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The Influence of Research-Based Learning with Portfolio Assessment on Science Process Skills in Microbiology Course for Biology Program Students

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***Abstract*— The purpose of this study is to determine the influence of research-based learning with portfolio assessment on student science process skills in microbiology material. This quasi-experimental study uses a pretest-posttest design. Implemented in April - June 2018, the population of this study are all Biology students in the sixth semester of 2017/2018 academic year consisting of 8 classes. The sampling technique is a cluster random sampling: class A as research-based learning treatment with portfolio assessment, class B as research-based learning treatment without portfolio and class C as direct learning treatment with ordinary practicum. The number of students in class A as experimental class I amounted to 40 people, class B for experiment class II amounted to 35 people, and class C control class amounted to 32 people, bringing the total of all students to 107 people. Data collection uses trial techniques. Students' science process skills are analyzed by Manova data analysis techniques (Multivariate analysis of variance) and further testing by Tukey's test with a significant level of $\alpha = 0.05$. The analysis technique is done using Microsoft Excel and SPSS 23.0. The Manova results show that there is a significant influence of research-based learning with portfolio assessment on student science process skills (F = 39,322; P = 0,000). Posttest average scores for students' science process skills that are taught with research-based learning with a higher portfolio compared to research-based learning without portfolios and direct learning.**

Keywords*— *Research Based Learning, Portfolio, Science Process Skills.

I. INTRODUCTION

Education is a learning process where students receive and understand knowledge as a part of themselves and then process it in such a way for good and mutual progress. The education referred to above is not in the form of learning material that is heard when spoken, is forgotten when the teacher finishes teaching and just being remembered when the test period comes, but an education that requires a process, which is not only good, but also fun and interesting, good for teaching staff and students. A good teaching material, though important and highly necessary may be failed to be properly digested by students when the methods or approaches used are not good enough in conveying the material [6].

The progress of Indonesian education could be achieved through good regulation of education. The means to improve the quality of education are expected to increase Indonesia's human dignity. Various efforts have been made by the government to improve the quality of education, namely through the development of learning models, the development of learning media, upgrading of teaching staff, provision of facilities and infrastructure that support learning and training. However, all these attempts have not shown optimal results. According to [3] research-based learning is a system of teaching that is authentic problem solving with a viewpoint of problem formulation, problem-solving, and communicating the benefits of research results. This is believed to be able to improve the quality of learning.

Microbiology is a compulsory subject in the sixth semester of Biology program. This course examines the history of the development of microbiology, microorganisms and their characteristics, the role of microorganisms in life, metabolism, and growth of microbes, bacterial biochemical activity, and food fermentation. Almost all the subjects in the applied microbiology course includes practical works. So that after attending microbiology courses, students are expected to have insight into the concept of microbiology and microorganisms studies and have skills in aspects and activities related to microorganisms.

The Biology Department of the Mathematics and Natural Sciences Faculty at the State University of Medan itself has implemented the KKNI curriculum that has been started for the past two years. Six tasks that must be carried out by all students include routine assignments, Critical Book Report (CBR), journal review, idea engineering, mini research, and projects. One of the six tasks is related to what the writer will examine, namely mini research. In the process of carrying out this mini research task, there were still many obstacles faced by students. For example, when a student conducts a practicum, not all learning materials integrate research results in each practicum. This is consistent with the results of

research which state that student difficulties and failures are caused by internal and external factors including students, facilities, curriculum, learning resources and the ability of lecturers to teach students [10]. .

The results of research conducted by [3]on the implementation of research-based learning on the study of rice laundry waste fermentation for the manufacture of nata in the basic science concepts subject of PGSD undergraduate students of FKIP UNS shows that research-based learning may improve the quality of learning. Furthermore, according to research conducted by [3], research-based learning with a scientific approach is effective enough to be applied in improving science process skills. The difference in science process skills between students who take learning with a scientific approach and students who follow the direct learning model is because in the scientific approach learning there are elements of scientific methods and inqury so that students' psychomotor abilities are optimally obtained. This happens because students do their own learning activities in groups, conduct investigation, trial, make decisions, conclude and communicate what is gained from the learning experience.

