The Influence of SETS Learning Model-Based Local Wisdom on Students' Critical Thinking Skills and Collaboration 21st Century in Environmental Topics

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Abstract. The purpose of this research is to find out the effect of SETS (Science Environment Technology Society) learning model based on local wisdom on students' critical thinking and 21st century collaboration skills. This research was conducted in SMAN 13 Pekanbaru class X in the academic year 2021/2022 on environmental issues, by the matching only pretest posttest control group design. The study sample consisted of two classes X4 as experimental class and X5 as control class which were taken by simple random sampling method. The instruments used multiple choice questions in critical thinking test questions and collaboration skills observation sheets with data collection techniques using pre-test, post-test and observation. The results showed that the mean of N-Gain critical thinking in the control class was 0.25 (low) and 0.49 (medium) and the experimental class, the N-Gain t-test results found significant differences between critical thinking thought control class and reference class experimental class. The average of N-Gain collaboration skill of the control class was 0.67 (medium) and the experimental class was 0.84 (high), the N-Gain t-test showed a significant difference between the collaboration skill of the control class and the experimental class. Thus it can be concluded that the implementation of the SETS learning model based on local wisdom has a positive effect on students' critical thinking and collaboration skills.

Keywords: SETS, local wisdom, critical thinking, collaboration, environment

1 Introduction

Global develeopment world in the 21st century requires various sectors of life to improve to deal with it, including the education sector. Changes in the pattern of life in today's era supposedly can answer and solve various complex and complicated problems as a result of the progress that has taken place. The changes that occur are principally aimed at improving the quality of people's lives, because the ultimate goal of

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the 21st century is a knowledgeable society after the previous changed from an agrarian society to an industrial society [1].

The knowledge society is the responsibility of the educational process that occurs, so that it is able to face the challenges of the 21st century which are so complex, therefore 21st century skills need to be developed from the start when someone is at the school level, because school is a place to prepare and develop human skills so that they have potential. in the family, work and community environment [2]. states that life in the 21st century requires skills that must be developed in the educational process [3].

Education has an important role in developing various individual skills, including critical thinking skills and collaboration skills as stated in the 21 st century partnership learning framework. Critical thinking skills are very important to develop as a provision for students to face and solve complex environmental problems [4].

A deep understanding of knowledge and skills from various disciplines is a must for students in participating in today's learning, because students can easily change the knowledge they have from contextual situations to factual [5]. How do students think critically and creatively, solve problems, innovate, manage metacognition, make decisions, how to communicate, collaborate, master technology and be proficient in dealing with science and the environment are ways to change this knowledge [6].

Critical thinking skills need to be trained in preparing students for the world of work [7]. Critical thinking is able to objectively reflect on various technological developments and develop and choose the right solution [8]. In addition to critical thinking skills, students are also directed to master collaboration skills, because in real world situations individuals are required to be able to work with others.

Collaboration skills demonstrate the ability to work together effectively and care about group differences and diversity. These skills are important for someone to be able to survive both in the work environment and the surrounding environment [9]. The environment or world of work in the 21st century demands that someone can work in groups. These skills in groups are needed in order to get maximum results.

Critical thinking and collaboration skills are a description of someone to show the abilities and knowledge they have. Someone who has the ability to think critically and collaborate well will show activeness in the learning process. One of the lessons that train critical thinking and collaboration skills is biology subject B as one of the science subjects which aims to develop analytical, inductive and deductive critical thinking skills in solving problems related to surrounding events qualitatively, and can develop collaboration skills and an attitude of trust self. Thus, in the learning process, the teacher should be able to practice critical thinking and collaboration skills so that the biology learning process can match the desired goals that are directly related to the teaching and learning process.

Presenting culture in science material is a must. integrating culturally oriented scientific knowledge is called ethnoscience. With an ethnoscience approach, in the learning process, knowledge about science can be explained using the cultural perspective of the nation. Local learning culture can improve students' thinking skills, students learn more effectively when they use the surrounding environment or equipment that arouses students' curiosity, make observations, questions, draw conclusions, and gain

experience through the scientific process [10]. Learning experiences obtained from scientific processes will be easily reminded and understood by students so as to create meaningful learning [11].

Local wisdom-based learning will train students' critical thinking skills, because the issues associated are contextual in nature which require solving problems through the surrounding environment approach, this encourages students to enrich literacy on environmental issues, because learning with local wisdom provides new knowledge from what is constructed by the students themselves which ultimately improves the quality of learning [12].

Various improvement efforts have been made by related parties, starting from improving the curriculum, holding training and empowering MGMPs in schools. But the reality in the field, students' critical thinking and student collaboration skills have not been optimally achieved. Previous research regarding the application of critical thinking skills and student collaboration at a high school in Pekanbaru city resulted in an average student still having low critical thinking skills, and student collaboration skills also showed less than optimal results from the discussion method. The cause of all this is the lack of active role of students in groups.

