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Implementation of Problem Based Learning in VLP Software Assisted Volunte Physics Learning on Students' Problem Solving Ability

Melinda Cahya Ningrum[1], Eko Hariyono[2], Wiwien Maryuni[3]
[1,2]*Faculty of Mathematics and Natural Sciences, Universitas Negeri Surabaya, Indonesia*
[3]*21 Junior High School, Surabaya, Indonesia*
melinda.18081@mhs.unesa.ac.id, ekohariyono@unesa.ac.id, wiwienmaryuni@gmail.com

Abstract

This study is an experimental study that aims to analyze students' problem solving abilities in appyling the problem based learning (PBL) learnig model assisted by VLP software and wants to know the student's response to the integrated physics learning of volcanoes. The research method uses Quasi Experiment quantitative research with Post-test Only Design. The reasearch subjects used were 65 students of class XI MIPA 1 and XI MIPA 2 at SMA Tamansiswa Mojokerto City. Rhe data collection instruments used were students response questionnaire sheets and problem-solving ability test sheets. The result showed that there was an increase in students' problem solving abilities after applying VLP software assisted problem based learning in volcano integrated physics learning. The student responses obtained from the integrated volcano physics learning are that students are more active and enthusiastic in using VLP software for training solve a volcanic problem, students' desire to ask questions increases, and they are active discuss with groups in solving volcanic disaster mitigation problems. The conclusion of the research is that by applying problem based learning to physics learning assisted by VLP simulation software, it can improve students' problem solving abilities and provide good responses in learning.

Keywords
volcano; problem solve; VLP software

I. Introduction

Physics is a branch of various fields of Natural Sciences and then develops through observation, experimentation, to the discovery of theories and concept (Arofah et al., 2015). Phenomena that are directly related to the concept of physics are volcanoes. Volcanoes are something that is interesting to be discussed in the physics learning process. Volcano integrated physics learning rarely used in the learning process because teachers find it difficult to teach. These factors are influenced by education that discusses disaster mitigation has not become the main program of learning in school, the development of materials and teaching materials on mitigation has not yet been developed volcanic eruption disaster, the material delivered through lessons related to volcanic disaster mitigation is still to general (Suryaningsih et al., 2017). Students who are equipped with disaster mitigation knowledge to have a high response and preparedness in dealing with natural disasters that come at any time (Rosali, 2016).

Some volcanoes in Indonesia are stratovolcanoes, however not all are explosive some are effusive. Volcanoes are explosive with basaltic magma compositions containing silica, gases and low viscosity (Bobanto et al., 2021). Volcanic eruptions are processes that naturally occur on earth and endanger humans (Handayani et al., 2013). Volcanic eruptions

produce volcanic tsunami, mu, lateral explosion, pyroclastic rock fall, lava flow (Pratama et al., 2014). Magma is called lava when it reaches the earth's surface and gushes out. Through this lava flow, can see the viscosity or viscosity produced by the volcano because each mountain has a different lava flow. The velocity of the lava flow depands on the viscosity of the magma. Magma that has more silica content will be slower because it's viscosity is higher. While the silica content in the magma chambar is small, the viscosity is lower.

With the VLP software simulation, it can make easier for students to obtain information about voncanoes. VLP interactive software simulation is an effective medium for physics students because students can learn about volcanic phenomena volcano and VLP software is recomended as a medium for public education (Hariyono et al., 2017).

According to Astuti et al (2019) Education is an obligation of every human being that must be pursued to hold responsibilities and try to produce progress in knowledge and experience for the lives of every individual. Education is one of the efforts to improve the ability of human intelligence, thus he is able to improve the quality of his life (Saleh and Mujahiddin, 2020). Education is expected to be able to answer all the challenges of the times and be able to foster national generations, so that people become reliable and of high quality, with strong characteristics, clear identities and able to deal with current and future problems (Azhar, 2018).

