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Efforts to Enhance Sustainable Consciousness and Critical Thinking in High School Students Through Learning Projects

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ABSTRACT

Awareness or Sustainability consciousness (SC) is an essential part of Education For Sustainable Development (ESD) and closely relates to critical thinking skills. Therefore, training and instilling the two things above is a necessary task for teachers in contributing to realizing sustainability Development Goals (SDGs). This research aims to identify the influence of learning project zero waste school on sustainable awareness and students' critical thinking ability. This study uses a Quasi-Experimental method with a Non-Equivalent Control Group Design. The sample consisted of 63 students in the experimental class and 63 students in the control class. In the implementation of learning in the practical class using the model zero waste school project and in the control class using conventional models. Data study collected with the use awareness questionnaire sustainable and test descriptions given before and after learning is done. The research results show that the zero waste school project can influence sustainable awareness and skills. Students' critical thinking is higher than learning given without a project. The results of students' critical thinking are trained through model learning project zero waste school, generally for all indicators showed significantly higher results than the control class. Of the six hands, the indicator that experienced the highest increase was the evaluation indicator, while the indicator that experienced the lowest growth was the interpretation indicator.

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1. INTRODUCTION

In 2015, 193 countries gathered to adopt 17 Destination Sustainable Development Goals (SDGs) designed by the Assembly General United Nations- Nation, which will be achieved in 2030. The target covers the third dimension of sustainability, namely the social, economic, and environmental dimensions (Balakrishnan *et al.,* 2020). One way to achieve this sustainable development goal is through education. Education is a means to introduce SDGs to change humans' perspectives and attitudes toward environmental life. Part big problem rooted environment from lack of education about ecological life and ways to sustainably. Related To these problems, UNESCO has an approach to learning known as Education for Sustainable Development (ESD).

ESD is one idea and principle of sustainable development for individuals through education (Nikolic *et al.,* 2020). Mogensen and Schnack (2010) stated that ESD places more emphasis on approach competence action that is in Thing develop Skills, motivation, and desire student for role active in finding solutions for problems and issues of Sustainable Development (SD). ESD supports five basic types of study to provide education: quality, i.e., learning to you know, learning to be, learning to live together, learning to do, and learning to transform oneself and society. The application of these five essential learning can be made in schools which are important places and facilities in knowledge development and awareness needed by circles of future youth towards sustainable development. As such, it may help at the end of open Street to reach SDGs.

An essential aspect of ESD is integrating the cognitive and affective components to broaden the facts and understanding of the SD issues associated with elaborating values and attitudes that underlie various alternatives and other solutions to SD problems. According to Littledyke (2008), the integration between cognitive and affective in education this important for increasing the interest and involvement of the student in dealing with various elementary school problems through education. Mental components could push the conception and attitude of students, which are related to the environment, economic and social in coping with everyday life problems and parts affective significant for developing students in deciding life daily. Application ESD could grow students' understanding, and awareness students will demonstrate the importance of sustainable development (Kalsoom *et al.,* 2017). Related Thing that Berglund *et al.* (2014) developed draft Sustainability consciousness (SC) or Awareness sustainability (SB), which aims to connect cognitive and affective components with the three dimensions of SD. Draft sustainable awareness is a comprehensive concept that is investigated with takes a holistic approach to both mental (knowledge) and affective components (attitudes and behavior) that are connected to the three dimensions of development sustainable that are the environment , social , and economy (Sanchez & Lafuente, 2010; Summers & Childs, 2007). Olsson *et al.* (2016) suggested that Consciousness is sustainable as draft competence students consider knowledge, attitudes, and behavior of students based on awareness of the dimensions of environment , society , and economy for developing life which is more sustainable.

