ETDC Indonesian Journal of Research and Educational Review
Volume 2, No. 2, 2023, pp 51-60
e–ISSN 2809-3682
p–ISSN 2809-7505

https://doi.org/10.51574/ijrer.v2i2.588

PRE-SERVICE TEACHERS WITH COURSES IN PROBLEM-BASED LEARNING IN MATHEMATICS

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Article Info

Article history:

Received October 06, 2022
Revised February 20, 2023
Accepted March 21, 2023

Keywords:

Learning;
Mathematics;
Problem-based learning;
Pre-service Teachers;
Statistical Material

ABSTRACT

Study This aim is to determine the effectiveness of the application of the problem-based learning model in learning statistical material for lower-level students. This research was conducted at the As'adiyah Sengkang Islamic Institute. Data collection techniques used are test results studies, sheets of observation activity, and questionnaire responses by students. The results show that: (1) the average score of the results study statistics student before the problem-based learning model is applied is 25.41 and is in the very low category with a standard deviation of 9,688. From the results obtained, 37 students, or 100%, did not reach completeness. Meanwhile, the average score of the results of the study statistics for students after the PBL model is applied is 8.3, with a standard deviation of 9,036. From the results obtained, 35 students, or 9.60%, reached completeness as individuals, and 2 students, or 5.40%, did not reach completeness as individuals. (2) Activity students are in the category of good. (3) Questionnaire responses from students show that responses are positive. (4) Average implementation of learning in the PBL model, which is 3.73, and this means we are in the category accomplished with ok. Based on the results of the study, it can be concluded that the application of the problem-based learning model is effective in teaching statistics to students at the Sengkang As'adiyah Institute of Islamic Religion.

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1. INTRODUCTION

Mathematics is one of the most important lessons in developing an intellectually strong student (Franke et al., 2007; Louie, 2017). By studying math, a great student can think critically, be skilled at counting, and have the ability to apply concepts based on mathematics in other subjects and in mathematics alone and within his life every day. One of the characteristics of mathematics is that it has characteristic objects or abstracts (Hoffmann & Even, 2023). Abstract nature This causes lots of students to experience difficulty in math. However, in the conditions of the study environment, the student, and the social and cultural environment, mathematics can be served with notice. Where great students grow and develop. In learning mathematics during this period, the real world

only made sense when applying concepts. As a result, students are less likely to notice or understand math concepts, have lower motivation to learn, and have difficulty applying what they learn in everyday life. One of the subjects in tertiary institutions that students must study is statistics (Bromage et al., 2022). This course is a prerequisite for a student to pursue research activities when creating scientific papers for use in data analysis.

Based on the results of observations of student learning activities in class and interviews with one of the statistics lecturers at the As'adiyah Sengkang Islamic Institute, the statistics learning results obtained by students were still in the low category. That can be seen from the average value obtained by students in an even semester, only some of which reached the target set by the lecturer concerned. The low activity and results Study statistics for students in class were caused by a number of factors, namely: first, the existence of disturbance from students during the learning process, so that concentration was a little reduced. Second, students lack interest and motivation to learn statistics, so they argue that statistics is a difficult lesson because they have lots of necessary solutions and formulas memorized. Third, there are fewer students who are engaged in responsive learning. Fourth, often the learning process is dominated by students who have more ability in the eyes of the lesson statistics, which also results in inactivity by students and others in the learning process.

In connection with this matter, efforts can be made, i.e., to streamline the learning process statistics at the As'adiyah Sengkang Institute of Islamic Religion. One alternative learning model that can make effective learning in class, namely the learning model of purposeful problem-based learning, activates great students in study through various problems in real life that are daily associated with knowledge that has been acquired or will be acquired.

Problem-based learning employs various types of intelligence to confront real-world challenges, as well as abilities to confront everything new and complex that exists. Problem-based learning is an effective model for developing and activating the ability to think as well as teaching thought processes at a high level. Learning this helps the student process what is already in his mind and put it together as knowledge alone about the social world and its surroundings. Learning this is not suitable for developing a knowledge base or complex.

