IOSR Journal of Research & Method in Education (IOSR-JRME)
e-ISSN: 2320–7388, p- ISSN: 2320-737x Volume 12, Issue 1 Ser. I (Jan. – Feb. 2022), 09-13
www.iosrjournals.org

The Influence of Problem Based Learning toward Grade IV Students' Learning Outcomes on Force and Motion in SDK Larantuka 1

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Abstract. *This is a descriptive quantitative research using one-group pretest-posttest design. The instrument had been tested using validity and reliability test. Data collection techniques of the study were tests, observations and documentation. Data was analyzed using normality test, homogeneity test and hypothesis testing. The research was conducted in SDK Larantuka 1 with a total of 16 Grade IV students consisting of 6 male and 10 female students were chosen as samples through saturated sampling technique. The results of data processing on students' pretest revealed that their average pretest score was 56.25. After being treated using problem based learning model, the average score of their posttest was 79.06. then, a hypothesis test run using paired sample t test with the assistance of Microsoft Excel obtained* t_{count} *22.421 meanwhile the* t_{table} *value was on 5% significance level with db = N-1 = 16-1 = 15 which was 2.131. Therefore, the value of* $t\text{-}test_{count}$ *= 22.421 was higher than* $t\text{-}test_{table}$ *= 2.131. Thus, Ho was rejected and Ha was accepted. The result implied that there was significant effect of applying problem based learning toward grade IV students' learning outcomes on force and motion in SDK Larantuka 1.*

Keywords: STAD Model, Learning Outcomes

Date of Submission: 27-12-2021 Date of Acceptance: 07-01-2022

I. Introduction

Science learning is a science humans seek after as it forms a way of thinking as a comprehensive knowledge structure. In particular, IPA applies an empirical approach to find an explanation of the observed universe. Similar opinion was proposed by Dewi, et.al (2013); Andinii, et.al (2016) that science learning is related to how to discover systematic natural phenomena. Therefore, in science learning students are often required to make use of natural surroundings.

Science is an important subject in elementary school education because science learning trains students to think logically and rationally. In addition, Martini, et.al (2017) also stated that learning science can also help train critical, creative, innovative, and problem solving attitudes. The nature of science learning is that students learn to understand the universe through targeted observations and using procedures and explained by reasoning to get a conclusion (Murfiah, 2017: 105). Basically, science is built on scientific products, processes, and attitudes. One of the Science materials learned in elementary schools is about force and motion. Force is a power that causes an object subjected to the power to move, change its position, or change shape. On the other hand, motion is the displacement of an object's position from its original place because of a force.

An early observation result in grade IV students of SDK Larantuka 1 revealed that majority of student learning outcomes especially in Science class did not reach minimum achievement criteria. There were only 40% students who met the criteria meanwhile the other 60% failed to meet the criteria. This was highly caused by the use of monotonous learning method like lecturing and limited source of material during learning process which tended to be teacher- centered and hindered students' participation as well as attraction and attention to the material teacher delivered. Another follow-up observation demonstrated that when teacher gave the opportunity to ask questions, only some students were active.

Seeing these problems, it is necessary for teachers to find solutions to overcome these problems. One of them is changing Science learning process. One of the efforts teachers can afford is to use innovative learning models such as problem based learning so that they can put students in an active position in learning. As stated by Dewana (2017), problem based learning model is a student-centered learning model that can stimulate student active participation in learning process. Amin (2017); Martini, et.al (2017) further suggested that PBL model can develop students' ability to solve contextual problems in real life experience so that they can stimulate their critical, creative and problem solving abilities. The application of this learning model surely can

also increase the interest and learning outcomes of students. Relying on the notion above, the researcher intended to conduct a research regarding the effect of using Problem Based Learning model on Grade IV students' Science learning outcomes on Force and Motion in SDK Larantuka 1.

II. Research method

Research Design

This study applied one group pre-experimental design of quantitative method. As stated by Sugiyono (2015:110), one group pretest-posttest design is a comparison of situation before and after giving treatment. The design is presented as follows:

O_1 X O_2

Details:

O1 : initial test given to experiment group
X : *Problem Based Learning* treatment
O2 : final test given to experiment group

Context of the Study

This study was conducted in SDK Larantuka 1, Larantuka Subdistrict, East Flores Regency. The school was chosen since there was no data on recent study and observation result in this area that indicated students' low learning outcomes on force and motion materials due to unattractive learning process and less stimulating for students activeness to think critically, creatively and innovatively in solving problems.

Population

Population of the study covered all 16 IV grade students of SDK Larantuka, which consisted of 6 male and 10 female students. As referred to Sugiyono (2007:80), population is a generalized zone which comprises object and subject with certain quality and characteristics defined by researcher to be studied and summarized.

