

## **Research-Based Learning on Student Learning Outcomes in Statistics Course**

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### **Abstract**

This study aims to describe the application of research-based learning in statistics courses and determine its effectiveness on student learning outcomes in statistics. This research was an experimental research with a qualitative-quantitative approach. The research design used a post-test-only design, where there were two classes studied, one experimental class and one control class. The population of this study was 250 students of the Department of Governmental FISIP UMM who were taking the Statistics subject. The sample was 100 students divided into two classes, namely class A, consists of 50 students as the control class, and 50 students in class C, as the experimental class. The treatment of research-based learning was given to the experimental class, while conventional learning was given to the control class. Then both classes were offered a posttest to find out the learning outcomes—the analysis of research data using independent sample T-Test. Five aspects were observed of Research-Based Learning implementation in experimental class, that is: the implementation of preliminary, core and closing activities, the presentation of the latest research results by lecturers relating to teaching material, the lecturer asks students to look for statistical data in the latest research, the lecturer asks students to look for issues of the latest research topics, and the lecturer asks students to do a little research in learning. The effectiveness of the application of Research-Based Learning can be seen by comparing the average final work of experimental and control class students. Based on the data processing with SPSS, the experimental group's average was better than the control group. It showed that Research-based Learning had an impact on the average final grades of experimental class students so that it becomes better than the average control class students.

**Keywords:** Research-Based Learning, Learning Outcomes, statistics-course.

## **INTRODUCTION**

Statistics is a branch of mathematics that studies the collection, processing, analysis, and drawing conclusions based on data analysis. Statistics courses are subjects that are studied in many fields. Statistics courses can be found on the list of courses in the Faculty of Engineering, Science, health, Literature, and Social. However, in non-mathematics fields and faculties such as the Faculty of Social and Political Sciences, students are generally less enthusiastic about studying Statistics (Fitri, 2011), which of course, will also affect the spirit of learning and student's understanding of Statistics material. Though Statistics is vital for undergraduate students because it will be advantageous when preparing theses. Today also Statistics is considered very important because studying Statistics has many uses in many fields. According to (Abdullah & Suhartini, 2017), economic statistics are used for economic policy based on research data. Health statistical, commonly known as biostatistics, which is useful in research related to

medicine, pharmacy, and other health sciences. Statistics in education are also helpful when researching the effectiveness of learning, the effectiveness of learning models, the validity of learning instruments, and much more.

The use of statistics in the social and political fields is apparent in the presidential election and the election of legislative candidates (Zega, Muda, Masitho, & Suharyanto, 2019). Statistics is beneficial in many ways, such as exposure to the survey results, which, of course, uses statistical research methodologies. Statistical data are also useful in mapping the area and population of voters and party sympathizers and candidates as well as being a reference for the government in determining state policies. The statistical data used are generally the results of BPS surveys, ministry surveys, and internal surveys of parties or independent survey institutions concerned. So, it is essential to master Statistics as a basis for conducting research in-depth knowledge and also as a reference for policy decisions in the social and political fields (Astri, Nikensari, & W 2013; Eliza, 2015).

According to Parma & Saparwadi (2015), assessment of the learning process needs to be routinely carried out in order to improve learning methods and adjust the demands of existing learning competencies. Students of the Government of Muhammadiyah University of Malang study programs are required to master the concepts and applications of Statistics courses because this subject is one of the basic courses that are the foundation for taking further courses and the foundation in conducting thesis research. Due to the importance of Statistics courses so that learning methods are needed that can maximize student understanding of the material and applications of Statistics courses and improve students' research abilities. According to Charitas, Prahmana, & Kusumah (2016), one lesson that can improve students' academic skills and foster student skills in conducting research is a research-based learning model. Based on these problems, it is necessary to do research-based learning in Statistics courses. By using research-based learning, students are expected to be able to better understand the concepts and applications of Statistics material and foster the skills of research students, especially Government students.

