



The Effect of Implementing ESD in the PBL Model on Critical Thinking Ability in Environmental Pollution Material

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Abstract: Education for Sustainable Development (ESD) is an effort to realise the goals listed in the SDGs. ESD is an alternative approach to the field of education to prepare a generation that has an awareness of sustainable life. The purpose of this study is to analyze the effect of the application of the problem-based learning model on students' critical thinking skills on SDGs-oriented environmental pollution materials. The research method employed was a quasi-experimental with the control group pretest-posttest design. In determining the sample, the researchers employed purposive sampling techniques by considering the differences in academic achievement, differences between the two classes, and differences in the number of students. Therefore, class VII B with 27 students was chosen as the experimental class and class VII E with 25 students was chosen as the control class. The types of data used were quantitative. The pretest-posttest in the experimental class obtained an N-gain score of 0.58 in the medium criterion. The normality test in the experimental class obtained a score of Sig 0.48, which was lower than 0.05. Conversely, the control class obtained a score of Sig 0.20, which was lower than 0.05. The homogeneity result was Sig 0.12, which was lower than 0.05. The hypothesis testing using the independent-sample t-test, a Sig (2-tailed) value of 0.00 was obtained, and the results of the effect size test were 1.77 with the high criterion. Therefore, there was a significant effect of using the SDG-oriented PBL model towards critical thinking skills on the topic of environmental pollution.

INTRODUCTION

Education for Sustainable Development (ESD) is used as a learning approach in the hope of realising a generation with a sustainable mindset and awareness of sustainable development. The problem of education in Indonesia that cannot be overcome is the weak learning process. In learning, students are less encouraged to develop thinking skills but rather students are directed to memorise information, remember and hoard various information without being required to understand and connect the information they get with their daily lives (Ripai &

Sutarna, 2019). Therefore, students are only capable of the theory without knowing its implementation in everyday life.

Learning activities must be carried out with innovations that make students understand and not just remember. In learning biology, innovation in learning is needed, so that students can develop their full potential (Zuleni, 2023). Learners should be able to develop their creativity in learning (Jayawardana & Gita, 2020).

Learning activities such as activities, learning interests and learning experiences require teaching techniques that educators

must pay attention to. Presentation is a technique that educators must master to present learning materials to students. It aims to make students easy to accept, understand, and adjust to the learning objectives and material presented. There are various learning methods used, such as discovery, inquiry, cooperative demonstration, self directed learning and many more others. There is no superior learning method, each learning method has its advantages and disadvantages. (Rahayu & Firmansyah, 2019).

One of the school's goals is to develop students' critical thinking skills, and one of the subjects where critical thinking is taught is science. This is by Permendiknas (Regulations of the Minister of National Education) Indonesia No. 23 of 2006, which states that science subjects should be taught to all students at every level of education, including middle school, as a basis for equipping students with the ability to think logically, analytically, systematically, critically, and creatively and the ability to work together (Permendiknas, 2006). In Indonesia, however, the critical thinking skills of middle school students remain relatively low. This is based on the quadrennial Trends in International Mathematics and Science Study (TIMSS) report on middle school students, which includes characteristics of high cognitive ability questions measuring students' critical thinking skills and shows that Indonesian middle school students consistently score at the lowest level.

Efforts for optimal formation of students' critical thinking skills require an interactive classroom, where students are seen as thinkers and the teacher acts as a mediator, facilitator, and motivator who helps students learn (Susanto, 2016). One of the key factors for success in developing students' critical thinking skills is the ability to select and apply the right learning model. The applied learning model requires students to build, develop, and even refine critical thinking skills. Critical

thinking according to Ennis (2011) has 5 indicators, namely (1) providing basic explanations, (2) building basic skills, (3) concluding, (4) making further explanations, and (5) strategies and tactics. One of the learning models that is considered to facilitate the formation of critical thinking skills is the problem-based learning (PBL) model (Carrió-Llach & Llerena-Bastida, 2023).

