



Analysis of the Application of Problem Based Learning Model to Students' Problem Solving Skills on the Material of the Stages of Foundation Work Implementation in SMK

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Abstrak

Permasalahan dalam penelitian ini adalah kemampuan pemecahan masalah siswa masih kurang ditandai dengan kesulitan siswa dalam menganalisis masalah secara mendalam sebelum mencoba menyelesaikannya, diakibatkan karena kurangnya siswa mendapat kesempatan untuk memecahkan masalah secara teratur dan mengakibatkan siswa tidak memiliki keterampilan yang cukup. Tujuan penelitian untuk menganalisis penerapan model Problem Based Learning terhadap kemampuan pemecahan masalah siswa di SMK. Jenis penelitian adalah penelitian eksperimen. Penelitian ini dilaksanakan di SMK Negeri 1 Hiliserangkai. Populasi penelitian adalah seluruh siswa kelas XI-BKP SMK Negeri 1 Hiliserangkai tahun pelajaran 2023/2024 yang terdiri dari 2 kelas. Penelitian ini menggunakan desain randomized pretet posttest experiment control group design. Instrumen penelitian adalah tes kemampuan pemecahan masalah berbentuk tes uraian. Sebelum ditetapkan sebagai instrumen penelitian tes divalidasi kepada guru kejuruan teknik bangunan dan diujicobakan di SMK Negeri 1 Botomuzoi untuk keperluan uji kelayakan tes. Hasil penelitian: 1) Rata-rata hasil kemampuan pemecahan masalah siswa dengan menggunakan model pembelajaran Problem Based Learning adalah 77,83 tergolong baik; 2) Rata-rata hasil kemampuan pemecahan masalah siswa dengan menggunakan model Konvensional adalah 68,25 tergolong cukup; 3) Hasil pengujian hipotesis diperoleh $t_{hitung} = 2,23$ dan $t_{tabel} = 2,001$. Karena t_{hitung} tidak terletak pada interval $-t_{tabel} \leq t \leq t_{tabel}$. Maka hipotesis yang berbunyi: "ada pengaruh yang signifikan model Problem Based Learning terhadap kemampuan pemecahan masalah siswa pada materi tahapan pelaksanaan pekerjaan pondasi di SMK Negeri 1 Hiliserangkai." diterima pada taraf kepercayaan 95% atau taraf signifikan 5% ($\alpha=0,05$). Saran peneliti hendaknya guru menerapkan model Problem Based Learning dalam pembelajaran khususnya untuk menyajikan materi kejuruan seperti tahapan pelaksanaan pekerjaan pondasi.

Kata kunci: Model Pembelajaran Problem Based Learning, Hasil Kemampuan Pemecahan Masalah Siswa

Abstract

The problem in this study is that students' problem solving skills are still lacking, marked by students' difficulty in analysing problems in depth before trying to solve them, due to the lack of opportunities for students to solve problems regularly and resulting in students not having sufficient skills. The purpose of the study was to analyse the application of the Problem Based Learning model to students' problem solving skills in vocational schools. The type of research is experimental research. This research was conducted at SMK Negeri 1 Hiliserangkai. The research population was all students of class XI-BKP SMK Negeri 1 Hiliserangkai in the 2023/2024 academic year consisting of 2 classes. This study used a randomised pretest posttest experiment control group design. The research instrument was a problem solving ability test in the form of a description test. Before being determined as a research instrument, the test was validated to the building engineering vocational teacher and tested at SMK Negeri 1 Botomuzoi for the purpose of testing the feasibility of the test. Research results: 1) The average result of students' problem solving ability using the Problem Based Learning model is 77.83 classified as good; 2) The average result of students' problem solving ability using the conventional model is 68.25 classified as sufficient; 3) The results of hypothesis testing obtained $t_{count} = 2.23$ and $t_{table} = 2.001$. Because t_{hitung} does not lie in the interval $-t_{tabel} \leq t \leq t_{tabel}$. So the hypothesis that reads: 'there is a significant effect of the Problem Based Learning model on students' problem solving skills on the material of the stages of foundation work implementation at SMK Negeri 1 Hiliserangkai.' accepted at the 95% confidence level or 5% significant level ($\alpha=0.05$). Researchers suggest that teachers should apply the Problem Based Learning model in learning, especially to present vocational material such as the stages of foundation work implementation.

