The Effect of Zero-Waste Project Learning on Collaboration Competence and Self-Awareness on the Concept of Climate Change

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Abstract

Background: Learners' collaboration and self-awareness competence in schools are still low. Collaboration competence and low self-awareness competence require learning activities that can provide these competencies. This study aims to determine the effect of ESD-integrated zero-waste learning on collaboration competence and self-awareness. **Methods:** This type of research is quasi-experimental. The research design used was a nonequivalent group design. The sample in this study was seventh-grade students. **Results:** Collaboration competence and self-awareness hypothesis test results using the independent sample T-test obtained sig values of 2-tailed 0.000, indicating a significant difference. In addition, this study conducted a correlation test on collaboration competence with self-awareness competence. The test results between the two competencies showed a positive correlation with a value of 0.596, which was in the fairly strong category. Conclusion: Learning using a zero-waste project model integrated with ESD on the concept of climate change affects collaboration competence and self-awareness, with a significance value from the results of the statistical test independent sample T-test 0.000.. **Conclusions:** Besides these two competencies that can be improved through project learning, collaboration competence and self-awareness competence are positively correlated, belonging to the moderately strong category.

Keywords: Collaboration competence; Education for sustainable development; Self-awareness competency

Introduction

The current challenge for students is being able to master content, have skills, language proficiency, economic strength, and impact on society (Greenhill, 2010). In this case, Education for Sustainable Development (ESD) is present, which is part of the sustainable development goals (SDGs) with an education approach (Wilujeng et al., 2019). ESD provides orientation about the 2030 development agenda (UNESCO, 2018). ESD aims to create skills that enable people to consider their options considering socio-cultural, economic, and environmental impacts (Klarin, 2018). Education for Sustainable Development has a series of responsibilities to increase the role and contribution to the field of education in building society. ESD not only provides support for the integration of SDGs in Education and learning but also ensures that education and learning are integrated into every project that ensures the progress of SDGs (Purnamasari & Hanifah, 2021; UNESCO, 2020).

ESD is believed to ensure that everyone gets knowledge, values, skills, and encouragement for a better future with the provisions that have been applied. It is hoped that they will be able to expand and utilize information to assist them in developing strong statements and responses to the state of the economy, the sustainability of ecosystems, and the survival of society (UNESCO, 2020). ESD can be implemented in science subjects. Science

and ESD learning are closely related because science and technology are essential for sustainable development in modern society (Eilks, 2015). Education equips students to be active, responsible, and involved. The competencies that learners must possess are collaboration competence and self-awareness. According to UNESCO, collaboration competence is the competence to appreciate and learn from others, be sensitive and able to handle problems and facilitate problem-solving (Rieckmann, 2017). In addition to being one of the key ESD competencies, this collaboration competency is important because it is part of the 21st-century competencies that have been integrated with the curriculum.

Competencies that are also important to be supplied to students are self-awareness competencies, which are included in the 8 ESD competencies and 21st-century meta-skill competencies. Self-awareness is the basis of emotional Intelligence, leading to the ability to know one's emotions and recognize a decision (Igbinovia, 2016). Collaboration and self-awareness competence in some schools are still low. There needs to be an activity or learning model that can encourage students to have these competencies. The project learning model is one learning model that can help provide collaboration competence and self-awareness. Project Based Learning (PJBL) is a learner-centered learning model that provides a meaningful learning experience. The ideas and learning experiences of learners are determined by the products created in this process (Afriana, 2015).

Saenab et al. (2019) applied the Project Based Learning (PJBL) learning model to Collaboration with Science Education students. The type of project carried out is in the form of a student research project. The results of this study state that learning with Project Based Learning affects the competence of Collaboration. Another research was also conducted by Hambali (2020), who uses Project Based Learning for Collaboration. The research sample used was Biology Education Students. PJBL learning is applied to Nutrition and Health courses. The results showed that project-based learning affects collaboration competence (Hambali et al., 2020).