Volcano simulation software has a menu option containing volcano simulation, exploration, mentoring techniques, disaster mitigation and references. The volcano simulation menu contains silica content, eruption type, volcano type, pressure, lava temperature, lava viscosity, rock type, and seismograph. The exploration menu contains a selection of gases and viscosity when operated will describe volcanoes, magma viscosity and description (Mahfudin et al., 2020).

The right strategy used in physics learning is problem based learning (PBL) because it is a problem based learning model for students faced with a real and simple problem to problem more complate. Problem based learning model makes students able to identify a problem, cause and effect relationships that occur in life and apply concepts according to the problem (Fauzan et al., 2017). It is expected that problem based learning students can problem solve independently (Rumiati, 2019). Students' physics problem solving ability is very low, therefore efforts are needed to improve students' problem solving skills by give meaning to the concepts that students learn, linking the material being studied with students' prior knowledge (Dewi et al., 2018).

Based on the explanation that has been conveyed above, the researcher has the desire to conduct research on student problem solving in the integrated physics learning of volcanoes in applying the problem based learning (PBL) model and conventional learninng. In addition, the researcher wants to know the students' responses regarding the integrated physics learning of volcanoes.

II. Research Method

This research is included in quantitative research that uses quasi experimental rresearch with post-test only non equivalent control group design. The research design pattern is as follows:

Table 1. Research Pattern

Class Experiment	X_1 ⟶	O_1
Class Control	X_2 ⟶	O_2

The pattern of this study shows that the experimental and control groups were not chosen randomly and received a one time test, namely the post-test so that both clases XI MIPA 1 and XI MIPA 2received the same treatment. The difference between the two classes XI MIPA 1 with a problem based learning model, while the control class XI MIPA 2 uses a conventional learning model.

The place for conducting experimental research is at SMA Tamansiswa, Mojokerto. The population used by all students of class XI SMA Tamansiswa Kota Mojokerto for the academic year 2021-2022 only consist of 2 classes, namely XI MIPA 1 dan XI MIPA 2. Research subjects in class XI MIPA are 65 students.

The research sample technique is a cluster technique because the sample used is not based on individual students, but rather based on groups. The data collection instruments in this studedy were students response questionnaire sheets and test sheets problem solving skill. Student questionnaire sheets use the guttman scale if the answer to positive questions can cjoose yes while no for answer negative. The problem solving ability test sheet consists of 5 questions. According to Heller, every problem solving problem has 5 stages, namely a) explore and understand the problem, b) diagnose the problem, c) plan the problem, d) implementation the plan, e) monitor and reflect the problems.

Table 2. Assessment Rubric for Problem Solving Ability

Skor	**Stages of problem solving skills**				
	Explore and understand the problem	**Diagnose the problem**	**Plan the problem**	**Implementation the plan**	**Monitor and reflect the problems**
0	Blank	Blank	Blank	Blank	Blank
1	Difficulty understand the problem	Difficulty diagnose the problem	Difficulty determine the exact equation	Difficulty to problem solve	Able to find mathematical errors in problem solve
2	Able to diagnose some problems (not all)	Unable to make drawings or sketches that illustrate problem solve	Able to find mathematical equations but not related	Able to determine calculations but not complate in completion	Able to find errors mathematically but stopped in problem solve
3	Able to describe the basic problem but not in detail	Able to make drawings or sketches that problem solve but unable to determine the relationship between quantities	Able to find mathematical equations correctly	Able to plan solve	Evaluate according to concepts and units, but not complate
4	Able to describe the basic problem and complate	Able to make drawings or sketches that problem solve but able to determine the relationship between quantities	Able to determine the right equation in problem solve	Able to determine the selected equation	Evaluate according to concepts and units, complate
Skor Maks	4	4	4	4	4

The data analysis technique used descriptive qualitative because it wanted to describe in accordance with the facts that occured at school. Here are the research steps