Keywords: Problem Based Learning Learning Model, Results of Students' Problem Solving Ability.

INTRODUCTION

Science and innovation are growing rapidly today and expect humans to have abilities and skills that are in line with today's needs and demands. Therefore, education is important as an effort to work on the nature of human resources. Through education humans can be educated, prepared, and grow the potential that exists in themselves. This is in accordance with Regulation Number 20 of 2003 concerning the National Education System, which explains that: Education is a planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation and state.

For the implementation of education, learning activities are a very important component to achieve the goals of education and have implementation rules in the education programme in the curriculum. Efforts are being made by the government to improve the quality of education in schools by improving the curriculum. This statement is in line with Regulation No. 20 of 2003 concerning the National Education System explaining that the education plan or curriculum is a set of plans and actions concerning the objectives, content and subject matter and techniques used as the rules for organising education and guidelines for carrying out learning activities to achieve certain educational goals.

In the current learning curriculum, it is expected that the current learning process can facilitate mutual communication between teachers and students during the learning process. This will allow for positive learning interactions and maximise the achievement of learning objectives. To achieve these learning objectives, teachers who were initially only a source of learning must adapt during the learning process and act as facilitators of learning activities this involves and helps students solve problems in the classroom to increase motivation and the number of learning activities carried out by students (Sahyar, 2015).

The ability to solve problems is very important for students, because in everyday life

students will be faced with various problems that must be overcome and expect imagination to be able to find answers to the problems they face (Yani & Margana, 2014). The ability to deal with the problem itself is an important part of learning because in developing experience and in overcoming it, students are empowered to gain experience by using the information they have (Muna, 2022).

Education at the Vocational High School (SMK) level aims to prepare students to become a workforce that is ready to be skilled and trained to enter the business and industrial world. One very important competency in the world of construction is a deep understanding of the stages of foundation work implementation. The foundation is an integral part in the construction of the building structure, and errors in the implementation of foundation work can have a serious impact on the building structure or even structural failure.

The subject of implementation and supervision of construction and property is an important subject that must be studied at the Vocational School Level of Construction and Property Business (BKP), this subject contains logical disciplines regarding the analysis of stages in the supervision and implementation of construction work, for example the implementation of foundation work and foundation work assessment reports and other basic competencies. This subject trains skills, professional attitudes, and problem-solving abilities about the stages of implementation and supervision in the realm of building construction. Students are encouraged to open their minds about how important this discipline is, so that in today's competitive world of work students get what they get from the growing experience.

Based on preliminary studies at SMK Negeri 1 Hiliserangkai, the problem is that the learning process is still teacher-centred so that student participation is less active in the learning process where this can be caused by the use of learning models that are not varied which can increase student motivation to be active and creative in learning. Furthermore, based on interviews with subject matter experts of Construction and Property Implementation and

Supervision at SMK Negeri 1 Hiliserangkai said that students' problem solving skills are still lacking. There are still many students lacking in analytical skills, where students have difficulty in analysing problems in depth before trying to solve them. Students lack the opportunity to solve problems regularly and as a result students do not have sufficient skills.

Problems that often occur in the learning process are generally related to the abilities possessed by students. For this reason, students must have a strong ability in problem solving in the field of construction, which involves understanding the construction process and applying appropriate techniques. To produce qualified students in the construction field, students must have a good understanding of the stages of foundation work implementation and the ability to solve problems related to this. Problem solving skills must be possessed by every student in the hope that students are accustomed to solving or facing problems given by teachers with various forms of problems (Mariam et al., 2019).

