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The Influence of Science, Environment, Technology, Society (SETS) Learning Models on Learning Activities and Biology Learning Outcomes

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ABSTRACT

This study aims to determine the effect of the Science, Environment, Technology, Society (SETS) learning model on learning activities and biology learning outcomes. The sample of this research was students of class VII totaling 30 students people. The research data collection method is using data collection instruments in the form of learning activity observation and a written test in the form of multiple choice. Methods of data analysis of learning activities using the formula Weight Means Score and data analysis of learning outcomes is done by using the "t_{test}" test. The average result of the interpretation score is 3.30 with the interpretation number criteria interval from 3.25 to 4.00. The mean rate of this interpretation means that it falls into the "Very Active" criterion. The prerequisite test proved to be normally distributed and homogeneous. The results of the ttest test calculation show that t count is 2.265 and t table is 2.048, so from these values it can be concluded that t count> t table. Based on the research results, it can be concluded that there is an influence of the science, environment, technology, society (SETS) learning model on biology learning activities. The benefit of this research is that it can find the right learning model to be applied to plant material and can be used as a reference for teachers in delivering material.

How to Cite

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INTRODUCTION

Education is defined as a human effort to foster his personality in accordance with the values in society and culture. In an education, educational programs will create a learning atmosphere and learning process so that students are actively able to develop their abilities to have religious spiritual strength, self-control, intelligence, personality, noble character, and skills needed by themselves, society, nation and state. This is in accordance with Law No. 20 of 2003 concerning the National Education System (Sujana, 2019). To have this ability, students are expected to be active in developing higher-order thinking skills that can be seen from several aspects

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such as critical thinking, creative, able to solve problems and have good reasoning. This ability can be seen through learning activities and student learning outcomes in the learning process.

A process to acquire skills and knowledge by direct experience (Yahya, 2017). The direct experience that teachers give to students in learning biology, one of which can develop the abilities, processes, and attitudes needed for critical thinking and interpersonal relationships and group learning. The problem that appears today is that biology is a subject that is considered to have a lot of memorization. So if students do not know the concept then the student does not understand the material given by the teacher.

Biology learning in secondary schools is expected to be a vehicle for students to improve knowledge, skills, attitudes and responsibility to the environment. Biology learning is related to how to find out, understand nature and living things so that biology lessons are also a process of discovery (Putra, 2021). Therefore, students should be given direct experience in understanding biology lessons. In this case, students are trained, among others, to observe, record data, interpret data, formulate hypotheses, conduct experiments, compile reports, presentations and make portfolios for authentic assessment purposes in learning.

Based on the many references obtained, it is stated that there are differences in learning outcomes between students who take lessons with the SETS Vision Integrated Science learning model and students who study with conventional learning models in class VII students. In line with this, researchers will apply the SETS learning model (Science, Environment, Technology, and Society) as one of the solutions in learning that can affect learning activities and student learning outcomes (Dewi *et al.*, 2020). The implementation of the SETS learning model involves learning activities in the learning process which are then affected through the use of the stages of the SETS learning model including Invitation, Exploration, Solutions, Applications, Concept Consolidation, and Evaluation (Safitri, *et al* 2018). Through the results of the evaluation/test, it can also be seen the influence of SETS on student learning outcomes in addition to seeing the effect of SETS on learning activities. The list of student activities is classified as follows (Ayuwanti, 2016):

1. Visual activities, which include for example: reading, paying attention to demonstration pictures, experiments, other people's work.
2. Oral activities, such as: stating, formulating, asking, giving suggestions, issuing opinions, holding interviews, discussions, interruptions.
3. Listening activities, for example listening to: descriptions, conversations, discussions, music, speeches.
4. Writing activities, such as writing stories, essays, reports, questionnaires, copying.
5. Drawing activities, for example: drawing, making graphs, maps, diagrams.
6. Motor activities, which include among others: conducting experiments, making construction, repairing models, playing, gardening, raising livestock.
7. Mental activities, for example: responding, remembering, solving problems, analyzing, seeing relationships, making decisions.
8. Emotional activities, such as being interested, feeling bored, happy, excited, passionate, brave, calm, nervous.

This study aims to determine the effect of the Science, Environment, Technology, and Society (SETS) learning model on learning activities and learning outcomes of biology.

