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Project-Based Learning by using Science KIT to Enhance Confidence and Problem-Solving Skills in Fifth Grade Students

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Abstract

The purpose of this study is to test the effectiveness of PjBL model by using Science KIT to improve students' confidence and problem-solving skills. This research is done by using a quasi-experimental design with a type of non-equivalent control group design. The research subjects were 50 fifth grade students from Elementary School 02 Krompeng and Elementary School 01 Kalirejo. Data on students' self-confidence and problem-solving skills assessment are collected through observation and tests. Using N-Gain analysis and t-test. Research results show that there are different results in terms of self-confidence attitudes between groups of students who follow PjBL model with Science KIT and the other groups of students who follow PjBL learning model, obtained a value (t_{value} = 37.12 > t_{table} = 1.68), there are differences in learning outcomes as well, in terms of problem-solving skills between groups of students who follow PjBL learning model with Science KIT with groups of students who follow PjBL learning model, it is proven post-test result obtained in experimental class is 74.96 while in the control class is 60.72 (t_{value} = 19.55 > t_{table} = 1.71). The results of this research are beneficial for teachers as an overview of condition self-confidence and problem-solving skills that can be taken into consideration in planning the lesson.

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INTRODUCTION

Science is a knowledge that is obtained by conducting research, testing, compiling theories, taking conclusions, and then testing and investigating again and so on because this knowledge is interrelated with one another. We live in a global society where the impact of knowledge diversity brings various perspectives and appreciation of different learning needs and methods that make students able to understand science even at the most basic level such as conducting investigations in the natural environment (McFarlane, 2013). Based on the description above, Science is one of the subjects in elementary school that is strongly correlated with how to find out nature systematically, so that science is not only about mastery of a knowledge series in terms of facts, concepts, or principles but also a process of discovery that involves students activity.

The observation results are taken from the fifth grade in Gugus Gajah Mada, which are Elementary School 02 Krompeng and Elementary School 01 Kalirejo in Talun district, Pekalongan in March 2017, showed that the science learning process does not emphasize on scientific performance, students tend to lack confidence in participation, students do exercises on a less structured student worksheets, students are less facilitated in terms of science kit, the passing grade of Science subject is still under 70. Some of the problems above show that the learning process has not developed students' confidence in that area.

Self-confidence is a person's belief in their ability to do or to show something (Adywibowo, 2010). This opinion is reinforced by Lie (2004), saying that confidence is confident about their ability to complete a job or a problem. Moreover, according to Singh, and Kaur (2008), self-confidence refers to the ability felt by someone to successfully overcome a situation without relying on others. One way to develop a confident attitude is through scientific activities to work on, like completing a particular project and stimulating students' science problem-solving ability. Salirawati (2012) highlighted that a confident attitude is about believing oneself ability to fulfill their desire. Self-confidence is the basic for every person is confident in his ability to solve problems

A learning model that emphasizes problem-solving is Project-Based Learning (PjBL). Bagheri, Ali, Abdullah, and Daud (2013) found that Project-Based Learning can improve student independence. Ambarwati, Dwijanto, and Hendikawati (2015) also said that the Project-Based Learning model could generate students activity, giving students the opportunity to carry out physical and mental activities, such as practicing theory, discussing, doing a work/project as a learning media; then students and their groups explain or present the results both verbally and in writing. PjBL designed to be used on complex problems faced by students in conducting investigations and understanding it.

Gültekin (2005) Project-Based Learning (PjBL) model is an alternative learning model that can is an alternative learning model that fits elementary students' characteristics that can improve various skills, make learning more fun, entertaining, and meaningful. Research conducted by Siwa, Muderawan, and Tika (2013) shows that PjBL also influences learning outcomes. Rais (2010) in his study, concluded that the PjBL model could improve student academic achievement. Luthvitasari, Putra, and Linuwih (2014), in their research, concluded that the project-based learning model influenced improving critical thinking skills and creative thinking skills of vocational students.