According to research conducted by Saenab (2019) and Hambali (2020), this research was carried out by applying project learning to science learning. The project carried out is a zero-waste project. The zero-waste project, which means waste-free, is carried out by recycling, especially plastic waste, in the school environment. Zero waste projects carried out by students are integrated into three pillars of Education for Sustainable Development (ESD): environmental, social, and economic, and to inspire recycling. Producing a reusable product can create waste reduction (Awasthi et al., 2021). Zero waste is a Sustainable Development Goals (SDG) program to address one of the global problems in point 13 of SDG, namely climate action. Therefore, this study aims to determine the effect of ESD integrated zero waste projects on collaboration competence and self-awareness of the concept of climate change.

Methods

The type of research used in this study is quasi-experimental research. The research design in this study used a Nonequivalent Control Group Design. The experimental class is a class that is given treatment, namely by using zero-waste project learning activities. In contrast, the control class is a class that carries out learning activities that are usually used in learning activities. The design of the research to be carried out can be seen in Table 1.

Table 1. Nonequivalent Control Group Research Design

Class	*Pretest*	Treatment	Post-test
Experiment	O_1	X	O_2
Control	O_3	X	O_4

(Sugiyono, 2017)

Information:
O1 : Pretest in Experimental class
O2 : Posttest in Experimental class
X1: Treatment with Project-Based Learning learning model
X2: Treatment without a Discovery learning model
O1 : Pretest in control class
O2 : Posttest in control class.

Sample or Participant

The research was conducted at SMP Negeri 2 Cilograng in seventh-grade students for the 2022/2023 school year. The sample in this study was class VII students who were divided into experimental classes and control classes. The Experimental Class is class B, which conducts learning on zero waste projects that are integrated with Education for Sustainable Development (ESD). At the same time, the control class is class C, which is given learning with conventional methods (Discovery Learning). Both classes are given self-questionnaires and peer assessments, collaboration competencies, and self-awareness competencies that are filled in before and after learning activities.

Instrument

This research instrument uses a Self-questionnaire, Peer Assessment of collaboration competence, and self-awareness competency questionnaire. The questionnaire uses the Likert scale, according to Sugiyono (2017). The questionnaire was made by the sequence of indicators that UNESCO has launched.

Table 2. Questionnaire instrument indicator

Questionnaire Instruments	Indicator
Collaboration Competency (*Self and Peer Assessment*)	Able to learn from those around him
	Able to understand, respect, and empathize with others
	Being able to understand something sensitive to someone
	Able to resolve a conflict that occurs in a group
	Able to facilitate cooperation and problem-solving in a participatory manner
	Able to represent his role in the community and global society
Self-awareness competence	Able to evaluate and motivate more deeply toward an action
	Able to handle individual feelings and desires
Student Response	Student response to previous experience with Zero waste-based PJBL model integrated ESD (Education for Sustainable Development) / Sustainable development.
	Demonstrate the benefits of learning activities.
	Student Response to Zero-Waste Project Learning to Collaboration Competencies
	Students' response to Zero-Waste Project learning to self-awareness competencies
	Learners' response to Zero-Waste projects with collaboration competence and self-awareness

Questionnaires were given to experimental and control classes on a pretest and post-test basis. In addition to collaboration competency questionnaires and self-awareness competencies, students were given questionnaires of student responses in

experimental classes at the end of learning. The questionnaire uses the Guttman scale and is given to know the students' responses to the learning that has been done.

Data analysis

The data analysis technique carried out in this study is a parametric test, namely the Normality Test, to determine whether the data is normally distributed or not by predetermined criteria. After that, a homogeneity test is carried out to determine the relationship between the data. Then, a hypothesis test was also carried out using an Independent sample T-test. Finally, the test carried out is the Pearson Correlation test to determine the relationship between two variables.

Result

Data that has been taken from the learning process and filling out questionnaires given to participants produces the following data.