The benefit of this research is that it can find the right learning model to be applied to plant material and can be used as a reference for teachers in delivering material, serve as input in the development of the world of education and the application of the SETS learning model can create active and fun learning and be able to influence learning activities and activities. student learning outcomes until educational goals are achieved.

MATERIALS AND METHODS

Research Place and Sample

This research was conducted at the Khoiru Ummah Islamic Boarding School with the research sample being class VII, Wave I as the experimental class. The experimental class was then given treatment with the SETS learning model. While class VII Wave II as a control class, namely by providing learning using a conventional model.

Feasibility Test of Research Instruments

This research instrument was first tested by the validator lecturer, the validated instruments included learning activity observation sheets and multiple choice test questions to see some descriptions of questions that were suitable to be tested on the research sample. Furthermore, the test instrument was tested on students by testing 50 multiple-choice questions with Seed Plant material (Spermatophyta) in class VIII students who had studied Seed Plant material. The data processing of the research instrument feasibility test was carried out with the help of the Microsoft Office Excel 2010 program. The following are the results of the research instrument feasibility test:

1. ***Validity Test***
   Calculation of the validity data obtained the results of the calculation of the validity test, of which there were 19 items that were not valid and 31 items that were declared valid.
2. ***Reability Test***
   The calculation of the reliability test results obtained a reliability coefficient of 0.91 and was declared to have very high reliability.
3. ***Difficulty Test***
   In the results of the test of the level of difficulty of the test instrument, there were 6 items in the too difficult category, 43 items in the medium category and 1 question in the easy category.
4. ***Distinguishing Power Test***
   In the results of the discriminatory test, the test instrument obtained 4 items in the very good category, 18 items in the good category, 10 questions in the sufficient category, 13 questions in the poor category, 5 questions in the poor category.

Researchers can determine the 25 items used for research including questions that have a valid category, questions that have a high level of reliability, and have a level of difficulty in the easy-medium category and questions that have a classification of different power indexes very good-good-enough.

Research Implementation

1. ***Invitation***
   Students are given spermatophyte material (science component). Then invite students to find issues/problems that are developing in the community (these diseases include; fever, cough, easily tired.
2. ***Exploration***
   Students are invited to connect the subject matter (science) with the environment based on the science being studied. Students identify the morphology of Betel (*Piper betle*) and Ginger (*Zingiber officinale*) plants. The teacher explains the benefits of these two plants.
3. ***Solution***
   The teacher invites students to process Betel (*Piper betle*) into antiseptic and

Ginger (*Zingiber officinale*) into ginger wedang.

4. ***Application***
   After the antiseptic and ginger wedang are finished, the students present and promote the products that have been produced to students in other classes.
5. ***Concept Consolidation***
   Students conclude the relationship between the subject matter and the SETS concept and explain the benefits of plants around the environment.
6. ***Evaluation***
   Furthermore, the researcher entered the final stage, namely carrying out a multiple choice test of 25 questions. During the learning process, the observer can observe student learning activities using research instruments (learning activity observation sheets) that have been prepared.

Data Analysis

Analysis of Learning Activity Data

The initial data on this observation sheet were assessed using a Likert scale. Alternative assessment numbers on this scale may vary, some use 4, 5, 7 or 9 scales (Syahrum & Salim, 2016). In this study, using a scale of 1-4.

Table 1. Likert Scale Measurement

Scale	Information
1	Less Active
2	Active Enough
3	Active
4	Very Active

The observation sheet that has been assessed is then determined the average value of each activity. The results/data of student learning activities are then analyzed to obtain an interpretation number (M). The interpretation value is obtained by using the Weight Means Score analysis, with the formula (Helmi, 2016):

$$\mathbf{M} = \frac{\Sigma fx}{n},$$

Information:

M : Gaining interpretation score
f : frequency
x : value scale weighting (score)
Σ : Sum
n : Total students

Based on the acquisition of the interpretation value above, it is then adjusted to the interval of interpretation criteria and is used as a conclusion in measuring the Likert scale. Based on table 1, there are variations in scores that move from numbers 1 to 4, for that the interval between one criterion and another is 0.75. The number 0.75 is obtained by subtracting the highest value (4) with the lowest value (1), then the number of these criteria is divided. The formula: $\frac{4-1}{4} = 0.75$. Interpretation criteria interval / interpretation of learning activities as follows:

Table 2. Interpretation Criteria Interval

Scale	Information
1.00 – 1.75	Less Active
1.75 – 2.50	Active Enough
2.50 – 3.25	Active
3.25 – 4.00	Very Active

Learning Outcome Data Analysis

The test results were first analyzed by prerequisite test (homogeneity test and normality test). Normality test formula with Liliefors test formula (Nizar, 2016):

$$L_{count} = Max\,|\,f(z)\text{-}S(z)\,|\,,\ L_{table}=L_{(a,n)}.$$

Information:

f(z): Normal cumulative probability
S(z): Empirical cumulative probability

Research Hipotesis

After the data is homogeneous and normal, a hypothesis test will be carried out which will be analyzed using the t-test. The formula for the t-test test is (Jaya & Ardat, 2017):

$$t = \frac{X_1 - X_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_1^2}{n_2}}}$$

Information:

X_1 & X_2 : The mean of the two groups being compared

S^2 : The combined standard error of the two groups

n_1 and n_2 : Number of observations in each group

The hypotheses in this study are:

1. H_{o1}: There is no Effect of SETS Learning Model on Biology Learning Activities
   $H_{a1:}$ There is an Influence of SETS Learning Model on Biology Learning Activities.
2. H_{o2}: There is no Effect of SETS Learning Model on Biology Learning Outcomes.
   Ha_2: There is an Influence of SETS Learning Model on Biology Learning Outcomes.

RESULTS AND DISCUSSION

Analysis of Learning Activities

The results of research from the learning process are based on the SETS model of students in the experimental class, and the results of the Pretest and Posttest on learning outcomes and the results of observations on learning activities on spermatophyte material are obtained. The results of the data analysis of learning activities can be seen in Table 3.

Based on the results of the analysis of learning activities in the control class contained in Table 3, of the eight categories of learning activities there are two categories that have an "active" interpretation, including listening activities, motor activities. Meanwhile, there are three categories of learning activities that have a "Sufficiently Active" interpretation, including visual activities, oral activities, writing activities, drawing activities, mental activities and there is one category of learning activities that have an "less active" interpretation, namely emotional activities. Thus, the average number of interpretations obtained from Table 3 is 2.13. This interpretation number is included in the "**Sufficiently Active**" criteria. This illustrates that learning activities in the control class using conventional models in learning did not experience good changes in developing student learning activities.

Table 3. Results of Analysis of Control Class Learning Activities

No	Learning activity	M	Interval	Interpretation
1	*Visual Activities*	1.93	1.75 – 2.50	Sufficiently Active
2	*Oral Activities*	2.46	1.75 – 2.50	Sufficiently Active
3	*Listening Activities*	2.66	2.50 – 3.25	Active
4	*Motor Activitas*	2.86	2.50 – 3.25	Active
5	*Writing Activities*	2.13	1.75 – 2.50	Sufficiently Active
6	*Drawing Activities*	1.8	1.75 – 2.50	Sufficiently Active
7	*Mental Activities*	2	1.75 – 2.50	Sufficiently Active
8	*Emotional Activities*	1.2	0.00 – 1.75	Less Active
	Mean	**2.13**	**1.75 – 2.50**	**Active Enough**

Source: Calculation Results of Control Class Learning Activities

Table 4. Results of Experimental Class Learning Activity Analysis

No	Learning activity	M	Interval	Interpretation
1	*Visual Activities*	3.13	2.50 – 3.25	Active
2	*Oral Activities*	3.26	3.25 – 4.00	Very Active
3	*Listening Activities*	3.26	2.50 – 3.25	Active
4	*Motor Activitas*	3.36	2.50 – 3.25	Active
5	*Writing Activities*	3.06	2.50 – 3.25	Active
6	*Drawing Activities*	3.26	2.50 – 3.25	Active
7	*Mental Activities*	3.66	3.25 – 4.00	Very Active
8	*Emotional Activities*	3.46	3.25 – 4.00	Very Active
	Mean	**3.30**	3.25 – 4.00	**Very Active**

Source: Results of Calculation of Experimental Class Learning Activities

Based on the results of the analysis of learning activities in the experimental class contained in Table 4, of the eight categories of learning activities there are three categories that have the interpretation of "**Very Active**", namely oral activities, mental activities and emotional activities. Meanwhile, there are four categories of learning activities that have an "**Active**" interpretation, including visual activities, listening activities, motor activities and drawing activities. So that the average number of interpretations obtained from Table 4 is 3.30 with a criterion interval of 3.25-4.00. The average score for this interpretation is classified as "**Very Active**". Consider the following learning activity hypothesis:

Hypothesis 1:
H_{01} : $\mu A_1B_1 < \mu A_2B_1$

H_{a1} : $\mu A_1B_1 > \mu A_2B_1$
Accept H_{a1}, if $\mu A_1B_1 > \mu A_2B_1$

Description:

μA_1B_1: The average score of the interpretation number (M) of student learning activities in the experimental class.