The results of the researcher's interview with the biology teacher showed that students' low critical thinking skills were caused by a lack of student participation in group discussions as seen from the infrequency of students giving questions and responses. The results of observations of learning activities that occur are known to be learning models that still apply the lecture method in which the teacher explains biology material without asking questions and problems related to everyday life by providing phenomena or images that motivate students, besides that the teacher does not provide opportunities for students to discuss problems in groups, this is what makes students less involved in learning.

Indonesian students' critical thinking skills based on research conducted on Indonesian students' critical thinking skills are at an average of 16.49 out of 100 which are categorized at a low level [13]. Students' critical thinking skills are still low, students tend to only memorize things that are arranged far from the reality of student life [14].

Biology learning based on local wisdom is also still not widely implemented in Pekanbaru High School, this was revealed from the results of previous research conducted that 40.90% had never implemented local wisdom, some had told local wisdom in learning, but were not prepared carefully in the lesson plan . This is because teachers do not understand how to integrate local wisdom in learning [15].

The learning problems described above need to find solutions so that the implementation of biology learning is more effective and efficient so that it can improve the quality of learning. The use of appropriate learning models needs to be considered and alternatives. One of the learning models that can be combined with local wisdom is the SETS model, because it is used in learning biology in the context of society and environment and technology is the Science Environment Technology Society (SETS) model. The term SETS learning gives a message that students must be able to adopt Biology technology that exists in the community into learning in the classroom. Then the technology is analyzed by students individually and in groups regarding the con-

cepts and principles of science used and their various applications to the physical and mental environment.

Learning with the SETS model is learning that focuses on real-world problems with science and technology components from the student's perspective, with concepts and processes that invite students to explore, analyze, and apply the concepts and processes in real life. situations [16]. SETS-based learning, students can also practice improving their critical thinking skills [17]. SETS learning is expected to open students' insights to understand the essence of science, environment, technology and society as a whole. The point is that SETS learning is intended to help students know science, its development and how scientific developments can affect the environment, technology and society in a reciprocal way [18].

With the implementation of the SETS model in learning, it is hoped that biology learning will be more interesting and easily understood by students so that biology is no longer seen as a subject full of difficult formulas and theories, but is close to students' lives. Based on the background that has been described, it is necessary to conduct research on "The influence of local wisdom-based SETS learning models on Critical Thinking Skills and Collaboration."

2 Methods

2.1 Research Strategy

This research is a quantitative quasi-experimental research with the matching only pretest posttest control group design according to Fraenkel & Wallen [19]. The researcher chose an experimental research design, because in this study measurements were made of variables before and after treatment for investigates the causal relationships of the phenomena under study. In this design, in At the beginning of learning, measurements are carried out by teaching at school first, then after that Researchers measure variables using validated test questions the experts. After being given treatment, the dependent variable is measured again with the same measuring tool, namely test questions.

The population of this research is class X students of SMA Negeri 13 Pekanbaru school year 2021/2022 which consists of 5 classes, namely X^1, X^2, X^3, X^4, X^5. The sample in this research were 2 classes, class X^4 as the experimental class and class X^5 as the control class. Sampling was carried out by simple random method in the available classes. A simple random sampling technique is a method by which members of a population are sampled at random, without considering the existing strata of the population.

2.2 Data Collection Methods

The data for this research was collected through tests and observations. In this study tests were conducted to measure students' critical thinking skills before treatment and after treatment. The test questions used are multiple choice which have been validated before being used. Observation is a complex data collection method because it in-

volves various factors in its implementation. In this research, observation was used to collect data on students' collaboration skills.

2.3 Data Collection Instrument

The data collection instrument used in this research are:

1. Question Sheet

The test sheet or question sheet used contains 30 validated multiple choice critical thinking skills questions. This test sheet is given to students during the pretest, namely before students get the research treatment and the width of this test is also given to students at the time of the posttest, namely after students get the research treatment.

2. Observation Sheet

The observation sheet is used to obtain data on students' collaboration skills. the observation sheet has been validated by experts. The observation sheet contains a nuber of criteria or descriptors that serve as a reference for the observer to indicate the student's skill level.

2.4 Data Analysis

Data analysis was done in several stages:

Normality Test. Data distribution pattern is known through a normality test, one of the models used to test data normality is the Kolmogorow Smirnov (KS-21) model by SPSS 21 program. If the K_s count < $_{Ks}$ tabel value then the decision is to accept H_0, meaning that the data from the simple regression model or homepage regression follows a normal distribution. And conversely, if the K_s count> K_s table value then reject H_0, meaning that the simple regression and multiple regression model data do not follow a normal distribution.Or data normally distributed if the value of Asymp is for the variable with Sig. greater than the 5% significance level (>0.050). A variable is not normally distributed if Sig. is less than the 5% significance level (<0.050).

