



ESD-Based Collaborative Learning to Strengthen Fourth-Grade Students' Critical Thinking Skills: A Quasi-Experimental Study

Nur Asiyah¹; Imas Srinana Wardani²; Erlin Ladyawati³

^{1,2,3}Primary School Teacher Education, Universitas PGRI Adi Buana Surabaya, Indonesia

^{1*}Corresponding Email: isa22nurasiyah@gmail.com

Article History:

Received: Jul 04, 2025

Revised: May 01, 2026

Accepted: Jun 28, 2026

Online First: Sep 28, 2026

Keywords:

Collaborative learning,
Education for Sustainable
Development (ESD),
Critical thinking,
Science and Social Studies.

Kata Kunci:

Berpikir Kritis,
Education for Sustainable
Development (ESD),
IPAS,
Pembelajaran Kolaboratif.

How to cite:

Asiyah, N., Wardani, I. S., & Ladyawati, E. (2026). ESD-Based Collaborative Learning to Strengthen Fourth-Grade Students' Critical Thinking Skills: A Quasi-Experimental Study. *Edunesia : Jurnal Ilmiah Pendidikan*, 7(3), 2015-2028.

This is an open-access article under the CC-BY-NC-ND license



Abstract: Critical thinking is an essential competency that should be fostered through meaningful and sustainable learning. However, elementary students' critical thinking skills remain limited because classroom instruction is predominantly teacher-centered. This study aimed to examine the effect of an Education for Sustainable Development (ESD)-based collaborative learning model on fourth-grade students' critical thinking skills in Integrated Science and Social Studies (IPAS). A quasi-experimental study employing a posttest-only control group design was conducted with 50 students from SDN Tenggilis Mejoyo 1 Surabaya, consisting of 26 students in the experimental class and 24 students in the control class. Data were collected using a 20-item multiple-choice critical thinking test and analyzed through descriptive statistics, normality, homogeneity, and independent samples *t*-tests. The findings revealed that students who participated in ESD-based collaborative learning achieved significantly higher critical thinking scores than those receiving conventional instruction ($p < .05$). These findings demonstrate that integrating collaborative learning with ESD principles effectively strengthens students' critical thinking skills and supports the development of sustainable learning competencies in elementary education.

Abstrak: Kemampuan berpikir kritis merupakan kompetensi penting yang perlu dikembangkan melalui pembelajaran yang bermakna dan berorientasi pada keberlanjutan. Namun, kemampuan berpikir kritis siswa sekolah dasar masih tergolong rendah karena pembelajaran cenderung berpusat pada guru. Penelitian ini bertujuan menganalisis pengaruh model pembelajaran kolaboratif berbasis *Education for Sustainable Development* (ESD) terhadap kemampuan berpikir kritis siswa kelas IV pada pembelajaran IPAS. Penelitian menggunakan desain kuasi eksperimen dengan *posttest-only control group design* yang melibatkan 50 siswa SDN Tenggilis Mejoyo 1 Surabaya, terdiri atas 26 siswa pada kelas eksperimen dan 24 siswa pada kelas kontrol. Data dikumpulkan menggunakan tes berpikir kritis berupa 20 soal pilihan ganda dan dianalisis melalui statistik deskriptif, uji normalitas, uji homogenitas, serta *independent samples t-test*. Hasil penelitian menunjukkan bahwa siswa yang mengikuti pembelajaran kolaboratif berbasis ESD memperoleh kemampuan berpikir kritis yang lebih tinggi secara signifikan dibandingkan siswa yang mengikuti pembelajaran konvensional ($p < 0,05$). Temuan ini menunjukkan bahwa integrasi pembelajaran kolaboratif dengan prinsip ESD efektif meningkatkan kemampuan berpikir kritis serta mendukung pengembangan kompetensi pembelajaran berkelanjutan di sekolah dasar.