Environmental issues are very broad issues because the complexity of the problem involves crucial aspects and a wide range of multidisciplinary economic, political, and social sciences, and from groups of sciences such as biology, chemistry, geology, and so on. One of the commitments to environmental issues is the UN General Assembly agreeing to establish the Sustainable Development Goals (SDGs) for the implementation period 2015-2030. The SDGs have 17 goals grouped into 4 pillars, namely the social development pillar which includes goals 1, 2, 3, 4, and 5; the economic development pillar which includes goals 7, 8, 9, 10, and 17; the environmental development pillar which includes goals 6, 11, 12, 13, 14, and 15; and the legal and governance development pillar which includes goal 16 (Tan, 2019). SDGs on environmental issues are interesting because in practice the environmental SDGs programme is implemented by various cross-sectors, such as the Ministry of Environment, Ministry of Mineral Resources, energy and Mining, Ministry of Agriculture, Ministry of Education, and others. (Wijayanto & Nurhajati, 2019).

The implementation of Education for Sustainable Development is expected to realise a generation with a sustainable mindset by understanding the 11 crucial issues in the SDGs which include: (1) biodiversity, (2) climate change education, (3) disaster mitigation, (4) cultural diversity, (5) poverty elimination, (6) gender equality, (7) health improvement, (8) sustainable lifestyle, (9) human peace and safety, (10) water, and (11) sustainable

urbanisation (Salam & Hamdu, 2022). These eleven issues can be developed and integrated into learning to prepare learners with sustainable lifestyles that support the achievement of the SDG goals.

With the application of ESD, it can improve students' critical thinking skills. Education for sustainable development is also an important pedagogical tool because it is based on the principle that individuals need to see and understand the interdependence between people and ecological units. Sustainable development requires meeting the basic needs of all people and expanding opportunities for individual fulfilment of the good life. ESD has a role that is based on three pillars: social, environmental, and economic. Around the world there is a commitment to integrate sustainable education at all levels of education (Huckle & Wals, 2015). Through the main function of education, ESD is expected to generate new knowledge and contribute to developing competencies and raising awareness of sustainable issues (Dlouha et al., 2013b).

The results of observations and observations at SMPN 18 Bandar Lampung, science learning, especially environmental pollution material, is not able to improve students' critical thinking skills. This is because learning is still teacher-centred learning. In class activities, students are less active in learning, especially in deepening the material presented by the teacher. By applying lecture and discussion methods, students are less free to develop their abilities. In addition, the form of questions presented in the test is still a question with a low cognitive level. In critical thinking, students are guided to think rationally when evaluating something. Before making a decision or taking action, it is important to gather as much information as possible about something. ESD is expected to increase

awareness and ability to make decisions for the future in a sustainable manner and make innovative contributions to educational, economic, social, environmental, and cultural problems (Karatzoglou, 2013).

Knowledge about environmental pollution in grade 7 students of Junior High School 18th Bandar Lampung is still relatively low so appropriate learning activities are needed. One of the appropriate learning activities in knowledge about environmental pollution can be implemented through science learning and using the PBL model. Science learning is appropriate for introducing and developing problem-solving skills in the surrounding environment with an SDGs orientation. With the application of ESD in formal education, it is hoped that it can overcome sustainable problems by the agreement of UN countries approved by UNESCO that ESD is developing from an idea into a global movement (Laurie et al, 2016).

One of the learning models that starts from a problem is PBL. This model expects learners to become problem solvers. With this learning, learners are not only focused on answering or responding correctly but also focus on reflecting on the problem. Therefore, this research aims to analyze the effect of the application of the problem-based learning model on students' critical thinking skills on SDGs-oriented environmental pollution materials.

METHOD

Research Design

The research design used was quasi-experimental with the control group pretest-posttest technique (Azizi & Rasyidi, 2019). The types of data in this study are quantitative data. The following is a table of quasi-experimental research design (Isnawan et al., 2020).