Essence Statistics

Statistics is a method of scientific study that involves collecting, organizing, calculating, describing, and analyzing data, as well as drawing valid conclusions based on the analysis carried out and making rational decisions (Bromage et al., 2022). In short, statistics is knowledge related to data. Or statistics is a striving science. Try processing data to benefit from decisions in life.

Function statistics, including:

1. Describe the data in a certain form. Without statistics, the data will be fuzzy and unclear.
2. Simplify complex data (descriptions). into average data, percentages, and so on.
3. Represents a technique for making comparisons.

4. Expand individual experience (with method, learn conclusions based on other assessments).
5. Measure the magnitude of something's symptoms.
6. Got it, explain the connection because the consequence, yes, determines reasons, tree something subsequent symptoms, used for stage predictions.

Problem-Based Learning Model

Problem-based learning is one in which lessons learned through the process of gaining understanding will resolve a problem (Muzaini et al., 2022). A study based on the problem of interaction between stimulus and response, namely the connection between two directions of learning and the environment.

Problem-based learning is a learning model that prioritizes how active students are in always thinking critically and being skilled when faced with solving a problem (Bosica et al., 2021). The flow of how students learn depends on how complex the problems they face are. Learning objectives using problem-based learning are related to mastery of material knowledge, problem-solving skills, multidisciplinary learning, and life skills (Naimnule et al., 2020). Learning with the problem-based learning model begins with a problem, which in this case can be raised by the teacher, and then students deepen their knowledge of what they know and what they need to know to solve the problem (Suparman & Tamur, 2021). Problems that serve as the focus of learning can be solved by students through group work so as to provide diverse learning experiences to students, such as collaboration and interaction in groups, in addition to learning experiences related to problem-solving such as making hypotheses, designing experiments, conducting investigations, collecting data, interpreting data, making conclusions, presenting, discussing, and making reports. This situation shows that the problem-based learning model can provide a rich experience for students. In other words, the use of this learning model can increase students' understanding of what they learn so that they are expected to be able to apply it in real-life situations (Ng et al., 2020).

The syntax of the problem-based learning model consists of five main phases (Anazifa & Djukri, 2017; Ramadhani et al., 2020). The fifth stage is presented in the table 1 following:

Table 1. The syntax of the problem-based learning model

Stage	Teacher Behavior/Teacher Behavior
Stage 1 Student orientation to the problem	The teacher explains the learning objectives, explains the logistics required, proposes phenomena to raise problems and motivates students to get involved in solving the problem they choose.
Stage 2 Organizing students to study	The teacher helps students define and organize learning tasks related to these problems.
Stage 3	The teacher encourages students to collect appropriate information, carry out experiments to get an explanation of the problem.

Stage	Teacher Behavior/Teacher Behavior
Guiding individual as well as group investigations	
Stage	Act Teacher behavior / Teacher behavior
Stage 4 Develop and present work results	Teachers assist students in planning and preparing appropriate work such as reports, videos, and models and help them to share assignments with their friends.
Stage 5 Analyze and evaluate processes solution to problem	Teachers help students to reflect or evaluate their investigations and the processes they use.

Therefore, based on the above conception, this research aims to determine the effectiveness of applying problem-based learning models to learning statistics material for low-level students.

2. METHOD

The type of research used is experimental. Experimental research is research that looks for a causal relationship between the independent variable and the dependent variable, where the independent variable is controlled to be able to determine the influence it has on the dependent variable (Gersten et al., 2005; Ross & Morrison, 2013). The research was carried out at the As'adiyah Sengkang Islamic Institute. There are 37 students, consisting of 19 men and 18 women. In research, this treatment is great for students taught with the problem-based learning model.

Procedure Implementation Study

a. Stage Implementation

Give a pretest to the student. Carry out learning in a selected class by using the problem-based learning model. Learning done during four meetings, and posttests to students.

b. Stage end

Collecting data from the experimental process, Describing the data accordingly with variables that have been determined, and doing data analysis with technique-relevant statistics.