Table 3. Research Results

Aspect	Types of Questionnaires	Average						Independent T-test (Sig. (2- tailed))		Correlation	
		Pretest		Post-test		N-gain				Pearson Correlation	
		E	C	E	C	E	C	Pre	Post		
Collaboration Competency	*Self-assessment*	80	76	99	85	0.50	0.21				
	Peer Assessment	74	76	93	81	0.42	0.11	.450	.000	0.552	0.596
Self-awareness	*Assessment*	76	75	101	89	0.46	0.25	.560	.000		

Not: E; Experiment; C;Control

The data were analyzed from the pretest and post-test results. They had passed the parametric test stage of the data normality test, which showed normal and homogeneous distributed data, so a hypothesis test was carried out using the Independent sample T-test.
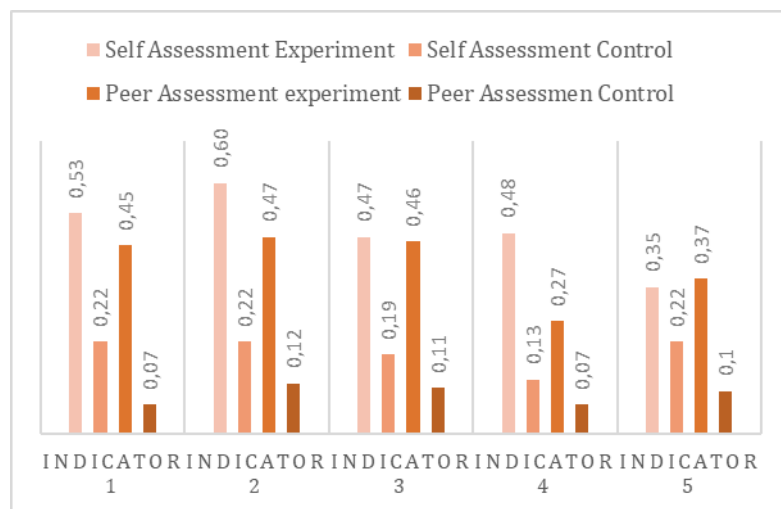

Figure 1. Recapitulation of Each Indicator of Self Questionnaire and Peer Assessment

The experimental class is superior to the control class. The self-assessment score is an indicator one can learn from others. The experimental class has an N-gain score of 0.53 and a Peer assessment score of 0.45. However, self-assessment in the control class with an N-gain score of 0.22 and Peer assessment with an N-gain score of 0.07 (Figure 1). In Indicator 2, Able to understand, respect, and empathize with others. The experimental class self-assessment score is 0.60, and the peer assessment score is 0.47.

Furthermore, in the control class, the results of the N-gain Self-assessment were 0.22, and the Peer assessment was 0.12. Indicator 3: Being able to understand something sensitive for a person. The experimental class's N-gain score on Self-assessment was 0.47,

and Peer assessment was 0.46, while in the control class, the N-gain score on self-assessment was 0.19, and peer assessment was 0.11.

Indicator 4: Able to resolve a conflict that occurs in a group. The N-gain Self-assessment score in the experimental class was 0.48. In contrast, the Peer assessment is 0.27, including the low category. In the control class, the N-gain score at self-assessment was 0.13, and at peer assessment, 0.07. Indicator 5: Able to facilitate participatory cooperation and problem-solving. The N-gain score on the experimental class self-assessment was 0.35, and the peer assessment was 0.37. This result is in the medium category. However, in the control class, N-gain scores of 0.22 and 0.10 for peer assessment scores are included in the low category.

