The Effect of Practicum-based Contextual Teaching and Learning Learning Model on Science Process Skills and Student Learning Outcomes on Fungi Material

1st Umi Farihah
Department of Mathematics Education
UIN Kiai Haji Achmad Siddiq Jember
Jember, Indonesia
umifarihah@uinkhas.ac.id

2nd Aminatus Zakiyah
Department of Biology Education
UIN Kiai Haji Achmad Siddiq Jember
Jember, Indonesia
aminazakiyah11@gmail.com

3rd Maharani Conilie
Department of Biology Education
UIN Kiai Haji Achmad Siddiq Jember
Jember, Indonesia
maharaniconilie@gmail.com

4th Imaniah Bazlina Wardani
Department of Biology Education
UIN Kiai Haji Achmad Siddiq Jember
Jember, Indonesia
imaniahbazlinawardani@uinkhas.ac.id

***Abstract*—The purpose of this study was to determine the effect of the practicum-based *Contextual Teaching and Learning* model on science process skills and student learning outcomes in grade X social science on *Fungi* material at State Madrasah Aliyah 1 Situbondo, Indonesia. The sampling technique is purposive sampling, where two classes have an initial entry test score with an average of almost the same, namely class X Social Science 1 (experimental class) and class X Social Science 3 (control class). The data collection technique used were observation, test, and documentation, while the data collection instruments were observation sheets, test instruments, and documentation instruments. To analyze the data, an *Independent Sample T-Test* was used with *prerequisite tests* including the *normality test* and *homogeneity test*. The results showed that there was a significant effect of the practicum-based *Contextual Teaching and Learning* model on science process skills and student learning outcomes on *Fungi* materials in class X social science at State Madrasah Aliyah 1 Situbondo, Indonesia. It can be concluded that the collaboration between the practicum-based *Contextual Teaching and Learning* model can be applied in biology learning to empower students' science process skills and improve student learning outcomes on *Fungi* material.**

***Keywords*—biology, Contextual Teaching and Learning, practicum, Fungi, learning outcomes, science process skills**

I. INTRODUCTION

As part of science, biology is not only a set of concepts, facts, and principles but also a process of discovery. [1]. In biology learning, ideally, students can be actively involved in the process of discovery and experimentation through practicum activities. From various practicum activities in each material taught, students will gain basic science process skills that are very important for finding scientific facts, building concepts, and using scientific methods[2]. There are ten aspects of science process skills, including observation, interpretation, classification, prediction, asking questions, hypotheses, experiments, use of tools and materials, application of concepts or principles, and communication.[3].

Several studies report that process science skills are essential for students to aid in understanding concepts, solving problems, thinking critically, understanding scientific phenomena, and higher-order thinking, as well as providing students with more meaningful learning experiences.[4]–[6]. Hasanah et al. revealed that students with good science process skills would help achieve good learning outcomes. Also, Hasanah et al. said that students with good science process skills would help achieve good learning outcomes. [1]. As one of the indicators to measure student understanding, learning outcomes can also reflect student learning efforts [7]. However, the reality is that in biology learning, there are still schools that have not deceived science process skills optimally, which can be caused by improper selection of models and learning methods.

Observations in MAN 1 Situbondo, East Java, Indonesia, show that the learning model used in biology subjects is a conventional learning model that is teacher-centered and does not involve students actively during learning. This results in achieving only some aspects of students' science process skills. Mahmuda explained that the only teacher-centered learning process is a factor in the low skills of students' science processes.[8]. In addition, based on the results of interviews with biology teachers, it was found that biology practicum is rarely carried out, especially on Fungi material. This causes the non-achievement of essential and core competencies, affecting students' learning outcomes who have yet to reach the minimum completeness criteria. Competencies that must be achieved include 1) Core Competence 3.7 (Knowledge) which is to group fungi based on their characteristics, how to reproduce, and their role in life, and 2) Basic Competence 4.7 (Skills), which is to present reports on the results of investigations on the diversity of fungi and their role in life[9].