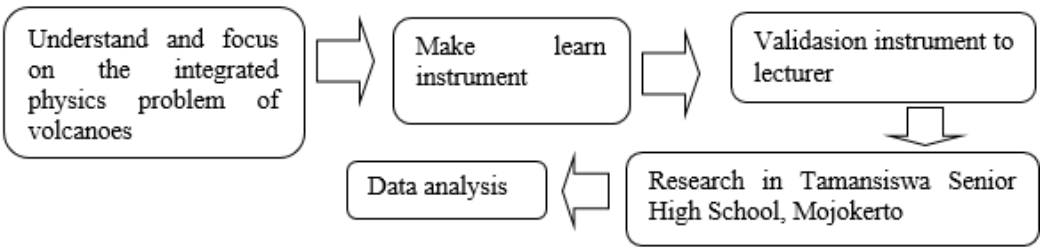

Figure 1. *Research steps*

III. Results and Discussion

Data analysis is an important stage of research because it serves to conclude research result. The data analysis phase used descriptive analysis. Research can be said to be valid if it meets the aspects of validity and reliability. While R_{tabel} with $\alpha = 0{,}05$ then research sample 65 respondentes so that it is R_{tabel} 0.244.

Table 3. Validity test result

QUESTION	R_{TABLE}	R_{COUNT}	DESCRIPTION
1		0.662	VALID
2		0.590	VALID
3	0.244	0.555	VALID
4		0.562	VALID
5		0.438	VALID

The data table above is a table of validity test result. The instrument is said to be valid if $R_{count}>R_{table}$. The mean validity of questions 1-5 is 0.561. Calculate each question obtained 0.661; 0.590; 0.555; 0.562; 0.438 while R_{table} 0.244. Rcount is greater than R_{table} so the validity of the questions above is good and declared valid. After the test questions are valid, then the reliability test is carried out using SPSS.

Tabel 4. Reliability test result

R_{TABLE}	R_{COUNT}	DESCRIPTION
0.244	0.456	Consistent/reliabel

It can be seen in the table above, namely the result of the reliability test. Reliability test is used to determine whether the indicators are consistent or trustworthy. R_{count} tested using SPSS the result obtained are 0.456 with 65 respondents so that the R_{table} with 0.05 is obtained 0.244. then $0.456>0.244$ or $R_{hitung}>R_{table}$ then the reliability test result are declared consistent or reliable.

The learning model used in class XI MIPA 1 as an experimental class using *Problem Based Learning* (PBL) and XI MIPA 2 as a control class using conventional learning. The following is a graph of the average problem solving ability of each indicator on the post-test result.