According to [3] to achieve all of the points above, one of the factors that influence learning outcomes is a learning method that can be applied through a particular learning model. One learning model that is able to improve science process skills according to [15] is to use a learning model through a research-based learning approach, because this learning requires students to be able to find, explore (develop knowledge) to solve problems faced, and then test the truth of the knowledge. The interaction of learning between students and educators is an active interaction. Educators act as facilitators, and mediators in order to bring students to achieve the expected competencies.

Based on observations, studies of literature from various sources such as journals, books, and other research, there is no research on the influence of research-based learning with contextual portfolio assessments on microbiological material science process skills in biology students. Therefore. research related to research-based learning needs to be done.

Based on the background and formulation of the above problems, the purpose of this study is to find out the influence of research-based learning including the assessment of contextual portfolios, research learning without portfolio assessment, and direct learning with ordinary practicum on the science process skills in Microbiology course for Biology program students.

II. METHODS

The method used in this study was a quantitative method with a quasi-experimental design approach. Both the experimental class and the control class were given process skills tests before and after learning was applied. The population in this study were all sixth-semester students of the Department of Biology FMIPA Medan State University. The sampling technique was random sampling with a total sample of 107 people, namely the experimental class I with a number of 40 people receiving treatment with research-based learning through portfolio assessment, experimental class II with 35 people receiving treatment with research-based learning without a portfolio, while the control class with a number of 32 people using direct learning with ordinary practicum.

The data taken from this study was a test of science process skills in some practical materials given at the beginning and end of the treatment.

The research design used can be seen in Table 1.

Table 1. Research Design

Class	Pretest	Posttest
CLASS A	X1	X2
CLASS B	X1	X2
CLASS C	X1	X2

Information:

A. Experimental Class I (research-based learning with portfolio)
B. Experimental Class II (research-based learning without portfolio)
C. Control Class (direct learning with ordinary practicum)

X1 = pretest (the same test was used)

X2 = posttest (the same test was used)

An inferential statistical analysis was done to test the hypothesis. Before testing the hypothesis, the requirement tests was done, namely the normality test and homogeneity test. The normality test was carried out using the Kolmogorov-Smirnov test at a significance level of 0.05 using the SPSS 23.0 program. The homogeneity test was done to test whether the groups that make up the sample came from the same population, which means that their distribution in the population was homogeneous. The homogeneity test of the data used Levene's Test at a significance level of 0.05. After the requirements were fulfilled, then the research hypothesis was tested. The students' science process skills data were analyzed using Multivariate Analysis of Variance (MANOVA) analysis technique at the level of $\alpha = 5\%$. Furthermore, if the results of the F statistic was on a significant level or $\alpha = 5\%$, there was a significant effect between the three sample groups. Thus, the analysis followed by the Tukey's test using the SPSS 23.0 program.

III. RESULT AND DISCUSSIONS

The highest and lowest score of the initial ability data (pretest) on student's science process skills tests at research-based learning course with portfolio assessment are 66 and 37 respectively, with an average of 49.93 ± 6.86 and normally distributed data ($Z = 0.137$; $P = 0.056$). In the research-based learning course without portfolio assessment, the highest score is 60 and the lowest is 34 with an average of 46.49 ± 6.209 and normally distributed data ($Z = 0.143$; $P = 0.068$). The control class that is direct learning with ordinary practicum obtain the highest score of 54 and the lowest of 31 with an average of 41.40 ± 5.951 and the data is normally distributed ($Z = 0.125$; $P = 0.200$).