By paying attention to the objectives of learning and the characteristics of the problems above, it is necessary to use a relevant learning model in an effort to develop problem solving skills, one of the learning models that can improve problem solving skills is Problem Based Learning (PBL). The Problem Based Learning model is a learning model based on problems and requires investigation in solving real problems. This learning model gives students the ability to solve problems faced, so that it can motivate to be active and creative and can solve problems in the learning process. Problem-based learning is a learning model that emphasises the presentation of problems as a starting point for obtaining new information by finding solutions cooperatively (Niami & Kosim, 2018). Problem-based learning is a learning action that maximally includes the ability of each learner to search and explore something systematically, critically, logically, analytically so that they can plan it themselves with confidence (Nurlaila, 2013).

Furthermore, some of the advantages of the Problem Based Learning model are that students are encouraged to have problem solving skills in

real situations, learning focuses on problems and students have the ability to build their own knowledge. The advantages of the Problem Based Learning model are very useful for improving students' problem solving skills (Shoimin, 2016).

Based on the explanation of the problem above, therefore the researcher is interested in taking the title 'Analysis of the Application of the Problem Based Learning Model to Students' Problem Solving Ability in the Material of Stages of Implementation of Foundation Work in Vocational Schools'

METHOD

The research was conducted at SMK Negeri 1 Hiliserangkai Jln. Nias Tengah Km. 21.5 Hilizia Luru, Kec. Hiliserangkai, Nias Regency, North Sumatra Province. This research was conducted in the even semester of the 2023/2024 academic year, namely in January 2024.

In this study, researchers used a quantitative paradigm based on a deductive-inductive approach. The implementation of this study begins with grouping the research sample into an Experimental Class and a Control Class. Both classes were given an initial test which served to determine the initial ability of students. Furthermore, the Experiment Class carried out learning activities by applying the Problem Based Learning model while the Control Class carried out learning activities by applying conventional learning models. After the learning activities in both classes were completed, followed by giving the final test. The final test results were used for hypothesis testing purposes. This research method is an experimental method using Randomised pretest posttest experiment control group design.

The instrument in this study was given a problem solving ability test consisting of two parts, namely an initial test with 4 problem items and a final test with 4 problem items arranged according to the problem solving ability test indicators. This research instrument includes test validity, reliability test, test difficulty level, test distinguishing power, normality test, homogeneity test and hypothesis testing.

Data Collection Techniques In this study,

1) Before the learning activities of the experimental class and control class were given an initial test. 2) From the initial test results in the experimental class, a normality test was carried out. The experimental class represents the population if the results are normally distributed, if not normally distributed the experimental class does not represent the population. 3) From the initial test results in the control class, a normality test is carried out. The control class represents the population if the results are normally distributed, if not normally distributed, then the control class does not represent the population. 4) From the initial test results, a homogeneity test is carried out in the experimental class and control class. If not homogeneous, then review the withdrawal of research samples. If homogeneous, then proceed with giving treatment in the form of a learning process. 5) After the learning activities are carried out, the experimental class and control class are given a final test in the form of a problem solving ability question. 6) Based on the results of the final test in the experimental class and control class, the results of students' problem solving ability are obtained, then hypothesis testing is immediately carried out using the t test.

The scoring guidelines for students' problem solving ability tests will be shown in the following table.

Table 3.4
Rubric for Scoring Problem Solving Questions

Aspects assessed	Score	Description
Understand the problem	0	Did not write what is known and asked in the problem
	1	Write down what is known but not what is asked or vice versa
	2	Write down what is known and asked but not quite right
	3	Write down what is known and asked correctly.
Create plan the	0	Does not plan to solve a problem at all

solution	1	Planning to solve the problem by making a drawing but the drawing is less precise
	2	Plan problem solving by making drawings with the right
	0	No answer at all
Resolve plan completion	1	Makes a plan by writing an answer but the answer is wrong or only a small part of the answer is correct
	2	Makes a plan by writing half or mostly correct answers
	3	Makes a plan by writing the answer completely and correctly
Check back	0	There is no conclusion written
	1	Interpret the results obtained by making conclusions but less precise
	2	Interpret the results obtained by making appropriate conclusions

(Mawaddah & Anisah, 2015)

The calculation of the final score is as follows:

$$N = \frac{\text{Score obtained}}{\text{Maximum score}} \times 100$$

The value of problem solving ability obtained from the calculation, then qualified according to the following table.