Table 1. Quasi-Experiment Research Design

Group	Pretest	Treatment	Posttest
7E	Y ₁	K	Y ₂
7B	Y ₁	E	Y ₂

Description: Y₁ = pretest; Y₂ = Posttest; E = Learning with the SDGs issue-oriented PBL model; K = Learning with the discussion method

Participant

The population in this study were all seventh-grade students of Junior High School (SMPN) 18th Bandar Lampung, North Teluk Betung District, Bandar Lampung City, Lampung Province in the 2022/2023 academic year which was spread into 5 classes. From the population, two classes were taken, namely class 7B with 27 students and class 7E with 25 students to be used as research samples. Because the sample was chosen for specific purposes, such as using purposive sampling techniques, differences in academic achievement, differences between the two classes, and differences in the number of students (Sugiyono, 2013). Furthermore, the VII B class with 27 students was obtained as an experimental class with low academic ability in science subjects and VII E class with 25 students as a control class with high academic ability in science subjects.

Instrument and Data Analysis

In this study test instruments. The test instrument was used to measure critical thinking skills in the form of description choice questions using the PBL model. Before use, the instrument is tested using a validity test to measure whether the instrument used is feasible and can reveal data from the variables studied appropriately (Arrasyid, 2022). As a result, ten items of description questions on

environmental pollution material were obtained. The research proceeded with the reliability test, which obtained 0.88 with very high criteria.

Research data in the form of data on the results of students' critical thinking skills will be calculated N-Gain value to be able to compare the actual gain score with the maximum gain score (Puspitarini et al, 2014). Furthermore, the prerequisite tests will include normality and homogeneity tests, followed by hypothesis testing using the Independent Sample T-test. Followed by the calculation of effect size to determine the influence of the SDGs issue-oriented PBL model (Cohen, 2013). After the research activities were completed, the two classes were given a posttest to determine the differences in student learning outcomes on the application of the two learning models.

RESULT AND DISCUSSION

Based on the results of research conducted at SMPN 18 Bandar Lampung, the results can be seen in Table 2, it can be seen that the critical thinking ability of students in the experimental class is higher than the control class. This is because in the experimental class the learning was carried out using the Problem Based Learning model oriented to the SDGs issue. This can affect the improvement of students' critical thinking skills.

Table 2. Critical Thinking Ability Results.

Group	\bar{x}	Normality Test	Homogeneity Test	Independent Sample t-test
E	0.58	Sig 0.48 > 0.05	Sig 0.12 > 0.05	Sig (2-tailed) 0.00 < 0.05 (BS)
K	0.25	Sig 0.20 > 0.05		

Description: E = Experiment (with PBL model), K = Control, BS = Significantly Different

Based on Table 2, the decision obtained from the normality and

homogeneity test is Sig. > 0.05, which means that the data is normally distributed

and the data variance is homogeneous. Then, the researchers proceeded with the hypothesis test using the Independent Sample t-test and obtained Sig. (2-tailed) 0.00, which was lower than 0.05. Therefore, there is a significant effect of applying the SDGs issue-oriented PBL model. This finding follows the opinion of Agnesa and Rahmadana (2022); the PBL

model can be an effort that can be made to improve critical thinking skills in learning. The PBL model trains students to be able to solve problems so that they can improve critical thinking skills. The use of the PBL model has the aim of improving critical thinking skills, and problem solving, and as a process of independent learning by students. (Al-Tabany, 2017).

Table 3. Results of N-Gain Analysis.

Indicator	N-Gain Experiment Class	N-Gain Control Class
Elementary Clarification	0.56 (Medium)	0.25 (Low)
Basic Support	0.67 (Medium)	0.26 (Low)
Inference	0.58 (Medium)	0.16 (Low)
Advanced Clarification	0.43 (Medium)	0.20 (Low)
Strategies and Tactics	0.77 (High)	0.17 (Low)

Table 3 shows that each indicator of students' critical thinking skills in experimental and control classes has increased. However, the experimental class experienced a more significant increase compared to the control class. Critical thinking indicators in the experimental class experienced the most significant increase in the strategies and tactics indicator with an N-Gain value of 0.77 with a high category; while in the control class, the indicator that experienced the most significant increase was shown by the basic support indicator with an N-Gain value of 0.26 with a low category.