Samples

The sample was grade IV class as experiment class with a total of 16 students using saturated sampling. It is a sample determination technique in which all population members are counted as samples. This occurs if the amount of population members is relatively small with less than 30 people or if the study intends to make generalization with small errors. In other words, saturated sampling is a census in which all population members are samples.

Variables

There were two variables used in this research. The independent variable was Problem Based Learning meanwhile the dependent variable was learning outcomes.

Instrument

Validity Test

A test can be declared valid if it can measure what is intended to be measured (Arikunto, 2012). To check test items validity, product moment correlation coefficient formula was used with raw numbers of the formula as follows:

$$r_{xy=} \frac{N.\sum XY - (\sum X).(\sum Y)}{\sqrt{\{N.\Sigma X^2 - (\sum X)^2\}\{N.\Sigma Y^2 - (\sum Y)^2\}}}$$

(Source: Ananda, 2018:118).

Details:

r_{xy} = correlation coefficient
N = Total respondent
X = total score per item
Y = total score (whole item)

The significance level is 5%. Product moment obtained from calculation result is compared to r-table with df = n-2, in which 'n' states total respondents. There were 16 respondents for try out so r-table = 0.497. The validity test was run using product moment in SPSS 16.0 program.

Reliability Test

Reliability test is defined as the ability of an instrument to measure attributes of a concept or construction consistently (Sugiyono, 2007). To identify the instrument's reliability, the researcher applied KR 20 formula as follows:

$$r_{11} = \left(\frac{n}{n-1}\right)\left(\frac{S^2 - \sum pq}{S^2}\right)$$

Details:

r_{11} = Reliability test
P = Proportion of subjects answered items correctly
q = Proportion of subjects answered items incorrectly
$\sum pq$ = Multiplication result of p and q
n = Total items
S = Test standard deviation

Teknik Pengumpulan Data

Data collection techniques used in this study were (1) test which was used to obtain scores of student learning outcomes about force and motion. The tests were in form of pretest (before being given treatment) and posttest (after being given treatment); (2) observation, that would be done by directly observing learning activities on force and motion material during learning process using Problem Based Learning model; and (3) documentation to obtain data directly from the research site including relevant data. This technique is used in research to determine student learning outcomes and to obtain pictures or photos of events during research activities.

Data Analysis Technique

Normality Test

A normality test using chi-square formula was done to test data in group form on frequency table. The chi-square formula is presented below:

$$X^2 = \sum_{i-1}^{k} \frac{(f_{o-fh)^2}}{f_h}$$

(Source: Sugiyono, 2010: 107)

Details:

χ^2 : *Chi Kuadrat* or sample normality
fo : Observed frequency
f*h* : Expected frequency
k : Total interval class

Testing criteria:
If χ^2 count $<\chi^2$ table accept Ho
If χ^2 count $>\chi^2$ table reject Ho

Homogeneity Test

A homogeneity test using Fisher test is done if the the data to test only has two groups of data or samples. It is done by dividing bigger data variant to smaller data variant as presented below.

$$F_{count} = \frac{\text{biggest variant}}{\text{smallest variant}}$$

(Source : Ananda, 2018:175-181).

Testing criteria:
Accept Ho if $F_{count} < F_{table}$
Reject Ho if $F_{count} < F_{table}$

Hypothesis Test

Hypothesis test was done using paired sample t test with the following formula:

$$t = \frac{\frac{\sum D}{n}}{\frac{s}{\sqrt{n}}}$$

(Source: Julius H, 2017:195)

Details:

t = t count score
D = Difference per paired value
s = Standard deviation
n = Number of samples

The testing criteria were:

a. If $t_{count} > t_{table}$, then H_o is rejected and H_a accepted
b. If $t_{count} < t_{table}$, then H_a is and H_o accepted.

Therefore, the hypotheses were formed as follows:

H_o : There was no significant influence of Problem Based Learning toward students' learning outcomes about force and motion in Grade IV SDK Larantuka 1.

H_a : There was significant influence of Problem Based Learning toward students' learning outcomes about force and motion in Grade IV SDK Larantuka 1.

III. RESULT AND DISCUSSION

Result

This result was meant to evaluate the influence of Problem Based Learning Model toward grade IV students' learning outcomes on force and motion material. This research applied one group pretest posttest model of pre-experimental design and data was analyzed quantitatively. Samples of the study were taken using saturated sampling in which all population members were included as samples which meant that all 16 students participated in data collection.