Research-based learning is a model that connects such activities as analyzing, synthesizing, and evaluating and improving the assimilation of learners and lecturers (Susiani, Salimi, & Hidayah, 2018). Research-based learning (RBL), one of the outcome-based learning techniques, closes the gap between theory and application. It involves the learner to design, experience, and reflect the entire process of learning. Inquiry forms one of the important elements of RBL, which also develops creativity and discovering new techniques breaking the monotonous process for solution development (Herrmann et al., 2019). Many researchers studied about research-based learning before (Brew & Saunders, 2020; Herrmann et al., 2019; Susiani et al., 2018); however, no one has yet described how to implement RBL in the classroom. Likewise, discussions that link research-based learning with learning outcomes have not been widely studied.

The formulation of the problem of this research is How is the application of research-based learning in statistics courses? And how is the effectiveness of research-based learning on student learning outcomes in statistics courses?

## RESEARCH METHOD

This research uses a quantitative approach with a quasi-experimental type of research. The research design used was the posttest only control group design.

Table 1 Research design

Group	Dependent Variable	Posttest
Control	-	O1
Experiment	X	O1

Explanation:

X: Application of Research-Based Learning

O1: Post-test

The population of this study was 250 students of the Department of Governmental FISIP UMM who were taking the Statistics subject. The sample was 100 students divided into two classes, namely class A, consists of 50 students as the control class, and 50 students in class C, as the experimental class. The research steps taken are starting from research planning, implementing actions, analyzing, and evaluating activities. The research steps carried out in this study are described in the chart below.

Data analysis of the results of the study used two approaches, namely, qualitative and quantitative approaches. To answer the problem formulation of this study, researchers used a descriptive type of research to explain the problem formulation. The researcher used quasi-experiments, so the data analysis used SPSS software, namely by using the Independent Sample T-Test. Following is the hypothesis of this research, H0: There is no difference in the average learning outcomes of the control class and the experimental class, and H1: There are differences in the average learning outcomes of the control class and the experimental class

## RESULT AND DISCUSSION

The study was conducted in a period of 2 months, April and May 2019. The study was conducted in two classes Introduction to Social Statistics, namely class II A and II C. Class II A as an experimental class that was treated by research-based learning. In comparison, class II C is a control class, which is given conventional learning.

Research-based learning is applied not only at one meeting but throughout the all meeting course. It is seen from the assignments given by lecturers when applying research-based learning. First, The assignment was that students were asked to review the latest research using worksheets that had been compiled by researchers. Second, the middle exam showed research data, and then students were asked to analyze it. Third, assignments to the final exam, where students were asked to do a little research.

The application of research-based learning was observed by two observers. The purpose of observation is to determine the achievement of research-based learning aspects that have or have not been achieved in Statistics lectures. The following are the results of observations on the application of learning based on aspects of research-based learning.

The first aspect observed was the implementation of preliminary, core, and closing activities. This aspect is considered to be implemented well. In the preliminary activities, the model lecturer reminds the learning material beforehand and illustrates the introductory material before entering the core material. The lecturer explained statistics material related to daily life, especially the use of statistics in education and social affairs. In the core activity, the model lecturer explained the material about compare means, which was followed by questions and answers and practicum of compare means in SPSS. This activity is in accordance with research conducted by Usmeldi (2016), which applies research-based learning in learning through practicum activities.

The second aspect observed was the presentation of the latest research results by lecturers relating to teaching material, namely compare means. The model lecturer has given and invited students to study the latest research journals. Students are invited to look at research data and study the analysis of research data. By analyzing research data, lecturers hone students' problem-solving skills. This is in accordance with Herrmann et al. (2019), which states that RBL contributes to the development of problem-solving, domain knowledge, language, and communication, communication & information technology, general learning, academic knowledge, attitude, ethics skills.

In the third aspect, the lecturer asks students to look for statistical data in the latest research. Students are asked to look for statistical data from journal articles provided by the lecturer. The second and third aspects are contained in the Student Worksheet as follows (see Figure 1). It emphasizes on research process and problems underlying inquiry-based learning involving students as participants

1. Baca dan perhatikan skripsi dengan judul "Kesejahteraan Psikologis Guru Honor SD Dan SMP Di Kota Wates", terutama pada Bab IV Hasil. Skripsi tersebut menggunakan pendekatan kuantitatif, di dalamnya terdapat pengolahan data kuantitatif menggunakan *one sample t test* dan *independent sample t test*.