The indicators that experienced the most significant increase in the experimental class were strategies and tactics which showed that students had been able to decide on an action such as defining the problems listed in the student worksheets (LKPD) and pretest/posttest questions, sources of problems, choosing problem solutions, formulating alternatives to solutions, and deciding on an action to be chosen. A Significant increase in students' critical thinking skills in aspects of strategy and tactics. The strategies and techniques developed as P21 direct students' critical thinking activities by strengthening skills in the

fields of technology, media and information as well as knowledge to face real problems. At the heart of ESD is the strengthening of sustainable student competencies through a holistic, interdisciplinary view of content and democratic, pluralism-oriented learning strategies (Boeve-de Pauw et al., 2015).

The inference indicator in the control class is the indicator that has the lowest increase. This shows that students have not been able to make conclusions properly about the problems presented. Students have not been able to make conclusions with their sentences, tending to write conclusions as previously taught. It has not been able to achieve results by learning objectives. According to Afifah & Kusuma (2021), at the stage of concluding, students are trained to build their knowledge gained during the learning process so that getting learning results will last long in the memory of students.

Table 4 presents the results of the PBL model's impact metrics calculations on students' critical thinking skills on pollutants aligned to the SDGs. The following table shows the results of the impact size calculations for pupils in the experimental and control classes.

Table 4. Effect Size Calculation Result.

Class	Average N-Gain	Std. Deviation	Effect Size	Criteria
Experiment	0.58	0.12	1.77	High
Control	0.25	0.16		

Based on Table 4, the effect size value is 1.77. This shows that the use of the SDGs issue-oriented PBL model has a large effect on the critical thinking skills of students on environmental pollution material in class 7 of SMPN 18 Bandar Lampung. The results showed that the critical thinking skills of experimental class students increased significantly (Table 2). This is because learning using the PBL model oriented to the SDGs issue has a learning process based on problems in everyday life so that it can encourage students to think critically. The material oriented to the SDGs issue requires students to read a lot, criticise problems, and make in-depth analyses, before presenting and producing writing in the form of mini-research based on the research articles they are looking for (Yuliani, et.al, 2020). This is supported by the Ministry of Education and Culture (2014), PBL is a learning model that presents contextual problems to stimulate students to learn in groups to solve real-world problems and to engage students with curiosity to learn so that they have their learning model. This is also the opinion of Darwati (2021), PBL is one of the learning models that can be applied because it encourages students to think critically, skillfully solve problems, and connect knowledge about problems, and current issues in the real world. The concept of ESD emphasizes environmental issues related to social, educational, and economic issues. The goal of ESD is to balance the welfare and improvement of human life globally in space and time, and preserve natural resources and ecosystems (Atkinson, et al, 2014).

The use of the PBL model in SDGs-oriented environmental pollution materials can enhance students' ability to

think critically about environmental pollution materials. Learning oriented to current environmental issues is one alternative to fostering awareness of the surrounding environment. Building awareness is closely related to the thinking ability and character of students (Narut & Nardi, 2019). This is by the opinion of Agnesa and Rahmadana (2022) stating that the PBL model can be an effort that can be made in improving critical thinking skills in learning. The PBL model trains students to be able to solve problems so that they can improve critical thinking skills. The use of the PBL model has the aim of improving critical thinking skills, and problem solving, and as a process of independent learning by students (Al-Tabany, 2017). One of the goals of ESD is to improve students' critical thinking skills. This is the opinion of (Adomßent, et al, 2014) who states the purpose of ESD is to provide individual opportunities to reflect on learning through a multicultural, global, and future-oriented perspective on responsibility for decision-making and behaviour. Learning about new things is needed not only in the academic field, but also in open-mindedness, reflexive, and participatory processes that are important for learners' potential for a sustainable future. Educational efforts aim to empower learners with action competencies to deal with changes in achieving a sustainable future. Action is closely related to knowledge of competence, trust, confidence, and decisions in action (Breiting & Mayer, 2014).