A. Introduction

Education in Indonesia is currently facing significant challenges in fostering students' critical thinking skills, particularly in Integrated Science and Social Studies (IPAS). Critical thinking is an essential twenty-first-century competency that enables students to analyze information, evaluate evidence, solve problems, and make informed decisions. According to John Dewey, as cited by [Khairunnisa \(2019\)](#), critical thinking is a reflective process through which individuals systematically evaluate arguments and evidence before reaching conclusions. Within educational settings, this competency is indispensable because students are expected not only to understand scientific concepts but also to apply them effectively in real-life situations.

Despite its importance, many elementary school students continue to demonstrate low levels of critical thinking. This condition is largely attributed to the continued implementation of teacher-centered instructional practices, in which teachers dominate classroom activities while students remain passive recipients of knowledge ([Indrawati et al., 2022](#); [Prayitno et al., 2016](#)). [Wardani & Fiorintina \(2023\)](#) reported that elementary students frequently experience difficulties in expressing opinions, constructing logical arguments, and achieving the expected minimum learning outcomes. Likewise, [Risman \(2020\)](#) found that limited opportunities for social interaction and collaborative discussion restrict students from practicing higher-order thinking skills. Consequently, innovative instructional approaches are required to create more active and meaningful learning experiences.

One of the major challenges in elementary IPAS instruction is the limited implementation of learning models that actively engage students in constructing knowledge. [Izzatuna et al \(2024\)](#) reported that IPAS learning remains dominated by monotonous instructional strategies with limited variation, resulting in low classroom participation and reduced learning motivation. Furthermore, many teachers continue to employ teacher-centered approaches that provide insufficient opportunities for students to discuss, collaborate, and develop analytical thinking ([Eka & Candra, 2023](#)). Previous research has shown that collaborative learning can improve students' motivation and problem-solving abilities ([Fadillah, 2023](#); [Supena et al., 2021](#)). Nevertheless, its implementation remains limited in many elementary schools, including SDN Tenggilis Mejoyo 1 Surabaya.

Another issue concerns the limited integration of Education for Sustainable Development (ESD) into elementary learning. ESD equips learners with the knowledge, skills, values, and attitudes required to address global challenges, including climate change, environmental degradation, and social inequality. Integrating ESD into IPAS enables students not only to understand scientific concepts but also to recognize their relevance to sustainable development and responsible citizenship ([Aqillah, 2021](#); [Timm & Barth, 2021](#); [UNESCO, 2017](#)). Therefore, embedding ESD principles within classroom instruction offers opportunities to develop both cognitive competencies and sustainability awareness.

Education for Sustainable Development (ESD) emphasizes learning that promotes sustainability-oriented knowledge, attitudes, and behaviors. Rather than focusing solely on

knowledge acquisition, ESD encourages learners to critically examine social, economic, and environmental issues and to participate actively in solving real-world problems. Within IPAS learning, ESD provides meaningful contexts that help students connect scientific knowledge with environmental and societal challenges (Latifah et al., 2023; Leicht et al., 2018).

Collaborative learning is considered one of the most appropriate instructional approaches for achieving these objectives because it encourages active participation, knowledge construction, communication, and shared problem-solving. Through collaborative activities, students exchange ideas, evaluate different perspectives, and develop deeper conceptual understanding, thereby strengthening their critical thinking skills (Wulandari, 2020; Warsah et al., 2021). Consequently, integrating collaborative learning with ESD principles has considerable potential to enhance both critical thinking and sustainability competencies among elementary school students.

Although previous studies have confirmed that collaborative learning improves students' critical thinking skills (Fadillah, 2023; Warsah et al., 2021), existing research has predominantly examined collaborative learning as a general instructional strategy without systematically integrating Education for Sustainable Development into the learning process. Moreover, studies investigating ESD in elementary education have mainly emphasized environmental awareness rather than examining how ESD principles can be embedded within collaborative learning syntax to improve critical thinking in IPAS. Consequently, empirical evidence regarding the effectiveness of an ESD-based collaborative learning model for strengthening elementary students' critical thinking skills remains limited.