To overcome these problems, a learning model is needed to improve science process skills and learning outcomes. The alternative solution is to use a practicum-based Contextual Teaching and Learning (CTL) learning model that involves students fully in the learning process and optimally applies affective, cognitive, and psychomotor abilities.[10]–[12]. The CTL learning model has seven main components: constructivism, questioning, finding, community learning, modeling, reflection, and actual assessment [13]. Meanwhile, through practicum will help students master the material,

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cooperation, creativity, and empower science process skills [2], [14].

Previous studies have reported that CTL models have an impact on improving students' science process skills and scientific attitudes to vibration, wave, and sound materials [10]. Furthermore, Ningsih's research results showed that Inquiry-based CTL had a positive effect on students' science process skills in physics lessons [15]. While practicum-based learning is proven to affect student learning outcomes on arthropod material [16]. The three study results indicate that so far, no study has sought explicit solutions to student problems that occur in MAN 1 Situbondo through a practicum-based CTL learning model on the Fungi material.

This study aims to determine the influence of practicum-based Contextual Teaching and Learning learning models on science process skills and student learning outcomes on Fungi material. It is hoped that these findings can be a solution and evaluation material in empowering and improving science process skills and student learning outcomes in biology subjects, especially in Fungi material at MAN 1 Situbondo, East Java, Indonesia.

II. METHOD

This research uses a quantitative approach with a type of experiment. Quasi-Experimental Design is used in this study as a Non-Equivalent Group Post-Test Only Design. The research was conducted in November 2022 at MAN 1 Situbondo, East Java, Indonesia. The population in this study was all class X social studies students, totaling 60 students consisting of three classes. Purposive Sampling is used as a sampling technique, so two classes were selected that had an initial entrance test score with almost the same average, namely rank X IPS 1 with an average score of 37.17 as an experimental class and class X IPS 3 with an average score of 37.56 as a control class with the number of students in each category as many as 20 students.

Data collection techniques used in this study include observation, tests, and documentation. Instruments have observation sheets, post-test questions, and documentation sheets. The observation sheet adapts Iqbalia's survey with 17 queries.[17]. In this study, observation was carried out involving four observers who would observe and take data from all four groups. Each group was followed by one observer who had previously received an explanation from the researcher about the systematics of observation implementation and how to use the observation sheet assessment guidelines. The test instrument in this study was in the form of multiple choice questions of 20 questions given in the experimental and control classes.

Aspects observed in science process skills include: 1) Asking questions; 2) Hypothesis; 3) Plan experiments; 4) Using tools and materials; 5) Observation; 6) Classification; 7) Prediction; 8) Interpretation; 9) Applying concepts; and 10) Communication. The science process skill scoring follows the Likert scale; that is, if the results are excellent, they are given a score of 5, sound is given a score of 4, it is enough to score 3, it is not good to be given a score of 2, and it is not very good to be given a score of 1.

Indicators of Fungi learning outcomes test questions include: 1) Explaining the characteristics of divisions in the Fungi kingdom; 2) Explain the basis of grouping; 3) Describe the body structure of fungi from various groups; 4) Distinguish various classes of fungi based on their morphological characteristics; 5) Explain the breeding methods found in various classes of fungi; 6) Create a life cycle chart of fungi of various groups; and 7) Present data on examples of the role of fungi for life. The scoring of this multiple-choice learning outcome test is if students can answer correctly, given a score of 1, and if they answer incorrectly, are given a score of 0.

Before the instrument is used, validity and reliability tests are first carried out. The validity test in this study includes content validity tests conducted by experts and construct validity given to grade X IPS 2 students (other than research samples). At the same time, the reliability test uses Cronbach Alpha. The material expert's research results were very valid (87%), and the evaluation expert showed perfect (99%). The results of the construct validity test showed that the 20 test items were declared valid because the calculated value was located between 0.503 and 0.791 where the matter was more significant than the table, which was 0.444. In contrast, the reliability test calculation results obtained a Cronbach Alpha value of 0.712, more critical than 0.6, so it could be reliable. After the test instrument meets the requirements, the device can be given to the sample to obtain post-test value data.