The PBL model requires students to collaborate in groups. However, the application of the PBL model alone has not been able to shape students' critical thinking and collaboration skills. With

the PBL model oriented to the SDGs issue, it will overcome this weakness. This is by Barth & Rieckman (2015) who states that ESD aims for learners not only to acquire knowledge but also to reflect on the impact of behaviour and decisions in a future-oriented and global perspective of responsibility. This is also supported by Rogers (Tareze, 2022) who states that students will be motivated to learn more from what they get until a positive environmental attitude is formed. How to Knowledge behaviour is knowledge about how people use innovations appropriately which is important in the decision-making process of innovation or change.

The relationship with the research results shows in Table 2 that the application of the SDGs problem-oriented PBL model is proven to be more significant in improving critical thinking skills. This is because, through PBL oriented to the SDGs issue, students can foster the ability to think by using their insights without having to rely on textbooks or explanations delivered by the teacher, therefore students are freer in developing thinking skills. This is the opinion of Darwati (2021), PBL develops critical thinking skills because through problem-based learning students learn to solve real-world problems in a structured manner to construct students knowledge. The problem as the starting point of learning, which is designed and selected, should have quality and relate to the real world of students, stimulate cognitive, affective, and psychomotor abilities and allow students to find solutions in group discussions with peers. Education linked

to the SDGs can be viewed as an approach to education that fosters values that support sustainable development, to have students learn values, healthy lifestyles, and lifestyles that lead to the sustainable development of society as a whole.

The model also promotes the acquisition and practical application of knowledge, values and skills to balance the economic, social and environmental dimensions of sustainable development for progress in the lives of individuals and communities (UNESCO, 2006). The delivery of SDGs issue-oriented material will create Creation awareness, containing local and global vision, learning to be responsible, learning to change, participation, lifelong learning, and critical thinking, emphasis on systemic approach and understanding complexity, decision-making, interdisciplinarity, problem-solving, and satisfying the needs of the present without compromising future generations (UNESCO, 2009).

The results of the response data were obtained from the questionnaire scores that had been filled in by 27 students who had carried out learning with the PBL model. The students' response questionnaire consists of 14 statements and on positive statements most students answer strongly agree and agree, while on negative statements most students answer disagree and strongly disagree. The learning response questionnaire contains several indicators that were developed to be the focus of observation according to the learning syntax.

Table 5. Categories of Questionnaire Responses of Students.

Indicators	Percentage (%)	Category
Learners responses to learning activities	86.7	Very High
Learners' Responses to ESD	73.0	High
Learners responses to critical thinking skills	72.2	High

Based on Table 5, the first indicator got a percentage of 86.7 % in the very

high category. In the second indicator, the percentage is 73 % with a high category.

In the third indicator, the percentage was 72.2 % with a high category. Students' responses to the application of the SDGs issue-oriented PBL model in learning as in Table 5 show that on average students answered strongly agree and agree for positive statements and on negative statements, most students answered disagree and strongly disagree. This shows that learning activities with the use of the SDGs issue-oriented PBL model can be well received by students and can improve students' critical thinking skills.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that the theme-oriented PBL model for sustainable development goals affects critical thinking skills. This is evidenced by the experimental class N-gain value which is higher than the control class, as well as the effect size value which shows that the effect of the PBL model is included in the large effect size category. ESD has an important role in raising awareness of sustainable goals for the future of the world. In addition, ESD also plays a role in the development of various fields and disciplines.