The data of the final ability (posttest) in the research-based learning course with portfolio assessment obtain the highest score of 93 and the lowest 83 with an average of 87.90 ± 3.011 and the data is normally distributed (Z = 0.136; P = 0.060). In research-based learning course without portfolio assessment, the highest score is 90 and lowest 80 with an average of 84.71 ± 2.295 and normally distributed data (Z = 0.136; P = 0.097). The control class that is direct learning with ordinary practicum, the highest score is 88 and the lowest is 77 with an average of 82.38 ± 2.55 with a normally distributed data distribution (Z = 0.144; P = 0.088). The homogeneity test results show the variation of data between the three sample groups in the population is homogeneous F = 51,256; P = 0,000 (Figure 1).

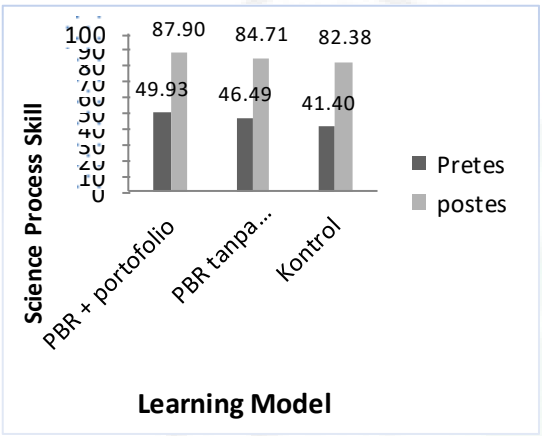

Fig 1. The influence of research-based learning with portfolio assessment, without portfolio assessment, and direct learning with ordinary practicum on science process skills (F = 39,322 and P = 0,000).

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	HOT	681,760[a]	2	340,880	51,256	,000
	KPS	555,234[b]	2	277,617	39,322	,000
Intercept	HOT	764625,497	1	764625,497	114971,185	,000
	KPS	766546,107	1	766546,107	108575,513	,000
Metode	HOT	681,760	2	340,880	51,256	,000
	KPS	555,234	2	277,617	**39,322**	,000
Error	HOT	691,661	104	6,651		
	KPS	734,243	104	7,060		
Total	HOT	776660,000	107			
	KPS	778109,000	107			
Corrected Total	HOT	1373,421	106			
	KPS	1289,477	106			

The results of the second hypothesis, carried out using the Multivariate Analysis of Variance (MANOVA) analysis using SPSS 23.0 for windows with the F value on the Test Of Between - Subjects Effect of 39.332 with a significance level of 0.000 shows less than 0.05. Based on this result, H0 is rejected which means that there is no difference in the effect of research-based learning with portfolios on students' science process skills. Because the null hypothesis H0 is rejected, Ha is accepted which means that there is an influence of research based learning with portfolios on students' science process skills.

These results are in line with the results of research done by [3] which said that research-based learning (PBR) with exposure steps (study of literature), experience (experience) and capstone (exposure) accompanied by a scientific approach may improve process skills in science learning, especially for elementary school students . Besides, this result is in line with the opinion of [10] which explained that science process skills are very important for every student as a provision to use scientific methods in developing science, which expected to gain new knowledge or develop knowledge that has been possessed. The reference from [4] stated that science process skills are a whole directed scientific skill that can be used to find a concept or principle or theory, to develop existing concepts.

Thus, Ha is accepted and H0 is rejected. So that it can be concluded that there is a significant influence between classes that use research-based learning with portfolios, research-based learning without portfolios and direct learning with ordinary practicum in Microbiology course towards Biology students' science process skills in The Faculty of Mathematics and Natural Sciences (FMIPA) of State University of Medan (UNIMED).

IV. CONCLUSION

Based on the results of the research findings and analysis conducted by the researcher, it can be concluded that there is a significant impact on research-based learning with portfolio assessment of science process skills in the Microbiology course of the Biology students. The students' science process skills taught by research-based learning with portfolio assessment are significantly higher than that without portfolio assessment or students who are taught by direct learning with ordinary practicum.

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