The novelty of this study lies in the development and implementation of an integrated instructional framework that combines collaborative learning with Education for Sustainable Development principles in fourth-grade IPAS instruction. Unlike previous studies, this research embeds authentic sustainability issues into every stage of collaborative learning, enabling students to analyze real-world environmental problems, construct knowledge collaboratively, and develop evidence-based solutions. This integration simultaneously promotes critical thinking, collaborative competence, and sustainability awareness, thereby extending the existing literature on innovative elementary education practices.

Based on the identified research gap, this study addresses the following research question: How does an Education for Sustainable Development (ESD)-based collaborative learning model influence fourth-grade students' critical thinking skills in Integrated Science and Social Studies (IPAS)? By answering this question, the study contributes both theoretically and practically. Theoretically, it enriches the literature on the integration of collaborative learning and ESD in elementary education. Practically, it provides an evidence-based instructional model that can assist teachers in designing meaningful IPAS learning experiences that foster critical thinking while promoting sustainability competencies aligned with twenty-first-century education.

B. Method

This study employed a quantitative approach using a quasi-experimental method with a posttest-only control group design to investigate the effect of an Education for Sustainable Development (ESD)-based collaborative learning model on elementary students' critical thinking skills in Integrated Science and Social Studies (IPAS). A quasi-experimental design was selected because the participants were assigned to intact classrooms, making random assignment impractical while allowing a valid comparison between experimental and control groups.

The research was conducted at SDN Tenggilis Mejoyo 1 Surabaya during the second semester of the 2024/2025 academic year. The population comprised all fourth-grade students enrolled at the school. Purposive sampling was employed to select two comparable classes based on recommendations from the classroom teachers and similarities in students' academic characteristics. Class IV-B, consisting of 26 students, served as the experimental group and received instruction through the ESD-based collaborative learning model, whereas Class IV-A, consisting of 24 students, served as the control group and received conventional teacher-centered instruction.

The intervention was implemented during IPAS learning on the topic "Photosynthesis: An Essential Process on Earth." The instructional activities in the experimental class followed five stages of ESD-based collaborative learning. First, the teacher introduced authentic environmental issues related to plant sustainability and oxygen production to stimulate students' curiosity and critical thinking. Second, students were organized into heterogeneous collaborative groups to discuss the presented problems. Third, each group conducted a simple photosynthesis experiment using readily available materials, observed the results, and completed worksheets designed according to ESD principles. Fourth, students analyzed the experimental findings collaboratively and discussed the relationship between photosynthesis, environmental sustainability, and human life. Finally, each group presented its conclusions, responded to peers' arguments, and reflected on sustainable solutions to environmental issues.

Data were collected using a critical thinking achievement test consisting of 20 multiple-choice items developed based on four critical thinking indicators: identifying problems, developing basic skills, drawing conclusions, and planning strategies and tactics. Prior to implementation, the instrument underwent expert judgment by two elementary education experts to establish content validity. Item validity was subsequently examined using the Pearson Product-Moment correlation, while internal consistency reliability was measured using the Kuder-Richardson Formula 20 (KR-20), which is appropriate for dichotomous test items.

The collected data were analyzed using IBM SPSS Statistics version 25. Descriptive statistics were first employed to summarize students' achievement in terms of mean scores and standard deviations. Assumption testing included the Shapiro-Wilk normality test and Levene's homogeneity test. An independent samples *t*-test was then conducted to determine whether significant differences existed between the experimental and control groups. To

determine the practical significance of the intervention, Cohen's d effect size was also calculated. Statistical significance was determined at the 0.05 level.