Science learning at elementary school must refer to the nature of science as a product, process, and attitude development by emphasizing the provision of direct experience to develop competencies to explore and understand the natural environment scientifically (Nurhidayah, 2015). Therefore, science learning should be done as interesting as possible such as choosing the right learning model and also using instructional media in explaining something abstract to students. According to Na'im, Sopyan, and Linuwih (2015) effective teaching methods will change children way of thinking from children who were only fixated on one

answer in the book to be more creative and thinking divergently in finding answers.

So that in science learning, students should be trained to solve their problems without constantly looking for answers from their provided textbook. According to Ajai, Imoko, and O'kwu (2013) constructivism learning is a concept where students build their understanding with concrete experience. Students can be considered that are considered as able to solve a problem if they can solve a problem that has never been encountered by building their understanding through the gained experiences.

Chi, and Glaser (1985) in his book, said that a problem is a situation where you try to reach a goal and have to find a way to get it. According to Muchlis (2012) problem-solving is an effort to find a way out of difficulty, achieving a goal that cannot be easily achieved. Setiawan, Dafik, and Lestari (2014) explains that students are said to be able to solve problems if they can apply the previously obtained knowledge into an unknown situation. Therefore, students need to be trained to solve problems so they can apply their knowledge to solve problems in everyday life. Students are considered as able to solve problems if they can solve a problem that has never been encountered by applying experiences that have been obtained.

Based on the explanation above, the study was conducted with the title "Project-Based Learning Using Science kit to Enhance Confidence and Problem-Solving Skills in Fifth Grade Students." The purpose of this study is to test the effectiveness of PjBL model by using Science KIT simple electrical circuit to improve students' confidence and problem-solving skills.

METHODS

This research is a quantitative study in the form of quasi-experimental design with the type of non-equivalent control group design. There are two class groups. In the experimental class, the PjBL model was used by using Science KIT simple electrical circuit, while in the control group learning was done by using PjBL model.

Table 1. Quasy Experimental Design

Pre-test	Treatment	Post-test
O_1	X_1	O_3
O_2	X_2	O_4

Information:
O_1 and O_2 = Pre-test
O_3 and O_4 = Post-test
X_1 = using PjBL Model with Science KIT.
X_2 = using PjBL Model

The study was conducted in elementary schools in Gajahmada, Talun, Pekalongan, namely in Elementary School Krompeng 02 and Elementary School Kalirejo 01. The study was conducted in April-May 2018 in the second semester of the 2017/2018 academic year. The study population was all fifth-grade students of Elementary School in the Gajahmada, Talun, Pekalongan. The sampling technique used is purposive sampling, which is sampling with certain considerations. The sample of this study was 25 students.

The balance test was conducted to determine the initial condition of the PjBL class students while using Science KIT simple electrical circuit, more or less the same as the expository class. The initial balance test was tested through an independent sample t-test both sides. Furthermore, value of t_{value} = compared with t_{table} with degrees of freedom (d.f) = n-1 and α = 5% for a two-tailed test (2-tail test)

After that t_{value} compared with the t_{table} with degrees of freedom (d.f) = n – 1 and α = 5% for a two-tailed test (2-tail test). Therefore, if the $t_{table} > t_{value,}$ so H_0 is accepted.

Tests were used to determine whether each student has completed classically. This is seen based on the learning outcomes (post-test) value. Students' ability to solve problems is said to be classically completed with at least 75% of students reach passing grade. The passing grade for science is 70.

$$\text{Completeness percantage} = \frac{t}{n} \times 100\%$$

Information:
t = students' who reached the passing grade or about ≥ 70
n = number of students

After knowing the total number of students who completed classically, then the proportion

test was conducted. Sudjana (2005) on his book, the statistical tests used are as follows:

$$Z = \frac{\frac{x}{n} - \pi_0}{\sqrt{\frac{\pi_0(1-\pi_0)}{n}}}$$

information:
x : number of successes
n : sample
π_0 : Success opportunity proportion

The test criteria used is H_0 is acceptable when $Z_{value} < Z_{table}$ and H_0 is rejected for another Z score.