The wrong effort could be conducted to realize draft SC or this KB, that is, to familiarize students with a culture of critical thinking in their learning process. Think Critical thinking is a reflective ability that focuses on decision-making patterns about what to believe and do (Papilaya & Tuapattinaya, 2022). Students are required to analyze, synthesize and conclude the information obtained with the ability to think critically so that they can differentiate between good and bad information, as well as decide on the information they got. Besides that, according to Redhana and Liliasari (2008), destination training the ability to think

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critically about a student is for preparing the student to become a thinker critically, capable solve and resolving problems faced, being a thinker independently, and making a decision with appropriate and appropriate and responsible answer in realizing destination SDGs. Related to things, awareness, sustainability, and skills thinking critically, which own student need and are very important for teaching and training as early as possible. Keep going continuously stages and developing students (Ekamilasari & Pursitasari, 2021). Through learning ESD, expected learning becomes more meaningful. In this case, students can apply ESD in their life.

Wrong one reason leading to natural damage is the appearance of a problem environment caused by development and activity in society. The production story triggered by the increase and consumptive lifestyle in the community has produced enormous waste. Unfortunately, waste production that overflow is not followed by sustainable waste treatment. Garbage accumulation impacts the environment and the health of society besides can cause a balanced disturbance environment. That matter is wrong one problem in realizing the SDGs. One of the efforts developed to solve the waste problem is the concept of zero waste. Zero waste is harmful one draft aims to minimize waste and maximize waste recycling and composting with principle 5S (Refuse, reduce, reuse, recycle, and rot) so that it does not cause mountains of waste in landfills (Rahmawati *et al.,* 2020).

The concept of zero waste can be applied with project-based learning, known as the zero waste school project. This kind of learning is hoped to help students achieve sustainable awareness and critical thinking skills. Zero waste school projects can be integrated into the theory of pollution environment as a vehicle effort to manage rubbish in the environment around students. Through the project, this student could be closer to the environment so that they can develop awareness to perform that action (Kusnoputranto *et al.,* 2020).

Based on the description of the background above, the formulation of the problem in this study is: What are the efforts to instill sustainable awareness and critical thinking in high school students through project learning?.

2. METHOD

Method study used quasi-experimental with design study pretest-posttest non- equivalent control group design. The study involves two groups: An experimental group and a control group. Taking the sample is not random. The experimental group was given a learning treatment using project zero waste school; conventional learning was carried out for the control group.

The research population is students of class X IPA in one of the Middle Schools at State Senior High School (SMAN) Bandung City. Semple consists of students of class X IPA 2, X IPA 3, X IPA 5, and X IPA 6. The determination sample was conducted in a manner of purposive sampling because this research needed class with all students having smartphones.

The research instrument consisted of a continuous awareness questionnaire (sustainability consciousness questionnaire) and critical thinking skills description questions. Instruments were given before and after treatment in questionnaires and critical thinking questions. Questionnaire data in the form of students' ongoing awareness consists of scores of knowledge, attitudes, and behavior of the student. Thinking skills critical student analyzed based on indicator evaluation using a rubric. The research instruments used in this study can be seen in **Table 1.**

Lattice-lattice questionnaire awareness sustainable students cover various constructions, namely knowledge construction with three indicators totaling nine questions, attitude

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construction with three indicators consisting of 8 questions, and behavior construction with three indicators of 10 questions.

Table 1. Research instruments.

No.	Variable Study	Instrument's Shape	Instrument	Information
1.	Awareness sustainable	Questionnaire	*Sustainability Consciousness Questionnaires* (SCQ)	Adopted from Gericke *et al*. (2019) amounts to 27 items.
2.	Skills Critical ThinkingStudent	Test Write	Problem description of the materialpollution environmentclass X senior high school	D is for *pre-test* and *post-test*.

The critical thinking instrument grid refers to Facione (2011). Critical thinking consists of 6 indicators: interpretation, analysis, evaluation, inference, explanation, and self-regulation. These indicators were then derived into eight learning indicators made into eight critical thinking questions.