Homogenity Test. The homogeneity test was carried out to determine the uniformity of the research data variants. In the regression analysis, good research data must have a homogeneous distribution of data and the model used to test it is the Levene test (Levene Test) through the help of the SPSS 21 program. The calculated Levene value obtained is then compared with the Levene table or you can also use a significant comparison value with α 0.05 = 5 %. If the calculated Levene value < Levene table or P value > 5% then the simple regression or multiple regression data has a homogeneous variety. And conversely, if Levene's value is large, Levenetab or P value is > 5%, then the simple regression or multiple regression data has an inhomogeneous variance.

T- Test. The t-test is a parametric statistic used to test the comparative hypothesis of the mean of two samples. If the data is in the form of intervals or ratios. The t-test is used because the data is normal and homogeneous. The t test was carried out using the SPSS 21 program. Nilai signifikansi hipotesis dua sisi, jika nilai sig lebih kecil 0,05 maka keputusannya tolak H_0 dan diartikan terdapat perbedaan yang signifikan antara keterampilann berpikir kritis dan kolaborasi siswa kwlas kontrol dan kelas eksperimen

3 Results and Discussion

3.1 Critical Thinkings Skill

The pre- and post-test data obtained in the control class and the experimental class, then data analysis is performed, in the form of a normality test using Kolmogorof Smirnov (KS-21), as a homogeneity test with levene's test by SPSS program, assuming familiarity with parametric comparative hypothesis test, or non-parametric if data is normally distributed, continue with t-test, if data is not normally distributed, then test with Mann Whitney U test. The results of the normality tests of the pre- and post-test data in the control class and the experimental class are shown Table 1.

Table 1. Pretest and Posttest Normality

Data	Kelas	Normality t-test				
		Asymp. Sig (2-tailed)	***α***	**Decision**	**Deskription**	
Pretest	Kontrol	0.315	0,05	Terima H_0	Normal	
	Eksperimen	0.521	0,05	Terima H_0	Normal	
Posttest	Kontrol	0.425	0,05	Terima H_0	Normal	
	Eksperimen	0.675	0,05	Terima H_0	Normal	

Table 1 shows the results of the normality tests of the pretest and posttest data in the control class and the experimental class. Asym. Sig (two-tailed) pretest data for the control class is 0.315 > 0.05, then accepting H0 means that the data comes from a normally distributed population. Asymp Sig value. The pretest data for the (2-tailed) experimental class is 0.521.> 0.05, so accepting H0 means that the data comes from a normally distributed population. Asymp Sig value. (2-tailed) control class 0.425 > 0.05 in the post-test data then accept H0, that is, the data is from a normally distributed population**.** Asymp Sig value. (2-tailed) the posttest data for the experimental class is 0.675 > 0.05, so accept H0, meaning that the data comes from a normally distributed population.

Homogeneity test to determine the homogeneity of data variants. Results of data analysis homogeneity of Pretest and Posttest data can be seen in Table 2.

Table 2. *Pretest* and *Posttest* Homogenity

Data	*Sig.(2-tailed)*	*α*	Decision	Deskription

Pretest	0.416	0.05	Terima H_0	Homogen
Posttest	0.540	0.05	Terima H_0	Homogen

Based on Table 2, we can see the results of the homogeneity test, the value based on the trimmed mean in the pretest is 0.416 > 0.05 with a significance level (α) of 0.05. The decision obtained is to accept H_0. This means that the pretest data comes from homogeneous variants. Meanwhile, the posttest was 0.540 > 0.05 with a significance level (α) of 0.05. The decision obtained was to accept H_0. This means that the posttest data comes from homogeneous variants.

The pretest and posttest data are known to be normally distributed and homogeneous, so a decision can be made to carry out a t-test. This comparative test is useful to determine whether data is significantly different or not significantly different. The results of t-test for pretest and posttest data can be seen in table 3.

Table 3. Pretest and Posttest Data t-test results

Data	*Sig.(2-tailed)*	*α*	Dicision	Description
Pretest	0.435	0.05	Accept H_0	Not Significantly Different
Posttest	0.000	0.05	Reject H_0	Significantly Different

Based on Table 3 above, the results of the pretest t-test obtained a value of 0.435> 0.05, so accept H_0, which means there is no significant difference in the pretest value between the control class and the experimental class. While the results of the t-test for the posttest data obtained a value of 0.000 <0.05, then reject H_0, which means that the posttest data has a significant difference between the control and experimental classes. Analysis of the N-Gain data can be seen in table 4.