REFERENCES

- Adomßent, M., Fischer, D., Godemann, J., Herzig, C., Otte, I., Rieckmann, M., & Timm, J. (2014). Emerging areas in research on higher education for sustainable development—management education, sustainable consumption and perspectives from Central and Eastern Europe. *Journal of cleaner production*, 62, 1-7. <https://doi.org/10.1016/j.jclepro.2013.09.045>
- Afifah, S. N., & Kusuma, A. B. (2021). The importance of mathematical self-efficacy and critical thinking in mathematics online learning. *Journal of MathEdu (Mathematic Education Journal)*, 4(2), 313-320. <https://doi.org/10.37081/mathedu.v4i2.2642>
- Agnesa, O. S., & Rahmadana, A. (2022). Problem-based learning model as an effort to improve critical thinking skills in biology learning. *Journal on Teacher Education Research & Learning in Faculty of Education* 3, 65-81. <https://doi.org/10.31004/jote.v3i3.4384>
- Al-Tabany, T. I. B. (2017). *Designing innovative, progressive, and contextual learning models*. Prenada Media.
- Arrasyid, I. (2022). The effect of strip story media on the learning outcomes of class V students in SKI subjects at MI MAN Bahul Ulum 2 Ciampea. *Instructor*, 1(2), 71-76. <https://doi.org/10.51192/instruktur.v1i2.160>
- Atkinson, G., Dietz, S., Neumayer, E., & Agarwala, M. (2014). *Handbook of sustainable development*. Edward Elgar Publishing.
- Azizi, A., & Rasyidi, M. (2019). Application of problem based learning model to improve problem solving ability and environmental care attitude of Darul Aminin NW Aikmual Junior High School Students in 2019. *JUPE: Journal of Mandala Education*, 4(5). <https://doi.org/10.58258/jupe.v4i5.1271>
- Barth, M., & Rieckmann, M. (2015). State of the art in research on higher education for sustainable development. *Routledge handbook of higher education for sustainable development*, 100-113. <https://doi.org/10.4324/9781315852249>
- Boeve-de Pauw, J., Gericke, N., Olsson, D., & Berglund, T. (2015). The effectiveness of education for sustainable development. *Sustainability*, 7(11), 15693-15717.

- <https://doi.org/10.3390/su71115693>
Breiting, S., & Mayer, M. (2014). Quality criteria for ESD schools: Engaging whole schools in education for sustainable development. In *Schooling for Sustainable Development in Europe: Concepts, policies and educational experiences at the end of the UN decade of education for sustainable development* (pp. 31-46). Cham: Springer International Publishing. https://doi.org/10.1007/978-3-319-09549-3_3
- Carrió-Llach, M. & Llerena-Bastida, M. (2023), "Exploring innovative strategies in problem based learning to contribute to sustainable development: A case study", *International Journal of Sustainability in Higher Education*, Vol. 24 No. 9, pp. 159-177. <https://doi.org/10.1108/IJSHE-07-2021-0296>
- Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Academic press.
- Darwati, I. M. A. (2021). Problem Based Learning (PBL): A learning model to develop learners' critical thinking. *Journal of Education Studies Widya Accarya FKIP Dwijendra University*, 12(2085), 55-66. <https://doi.org/10.46650/wa.12.1.1056.61-69>
- Ennis, H. (2011). *The nature of critical thinking an outline of critical thinking disposition and abilities*. Allyn & Bacon: Boston.
- Huckle, J., & Wals, A. E. (2015). The UN decade of education for sustainable development: Business as usual in the end. *Environmental Education Research*, 21(3), 491-505. <https://doi.org/10.1080/13504622.2015.1011084>
- Isnawan, M. G., Nahdlatul, U., & Mataram, W. (2020). *Quasi-Experiment (Issue February)*. Lombok: Nashir Al-Kutub Indonesia.
- Jayawardana, H. B. A., & Gita, R. S. D. (2020). Biology learning innovation in the era of Industrial Revolution 4.0. *Proceedings of the National Seminar on Biology*, 6(1), 58-66. <https://doi.org/10.20961/prosidingsnfa.v4i0.35915>
- Karatzoglou, B. (2013). An in-depth literature review of the evolving roles and contributions of universities to education for sustainable development. *Journal of Cleaner Production*, 49, 44-53. <https://doi.org/10.1016/j.jclepro.2012.07.043>
- Laurie, R., Nonoyama-Tarumi, Y., Mckeown, R., & Hopkins, C. (2016). Contributions of education for sustainable development (ESD) to quality education: A synthesis of research. *Journal of Education for Sustainable Development*, 10(2), 226-242. <https://doi.org/10.1177/0973408216661442>
- Narut, Y. F., & Nardi, M. (2019). Analysis of environmental care attitudes of grade VI elementary school students in Ruteng City. *Scholaria: Journal of Education and Culture*, 9(3), 259-266. <https://doi.org/10.24246/j.js.2019.v9.i3.p259-266>
- Permendiknas. (2006). Permendiknas No. 23 Year 2006 about graduate competency standards for primary and secondary education units. https://simpuh.kemenag.go.id/regulasi/permendiknas_23_06.pdf
- Rahayu, G. D. S., & Firmansyah, D. (2019). Development of mentoring-based innovative learning for elementary school teachers. *Abdimas Siliwangi*, 1(1), 17-25. <https://doi.org/10.22460/as.v1i1p17-25.36>

