-Test & Post-Test

Number	Institution	Avarage of Pre-test	Avarage of Post-test
1	SD N 1 (kontrol)	36,6	46,2
2	SD N 2 (exp)	42,3	67,8
3	SD N 3 (exp)	37,6	69,8
4	SD N 4 (exp)	41,5	78,2
5	SD N 5 (exp)	35,5	77,5

There are varying degrees of changes at different levels in each school. To make it easier to understand changes, be seen in the following diagram:



There is a significant visual difference between the average pre-test and post-test control class and experimental class. To know how more certainly whether the impact was significant or not, a prerequisite test was made to determine the type of test of the hypothesis, where the standard test would have been used Kolmogoto Smirnov test, the result is:

Table 4. Normality Test of Kolmogorow Smirnov

Asymp. Syg (2 tailed)	Condition	Description
0,991	**>0,05**	**Normal**

From the result, it can be seen that normally distributed data with asymp.sig (2-tailed) is more significant than 0.05. While for the low test using the Lavene test, the result is:

Table 5. Lavene Homogeneity Test

Syg	Condition	Description
0,247	>0,05	Homogenous

These results found a more considerable significance than 0.05, which is 0.247, which means homogeneous data.

With prerequisite tests showing normal distribution and homogeneous data, hypothetical tests can use parametria test, that is, test independent of t-test samples. The result is:

Table 6. Independent sample t-test

Syg (2-tailed)	Result	Description
0,00	**<0,05**	**signifikan**

It can be seen that its significance is smaller than 0.05, which means there is a significant difference in control classes and experiment classes.

Discussion

There are varying improvements in each class group as well as in each class. In general, the average pre-test of the control class was 36.6, and its post-test results average 46.2, where a 9.6 average rise. While the average experimental class, its pre-test was 39.2 and its average post-testing number 73.3, where there was an average rise of 37.85 points. From these results, there is a vast difference between the result of the pre-test and the post-test control class, and the experimental class. Hartati (2016: 96) explains that an advanced PBL learning model can enhance the ability of students' scientific literacy.

To be more specific, the most significant average change in the experiment class occurred in SDN 5, followed by SDN 4, SDN 2, and the least in SDN 3. As to this data, there are interesting facts that go hand in hand, the quality and quantity of learning facilities.

The proper PBL learning process is ideal for students with high curiosity levels, creating challenges to exert all their potential and effort in the learning process. Other friends will carry off students who have less activity because of the nature of group learning. Wood (2003: 328) explained that a group of students would not only potentially acquire new information from the theme but also improve communication skills, teamwork, teamwork, teamwork, teamwork, responsibility, and consideration. Interactions between different abilities will result in good synergy in each group, plus in maximally enlightened facilities.

CONCLUSION

Based on the data found, the PBL learning model is excellent as an alternate learning model that will affect the most underrated students' Scientific Literacy.

The disparity of effects on experimental schools coupled with the quality and quantity of the learning facility requires attention to all concerned in the education world, as the maximizing of the potential of learning that students hope to have is reduced in the presence of less than ideal conditions.

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