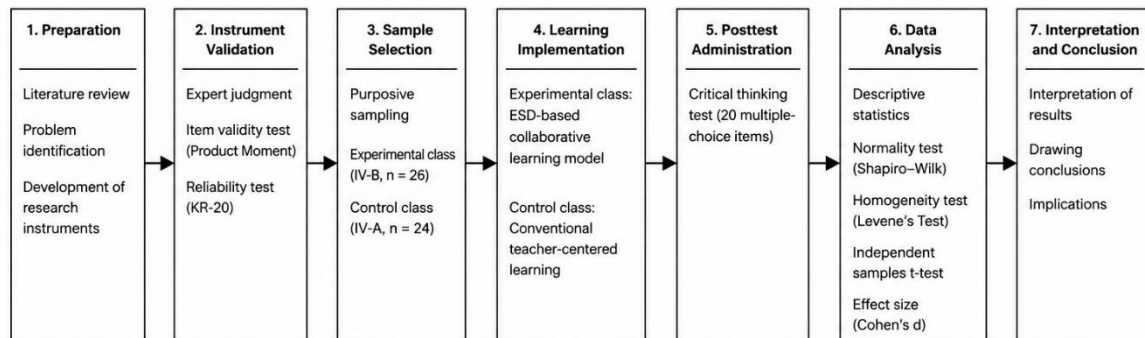


Figure 1. Research Procedure

Figure 1 presents the research procedure adopted in this study, encompassing six consecutive stages: research preparation, instrument validation, participant selection, learning implementation, posttest administration, and statistical data analysis. During the intervention phase, students in the experimental class participated in learning activities designed according to the principles of Education for Sustainable Development (ESD) and collaborative learning, while the control class received conventional teacher-centered instruction. Following the intervention, students completed a critical thinking test, and the collected data were analyzed to examine the effectiveness of the proposed learning model. To facilitate the implementation of the intervention and ensure instructional consistency throughout the study, the learning process in the experimental class was organized into several systematic stages integrating collaborative learning with ESD principles. These stages describe the roles of teachers and students, the sustainability aspects embedded in each activity, and the targeted critical thinking indicators. The detailed learning syntax is presented in Table 1.

Table 1. Syntax of the ESD-Based Collaborative Learning Model

Phase	Teacher Activities	Student Activities	ESD Integration	Critical Thinking Indicator
Orientation	Introduces sustainability-related problems	Observe and identify issues	Environmental awareness	Identifying problems
Group Formation	Organizes heterogeneous groups	Collaborate and exchange ideas	Social responsibility	Developing basic skills
Investigation	Facilitates experiments and discussions	Conduct experiments and analyze findings	Sustainable practices	Drawing conclusions
Presentation	Guides presentations and peer feedback	Present and defend arguments	Communication and participation	Evaluating arguments

Phase	Teacher Activities	Student Activities	ESD Integration	Critical Thinking Indicator
Reflection	Leads reflection and conclusion	Formulate solutions and reflect	Responsible citizenship	Planning strategies and decision making

C. Result

The data on the critical thinking skills of fourth-grade students at SDN Tenggilis Mejoyo 1 Surabaya, collected before and after the implementation of the ESD-based collaborative learning model, were analyzed using SPSS version 25.

Table 2. Data Analysis Results

Data Type		Posttest	
Group		Control	Experimental
N		24	26
Lowest Score		10	35
Highest Score		85	90
Mean		38.250	66.15385
Std. Dev		16.99185	12.10848
Normality Test (Shapiro-Wilk)	Sig.	0.143	0.170
	Description	Normal	Normal
Homogeneity Test	Sig.	0.246	
	Description	Homogeneous	
T-Test	Sig.	0.000	
	Description	Significant	

Based on Table 2, the normality test of the posttest data using the Shapiro-Wilk test shows that the experimental class obtained a significance value of $0.170 > 0.05$, while the control class obtained a significance value of $0.143 > 0.05$. This indicates that the data are normally distributed, as the significance values are greater than 0.05. The results of the homogeneity test for the posttest data of both classes show a significance value of $0.246 > 0.05$, indicating that the data are homogeneous since the significance value exceeds 0.05. After conducting the normality and homogeneity tests, hypothesis testing was carried out using an independent samples t-test. The hypothesis test yielded a significance value of $0.000 < 0.05$, which indicates that there is a significant effect of the ESD-based collaborative learning model on students' critical thinking skills in fourth-grade IPAS learning.