Result of Validity and Reliability Test

Validity test of test items was undertaken using product moment correlation with the assistance of Microsoft Excel to identify their validity. Test items are declared valid if $r_{count} > r_{table}$. Instrument trial was administered to 16 students (N= 16) and level of significance 5% whereas $r_{table} = 0.497$. Each test item was $r_{count.} > 0{,}497$ so it could be concluded that each test items administered was valid.

Then, a reliability test was run to know if the items used for testing were reliable as measuring tools. Test items are declared reliable if $t_{count} > t_{table}$. The result of reliability coefficient counting on 20 test items using KR 20 (*Kuder Ricardon*) obtained $r_{11} = 0.9$. the coefficient value lied on 0,80 – 1,0 interval therefore it was pronounced to be in high category.

Result of Normality Test

The analysis result of normality test on students' pretest score 2.02 < 11.07 meanwhile their posttest was 1.87 < 11.07. it was stated previously that the data of their learning outcomes in pretest and posttest valued X^2 count $< X^2$ table. The result affirmed that both pretest and posttest data of Grade IV students were normally distributed.

Result of Homogeneity Test

The result of homogeneity test using Microsoft Excel revealed that peroleh F = 1.98 < 2.43, therefore both data were declared homogeneous.

Result of Hypothesis Test

Based on Berdasathe calculation of hypothesis test using paired sample t test formula with the assistance of Microsoft Excel, the data $t_{count\ =}$ 22.42 and t_{table} = 2.13 were obtained. The testing criteria was Ha accepted and Ho rejected if $t_{count} > t_{table.}$ As the result showed that 22.42 > 2.14 it could be inferred that H_a was accepted and H_o was rejected. This result indicated that there was significant influence of Problem Based Learning toward students' learning outcomes about force and motion in Grade IV SDK Larantuka 1.

IV. Discussion

Based on descriptions on results of the study, there was an influence of problem based learning model on the Science learning outcomes of force and motion material. Before conducting the research, the validity and reliability of the research instrument was tested. Instrument's validity and reliability test was carried out so that the evaluation tool used met the criteria as a good evaluation tool as it was appropriate to use and could be used in different situations and conditions. Data analysis result showed that students' pretest learning outcomes were

obtained with average score of 56.25. After knowing the students' initial abilities, a different treatment namely Problem Based Learning model was implemented in during teaching and learning process.

After the given treatment, students were given posttest to identify student's level of mastery on material delivered using problem based learning. As the learning process ended, a posttest was administered and the average score of posttest learning outcomes was 79.06. Posttest learning outcomes are higher than pretest after applying Problem Based Learning model. It was found in this study that problem based learning model affected student learning outcomes because it was a learning model that required students to actively understand problems in group discussions, so that students not only reinforce their thinking process through textbooks or e-books but also from their peers in discussions and exchanged opinions.

The findings of this study are in line with several studies which show that the Problem Based Learning model affects or can even improve learning outcomes. Sumarni (2011); Andini (2016); Martini (2017); Dewanta (2017) Robiyanto (2021) also point out in their studies that students who are taught Science using problem-based learning model have better learning outcomes than those who are taught in conventional learning models. This is because students are given opportunity to explore their own problems, discuss problem-solving strategies and find solutions to the problems. This makes students more active, triggers their ability to think critically and creatively in solving problems. In addition, it is stated that their knowledge is longer in memory as they solve the problem themselves.

This research had its disadvantage as it took time so inapplicable to learning all materials. Therefore, teachers need to apply other learning models in learning science material. The benefits of this research can be the latest reference in the world of education where teachers can apply problem based learning models to improve learning outcomes.

V. Conclusion

Based on results of the study, it can be concluded that there was significant effect of problem based learning on student learning outcomes about force and motion in grade IV SDK Larantuka 1. This is proven by the difference in student learning outcomes before and after being given treatment, which is marked by the average learning outcome in which the average of posttest score was higher than pretest average score learning. It can be seen from student learning outcomes after using problem based learning model in which the average of posttest score was 79.06 compared to the average of pretest score which was 56.25. The paired sample t test revealed that $t\text{-}_{count}$ = 22.421 and t_{table} = 2.131, whereas the criteria defined that if $t\text{-}_{count} > t\text{-}_{table}$ then Ho was rejected and Ha accepted. The result posed that 22.42 > 2.131, therefore the proposed alternative was accepted in which there was significant effect of implementing Problem Based Learning toward Grade IV students' learning outcomes on force and motion materials in SDK Larantuka 1. The difference on students' learning outcomes was caused by using problem based learning model that emphasized on students' way of gaining knowledge through direct exploring and discovering in cooperation, discussion and active participation.

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