Table 3.5
Qualification of Students' Problem Solving Ability

Value	Qualification
85,00 - 100	Very good
70,00 - 84,99	Good
55,00 - 69,99	Simply
40,00 - 54,99	Less
0 - 39,99	Very Less

(Mawaddah & Anisah, 2015)

RESULT

1. Research Results

a) Initial Test Results

Before the learning activities were carried out, both classes (experimental class and control class) were given an initial test and the results were processed by calculating the average learning outcomes. From the processing of the initial test results in the experimental class, the average learning outcome of 58.75 was classified as sufficient. From the processing of the initial test results in the control class, the average learning outcome of 59.83 was classified as sufficient. As shown in the following figure.



Figure 4.1 Average percentage of the results of students' problem solving ability problem solving ability of students in the initial test

b) Final Test Results

After the learning activities in both classes (experimental class and control class) were given a final test and the results were processed by calculating the average learning outcomes.

From the processing of the final test results in the experimental class, the average learning outcome of 77.83 was classified as good. From the processing of the final test results in the control class, the average learning outcome of 68.25 was classified as sufficient.

The final test data is then used in hypothesis testing using the T test.



Figure 4.2 Average percentage of the results of students' problem solving ability students' problem solving ability in the final test



Figure 4.3 Average percentage of the results of students' problem solving ability students' problem solving skills in the initial and final tests

2. Normality Test

a) Normality Test in the Initial Test

Based on the calculation of the normality test carried out from the student problem solving ability test data in the initial test, the experimental class obtained $Lo = 0.1438$ and $Ltabel = 0.161$. In the control class obtained $Lo = 0.119$ and $Ltabel = 0.161$, Lo from each class is smaller than the $Ltabel$ price, so the test results of students' problem solving skills are normally distributed, meaning that the research results apply to the sample and also apply to the population as a whole.

b) Normality Test in the Final Test

Based on the calculation of the normality test carried out from the student problem solving ability test data in the final test, the experimental class obtained $Lo = 0.1256$ and $Ltabel$ which is 0.161 . In the control class $Lo =$

0.1592 and L_{table} is 0.161. Thus, L_o from each class is smaller than the L_{table} price, so the test results of students' problem solving skills are normally distributed, meaning that the assumptions for the use of parametric statistics are met.

3. Homogeneity Test

a) Homogeneity Test in the Initial Test

To find out whether the two classes as samples in the study were homogeneous or not, homogeneity calculations were carried out. Based on the homogeneity test calculation (appendix 18) obtained $F_{hitung} = 1.22$ and $F_{table} = 1.86$. Because $F_{hitung} < F_{table}$ then both classes are homogeneous. This means that the initial ability of the research samples (experimental class and control class) is equal or homogeneous.

b) Test of Homogeneity in the Final Test

Based on the calculation of the homogeneity test of the final test results using the F test (attachment 22) obtained $F_{hitung} = 1.59$ and $F_{table} = 1.86$. Because $F_{hitung} < F_{table}$ means both classes are homogeneous. So that the initial ability of the research sample (experimental class and control class) is the same or homogeneous. So the assumption of using parametric statistics is fulfilled.

4. Hypothesis Testing

Using the two-party t-test formula, hypothesis testing was conducted to prove the hypotheses of this study. The following statistical hypotheses will be tested in this study:

H_a : There is a positive and significant effect of the Problem Based Learning model on students' problem solving skills in the material of the stages of foundation work implementation at SMK Negeri 1 Hiliserangkai.

H_o : There is no positive and significant effect of Problem Based Learning model on students' problem solving ability on the material of the stages of foundation work implementation at SMK Negeri 1 Hiliserangkai.