The data analysis used in this study was descriptive and inferential statistics. Descriptive analysis uses calculations in frequency distribution, mean, standard deviation, minimum score, and maximum score. While inferential analysis uses parametric statistics, the Independent Sample T-Test test has previously been carried out as prerequisite tests, namely data normality and homogeneity tests. Steps in the T-Test include finding the combined standard deviation, determining the scale, determining the degree of freedom, determining the table, and testing the hypothesis. The first hypothesis in this study is:

H_a1 : There was a significant difference in the science process skills of control class and experimental class students after being taught using a practicum-based CTL learning model on class X social studies Fungi material at MAN 1 Situbondo.

$H_0 1$: There was no significant difference in the science process skills of the control class and experimental class students after being taught using a practicum-based CTL learning model on class X social studies Fungi material at MAN 1 Situbondo.

While the second hypothesis in this study is:

H_a2 : There is a significant difference in the learning outcomes of control class and experimental class students after being taught using a practicum-based CTL learning model on class X social studies Fungi material at MAN 1 Situbondo.

$H_0 2$: There was no significant difference in the learning outcomes of control class and experimental class students after being taught using a practicum-based CTL learning model on class X social studies Fungi material at MAN 1 Situbondo.

III. FINDINGS AND DISSCUSSION

The results of this study are in the form of Post-Test scores of science process skills on Fungi material. The data was analyzed to determine the difference in science process skills of grade X students between those who use and those who do not use the practicum-based Contextual Teaching and Learning (CTL) learning model.

A. Descriptive Analysis

1. Process Science Skills

Based on the results of descriptive analysis, data on the science process skills of experimental class students were obtained after learning using a practicum-based CTL learning model and control classes were taught using a practicum-based Think Pair Share (TPS) learning model, shown in Table 1.

TABLE I. RESULTS OF DESCRIPTIVE ANALYSIS OF SCIENCE PROCESS SKILLS

Data	Class	Min	Max	N	Average	Standard Deviation
Science process skills	Experiment	73	80	20	76,45	2,35
	Control	60	77		69,85	4,28

Based on Table 1, it is known that the average score of science process skills of the experimental class (76.45) is greater than that of the control class (69.85).

2. Learning Outcomes

Based on the results of data analysis of student learning outcomes after learning using the practicum-based CTL learning model for experimental classes and practicum-based TPS models for control classes, a comparison can be seen between the two in Table 2.

TABLE II. RESULTS OF DESCRIPTIVE ANALYSIS OF LEARNING OUTCOMES

Data	Class	Min	Max	N	Average	Standard Deviation
Learning Outcomes	Eksperiment	50	85	20	69,75	8,02
	Control	45	75		60,00	9,31

Based on Table 2, it can be seen that in the learning outcome data, the average score of the experimental class (69.75) is greater than the control class (60.00).

B. Prerequisite Test

1. Normality Test

Normality testing was performed using SPSS Statistical Software version 24 Shapiro-Wilk test with a grade significance 0.05. There are criteria in determining data normality, namely: 1) If the value of sig. > 0.05 then the data is normally distributed, but 2) If the value of sig. < 0.05 then the data is not normally distributed[18].

1.1 Process Science Skills Normality Test

The normality test in this study used the Shapiro-Wilk test. The results of the science process skills data normality test can be seen in Table 3.

TABLE III. PROCESS SCIENCE SKILLS NORMALITY TEST RESULTS

Data	Class	*Sig.*	*α*	Conclusion
Science process skills	Eksperiment	0,065	0,05	Normally distributed
	Control	0,179		Normally distributed

The results of the normality test using Shapiro-Wilk in Table 3 show that the experimental class science process skill data has a sig value. by 0.065 and the control class by 0.179. Both values are greater than 0.05 so it is concluded to be normally distributed.

