The Effect of Problem Based Module for Sampling Technique Courses Toward College Student Problem Solving Behaviour; Case Study in Indonesia

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Abstract. This study aims to look at the effectiveness of problem-based modules in lectures on Sampling Techniques toward problem-solving behavior. A module can also be used by using an e-learning platform if the lecturer cannot face-to-face because the modules designed can be used independently by college students because they contain material, examples, guided exercises, independent exercises, and answer keys. The subjects of this study were 26 college students from one of the private universities in Indonesia. The study used a One-Shot Case Study design. Data collection is done through a final Problem-Solving test, open interview, video analysis. Data were analyzed using a t-test and problem-solving behavior rubric. Based on the results of the study concluded that was the use of the Sampling Technique module in lectures affected college student problem-solving behavior. This means that the problem-based sampling technique module is effectively used in studies.

1. Introduction

The sampling technique course is one of the compulsory subjects for college students. This course deals with how techniques in sampling from a population. College students need this competency as one of the necessary knowledge in conducting research. Study one with other classes will have different sampling techniques. Some expert science studies using specific sampling techniques such as Nimmo research gastric emptying measurement: comparison fixed luster detection use the double sampling technique in his research [1]. Next, to determine rapid changes, new sampling techniques based on stop-flow methods have been developed in Buziol research [2]. Li, Clark, Lord, Stanton, & Suttie analysis them research, also do different sampling technique [3]. Besides educational studies, the various ways in which the sampling techniques are used: random sampling, purposive sampling, and other sampling techniques.

In this course, the students’ problem-solving skills are needed in analyzing the case. For example, given a study, students determine the right sampling techniques and choose the statistical calculation. Also, problem-solving is essential to be observed in the sampling technique courses, but throughout any learning process. Problem-solving is critical and is at the heart of the learning process [4, 5, 6]. The problem solving discussed in this study is not only in terms of problem-solving ability but also
problem-solving behavior. The behavior will be seen from aspects of self-confidence, ownership of knowledge, and so on.

Lecturers must be able to create innovative learning tools to help students develop problem-solving. Valid and practical problem-based modules on lectures for sampling techniques have been developed for a year. A module can also be used by using an e-learning platform, if the lecturer cannot face-to-face. This is because the modules designed can be used independently by college students because they contain material, examples, guided exercises, independent exercises, and answer keys. The development process has been discussed and presented in another paper. This paper will focus on how the module has been developed for students' problem-solving behavior. The following will be reviewed on modules, problem-based learning, problem-solving skills, and problem-solving behavior.

2. Method
The following will explain about participants, data analysis techniques, and data collection techniques.

2.1. Participants
26 students from one of the Indonesian campuses were involved in this research. Students are taught by using valid and practical problem-based modules and have been developed for one year. This paper discusses explicitly how the module affects the problem-solving behavior of students.

2.2. Data Collection and Analysis
Based on the study's problem and the purpose of the study, this study was included in a pre-experimental study. This study uses a "One-Shot Case Study" design. The design of this study can be seen in the following Table 1.

| Class   | Treatment | Post-test |
|---------|-----------|-----------|
| Eksperimen | X         | O         |

Information:
X: Treatment of sample classes, i.e., lectures using modules Problem-based sampling technique
O: Test student problem solving

Data is collected using the following valid and reliable problem-solving test questions in Table 2

| No | Problem-solving exercise |
|----|--------------------------|
| 1  | In a population, there is a proportion in class C of 35%.  
   a. Determine the variance of the proportion if 150 samples are drawn.  
   b. After sampling, the population size of 285 is known; what is the ratio of variance.  
| 2  | A random sample of 500 students turned out that 255 students brought a car to campus. Use a 95% confidence interval to estimate the proportion of students who don't get a car to campus.  
| 3  | A list of names contains 255 names and their addresses. If randomly sampled from 175 data, there are 75 names and lessons that are wrong. Determine the estimated amount of data names and addresses that need to be corrected and the standard error of these estimates.  
| 4  | A family consists of 4 men and four women. Determine the frequency distribution of the number of women with a sample size of 5. Then calculate the average and variance of the estimated amount.  
| 5  | A youth organization consisting of 400 people, of which 150 members are women. The data shows that 60% of them are male members with a bachelor's degree and the rest have a secondary school education. Likewise, for female members, information was obtained that 40% had a secondary school education, and the rest had a university education. According to their knowledge, 50% of communication is received in the organization's membership book, each from male and female fixed-income members. Determine the sample size to meet the sampling accuracy of 5% and the 95% confidence limit if someone will research with the population members. Then do the sampling
After 26 students are taught using the module in several meetings, students are given the test in Table 2. Furthermore, the test results of students' problem-solving abilities are analyzed using the rubric in Table 3 below.