The difference between the control class and the experimental class in indicator 1, Able to represent its role in the community and global society N-gain score in the experimental class is 0.46 (Medium), while in the control class 0.13 (low). Indicator 2 can evaluate and motivate more deeply towards an action. In the experimental class, the N-gain score was 0.53, and the N-gain score in the control class was 0.23. Indicator 3: Able to handle individual feelings and desires. On this indicator, the N-gain score of the experimental class was 0.44, and on the control class, 0.39 (Figure 3).
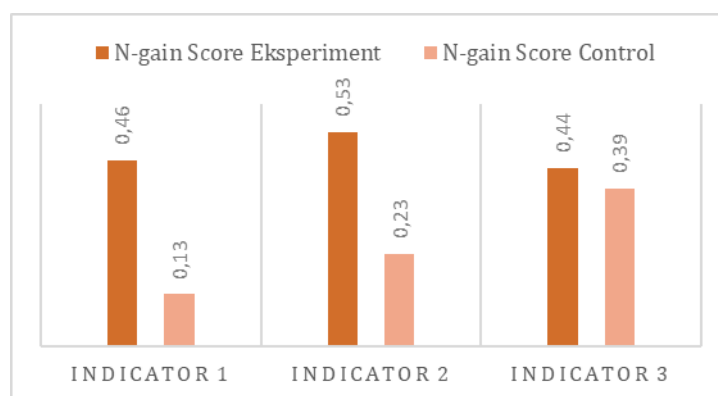

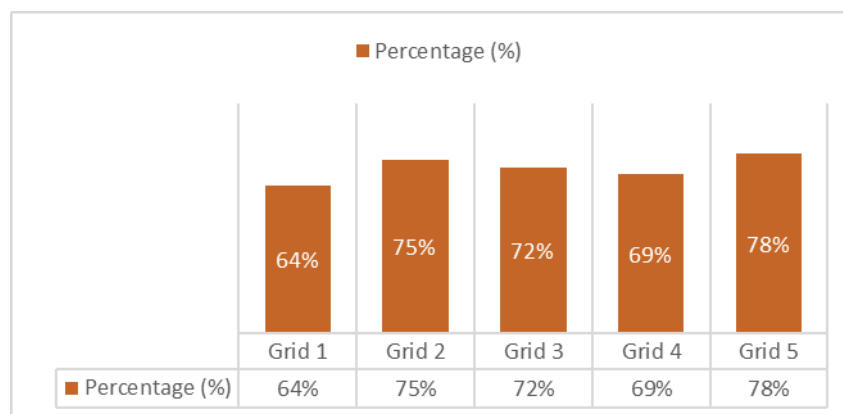**Figure 2.** Recapitulation of Each Indicator Self-awareness

Figure 3. Student Response

Description: Grid 1: learning responses; Grid 2: Benefits; Grid 3: Linkage of learning to collaboration competencies. Grid 4 linkages of learning with Self-awareness; Grid 5: Linkage of collaboration competencies and self-awareness "

Discussion

Evaluation and assessment are very important factors in the learning process. The assessment task focuses on content and performance objectives and provides opportunities for students to demonstrate their knowledge and abilities (Juhanda et al., 2021). In this case, ESD-integrated zero-waste project learning influences collaboration competence and self-awareness. Learners' collaboration competence and self-awareness

in the experimental class looked better than in the control class. This happens because ESD's integrated zero-waste learning encourages students to be more active in interacting and working together and being able to solve problems well. The results of self-assessment questionnaires of collaboration competence and self-awareness in experimental classes showed that students had a good assessment of themselves. This self-assessment will help them become more confident and motivate them. In line with previous research, the ability to identify one's emotions, fears, weaknesses, and motivations will impact oneself (Goleman, 2017).

Furthermore, peer assessment is carried out where other students will assess students. The results of the peer assessment show that the assessment between students and other students looks quite good. Peer assessment must be developed to assess team professionalism, practice-based learning, and lesson improvement (Pierre et al., 2014). Therefore, in learning zero waste projects, students are directed to conduct peer assessments of project learning that has been carried out. The results of self-assessment of collaboration competence and self-awareness competence are influenced by several factors, including learning systems that have never been carried out and consistency in using learning methods.