Table 4. Descriptive Statistics of N-Gain Data in the Control and Experiment Classes

No	Class	n	N-*Gain*			Average	Category
			Ideal Val	Score Min	Score Max		
1	Control	32	1.00	0.07	0.63	0.25	Low
2	Experiment	32	1.00	0.06	0.86	0.49	Medium

On Table 4, **In** Table 4, the minimum **gain** value **of N** for the control class is 0.07, while **for** the experimental class **it** is 0.06. The maximum result for the control class is **0.63 and for** the experimental class is 0.86. The **average** N-Gain value **of** the control class was 0.25 in the low **class,** while the N-Gain value **of the experimental class** was 0.49 in the **middle** category.

Comparative hypothesis testing to find out whether the N-Gain data is different between the control class and the experimental class using the 2 Sample Independent t-test. The results of the t-test for N-Gain data can be seen in Table 5 below:

Table 5. t- Test N-*Gain* Result

Data	*Sig (2-tailed)*	*α*	Decision	Description
N-gain	0.000	0.05	Reject H_0	Berbeda signifikan

Based on Table 5, the value of Sig. (2-tailed) for the N-gain data in the control class and the experimental class is 0.000 <0.05 with a decision to reject H_0, which means that there is a difference between the N-gain of the control class and the experimental class. The occurrence of an increase in N-gain results indicates an increase in the results of critical thinking on environmental material. The N-gain value of the experimental class is compared to the control class. This is due to class experiments using learning with the SETS model based on local wisdom. SETS learning is intended to help research science, its development and how scientific developments can influence the environment, technology and society in a reciprocal manner [20].

In science education, both teacher and student SETS learning play a crucial role in achieving learning goals. The role of the teacher creates a thinking model that sees the future with different consequences, makes students always think in an integrated way, invites students to think critically when dealing with issues**.** The integration of local culture into science learning will train students' critical thinking skills, because the issues involved are contextual in nature which require problem solving through an environmental approach [21]. Local wisdom-based learning in the form of ethnoscience can develop students' critical thinking skills [22]. SETS-based learning development is suitable for use in the learning process [23].

3.2 Collaboration Skill

Analysis of student collaboration skills data can be seen in table 6 below:

Table 6. Recapitulation of t-test results Data on Collaboration Skills pretest and posttest

Data	**Sig (*2-Tailed*)**	***α***	**Decision**	**Description**
Pretest	0.125	0.05	Accept H_0	Not Significantly Different
Posttest	0.000	0.05	Reject H_0	Significantly Different

Based on Table 6, the Sig (2-tailed) value for the pretest data in the control class and the experimental class is 0.125 > 0.05 with the decision being accepted as H0, which means that there is no difference in scientific attitude between the pretest and posttest with the t-test on sig (2-tailed).) for the posttest data in the control class and the experimental class is 0.000 <0.05 with the decision to reject H0, which means that there are differences in students' collaboration skills between the control class posttest and the experimental class posttest.

The average N-Gain for collaboration skills can be seen in the following table:

Table 7. Descriptive Statistics of Collaborative Skills N-Gain Data

Class	n	N-*Gain*	Average	Category

No			Ideal Val	Skor Min	Skor Max		
1	Kontrol	32	4	0.33	1.33	0.67	Low
2	Eksperimen	32	4	0.33	1.67	0.84	Hihg

In Table 7 it can be seen that the minimum N-Gain value for the control class is 0.33 while the experimental class is 0.33 the maximum result for the control class is 1.33 while the experimental class is 1.67. The mean N-Gain value for the control class is 0.70 in the low category while the experimental class has an N-Gain value of 0.84. The results of the t-test for N-Gain data can be seen in Table 8 below:

Table 8. Results of Collaboration Skills N-Gain t-test

Data	*Sig (2-tailed)*	α	Decision	Description
N-gain	0.000	0.05	Tolak H_0	Berbeda signifikan

Based on Table 8, the value of Sig. (2-tailed) for the N-Gain data in the control class and the experimental class is 0.000 <0.05 with a decision to reject H_0, which means that there is a difference between the N-Gain of the control class and the experimental class. The increase in N-Gain results indicates an increase in collaboration skills on environmental pollution material. The N-Gain value of the experimental class using media images is higher than the control class using conventional learning. Collaboration skills in learning are very important to improve students' scientific thinking processes that are formed through the stages of SETS learning [24]. Critical thinking skills are needed to empower collaboration skills, the application of collaborative learning in diverse groups gives positive results [25].

4 Conclusion

Based on the results and discussion described above, it can be concluded that the implementation of SETS learning model based on local wisdom has a positive effect on improving critical thinking and 21st century cooperation skills on environmental issues of high school students with an average average. N-Gain critical thinking in control class 0.25 (low) and experimental class 0.49 (medium), N-Gain t-test found significant differences between control class and experimental class in critical thinking. The average of N-Gain cooperative ability of the control class was 0.67 (medium) and the experimental class was 0.84 (high), the N-Gain t-test showed a significant difference between the cooperative abilities of the control class and the experimental class.

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