Experts validated the continuous awareness questionnaire and critical thinking questions before using it. Then carried out trials and analyzed through the stages of counting validity, reliability, difficulty level, and distinguishing power, so that it can be known worthy or nope for made as an instrument. Learning is carried out with different steps in the experimental and control classes, as seen in **Table 2**.

3. RESULTS AND DISCUSSION

The results of students' ongoing awareness are based on the construction of knowledge, attitudes, and behavior. Based on knowledge results, on knowledge construction, the average score obtained between the experimental class and the current control class pretest and posttest did not show change which drastic. The thing this k right is that Among class experiments and class, control have continuous knowledge that is not much different or considered the same. Before implementation, the learning score average obtained on the pretest and posttest was very high. This shows that students in the experimental class and the control class had a level of understanding which talked about issues of development sustainability.

Study this in line with those conducted by Al-Naqbi and Alshannag (2018), which state that results from domain knowledge show an understanding level which tall on student UAE about developing education sustainability, with thus if the student's understanding is high, the student 's knowledge of development sustainability also will tall. Height -level understanding will knowledge sustainable support students in integrating development sustainable for the interests of present and future generations. It also shows that students are aware of the relevance of sustainable development with its three dimensions viz environment, social, and economy.

Construction knowledge (knowingness) in awareness continuity could be depicted as thinking, opinion, or idea about something object reflecting awareness theoretical about three dimensions of sustainable development. Berglund *et al*. (2020) mention that knowledge in awareness of sustainability reflects the awareness component of theoretical development sustainability, which is intended to investigate factual knowledge about environmental, economic, and social issues.

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Table 2. Differences in the Implementation activities of the experimental class and the control class.

Meeting	Treatment	
	Control Class	**Experiment Class**
1	Learning is done conventionally with the discussion method through a concept approach 1. The teacher conducts directions and introduces new material through *Google Meet (Synchronous)* 2. Critical thinking skills *pretest* questions and a continuous awareness questionnaire are given through the *Google Form*	Learning is carried out through the "Zero Waste School" project activities 1. The teacher guides and introduces sustainable development and new material, namely environmental pollution, to students as an introduction. This meeting was conducted via *Google Meet (Synchronous)* 2. Critical thinking skills *pretest* questions and a continuous awareness questionnaire are given through the *Google Form*
2	1. Conduct preliminary activities before entering learning in the chapter on environmental pollution. Learning uses the discussion method with a concept approach 2. The teacher uploads material about environmental pollution on *Google Classroom* 3. The teacher uploads a video explaining environmental pollution on *Google Classroom* 4. The teacher distributes LKPD to each student via *Google Classroom* 5. The teacher asks students to work on LKPD in groups 6. Students hold discussions through the *Whatsapp Group* to discuss the results of the work 7. The teacher asks student representatives to conclude the concepts they have understood through *Google Classroom* 8. The teacher gives appreciation to students who have concluded the concepts understood 9. The teacher reinforces the concept	1. The teacher briefly explains the concept of sustainable development and environmental pollution material to students as a provision and reinforcement of learning. 2. The teacher explains the activities of the "Zero Waste School" project to motivate students to be involved in activities to overcome problems related to environmental pollution around where they live (*via Google Meet)* 3. The teacher divides students into six large groups consisting of 4-5 people per group 4. The teacher distributes LKPD 1 as a guide for student activities in the " *Zero Waste School" project* through *Google Classroom.* The LKPD contains instructions and information that students need to do to find solutions related to waste problems that occur in the environment around students' homes 5. The teacher directs students and accompanies students in implementing *zero-waste school project activities* 6. Discussions and monitoring are carried out through the *WhatsApp group* This activity is carried out during class hours and outside class hours.
3	1. This meeting was carried out *synchronously* through a *Zoom Meeting with PowerPoint* learning media 2. The teacher explains environmental pollution and various actions to reduce pollution caused by waste 3. The teacher explains various waste recycling activities to be used as goods that have added value/usefulness	1. This meeting was held *Synchronously* via *Zoom Meeting* 2. The teacher provides opportunities for students to ask questions that are not clear regarding the *zero waste school project* that has been given 3. The teacher provides opportunities for all groups to provide reports related to the development of activities that are being carried out, which include field observations, interviewing sources, identifying problems, and compiling solutions to overcome problems that occur, as well as preparation for making videos

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Table 2 (continue). Differences in the Implementation activities of the experimental class and the control class.