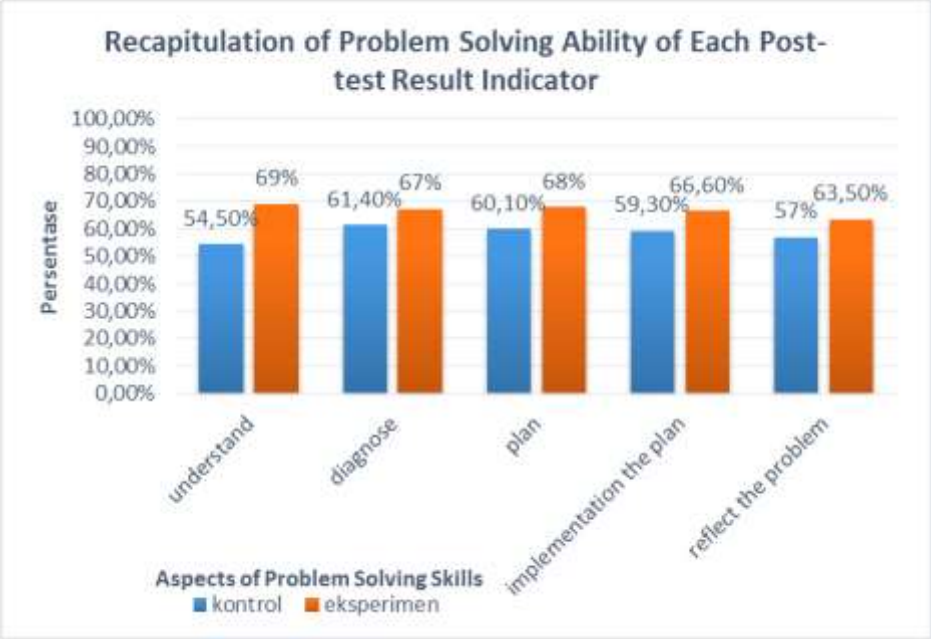

Figure 2*. Recaptulation of Problem Solving Ability of Each Post-test Result Indicator*

Based on the picture above, it is a graph of the average problem-solving ability of each indicator on the post-test results. In the post-test results, students' problem-solving abilities in the control and experimental classes had different average results. in the aspect of understanding the problem, the percentage of the control class was 53% and an increase in the experimental class was 69%. At the time of understanding the problem students are trained to describe the basic problems in detail with identify the problem of volcanoes according to the concept of physics, make the basis of known quantities and determine the quantities stated in the problem. In the aspect of diagnosing the problem, the percentage of the control class is 61% and the experimental class obtained 67%. In this aspect students are trained to make drawings, sketches that describe the problem with the volcano which is stated in the following problem students are trained to connect or link between quantities on mountain problems fire into the concept of physics. In the aspect of planning the problem obtained the percentage of class 63% control and 68% experimental class. Students can determine the equation that appropriate for problem solving. In the aspect of implementing the plan students are trained to carry out by doing calculations using the selected equation so as to obtain a percentage in the control class of 59% and the class experimental class of 66%. The next aspect of reflecting on the problem is obtained the percentage in the control class is 57% and the experimental class is 63%. In this aspect students are trained to evaluate problems according to the concept and students are able to evaluate according to the unit. Problem-solving ability aspects of understanding problems in the control class get the lowest percentage so that it has the highest level of difficulty from several other aspects. This happens because students find it difficult to organize information from problem to problem statement. According to Lestari (2019) This can happen because students are required to understand the problem first and then solve the problem. While the experimental class had difficulty in reflecting on a problem, this happened because students had difficulty giving appropriate arguments in solving the problems in the questions. In accordance with Nisak et al (2017) This can happen because of the difficulty of students in understanding problem solving problems and students' habits of solving problems problems without following the stages.