2. Tulis/Gambar kembali satu data yang Anda temukan pada skripsi tersebut.

Kategori dimensi penerimaan diri			
Data	n	Data	n
22	1	34	7
24	3	35	3
26	2	36	13
28	3	37	2
29	5	38	4
30	8	39	1
31	10	40	3
32	7	41	2
33	10	42	1

Figure 1 Students reviewed the research.

In the fourth aspect, the lecturer asks students to look for issues of the latest research topics. In this aspect, the model lecturer asks students to look for the latest research issues via the internet, especially online journals.

In the fifth aspect, the lecturer asks students to do a little research in learning. This is done at the end of the lecture, where students are given group assignments to do a small research. Students are asked to determine the research theme, define the hypothesis, then take research data, and end analyzing the data.

There are several obstacles to the implementation of research-based learning in Statistics classes recorded by observers, namely some students who are absent, causing some groups to work less than optimal. In this condition, the model lecturer should adopt

a policy of combining several groups into one. The position of group members also needs to be arranged by the model lecturer to make it easier for students to discuss. Seen groups of students sitting in a circle are more active in discussions than groups of students who sit horizontally.

Some suggestions were also given by observers to improve further learning; namely, the task of reviewing data and analyzing the model lecturer could give quantitative data at the previous meeting. So that learning in the classroom can be more effective and varied. Students can also be asked to search for articles or papers using quantitative data.

The effectiveness of the application of research-based learning can be seen from the difference in the average of the control and experiment classes, where the lecturer control class does not implement aspects of research-based learning while in the experimental class, the lecturer implements research-based learning. Learning outcomes are taken from the value of final student assignments. The normality test is done by Shapiro Wilk and Liliefors test, SPSS output obtained:

Table 1 Tests of Normality

Group	Kolmogorov-Smirnov			Shapiro-Wilk			
	Statistic	df	Sig.	Statistic	df	Sig.	
Score	1	.110	50	.179	.967	50	.173
	2	.122	50	.062	.963	50	.123

a. Lilliefors Significance Correction

The table above shows the results of the Kolmogorov\_Smirnov test. Lilliefors p-value (Sig) 0.179 in group 1 and 0.062 in group 2. Because both groups have p – values > 0.05, based on the Lilliefors test, the data for each group is normally distributed. Based on the Shapiro Wilk Test p-value (Sig), group 1 obtained 0.173, and group 2 obtained a p-value of 0.123. Because all > 0.05, both groups are equally Normal.

Independent sample test with t-test, SPSS Output obtained:

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Nilai	Equal variances assumed	4.317	.040	5.747	98	.000	5.620	.978	3.679	7.561
	Equal variances not assumed			5.747	82.329	.000	5.620	.978	3.675	7.565

Since it is assumed that the two independent sample variants are homogeneous, then use the results in the first row (Equal Variances Assumed). In the first row, the Sig (2-tailed) value or p-value is 0,000, where 0,000 <0.05. Because <0.05, then reject H<sub>0</sub>, which means there is a difference in the average between the Control class and the Experiment class. Viewed from the mean difference section with a positive value of 5,620, it means that the mean of the first group is better than the second group and showed that Research-based Learning has an impact on the average learning outcomes A class students

so that it becomes better than the average class C. This research were accordance to Susiani et al. (2018) that implementation of the RBL can improve the quality learning process and make positive changes for the students in the intellectual and emotional.

## CONCLUSION

Application of Research-Based Learning in Statistics class runs well according to five aspects of research-based learning, namely, covering preliminary, core, and closing activities, there is a presentation of the results of the latest research, the lecturer asks students to look for statistical data in the newest research, the lecturer asks students to look for issues the latest research topics and the lecturer asks students to do a small study in learning.

The effectiveness of the application of Research-Based Learning can be seen by comparing the average final work of experimental and control class students. From the data processing with SPSS, the mean of the experimental group is better than the control group and shows that Research-based Learning has an impact on the average final grade grades of class A students so that it becomes better than the average grade C.

In research, of course, there are many limitations that researchers do. Suggestions for further research is the need to develop instruments in the form of research-based learning tools to facilitate and support classroom learning for one semester. Expansion of research variables is also needed, not only limited to student learning outcomes that are considered

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