- Ripai, I., & Sutarna, N. (2019). Analysis of problem solving ability using problem based learning model. *Proceedings of the National Seminar on Education, 1*, 1146-1155. <https://prosiding.unma.ac.id/index.php/semnasfkip/article/view/167>
- Salam, A., & Hamdu, G. (2022). Application of education for sustainable development (ESD) in electronic learning media in grade V elementary school: A teacher's perspective. *PEDADIDAKTIKA: Scientific Journal of Primary School Teacher Education, 9(1)*, 161-172. <https://doi.org/10.17509/pedadidaktika.v9i1.53129>
- Sugiyono, D. (2013). *Educational research methods quantitative, qualitative and R&D approaches*. Bandung: Alfabeta.
- Susanto, A. (2016). *Learning and learning theory in elementary school*. Kencana. <https://doi.org/10.30641/ham.2019.10.179-194.1>
- Tan, W. (2019). Fulfilling the educational rights of street children in Batam city: Challenges in realizing sustainable development goals (SDGs). *Law: Journal of Legal Research, 29(1)*, 45-59. <https://doi.org/10.30641/ham.2019.10.179-194.1>
- Tareze, M., & Astuti, I. (2022). Collaborative learning model of SDGs in formal education as an introduction to global issues to increase learners' social awareness. *Visipena, 13(1)*, 42-53. <https://doi.org/10.46244/visipena.v13i1.1978>
- UNESCO Education for sustainable development toolkit. (2006). Diunduh dari (<http://www.unesco.org/education/desd>)
- UNESCO Review of contexts and structures for education for Sustainable Development (2009). Diunduh dari http://www.unesco.org/education/ju-stpublished_desd2009.pdf
- Wijayanto, X. A., & Nurhajati, L. (2019a). Online media framing of environmental issue coverage in efforts to achieve Indonesia's SDGs success. *Lugas Journal of Communication, 3(1)*, 14-23. <https://doi.org/10.31334/ljk.v3i1.409>
- Yuliani, S., Purwandari, D. A., Handayani, N. S., & Istiqomah, N. (2020). Implementation of blended learning in examining sustainable development goals (SDG) issues. factor: *Scientific Journal of Education, 7(1)*, 1-6. <http://dx.doi.org/10.30998/fjik.v7i1.5549>
- Zuleni, E. (2023). The effect of contextual teaching and learning and motivation against the understanding of Adzkia University students in the course of basic concepts of elementary biology. *Edumaspul: Jurnal Pendidikan, 7(1)*, 123-130. Retrieved from: <https://ummaspul.e-journal.id/maspuljr/article/view/5440>