The following instruments will be used for research:

a. Test results Study

b. Observation Sheet Process/Activity Skills Student

c. Questionnaire Response Student

d. Learning Implementation Sheet

Data collection techniques

As for technique, deep data collection studies This is the following:

a. Data about results Study statistics for students taken with test results Study math.

b. Data on student liveliness was collected with the use of a sheet observation activity.

c. Data about the activity lecturer in learning taken with the use of a sheet of observation activity lecturer

d. Data about responses from great students taken from the questionnaire

Data analysis techniques

Analysis descriptive was used for count size centering from the results of the study students. Data obtained from the results of the pretest and posttest were analyzed for the study student. The size enhancement before and after learning was counted with the normalized gain formula:

$$g = \frac{S_{pos} - S_{pre}}{S_{mak} - S_{pre}}$$

Description:

g = normalized gain

Spre = score _ pretest

S_{pos} = score post test

Smax = score _ ideal maximum

For normalized gain classification seen in the table following:

Table 2. Normalized Gain Classification

Coefficient gain normalization	Classification
$g < 0.3$	Low
$0.3 \leq g < 0.7$	Currently
$g \geq 0.7$	Tall

Analysis Inferential

After done normality test furthermore done testing the hypothesis using the average similarity test viz with apply technique t-test One Sample Test.

$H_0: \mu_B = 0$ *against* $H_1: \mu_B > 0$

Description:

Criteria taking decision:

H_0 rejected if P-value < α and H_0 accepted if P-value > α = 0.05. If the P-value < α means learning mathematics effective through application of the Problem-Based Learning model.

3. RESULTS AND DISCUSSION

3.1 Analysis Results Statistics Descriptive

Result score Study statistics student Sengkang As'adiyah Institute of Islamic Religion before given treatment in table 3.

Table 3. Learning Outcome Score Statistics Before Given Treatment

Statistics	Statistical Value
research unit	37
Ideal Score	100
Maximum Score	42

Statistics	Statistical Value
Minimum Score	10
Score Range	32
Average Score	25.41
Standard deviation	9,688

Learning Outcome Score Statistics statistics student As'adiyah Sengkang Islamic Institute after given treatment in table 4.

Table 4. Learning Outcome Score Statistics After Given Treatment

Statistics	Statistical Value
research unit	37
Ideal Score	100
Maximum Score	98
Minimum Score	68
Score Range	30
Average Score	83,89
Standard deviation	9,036

Table 5. Results activity students

No.	Observed components	Meeting to						Average	Percentage (%)
		I	II	III	IV	V	VI		
1	Students present appropriate time during the learning process teach going on .	PRE SQ	33	36	35	36	POSQ QESQ	35	94.59
2	Students who pay attention moment the lecturer explained material lesson .		28	32	33	32		31.25	84.45
3	Submit question about unfinished material understood		18	19	20	19		19	51.35
4	Answer questions / questions posed by the lecturer		19	22	20	23		21	56.75
5	Request guidance / help in do questions LKS practice		18	18	19	19		18.5	50
6	Give help to Friend experiencing group difficulty	PRE	23	24	24	17	PO	22	59

No.	Observed components	Meeting to					Average	Percentage (%)
		I	II	III	IV	V	VI		
7	Student present results Work groups on the board write	QESQ	11	5	6	8	SQQ	7.5	20
8	Do other outside activities activity learning	Q	5	4	2	4	ES	3.75	10.1

Table 6. Description of Overall Average Response Student

Frequency			Percentage (%)		
Yes	No	Amount	Yes	No	Amount
34,125	2,875	37	92	8	100

Results of Observation of the Implementation of Learning Through the *Problem Based Learning Model.*

Table 7. Results of Observation

Meeting	Average score	Classification	Criteria
I	4	3, 50 < value ≤ 4.00	Very good
II	3.46	2, 50 < value ≤ 3.50	Good
III	3.8	3, 50 < value ≤ 4.00	Very good
IV	3.67	3, 50 < value ≤ 4.00	Very good
Average	3.73	3, 50 < value ≤ 4.00	Very good

3.2 Analysis Results Statistics Inferential

Normality Test

Normality test aim for now is average score of results Study student statistics (pretest-*posttest*) normally distributed . Criteria the test are:

If the P- $_{value} \geq \alpha = 0.05$ then its distribution is normal.

If P $_{value} < \alpha = 0.05$ then its distribution is not normal.