To gain a deeper understanding of the differences in achievement between the two groups, it is necessary to examine the comparison of mean scores and data distribution through descriptive statistics. A detailed overview of the effectiveness of the treatment applied in the experimental class compared to the control class is presented in the following table:

Table 3. Descriptive Statistics of Critical Thinking Skills

Groups	N	Mean	Std. Deviation (SD)
Experimental	26	66.15	12.11
Control	24	38.13	16.99

Based on Table 3, there is a substantial difference in the mean scores between the two groups, with the experimental class outperforming the control class, achieving an average score of 66.15 compared to 38.13. This difference of 28.02 points further reinforces the previous hypothesis testing results, indicating that the ESD-based collaborative learning model has a significant positive effect on students critical thinking skills. Furthermore, to determine whether the difference in mean scores is statistically significant, an Independent Samples t-test was conducted. The results of the hypothesis testing are summarized in the table below:

Table 4. Results of the Independent Samples t-test

Variable	t	df	Sig. (2-tailed)	Mean Difference
Critical Thinking Skills	6.765	48	0.000	28.02

The analysis results in Table 2 show a Sig. (2-tailed) value of 0.000, which is lower than the significance level of 0.05 ($p < 0.05$). Therefore, the null hypothesis (H_0) is rejected and the alternative hypothesis (H_a) is accepted. This indicates that the implementation of the ESD-based collaborative learning model has a significant effect on improving the critical thinking skills of fourth-grade students. The data also show a mean difference of 28.02 points, which confirms the superiority of the experimental model.

To provide a more in-depth overview of the quality of students' critical thinking skills, the scores were categorized based on percentage criteria as follows: (1) 80–100% = very good category; (2) 61–80% = good category; (3) 41–60% = fair category; (4) 21–40% = poor category; and (5) 0–20% = very poor category. The results of the score calculations for each indicator are presented in the following table:

Table 5. Analysis of Students' Posttest Scores on Critical Thinking Skills

Indicator	Posttest Score Percentage (Control Class)	Posttest Score Percentage (Experimental Class)
Identifying Problems	58.33%	76%
Developing Basic Skills	44.79%	78%
Drawing Conclusions	59.38%	68.5%
Planning Strategies and Tactics	27.08%	57.33%

The table shows a comparison of the improvement in critical thinking skills between the experimental and control classes based on four indicators: the ability to identify

problems, the ability to build basic skills, the ability to draw conclusions, and the ability to plan strategies and tactics.

Table 6. Effect Size of the ESD-Based Collaborative Learning Model

Statistic	Value	Interpretation
Cohen's <i>d</i>	1.88	Large Effect

The calculated Cohen's *d* indicates a large practical effect of the ESD-based collaborative learning model on students' critical thinking skills. This finding demonstrates that the observed difference was not only statistically significant but also educationally meaningful.

D. Discussion

This study demonstrates that the implementation of an Education for Sustainable Development (ESD)-based collaborative learning model significantly improves fourth-grade students' critical thinking skills in Integrated Science and Social Studies (IPAS). The statistical findings indicate that students who participated in collaborative learning integrated with ESD principles achieved significantly higher critical thinking performance than those who experienced conventional teacher-centered instruction. These findings suggest that learning activities emphasizing collaboration, authentic problem-solving, and sustainability issues provide meaningful opportunities for students to construct knowledge actively while developing higher-order thinking skills.

The improvement in students' critical thinking skills can be explained through the principles of social constructivism, which emphasize that knowledge is developed through social interaction and collaborative meaning-making. According to Vygotsky's social constructivist theory, students develop higher cognitive abilities when they engage in dialogue, exchange perspectives, and solve problems collaboratively within their Zone of Proximal Development (ZPD). Through ESD-based collaborative learning, students were encouraged to discuss authentic environmental issues, evaluate evidence, and formulate collective solutions, thereby strengthening their analytical and reflective thinking. This finding is consistent with Dewey's concept of reflective thinking, which emphasizes that critical thinking develops when learners actively investigate real-world problems rather than merely receiving information passively (Khairunnisa, 2019).