Zero-waste learning method in this context is carried out by observing the performance of group members. These experiences can increase learners' self-awareness and social awareness. Learning with projects can improve problem-solving skills. Students are more active and can solve complex problems. In addition, learning with ESD encourages learners to formulate problems and find thinking solutions. In the learning process, some students have solved problems in groups, such as arguing and offering solutions. However, some students still need to adapt to the learning activities.

Similar to the research that has been conducted, learning with a project-learning model can support student cooperation, planning progress, decision-making, and time management (Kricsfalusy et al., 2018). ESD in learning can improve problem-solving skills because ESD itself is a skill related to Collaboration through critical thinking, conflict management, planning, and decision-making based on problem-solving (Pradipta et al., 2021) and explained in another study that Project learning is a learning model that allows learners to learn to think critically, work together, solve problems, and manage their own time to complete or produce a project (Biantoro et al., 2020). In line with some of these opinions, it can be concluded that zero waste project learning carried out by ESD-integrated learners helps students in several ways, such as taking decisions from several opinions of group members, solving problems that occur in the group, and doing time management so that their recycling project is completed on time.

The conclusion of the ESD integrated zero waste project learning that has been carried out by students not only affects collaboration competencies but also affects self-awareness competencies' These two competencies are interrelated. In learning, students carry out zero-waste projects, namely by recycling plastic waste. This zero-waste project is carried out in groups that can encourage students to work together with their group members, such as dividing tasks, solving problems together, arguing with each other, and respecting the decisions and opinions of group members so that the zero-waste project is carried out as they want and on time. So, to work well in a group, learners need to have self-awareness.

The implementation of the zero-waste project is applied to science subjects on climate change in the 2013 curriculum with special attention. This is done in character development, poverty reduction, entrepreneurship, health, gender equality, and environmental sustainability (Djojonegoro, 2020; UNESCO, 2017). This project is one of the projects initiated by UNESCO to reduce climate change and towards sustainable development. Applying the Zero waste project itself can be a solution to reduce carbon gas emissions, which cause climate change. This is contained in point 13 of SDGs, namely Climate Action. ESD integrated zero waste project learning activities focus on three basic ESD pillars: environmental, economic, and social. These three aspects are integrated because these pillars are the core aspects of global issues and problems.

The Environmental Pillar prioritizes students' concern for waste generation in the school environment. The generation of garbage around the school can disrupt the

surrounding ecosystem. So, efforts are needed to preserve the environment and take good care of the school's natural resources. A theory explains that wise use of natural resources includes conservation activities and awareness of the main functions of ecosystems, increasing human awareness as social beings, and community cooperation and economic aspects (Rahimah et al., 2017). It can be concluded that with the learning of zero waste projects, students have contributed to the wise use of natural resources.

The social pillar manifests in the value of habituating students to contribute and cooperate in zero-waste activities. Students learn to minimize the use of plastic by applying reduce, reuse, and recycling to reduce the generation of waste that causes the environment around the school and the surrounding community to be unhealthy. As well as students identify waste management in the environment around the school. The identification is done as an effort to find ideas in waste management.

The economic pillar of learners is taught to have skills in meeting needs by utilizing goods that can be reused or recycled. Individuals can reuse recycled products and can save money. In addition, recycled products can be used as creative products that have selling value so that they can have an impact on the economy. Nowadays, recycling is a trend. With recycling skills, it can become an MSME that can prosper the surrounding community.

Conclusions

The implementation of learning by applying the ESD-integrated project learning model to the concept of climate change to determine the effect of ESD integrated zero waste projects on collaboration competencies with self-awareness competencies is well implemented and states that project learning affects collaboration competencies and self-awareness with significance values from statistical test results using independent sample T-test 0.000. In addition, these two competencies can be improved through project learning. Collaboration competence and self-awareness competence are positively correlated with a close correlation value of 0.596, including the fairly strong category.

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Declaration statement

The authors reported no potential conflict of interest.

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