The average difference test was used to compare the problem-solving abilities of PjBL class students with the Science KIT simple electrical circuit and students from expository class. The students' problem-solving ability was seen based on the value of the learning outcomes post-test. Independent Sample of one party t-test was used as an average difference test.

The test criteria used accept H_0 when $t_{value} < t_{(1-\alpha)}$ and decline H_0 for the other t_{value}. The degree of freedom for the t distribution list is $d(k) = n_1 + n_2 - 2$.

Data obtained from this study are learning outcomes data and confidence attitude observation data. The instrument of data collection was carried out through pre-test and post-test, as well as an observation sheet of self-confidence. In the observation sheet, each students' self-confidence indicator contained a range of scores 1, 2, 3, 4. Then the results of observations and student achievement indicators were calculated as follows (Acep Yoni, 2010).

$$\text{Percentage} = \frac{\text{score obtained}}{\text{maximum score}} \times 100\%$$

Table 2. Achievement Criteria of Self Confidence Indicator

Percentage (%)	Criteria
≤ 55	Low
56 - 68	Medium
69 - 80	High
81 - 100	Very high

Regarding students' problem-solving abilities, the homogeneity test results obtained sig.= 0.163 is higher than 0.05 (0.163 > 0.05), so it can be concluded that the data is homogeneous variance.

Effectiveness analysis is done by using gain analysis, t-test, students' self-confidence and problem-solving ability are considered as increase if the normalized gain is minimum at the average criteria or about $0.3 \leq (g) < 0.7$ (Hake, 1998).

Table 3. N-Gain Criteria

Classification	Criteria
$(g) \geq 0{,}70$	High N-gain
$0.30 \leq (g) < 0.70$	Average N-gain
$(g) < 0.30$	Low N-gain

RESULTS AND DISCUSSION

Self Confidence Result

The confidence attitudes recapitulation results of the experimental class and control class students had significant differences. It is seen from the comparison of the number, mean, and confidence criteria in experimental class and the control class. In brief, the data is presented in table 4.

Table 4. Achievement Results from the Confidence Indicator

Meeting	Experiment class		Control class	
	Percentage (%)	Criteria	Percentage (%)	Criteria
1	75.8	High	54.2	Low
2	88.75	Very high	63.8	Medium
3	88.75	Very high	67	Medium
4	90.4	Very high	69	Medium

At the first meeting, the achievement results of students' confidence attitude in the experimental class reached 75.8% of students included in the high criteria, while 54.2% of students in the control class were included in the low criteria. On the second meeting, the achievement results of students' confidence attitude in experiment class are 88.75% with very high criteria while in the control class, the data obtained 63.8% with moderate or medium criteria. At the third meeting, the achievement indicators of Confidence attitudes of the

experimental classes reached 88.75% with very high criteria and the control class got 67% with moderate criteria; in the fourth meeting, the achievement indicators of confidence attitudes of the experimental classes reached 90.4% with very high criteria, and control class got an average of 69% with high criteria.

t-test results show that t_{value} = 37.12 > t_{table} = 1.68. Based on the differences from the test results, it is obtained data that there are differences in the effect of treatment on the achievement of confident indicators between the experimental class and the control class; this is proven by t_{value} = 37.12 > t_{table}= 1.68 so that H_0 is declined so that the confidence attitude of the experiment class is better than the control class. Based on these data, it can be concluded that the PjBL model with the Science KIT simple electrical circuit can improve students' self-confidence. Hendriana research (2014) stated that increased student confidence is a continuous process, so it takes time to get it.

The increase in the confidence of the experimental class was calculated by the N-Gain formula of 0.60, which was included in the medium category. Meanwhile, the control class is 0.32 included in the moderate category. The conclusion of the students' self-confidence attitude of experimental class increased. The data are presented in table 5.