Meeting	Treatment	
	Control Class	**Control Class**
3	4. The teacher guides students to conclude learning material	as the final task to socialize the results of *zero waste activities through* the media social 4. Teachers provide motivation and reinforcement to students regarding the activities they do 5. The teacher provides directions regarding the results of investigations carried out by students and assists in designing a project to overcome these problems 6. The teacher gives LKPD 2 to each student via *Google Classroom* This activity is carried out during class hours and outside class hours. The discussion was carried out via the *Whatsapp Group*
4	7. This meeting was held Asynchronously via the *Whatsapp Group* and *Google Classroom* 8. The teacher provides opportunities for students to ask questions that are not understood through the *Whatsapp Group* 9. The teacher gives LKPD for students to work on 10. Students are given a post-test of students critical thinking skills and a continuous awareness questionnaire through *Google Classroom*	1. This meeting was held *synchronously* via *Google Meet* 2. The teacher helps students prepare the results of projects that students have done to overcome problems from previous investigations 3. Students presented the results of the *zero waste school project activities* that had been carried out 4. Project activity reports are submitted in the form of activity reports and videos of *zero-waste activities* 5. Teachers help students to reflect on or evaluate their investigations and the processes they use 6. Students are given a post-test of students critical thinking skills and a continuous awareness questionnaire through *Google Classroom* This activity is carried out during class hours by reflecting and evaluating the benefits of learning for the students themselves and what obstacles they experience during learning.

Based on attitude results, students have a highly positive attitude towards sustainable development both before the implementation of learning and after learning is carried out. This is indicated by the high average scores on students' pretest and posttest results on attitude construction. This research is similar to that done by Pavliukh (2014), who reported that most students at Turks, regardless of their academic level, bring a good attitude towards issues in sustainable development.

As in the construction of knowledge, the attitude of sustainability in these two classes too not show a difference that is big enough so that it could be considered the same. Before, it has been shown that students' awareness of knowledge construction can be high. The high level of students' knowledge of sustainability positively affects their attitudes concerning sustainability-oriented challenges and their behavior. Courtenay-Hall and Rogers (2002) said

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that the relationship between knowledge, attitudes, and behavior is system complex which each other related and thereby must be considered whole.

Construction attitude in awareness sustainability related with a score, faith, and reaction somebody to the situation, object, or person related to development sustainability. According to research by Chang *et al.* (2018), a change in attitude leads to sustainable organizational development where attitude change will lead to change in feelings and perspective on issues environment, real life, the Public, and the economy.

In the behavior results, we have seen an increase in the average scores that occurred in the experimental and control classes. Based on the results of N-Gain calculations for the experimental class, it was obtained as 0.21. it means that class experiment experience enhancement awareness sustainable on behavior construction, but the increase is in a low category. While the control class obtained N-Gain -0.02, the control class did not experience an increase in awareness of sustainable construction behavior. Based on the data, so said enhancement awareness sustainability on construction behavior class experiment use model project zero waste school better compared with class control which uses a conventional model.

Construction behavior in awareness of sustainable showing action which supports sustainable development, which refers to the perception of individuals about ease or difficulty in performing the desired behavior (Braßler & Sprenger 2021). Kollmuss and Agyeman (2002) mention that construction behavior in awareness sustainability covers expression from the trust, attitude, norm, practice, and flavor, not quite enough answer which will give flavor well-being for all creature life in something Public.