### Table 3. Scoring rubric ability to solve problems

| Scores | Understanding the Problem | Devising a Plan | Carrying Out The Plan |
|--------|---------------------------|-----------------|-----------------------|
| 0      | Unable to identify the information that exists in the problem | Not using one of the problem-solving strategies | Loading errors in every step of the completion |
| 1      | Able to identify the information contained in the problem | Using problem-solving strategies but includes wrong steps | There are errors in several stages to resolve |
| 2      | Understanding the meaning of every statement in the problem | Using problem-solving techniques with the right steps | There are no errors in every step of completion |

Source: Modified by Muir (2008)

After obtaining the value of each student, data analysis was performed using the following $t$-test. The hypothesis in this research is:

H0: There is no effect of using the problem-based sampling technique module on Problem-Solving ability

H1: There is an effect of using the problem-based Sampling Technique module on Problem-Solving ability

The hypothesis is tested using the $t$-test as stated by Arikunto, namely:

$$ t = \frac{\bar{X}_1 - \bar{X}_2}{S_{X_1} - S_{X_2}} $$

Information:
- $t$ = price of $t$
- $\bar{X}_1$ = group average before treatment
- $\bar{X}_2$ = group average after treatment
- $S_{X_1}$ = standard deviation before treatment
- $S_{X_2}$ = standard deviation after treatment

The basis for decision making is to compare the value of the account with $t_{(\alpha/2)}$. If $-t_{(\alpha/2)} < t_{\text{count}} < t_{(\alpha/2)}$ then accept $H_0$ but if $t_{\text{count}} < t_{(\alpha/2)}$ or $t_{\text{count}} > t_{(\alpha/2)}$ then reject $H_0$ accept $H_1$ [7]. Then to obtain the category of student problem-solving behavior. Data of interviews, tests, and videos of students during the test are analyzed with the rubric in Table 4 below.

### Table 4. Overview of students' behavior based on a range

| Factors         | Category of Behaviors                      |
|-----------------|--------------------------------------------|
| Knowledge       | Naive                                      |
| Ownership       | Routine                                    |
| Knowledge       | Sophisticated                              |
| Made a mistake on Polya's four steps | Made mistakes in several steps of dealing with Polya's problem and did not attempt to verify the solution | Carry out the four steps of Polya's problem well |
3. Result and Discussion

3.1. Problem Solving Ability

After the final test is done, the last test data is analyzed to see whether there is an influence of using the problem-based sampling technique module on the students’ problem-solving abilities. To determine whether the hypothesis is accepted or rejected, the learning outcomes before and after using the module are analyzed using a two-way t-test. The following in Table 5 is the data of students’ problem-solving abilities before and after using the module.

| Sample Class | $\bar{X}$ | $S$ | $X_{\text{max}}$ | $X_{\text{min}}$ | t<sub>count</sub> | t<sub>table</sub> |
|--------------|-----------|-----|------------------|-----------------|------------------|-----------------|
| Before treatment | 35,13     | 16,17 | 59               | 4               | 2,31             | 2,06            |
| After treatment   | 51,5      | 23,25 | 99               | 16              |                  |                 |

Based on Table 5, it can be seen that the average score of students 'mathematical problem-solving abilities after being given learning by using the problem-based sampling technique module is more than the average score of students’ problem-solving abilities before learning. This shows a better value than before.

Hypothesis test results at the real level $\alpha = 0,05$ obtained prices $t_{\text{count}} = 2,31$ and $t_{\text{table}} = 2,06$, because $t_{\text{count}} < t_{\text{table}}$ then reject $H_0$ and accept $H_1$. So, it can be concluded that the use of the Sampling Technique module in lectures affects learning outcomes. This means that the Sampling
Technique module based on guided discovery is effectively used in lectures.

3.2. Problem Solving Behaviour

The following in Table 6 will be presented student behavior analyzed from the results of open interviews, coding the interview results, and matching with video. Data were analyzed using the rubric in Table 6.

| the category of student problem-solving behavior | the number of students | % |
|------------------------------------------------|------------------------|---|
| Naïve                                           | 5                      | 19|
| Routine                                         | 17                     | 65|
| Sophisticated                                   | 4                      | 16|

Based on the findings, students' problem-solving ability taught with problem-based modules is better. It can be interpreted that good teaching materials will give good achievements to students. Muir said that three things can affect student success, namely: teacher professionalism, teaching materials, and external factors of students themselves [8]. If seen from the problem-solving behavior of students, students are focused on routine behavior. Routine behavior is where students are still looking for structured completion steps and have not been able to generate their own strategies for problem-solving problems. When viewed from the lecture process where Sampling Techniques lectures with the use of modules using group learning. After students sit in groups, each student is given a module. Students are asked to read the material in the module. Students can discuss with groups in understanding the material. If there are obstacles in understanding the material, students can ask the lecturer. After the material is read, students are asked to do the exercises in the module. The thing that might make students not many in the position of sophisticated behavior is that in addition to developing modules there must be something else done by the lecturer in the learning process. This might be done by making books more interesting by collaborating with technology-based learning. Some education media and technology-based will also affect student behavior in learning in addition to developing modules [9, 10, 11, 12]. According to the expert digital will positively affect some students' behavior, so it could be that if the module is packaged in an attractive digital platform, it will foster independent learning in students. For this reason, it is necessary to carry out further research as recommendations from this research.

4. Conclusions

Hypothesis test results at the real level $\alpha=0.05$ obtained prices $t_{count} = 2.31$ and $t_{table} = 2.06$, because $t_{count} < t_{table}$ then reject $H_0$ and accept $H_1$. So, it can be concluded that the use of the Sampling Technique module in lectures has an effect on learning outcomes. This means that the Sampling Technique module based on guided discovery is effectively used in lectures. Sampling Technique module in lectures affected toward college student problem solving behaviour. This means that the problem-based sampling technique module is effectively used in lectures.

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