1.2 Learning Outcome Normality Test

The normality test in this study used the Shapiro-Wilk test. The results of the normality test of student learning outcome data can be seen in Table 4.

TABLE IV. LEARNING OUTCOME NORMALITY TEST RESULTS

Data	Class	*Sig.*	*α*	Kesimpulan
Learning Outcomes	Eksperiment	0,501	0,05	Normally distributed
	Control	0,351		Normally distributed

The normality test results in Table 4 show that the experimental class learning outcome data shows sig values. The control class is 0.501, and the control class is 0.351. Both discounts are more significant than 0.05, so it can be concluded that the learning outcome data is usually distributed. Because both science process skills and learning outcomes have a normal distribution of data, both data have been qualified for further test analysis, namely the homogeneity test.

2. Homogeneity Test

After both data were tested for normality and normal distribution, the homogeneity test was carried out. The homogeneity test is used to determine whether the two groups have the same variance or not. If both groups have the same variance then the group is said to be homogeneous. Homogeneity testing is carried out using SPSS Statistic version 24, with the following criteria: 1) If the value of sig. > 0.05 then it can be said to be the same (homogeneous), but 2) If the value of sig. < 0.05 then it can be said to be unequal (not homogeneous).

2.1 Science Process Skills Homogeneity Test

Hasil uji homogenitas data keterampilan proses sains pada penelitian ini dapat dilihat pada Tabel 5.

TABLE V. SCIENCE PROCESS SKILLS HOMOGENEITY TEST RESULTS

Data	Class	Df_1	Df_2	*Sig.*	*α*	Conclusion
Keterampilan proses sains	Eksperiment	1	38	0,148	0,05	Varians homogen
	Control					

Table 5 above shows that the homogeneity test of data on science process skills of the experimental class and the control class has a sig value. 0.148 > 0.05 so it can be concluded that students' science process skills data have variance from a homogeneous population.

2.2 Test the homogeneity of learning outcomes

The results of the homogeneity test of learning outcome data in this study can be seen in Table 6 below.

TABLE VI. TEST RESULTS HOMOGENEITY OF LEARNING OUTCOMES

Data	Kelas	Df_1	Df_2	*Sig.*	*α*	Conclusion
Learning Outcomes	Eksperiment	1	38	0,325	0,05	Homogeneous variance
	Control					

Table 6 above shows that the homogeneity test of the learning outcomes data of the experimental class and the control class obtained sig values. 0.325 is greater than 0.05 so it can be concluded that student learning outcomes data have variance from homogeneous populations.

C. Test the hypothesis

1. The Effect of Practicum-based Contextual Teaching and Learning Learning Model on Student Science Process Skills on Fungi Material

After the prerequisite test is carried out, the next step is to conduct a hypothesis test. Test the hypothesis used in this study is an Independent Sample T-Test using SPSS version 24 with a sig level. 0.05. The t-test is used because the data are normally distributed and have homogeneous variance. The Independent Sample T-Test was conducted to see the effect of the practicum-based CTL learning model on students' science process skills with testing criteria, namely if the sig score. > 0.05 then H0 is accepted and Ha is rejected, and if the value of sig. < 0.05 then H0 is rejected and Ha is accepted. The results of the t test data on science process skills of the experimental class and control class are presented in Table 7.