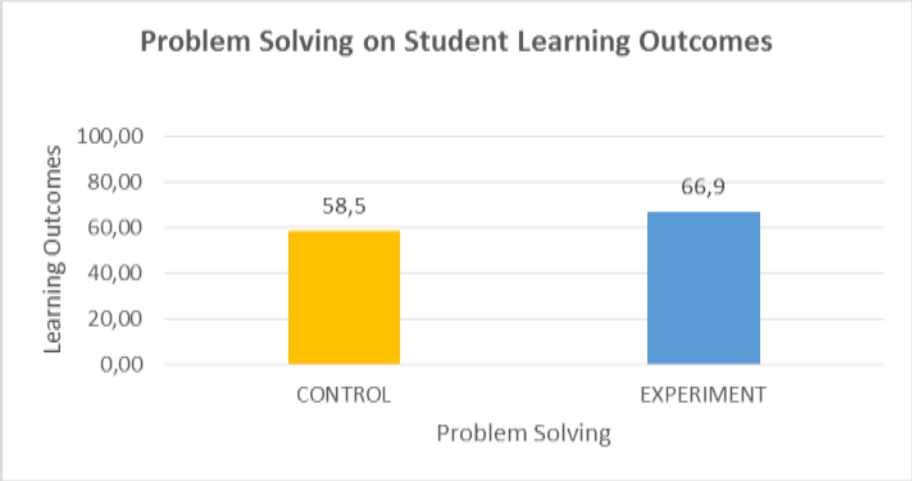

Figure 3. *The Relationship of Problem Solving to Student Learning Outcomes*

Based on graph above that class XI MIPA 1 as an experimental class using a problem based learning learning model obtained a higher score than class XI MIPA 2 as a control class using a conventional learning model. This can happen because when using the *problem-based learning* (PBL) model, students are more active in finding answers in solving problems, ask questions and discuss with friends. This is in accordance with Dewi et al (2016) the learning process using the problem based learning model has increased because students can understand the instructions in doing the test good problem solving skills so as to obtain maximum results and students look active in discussions, creative in expressing opinions, and students are responsible for expressing the results of group discussions. While conventional learning the teacher explains the concepts of physics by connecting the phenomenon of volcanoes and students only listen to the teacher. So, conventional learning makes students less active in learning and discussing with friends only during practicum.

Based on the student response questionnaire to the integrated physics learning of volcanoes, the total number of respondents is 65 students. The average score of the student response questionnaire was obtained by 84%. The following is a table of the percentage of student responses to the questionnaire responses in the integrated physics learning of volcanoes.

Table 5. Student Responses in Integrated Physics Learning of Volcanoes

No	Statement	Persentase	
		Yes	No
1	Students feel interested and do not get bored of studying integrated physics of volcanoes by using software Volcano Project Design (VLP)	90.7	9.3
2	Students feel more active in learning of integrated physics of volcanoes	78.4	21.6
3	Students find it easier to understand physics lessons, especially static fluid material which is directly related to volcanoes	86	14
4	Students are more motivated to learn more about volcanoes and excel in physics lessons	86.1	13.9
5	Students become more enthusiastic in solving problems when using Volcano Learning Project (VLP) software	87.6	12.4

6	Students gain new knowledge and insights after learning mountain physics integrated api	90.7	9.3
7	Students find it easier to solve physics problems	67.6	32.4
8	Students feel that their learning outcomes have improved after learning integrated physics of volcanoes	84.6	12.4

Seen in the table above that students who get the highest percentage of 90.7% are stated that students feel interested and do not feel bored in learning integrated physics learning of volcanoes using Volcano Project Design (VLP) software. From these results, the media used in learning plays an important role in attracting students' attention. By using simulation software VLP students gain new experiences in learning in accordance with learning objectives, therefore students gain new knowledge and insights. Based on the research results of Astuti (2015) students who feel interested in learning have good initial skills so they can understand the material quickly. The benefits of using VLP software simulations are that students become enthusiastic in solving a problem, students are easier to understand physics lessons, students become more motivated to learn physics related to mountain phenomena fire. According to Audie (2019) learning media helps teachers and students in the learning process and can increase student learning motivation. Positive impact by using the Volcano Learning Project software simulation, students are more active and curious if students know how to understand the phenomenon of volcanoes, the students will find it easier to solve problems. However, 32.4% of students still have difficulty insolve physics problem solving problems. This happened because the physics lesson hours under the Covid-19 pandemic were less effective. Based on the results of research Novitri et al (2017) this can happen because during the learning process students pay less attention to the teacher and students do not record the material that has been given by the teacher. However, the integrated physics learning of volcanoes can increase mastery of material concepts by 84.6% so as to obtain good learning outcomes.

IV. Conclusion

Problem solving ability on student learning outcomes resulted in a significant comparison of the scores of both the experimental class and the control class. Results student learning increases when using the right learning model. By using the Problem Based Learning model, improved results are obtained compared to using conventional learning models. This shows that the implementation of the Problem Based Learning model can make students active and improve physics learning outcomes. In the physics learning process, researchers use the help of Volcano Learning Project (VLP) software simulations. As is Volcano Learning Project (VLP) simulation software makes students more active and enthusiastic to solve a problem, the desire to ask questions increases, and actively discusses with the group. So that student learning outcomes increase when using assistance Volcano Learning Project (VLP) simulation software in physics learning.

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