Hypothesis testing uses data from the final test results with a two-party t test. From hypothesis testing (attachment 23) obtained $t_{count} = 2.23$

and $t_{table} = 2.001$. Because t_{hitung} does not lie in the interval $-t_{table} \leq t \leq t_{table}$ or 2.23 does not lie in the interval $-2.001 \leq t \leq 2.001$, H_a is accepted and H_o is rejected, meaning that the hypothesis reads: "There is a significant effect of the Problem Based Learning model on students' problem solving skills on the material for the stages of foundation work implementation at SMK Negeri 1 Hiliserangkai" is accepted at the 95% confidence level or 5% significant level ($\alpha=0.05$).

DISCUSSION

From the results of processing research data, research findings were obtained, including:

a. The average results of students' problem solving ability tests in the initial test in the experimental class were 58.75 classified as sufficient because students were not familiar with the problem solving ability test questions, students did not concentrate during the initial test, did not do the questions given properly. The average result of problem solving ability in the final test is 77.83 classified as good. Based on the comparison with the class that used the conventional model, the results of students' problem solving ability using the Problem Based Learning model were better than the results of students' problem solving ability using the conventional learning model. Thus it can be said that the Problem Based Learning model affects the results of students' problem solving skills in the material of the stages of foundation work implementation. This is also because the Problem Based Learning model provides real problems to students and involves students to solve and solve these problems through activities and learning experiences during the learning process.

b. The average result of students' problem solving ability test in the initial test in the control class was 59.83 which was classified as sufficient because students were not familiar with problem solving ability test questions, students did not concentrate during the initial test, did not work on the questions given properly. The average result of students' problem solving

ability in the final test was 68.25 classified as sufficient. This is also because conventional learning models tend to assume that students have the same needs, and learn in the same way at the same time, in a quiet classroom, with strictly structured subject matter activities and dominated by the teacher.

- c. From hypothesis testing, the $t_{count} = 2.23$ and $t_{table} = 2.001$ were obtained. Because $t_{count} > t_{table}$, H_a is accepted and H_0 is rejected, meaning that at a confidence level of 95% or a significant level of 5% ($\alpha=0.05$) there is a significant effect of the Problem Based Learning model on students' problem solving skills on the material of the stages of foundation work implementation at SMK Negeri 1 Hiliserangkai.
- d. From the evaluation results obtained from the results of problem solving skills from the four indicators, namely understanding the problem, making a solution plan, completing the solution plan and checking again. In the experimental class, the problem solving ability which is classified as the largest aspect is the indicator of making a solution plan with a percentage of 88.88 classified as a very good level of understanding, the influencing factor is that students are able to understand the problem in the problem instrument because Problem Based Learning involves students solving problems and solving problems themselves through learning activities and can involve students planning problems in learning. The smallest aspect of the problem solving ability result indicator is checking back with a percentage of 76.66 classified as a good level of understanding, this is caused by the lack of students in solving the problem correctly so that it affects the interpretation and conclusion of the problem being worked on.

CONCLUSION

1. The average result of students' problem solving ability using the Problem Based Learning model at SMK Negeri 1 Hiliserangkai in the 2023/2024 academic year is 77.83 which is classified as good.
2. Based on hypothesis testing, $t_{count} = 2.23$ and

$t_{table} = 2.001$ were obtained. Because t_{hitung} does not lie in the interval $- t_{table} \leq t \leq t_{table}$ or 2.23 does not lie in the interval $- 2.001 \leq t \leq 2.001$ then H_0 is rejected and H_a is accepted, meaning that the hypothesis that reads: "there is a significant effect of the Problem Based Learning model on students' problem solving skills in the material of the stages of foundation work implementation at SMK Negeri 1 Hiliserangkai." accepted at the 95% confidence level or 5% significant level ($\alpha=0.05$).

3. The Problem Based Learning model applied to students' problem solving skills is classified as good, this is because the Problem Based Learning learning model starts learning activities by giving problems to students and involving students in solving problems so that students are trained and improve thinking skills in problem solving and gain knowledge.

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