Based on the results of the different tests with the Independent T-test between experimental classes and class control on the pretest obtained a big 0.01, there is a difference in the results of students' ongoing awareness due to differences in different learning models used. Gain test calculation results increase in the average gain index from pretest to posttest is 0.21 with a low category which means in the experimental class, there is enhancement awareness continuity. However, I say in the category low. Temporary enhancement average index gain on class control as big 0.06 and category low. Thus it can be stated that the zero waste school project has not had an impact that signed on the awareness of the sustainable student.

Reason awareness continuity which hasn't reached optimal results, possibly due to effort to get used to the student with practice sustainability, is still lacking, so students rarely or never take sustainability action and need time long in implementation. This is in line with research conducted by Ekamilasari and Pursitasari (2021), where students are emotionally concerned which tall to the environment but seldom or not accustomed to carrying out sustainability actions, so knowledge, attitudes, and behavior, as well as awareness about continuity, no develop.

If review in a manner deeper about the construction of knowledge, attitude, and behavior which underlying development dimensions sustainable (environment, social, and economics) revealed that no significant differences were found between the two groups in the construction of knowledge and attitudes. However, that difference was significantly found in the construction of behavior indicated by the class average value experiment, which is higher than the control class.

Draft awareness sustainability is draft comprehensive which investigated by taking a holistic approach to both cognitive components (knowledge) and affective (attitude and behavior) connected to the three dimensions of sustainable development, which are environment , social and economic (Sanchez & Lafuente . 2010; Summers & Childs 2007). Thus,

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the concept of continuous awareness is considered to reflect competence in student sustainability actions. Following Berglund *et al.* (2014) and Olsson *et al.* (2016) in the study, this sustainability consciousness means awareness will issue continuity (environment, social, and economy) and the relationship with knowledge, attitude, and behavior which profitable in handling the issues.

The results of students' critical thinking skills are described based on the six indicators: interpretation, analysis, evaluation, inference, explanation, and self-regulation of knowledge, attitudes, and behavior.

After in test, different average scores and pretest indicator interpretations Among the class experiment and the control class showed significantly different means before implementation. There is a difference in the zero waste school project in the experimental class and the control class between the second class. Based on the results calculation gain, the average N-Gain in the experimental class was 0.11 higher than the class control with acquisition -0.15. N-Gains negative show that enhancement skills are critical for indicator interpretation in students.

The increase in the experimental class was due to students having obtained an understanding draft deep from experience study obtained through learning with projects so that students can work on problems on indicator interpretation with Correct. Learning through project zero waste school, which is applied to the experimental class in the material of environmental change, makes it easier for the student to develop the ability he thinks through atmosphere study, which is pleasant, as well as various methods used.

Interpretation trains students to explain again and understand the meaning of an event, data, procedure, or rule. Students can fulfill the interpretation aspect if they can classify the problems received so that they have a clear meaning. One important part of critical thinking that must be taught to students to have critical thinking skills is to make interpretations.

On the analysis, it can be seen that the experimental class has analytical skills students experienced an increase in the average score on the analysis indicator from 37.1 to 48.61. In contrast, in the control class, the average score of students did not experience an increase or could be said the same Among the pretest and the posttest. Therefore, the average ability analysis student class experiment with the zero waste school project at the posttest time was higher than the control class using lecture, discussion, and asking answers.

This is in line with research conducted by Rahmadhani (2018), which explain that in the learning process, activity analysis of the outcome data test with guidance teacher could help students get information which more trusted to add support the findings made so in terms of this increased his analytical skills as shown by the acquisition of posttest scores on class experiment increase from 37.1 Becomes 48.61.

Aspect evaluation on a study is the ability somebody to evaluate credibility from something statement or representation other from someone's opinion or evaluate a conclusion based on the relationship between information and concepts with questions in which there is something problem. Indicator evaluation is a skill that could access credibility statements or representations along with a statement, description question, or concept (Ekamilasari & Pursitasari, 2021).