Table 5. Confidence Attitude Score of Experimental and Control Class Students

Subject	Meeting 1	Meeting 2	Meeting 3	Meeting 4	(g)	Criteria
Experimental class	75.8	88.75	88.75	90.4	0.60	Medium
Control class	54.2	63.8	67	69	0.32	Medium

Students' Problem-Solving Skills Results

Students' problem-solving skills data are obtained from the pre-test and post-test test results. The results of the experimental and control class pre-tests were relatively similar. This is seen from the mastery learning comparison of experimental class and the control class. The test results of students' problem-solving abilities who learn by using the PjBL model with Science KIT simple electrical circuit are better than students who are not using Science KIT, it is proven by t_{value} = 6.572 > t_{table} = 1.677, so that H_0 is declined, so it can be concluded that the experimental class problem-solving ability is better than that of the control class problem-solving ability. Based on the test results, it is obtained that 84% or more than 75% of the experimental class students have reached the passing grade. So that the problem-solving ability passed classically in the experimental class for more than 75%.

Project assignments are given to make students feel compelled and challenged to solve problems they face and actively use inductive diagnostic thinking patterns by analyzing aspects of causes and solutions that may be following the parameters of the problem they have (Cennamo, Brandt, Scott, Douglas, McGrath, Reimer, and Vernon, 2011). The data of the problem-solving ability is presented in table 6.

Table 6. Pre-test and Post-test Results of Problem-Solving Abilities in Experimental Class and Control Class

Data	Class	Lowest score	Highest score	Average score	
				Passing (%)	Not passing (%)
Before	Experiment	24	70	4	96
	Control	22	70	4	96
After	Experiment	64	88	84	16
	Control	48	72	24	76

The results of the problem-solving ability test before learning show that the problem-solving ability of the experimental class is much higher than that of control class. This can be seen from the comparison of the average results of the experimental class and the control class. Pre-test results in experimental class got an average of 40.48 while in the control class is 41.2. The post-test result obtained in experimental class is 74.96 while in the control class is 60.72.

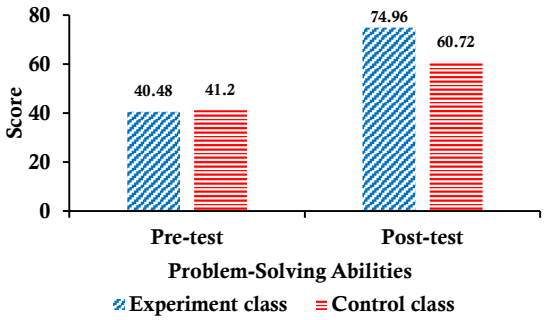

Figure 1. Average Improvement Result

The results of the paired average difference test showed that t_{value} = 19.55 > t_{table} = 1.71. The different results of the problem-solving ability in experimental class during post-test shows that the problem-solving ability of the experimental class students is better than pre-test. Based on the N-Gain test analysis, the problem-solving ability of experimental class students shows the value of 0.58, and it means that the student learning outcomes increase in the medium category.

This problem-solving ability differences are due to the use of Science KIT in the experimental class. Science KIT is a learning media that is used as a teaching aid. Teaching aids are used as a tool to explain something abstract to be more concrete. According to Apriliyanti, Haryani, and Widiyatmoko (2015) teaching aids can clarify the teaching material provided by the teacher so that students can be more easily understood the material or questions presented by the teacher. Based on these data and explanations, it can be concluded that the PjBL model with Science KIT can improve students' problem-solving abilities.

CONCLUSION

Project-Based Learning with Science KIT can improve students' self-confidence and problem-solving abilities in the experimental class, which treated by using the Project-Based Learning model with Science KIT better than students in the control class who were not treated by using the Project-Based Learning tool.

Based on the test of the confidence attitude obtained the difference in the effect of treatment on the achievement of indicators of confidence between the experimental class and the control class, evidenced by t_{value} = 37.12 > t_{table} = 1.68. Increased self-confidence shows that the students' confidence in experimental class belongs to the moderate criteria. Test the completeness of the ability to treat experimental class problems that 84% (more than 75%) of experimental class students have met the minimal completeness criteria and based on the paired difference test shows the results of t_{value} = 19.55 > t_{table} = 1.71 and an increase in N-Gain = 0.58 indicates that the problem-solving ability of the experimental class students is classified as medium criteria.

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