With use computer program assistance with the version of *the Statistical Product and Service Solutions* (SPSS) program 16 with the *Kolmogorov-Smirnov* Test. Analysis results average score for *pretest* shows mark P $_{value} > \alpha$, namely 0.200 > 0.05 and the average score for *posttest* show mark P $_{-value} > \alpha$ ie 0.125 > 0.05 . This thing shows that that There is difference pretest scores with score postest normally distributed.

Test Gains

Testing *Normalized gain* aim for know how much big completeness results Study students. From the results testing *Normalized* gain shows that gain index =

0.78. This thing means is in the interval g ≥ 0.7 then can concluded that enhancement results Study categorized as high. As for the classification enhancement results Study student statistics presented in the table following.

Table 8. Normalized Gain Classification at the As'adiyah Sengkang Islamic Institute

Gain normalization coefficient	Number of students	Percentage (%)	Classification
g <0.3	0	0	Low
0.3 ≤g <0.7	2	5	Currently
g ≥0.7	35	95	Tall
Average	0.78		Tall

Testing Hypothesis

Hypothesis testing analyzed with using the *t*-test for know is learning n mathematics material effective statistics through the *Problem Based Learning* model for female students As'adiyah Sengkang Islamic Institute.

Minor hypothesis test

1) Average yield Study student statistics after taught with using the *Problem Based Learning* model is calculated with using the *t* -test *one sample test* is formulated with hypothesis as following:

   $H_0: \mu = 70$ Oppose $H_1: \mu > 70$

   μ: The average score of the results Study great student

   Based on results SPSS version 20 analysis, visible that the p value (sig.*(2-tailed))* is 0.000 <0.05 indicates that average yield Study great student after taught through the *Problem Based Learning* model more from 70. This means that H_0 rejected and H_1 accepted ie average yield Study posttest great student The As'adiyah Islamic Institute of Sengkang exceeded the standard targets set.
2) Average normalized gain student after taught with using the *Problem Based Learning* model counted with using the *t* -test *one sample test* is formulated with hypothesis as following:

   $H_0: \mu_g = 0{,}3$ Oppose $H_1: \mu_g > 3$

   Description:

   μ_g Normalized average gain score.

   Based on results analysis looked that the p value (sig.*(2-tailed))* is 0.000 <0.05 indicates that the average gain is normalized in female students at the As'adiyah Sengkang Islamic Institute more of 0.3. This means that H_0 rejected and H_1 accepted that is, the normalized gain results Study great student is in category medium.

3) Completeness Study great student after taught with using the *Problem Based Learning* model in a way classic counted with using the formulated test of proportions with hypothesis as following:

$H_0: \pi = 80\%$ Against $H_1: \pi > 80\%$

Description:

π : Parameters of classical learning mastery

Testing completeness classic student done with using the proportion test. For proportion test with use level significant 5% obtained Z *table* = 1.64, meaning H $_0$ accepted if Z *count* $\leq$ 1.64. Because it is earned *calculated* Z value = 1.67 then H0 $_{is}$ rejected, that is proportion students who achieve criteria completeness 70 = 8 0 % of whole students who follow test.

Based on description above, visible proportion students who achieve criteria completeness from more from 80 %. So got concluded that in a way inferential results Study statistics student after taught with using the *Problem Based Learning* model fulfil criteria effectiveness.

From the analysis above can conclude that the average score of the results of Study student statistics after learning through using the *Problem Based Learning* model has fulfilled criteria effectiveness.

4. CONCLUSION

Based on the results of data analysis and discussion, it can be concluded as follows:

Learning outcomes students As'adiyah Sengkang Islamic Institute statistics material show that students before being given the treatment taught with models of problem-based learning averaged a score of 25,41 and deviated from the standard of 9,688. These results also show that there are 37 great students out of the total number of great students, or 100%, which does not achieve individual completeness. So in conclusion, this means that classical completeness is not achieved.

Learning outcomes students As'adiyah Sengkang Islamic Institute statistics material show that students after being given the treatment taught with the problem-based learning model, including in category tall, have an average score of 83,89 and a standard deviation of 9,036. So it's linked to criteria completeness. In the study, there are 2 students or 5% of students. There are no reach completeness individuals, and 35 students, or 95% of students, reach completeness individuals. Study in a classic way with a normalized gain value of 0.78, which is in the category of high. So in conclusion, this means that classical completeness has been achieved.

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