Based on the evaluation results, in the experimental class, the results of the pretest and average scores posttest experience enhancement with a difference as big 18.66 with category tall. On class control score average pretest and posttest, no experience increase or the same. Evaluation indicators have an average score, the highest among other indicators in the experimental class and the class control. In thing, this student is capable of testing and

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estimating reasoning logically from facts, data, descriptions, or representations of problem rubbish in Indonesia.

Aspect evaluation in the study is the ability of somebody to evaluate the credibility of something statement or representation other than someone's opinion or evaluate a conclusion based on the relationship between information and concepts with questions in which there is something problem. Indicator evaluation is Skills that could access credibility statements or representations along with a statement, description question, or a concept (Ekamilasari & Pursitasari, 2021).

Based on interference results, the average score results were obtained in the experimental class; there was an increase from 37.5 to 44.84, in contrast to the control class, which experienced a decrease in the average score from 38.49 to 30.56. This shows that the applied learning project zero waste school on class experiment positively influences students in practicing critical thinking skills on inference indicators. The inference indicator is an indicator that has the lowest percentage among other indicators both in the experimental class and the control class. Low indicators inference because students are not yet capable of identifying and solving the problem until finding a conclusion.

The inference is the skill of identifying and getting elements needed to conclude (Ekamilasari & Pursitasari, 2021). Students can fulfill indicator inference if they can identify connections from information to make a reasonable conclusion so that it can be used to solve problems and determine scores from a problem.

Based on explanation results, the experimental class has an increased average score with a difference of 11.53, whereas on class control only increased by a big 0.79 lower than the class experiment. In this case, it can be seen that learning uses project zero waste school to provide a positive influence and train thinking skills and critical students on explanation indicators. In the pretest results, almost all students get low values. This is because students still cannot connect between theories they got before with the theory they just got. This is evidenced by the number of students who answered not according to the indicators which have in specify.

Aspect explanation on study this related to the ability to state the results of one's reasoning justifies that reasoning from the side where evidential, conceptual, methodological, and contextual considerations one's results are based on and represent one's reasoning in the form of a strong argument (Facione, 2011). Students can fulfill explanation indicators if they can state results and present opinions supported by reasons which are right.

Based on self-regulation results, the experimental class average test results show an increase with a difference of 17.86, and this indicates that learning uses projects at zero waste school give influence positive and capable train Skills think critical students on indicators of self-regulation. While the control class does not show a significant increase, namely with a difference of 2.08, there are still students who have difficulty solving problems or answering questions and independence for serving proof or reason.

According to Facione's statement (2011) that self-regulation (self-regulation) is related to a person's awareness to monitor his cognition, the elements used in the process think and results developed, especially by applying skills in evaluating his abilities in making conclusions from inquiries, confirmations, validation and correct critical students on indicators of self-regulation. While the control class does not show a large increase, namely with a difference of 2.08, there are still students who have difficulty solving problems or answering questions and independence for serving proof or reason.

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4. CONCLUSION

Several conclusions are obtained based on the results of the research that has been done. Although not yet getting significant results, efforts to instill sustainable awareness in high school students through zero-waste school project learning have increased sustainable awareness. The results of knowledge construction show that students already have a level of knowledge tall about sustainable development issues. For construction, it also shows that students already have a highly positive attitude towards sustainable development both before the implementation of learning and after learning is carried out. Especially in the construction of behavior, it can be stated that a class experiment that uses model project zero waste school is better than class control which uses the conventional model.

The results of students' critical thinking are trained through the model learning project zero waste school, in general for all indicators, showed significantly higher results than the control class. Six indicators are measured: interpretation, analysis, evaluation, inference, explanation, and self-awareness. Of these six indicators, the indicator that experienced the highest increase was the evaluation indicator, while the indicator that experienced the lowest increase was the interpretation indicator.

5. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. Authors confirmed that the paper was free of plagiarism.

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