μA_2B_1: The average score of interpretation scores (M) of student learning activities in the control class.

The average number of interpretations (M) of student learning activities in the experimental class and control class can be seen in table 5.

Table 5. Average M Learning Activity

	Average M	Interval	Interpretation
Experiment Class	3.30	3.25 – 4.00	Very Active
Control Class	2.13	1.75 – 2.50	Sufficiently Active

Source: Average Calculation Results for Experiment Class and Control Class

Table 5 above shows the results of the average number of interpretations of learning activities in the experimental class of 3.30, which is classified as **very active**, while the results of the average number of interpretations of learning activities in the control class is 2.13, which is **sufficiently active**. This shows that $\mu A_1B_1 > \mu A_2B_1$.

Proving this hypothesis shows the following findings: there is a significant effect between learning activities in the experimental class taught using the SETS learning model compared to those who do not use the SETS learning model. Based on these findings, it can be concluded that the learning activities of students who are taught using the SETS learning model are better than those who are not taught using the SETS model. Based on the previous decision, Ha1 was accepted, which stated that "There is an Influence of the

Science, Environment, Technology, Society (SETS) Learning Model on Biology Learning Activities in Class VII Santri of Khoiru Ummah Islamic Boarding School.

Analysis of Learning Results

The learning outcomes were first analyzed by prerequisite tests, namely normality tests and homogeneity tests. In the normality test, the criteria for the significant value of the table α value is 0.05. The conclusion on the normality test is that if $L_{count} < L_{table}$, H_0 is accepted, which indicates that the data follows a normal distribution pattern.

Table 6. Experimental Class Normality Test Results

Experiment Class	L_{count}	L_{table}	Index	Interpretation
Pretest	-0.0475	0.22	$L_h < L_t$	Normal Distribution
Postest	0.015633	0.22	$L_h < L_t$	Normal Distribution

Source: Experimental Class Normality Test Calculation Results

Based on the results of the normality test calculation for the experimental class listed in Table 6, the data is normally distributed, and it is known that the pretest value with L_{count} is -0.0475 and L_{table} is 0.22, while the posttest value with L_{count} is 0.015633 and L_{table} is 0.22, so it can be concluded that $L_{count} < L_{table}$, then H_0 is accepted and the data is proven to have a normal distribution pattern.

Table 7. Normality Test Results for Control Class

Experiment Class	L_{count}	L_{table}	Index	Interpretation
Pretest	0.073433	0.22	$L_h < L_t$	Normal Distribution
Postest	-0.0934	0.22	$L_h < L_t$	Normal Distribution

Source: Normality Test Calculation Results for Control Class

Based on the results of the control class normality test calculations contained in Table 7, the data appears to be normally distributed, and it is known that the pretest value with L_{count} is -0.073433 and L_{table} is 0.22, while the posttest value with L_{count} is -0.0934 and L_{table} is is 0.22, so it can be concluded that $L_{count} < L_{table}$, H_0 is accepted and the data follows a normal distribution pattern.

In the homogeneity test, the critical value criterion for the distribution of F at a significant level is 0.05. The conclusion of the homogeneity test is that if $F_{count} < F_{table}$, then H0 is accepted, which indicates that the data is homogeneous. The homogeneity test results obtained in the experimental class and control class can be seen in Table 8.

Table 8. Results of Homogeneity Test for Experimental Class and Control Class

Test Type	F_{count}	F_{table}	Index	Interpretation
Posttest Experiment Class and Control Class	1.767327	2.484	$F_{count} < F_{table}$	Homogeneous

Source: Result of Homogeneity Test Calculation of Experiment Class and Control Class

Based on the results of the homogeneity test calculation for the experimental class and the control class in Table 8, it is found that F_{count} is 1.767327 and Ftable is 2.484, so from this value it can be concluded that $F_{count} < F_{table}$, then H_0 is accepted which indicates that the data is homogeneous. Thus, both classes have homogeneous population.