TABLE VII. SCIENCE PROCESS SKILLS T TEST RESULTS

Data	Class	Average	T_{count}	t_{tabel}	*Sig. (2-tailed)*	Decision
Science process skills	Eksperiment	76,45	6,042	2,024	0,000	H_a1 Accepted
	Control	69,85				

The results of the t-test in Table 7 show that the science process skills in the experimental class and the control class have a calculated value of 6.042, more significant than the table of 2.024 with a big deal. 0.000 is less than 0.05. Based on these results, it can be decided that Ha1 is accepted so that it can be concluded that there is a significant difference in students' science process skills between the control class and the experimental class after being taught using the practicum-based CTL learning model. This shows a considerable influence of the practicum-based CTL learning model on students' science process skills in class X social studies Fungi material at MAN 1 Situbondo. This is in line with the results of previous studies, namely the Muhsam & Letasado study, which reported that the CTL learning model improved elementary school students' science process skills [19]. In addition, the results of Saputra's study also show that there is an influence of the Contextual Teaching And Learning (CTL) learning model combined with audio-visual media in improving the science process skills of grade XI students on the structure and function of plant tissue[20].

2. The Effect of Practicum-based Contextual Teaching and Learning Learning Model on Student Learning Outcomes on Fungi Material

After the normality and homogeneity test is fulfilled, the next step is to test the hypothesis. The Independent Sample T-Test was also conducted to see the effect of the practicum-based CTL learning model on student learning outcomes with testing criteria if the sig score. > 0.05 then H0 is accepted and Ha is rejected, and if the value of sig. < 0.05, then H0 is rejected, and Ha is accepted. After the Independent Sample T-test test is carried out, the recapitulation of the results of the T-test data on student learning outcomes can be seen in Table 8.

TABLE VIII. LEARNING OUTCOMES T TEST RESULTS

Data	Class	Average	T_{count}	t_{tabel}	*Sig. (2-tailed)*	Decision
Learning outcomes	Eksperiment	76,45	3,545	2,024	0,001	H_a2 accepted
	Control	69,85				

Table 8 shows that the results of the variable t-test of student learning outcomes in the experimental and control classes have a calculated value of 3.545, more significant than the table of 2.024 with a big value. 0.001 is less than 0.05. Based on these results, it can be decided that Ha2 is accepted so that it can be concluded that there is a significant difference in student learning outcomes between the control class and the experimental class after being taught using the practicum-based CTL learning model. This shows that there is a significant influence of the practicum-based CTL learning model on student learning outcomes in class X social studies Fungi material at MAN 1 Situbondo.

The results of this study support the research of Asradiah et al. which states that learning using the practicum-based CTL learning model can improve student learning outcomes or have a positive influence on student learning outcomes[21]. This is also reinforced by the results of research conducted by Wati et al., which states that CTL-based learning through experimental methods (practicum) can improve students' cognitive learning outcomes because this learning can improve learning strategies so that learning with the CTL model through practical methods (training) is recommended to be applied[22].

However, it is different from the results of Juniwati's research, which shows that there is an influence of the CTL learning model on student learning outcomes in physics lessons even though it does not collaborate with practicum[23]. On the contrary, the results of the Rofiqoh & Martuti study showed that successful practicum affected students' learning outcomes scores on the Fungi material [24]. Although the study did not collaborate with the CTL learning model, this difference can occur due to differences in student characteristics and the material being studied. In biology learning, almost all of the material taught requires practicum activities both in the laboratory, the surrounding environment, and in nature.

IV. CONCLUSION

According to the description of the results and discussion, the conclusion that can be explained is that there is a significant influence of the practicum-based Contextual Teaching and Learning (CTL) learning model on students' science process skills in class X social studies Fungi material at MAN 1 Situbondo, East Java, Indonesia. In addition, there is also a significant influence of the practicum-based Contextual Teaching and Learning (CTL) learning model on student learning outcomes in class X social studies Fungi material at MAN 1 Situbondo, East Java, Indonesia. The suggestion for future researchers is to develop this research, for example by examining the Contextual Teaching and Learning (CTL) learning model based on Jelajah Alam Lingkungan (JAS) or by replacing dependent variables with variables other than those that have been studied to see their effect on science process skills and student learning outcomes or can use other variables such as learning motivation and student achievement on biology material with topics what's different.

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