Among the four critical thinking indicators, the greatest improvement was observed in developing basic skills, followed by planning strategies and tactics. The substantial improvement in developing basic skills indicates that collaborative discussions enabled students to evaluate information critically, compare different viewpoints, and justify their arguments using evidence. These findings support the study by Rahman et al (2022) and Wahyuddin et al (2022), who reported that collaborative interaction promotes critical and creative thinking through active knowledge exchange. Likewise, Dhitasarifa et al (2023) emphasized that responsibility, communication, and group flexibility are essential

components of effective collaborative learning that contribute to students' cognitive development.

Students also demonstrated notable improvement in the indicators of identifying problems and drawing conclusions. During the learning process, students analyzed photosynthesis not only as a biological process but also as an environmental issue closely related to ecosystem sustainability. Presenting authentic environmental problems encouraged students to formulate questions, investigate evidence, and generate logical conclusions collaboratively. This finding supports [Satwika et al \(2018\)](#) and [Saputra et al \(2019\)](#), who argued that collaborative learning encourages learners to formulate problem-solving strategies through active participation. Similarly, research has confirmed that collaborative learning enhances learning outcomes by promoting individual responsibility and active participation within group activities ([Supena et al., 2021](#)).

Although the indicator of planning strategies and tactics improved considerably, it remained the lowest among all critical thinking indicators. This finding may be attributed to several factors. First, strategic planning represents one of the highest levels of critical thinking because it requires students to synthesize information, evaluate alternative solutions, and make evidence-based decisions. Second, fourth-grade students are generally transitioning from concrete operational to more abstract thinking; consequently, designing comprehensive strategies remains cognitively demanding. Third, the relatively short duration of the intervention may not have been sufficient to establish well-developed strategic reasoning habits. Finally, the use of multiple-choice assessments may not fully capture students' reasoning processes compared with open-ended tasks, performance assessments, or classroom observations.

An important contribution of this study is the integration of Education for Sustainable Development (ESD) principles into collaborative learning. Rather than treating sustainability as supplementary content, ESD served as the context through which students explored authentic environmental problems and connected scientific concepts with everyday life. Throughout the learning process, students analyzed the relationship between photosynthesis, ecosystem balance, air quality, and responsible environmental behavior. Such learning experiences encouraged students to evaluate cause-and-effect relationships and develop reflective awareness regarding sustainable development ([Maulina et al., 2023](#)). According to [Gillies \(2016\)](#), collaborative learning becomes more meaningful when students jointly construct solutions to authentic problems, thereby fostering higher-order thinking and shared responsibility.

The findings also extend previous research on collaborative learning and ESD. Earlier studies primarily demonstrated that collaborative learning improves students' motivation, communication, and critical thinking skills ([Fadillah, 2023](#); [Warsah et al., 2021](#)), while studies on ESD generally focused on promoting sustainability awareness. In contrast, the present study demonstrates that integrating ESD principles into collaborative learning provides a meaningful pedagogical context for strengthening critical thinking through authentic environmental problem-solving. Sustainability issues functioned not only as

learning content but also as cognitive stimuli that encouraged students to analyze evidence, evaluate alternative perspectives, and formulate responsible decisions. This finding enriches the existing literature by providing empirical evidence that ESD can effectively support the development of higher-order thinking skills in elementary education.

Overall, the findings indicate that integrating collaborative learning with Education for Sustainable Development creates an active learning environment that promotes inquiry, evidence-based reasoning, collaboration, and reflective thinking. Theoretically, this study contributes to the growing body of literature by demonstrating that ESD can function as an effective pedagogical framework for developing critical thinking skills through collaborative learning. Practically, the findings provide empirical evidence for elementary school teachers that embedding sustainability issues into collaborative classroom activities can simultaneously enhance students' critical thinking, collaborative competence, and sustainability awareness, thereby supporting the implementation of twenty-first-century learning and the Sustainable Development Goals (SDGs).