Hypothesis testing was carried out after the learning outcomes data were proven to be normal and homogeneous. After the prerequisite test has been carried out, the analysis can be continued by testing the research hypothesis using the "t_{test}" test. Criteria for the critical value of the t distribution at a significant level of 0.05.

Consider the following statistical hypotheses of learning outcomes:

Hypothesis 2:

H_{02} : $\mu A_3B_2 < \mu A_4B_2$

H_{a2} : $\mu A_3B_2 > \mu A_4B_2$

Decision: Accept H_{a1}, if $\mu A_3B_2 > \mu A_4B_2$

Notes:

A_3B_2: Test analysis results t_{test} (t_{count})

A_4B_2: t_{table} with a significant level of 5%

The results of the "t_{test}" test hypothesis can be seen in Table 9 below:

Table 9. Results of t-test for Experimental Class and Control Class

Test Type	T_{count}	t_{table}	Index	Conclusion
Posttest Experiment Class and Control Class	2.265	2.048	$t_{count} > t_{table}$	Ha is accepted

Source: Calculation Results of t-test for Experimental Class and Control Class

Based on the results of the calculation of the experimental class t-test and control class in Table 9, it is found that t_{count} is 2.265 and t_{table} is 2.048, so that the value shows $\mathbf{t_{count} > t_{table}}$. Based on the previous decision, $\mathbf{(\mu A_3B_2 > \mu A_4B_2)}$ H_{a2} is accepted. From the results of proving this hypothesis, it was **found** that there was a significant influence in the use of the Science, Environment, Technology, Society (SETS) learning model on the biology learning outcomes of the seventh grade students of the Khoiru Ummah Islamic Boarding School. The results of data analysis showed that there was a very significant effect of the Science, Environment, Technology, Society (SETS) learning model on learning activities and biology learning outcomes in class VII students of the Khoiru Ummah Islamic Boarding School.

This is in accordance with previous research conducted by Yulistiana with the title "SETS (Science, Environment, Technology and Society)-Based Learning Research in Science Education". The results showed an increase in student learning activities and student learning outcomes, which means this method improves scientific work skills that are developed, applied, and measured during the learning process (Yulistiana, 2015).

The results of the research analysis conducted by Zahra entitled "SETS (Science, Environment, Technology, Society) Learning: Its Effect on Science Process Skills" shows that tcount = 11.1223, while ttable = 1.9908 with a significant level of 0.05% so that $t_{count} > t_{table}$. H1 is accepted, there is an effect of the SETS (Science, Environment, Technology and Society) learning model on science process skills (Zahra *et al*., 2019).

Research conducted by Riwu *et al*. (2018) shows that the application of the SETS (Science, Environment, Technology, and Societ) approach can optimize biology learning outcomes for class X IPA 7 students at SMA Negeri 2 Denpasar in the 2017/2018 academic year. Furthermore, the results of Sarjono's (2020) study show that there is an increase in the average daily test scores from 64.17 to 80.75, and classical completeness from 46.88% to 87.50% were accompanied by an increase in student activity. A study by Agustin (2017) showed that there was an increase in student learning activities carried out by motivating students to be more active in learning and presentation, as well as providing additional value for students who dared to express opinions in front of the class and who actively asked questions during the presentation.

From the description above, we can see that the implementation of the SETS learning model involves learning activities in the learning process which are then affected through the use of the stages of the SETS learning model. Thus, based on the evaluation

results, one can also see the influence of SETS on student learning outcomes.

CONCLUSION

The conclusions in this study are: There is an influence of the learning model of science, environment, technology, society (SETS) on learning activities and learning outcomes of biology in class VII students of the Khoiru Ummah Islamic Boarding School based on the acquisition of the average number of interpretations of experimental class learning activities of 3, 30 is included in the active category, while the average score for the interpretation of control class learning activities is 2.13 which is included in the moderately active category. Obtaining student learning outcomes an increase in learning outcomes from the posttest results in the experimental class which showed an average of 81.6 while in the control class showed an average of 76.2. The results of the t-test analysis results from the experimental class and the control class show that tcount is 2.265 and t-table is 2.048, so that it has a significant effect or increase.

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