E. Implication

The findings of this study have important implications for the implementation of Integrated Science and Social Studies (IPAS) in elementary education. Since the integration of Education for Sustainable Development (ESD) with collaborative learning was found to significantly improve students' critical thinking skills, this instructional approach may serve as an effective pedagogical strategy for promoting active, student-centered learning. Rather than relying on teacher-centered instruction, teachers are encouraged to design collaborative learning experiences that engage students in authentic sustainability issues relevant to their daily lives, such as waste management, environmental conservation, biodiversity, and energy consumption. Such learning activities provide opportunities for students to investigate real-world problems, evaluate evidence, construct arguments, and collaboratively formulate responsible solutions, thereby fostering both critical thinking and sustainability competencies. Furthermore, the findings support the integration of sustainability principles into IPAS learning outcomes and classroom assessment by embedding competencies such as environmental responsibility, collaborative problem-solving, ethical decision-making, and systems thinking within the curriculum. Consequently, this study provides practical guidance for teachers and curriculum developers in designing meaningful learning experiences that simultaneously strengthen twenty-first-century competencies and support the achievement of the Sustainable Development Goals (SDGs).

F. Limitations and Suggestions for Future Research

Despite the valuable contributions of this study in demonstrating the effectiveness of Education for Sustainable Development (ESD)-based collaborative learning for improving elementary students' critical thinking skills, several limitations should be

acknowledged. First, the study was conducted in a single elementary school involving only fourth-grade students, which may limit the generalizability of the findings to different educational settings and grade levels. Second, the use of a posttest-only control group design did not allow the measurement of students' initial critical thinking abilities or individual learning gains. In addition, the assessment relied primarily on multiple-choice tests, which may not fully capture students' reasoning processes and authentic critical thinking performance. Furthermore, the absence of structured classroom observations limited the analysis of students' collaborative interactions during the learning process.

Future research is recommended to employ a pretest–posttest experimental design involving larger and more diverse samples to strengthen the generalizability of the findings. Researchers are also encouraged to complement cognitive tests with essay-based assessments, performance tasks, observation protocols, and reflective portfolios to obtain a more comprehensive evaluation of students' critical thinking and collaborative competencies. In addition, incorporating effect size analysis and conducting longitudinal studies would provide deeper insights into the magnitude and long-term sustainability of the intervention, particularly regarding the retention of critical thinking skills and the development of sustainability-related attitudes fostered through ESD-based collaborative learning.

G. Conclusion

This study concludes that the implementation of an Education for Sustainable Development (ESD)-based collaborative learning model effectively enhances fourth-grade students' critical thinking skills in Integrated Science and Social Studies (IPAS). By integrating collaborative inquiry with authentic sustainability issues, the learning process encourages students to actively construct knowledge, evaluate evidence, formulate arguments, and develop responsible solutions to real-world environmental problems. These findings demonstrate that ESD functions not only as learning content but also as a meaningful pedagogical framework that strengthens higher-order thinking through collaborative learning. The study therefore contributes to the growing body of literature by providing empirical evidence that the integration of collaborative learning and ESD can support the development of critical thinking while simultaneously fostering sustainability awareness in elementary education. Practically, the findings offer guidance for teachers and curriculum developers in designing student-centered IPAS learning that aligns with twenty-first-century competencies and the Sustainable Development Goals (SDGs), thereby promoting more meaningful, relevant, and future-oriented learning experiences.

References

- Aqillah, A. N. (2021). *Penerapan Pembelajaran STEM-ESciT Berwawasan ESD terhadap Hasil Belajar dan Kemampuan Berpikir Kreatif Peserta Didik pada Materi Sifat Koligatif Larutan*.

- Dhitasarifa, I., Dyah Y. A., & Savitri, E. N. (2023). *Penerapan Model Problem Based Learning untuk Meningkatkan Keterampilan Kolaborasi Peserta Didik pada Materi Ekologi di SMP Negeri 8 Semarang*.
- Eka, A. Y., & Candra Y. A. (2023). Peningkatan Aktivitas dan Hasil Belajar Siswa Menggunakan Model Problem Based Learning (PBL) dengan Menggunakan Media Pembelajaran Video Mata Pelajaran IPAS Kelas IV SD Negeri 2 Tegalombo. *Jurnal Ilmiah Pendidikan Dasar*, 08(02).
- Fadillah, N. (2023). *The Effect of Models Solving Collaborative Learning Problems of Motivation and Ability Solving Problems in Learning IPS Elementary School Students in Moncongloe District Maros District*.
- Gillies, R. M. (2016). Cooperative Learning: Review of Research and Practice. *Australian Journal of Teacher Education*, 41(3), 39–54. <https://doi.org/10.14221/ajte.2016v41n3.3>
- Indrawati, H., Daud, F., & Alimuddin. (2022). Perbandingan Keterampilan Berpikir Kritis dan Hasil Belajar Biologi Siswa Ditinjau dari Tipe Kepribadian Ekstrovert dan Introvert di SMA Negeri Kota Makassar. *Jurnal Biotek*, 10(2), 201–211. <https://doi.org/10.24252/jb.v10i2.28581>
- Izzatuna, D. N., Wuryani, M., Muslim, R. I., & Nurani, D. C. (2024). Problematika Pembelajaran IPAS Kelas V SD N 1 Wonokerso. *Inovasi Sekolah Dasar: Jurnal Kajian Pengembangan Pendidikan*, 11(1), 211–222. <https://doi.org/10.36706/jisd.v11i1.53>
- Khairunnisa, D. (2019). Studi Literatur Mengenai Pendekatan Problem Posing Upaya Peningkatan Kemampuan Berpikir Kritis Siswa Sekolah Menengah Pertama dalam Matematika. *Article in Journal of Mathematics Teacher Education*. <https://www.researchgate.net/publication/337875157>
- Latifah, N., Hayat, M. S., & Khoiri, N. (2023). Potensi Implementasi Pembelajaran Berdiferensiasi Berorientasi ESD dalam Proyek IPAS Aspek Zat dan Perubahannya. *Jurnal Penelitian Pembelajaran Fisika*, 14(2), 261–268. <https://doi.org/10.26877/jp2f.v14i2.16955>
- Leicht, A., Heiss, J., & Byun, W. J. (Eds.). (2018). *Issues and Trends in Education for Sustainable Development*. UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000261445>
- Maulina, D., Hikmawati, A., & Marpaung, R. R. T. (2023). The Effect of Implementing ESD in the PBL Model on Critical Thinking Ability in Environmental Pollution Material. *Tadris: Jurnal Keguruan dan Ilmu Tarbiyah*, 8(2), 253–262. <https://doi.org/10.24042/tadris.v8i2.18444>
- Prayitno, L. L., Sulistyawati, I., & Wardani, S. I. (2016). Profil Kemampuan Berpikir Kritis Siswa SD di Kecamatan Bulak. *Jurnal Pendidikan Dasar Nusantara*, 1(2).
- Rahman, A., Masitoh, S., & Mariono, A. (2022). Collaborative Learning to Improve Creative and Critical Thinking Skills: From Research Design to Data Analysis. *International Journal of Educational Review*, 4(1), 79–96. <https://doi.org/10.33369/ijer.v4i1.22016>

- Risman, Z. (2020). *Pengaruh Model Pembelajaran Kolaboratif terhadap Hasil Belajar IPA Peserta Didik Kelas V MIS DDI Bosalia Kab. Jeneponto*.
- Saputra, M. D., Joyoatmojo, S., Wardani, D. K., & Sangka, K. B. (2019). Developing Critical-Thinking Skills through the Collaboration of Jigsaw Model with Problem-Based Learning Model. *International Journal of Instruction*, 12(1), 1077-1094. <https://doi.org/10.29333/iji.2019.12169a>
- Satwika, Y. W., Laksmiwati, H., & Khoirunnisa, R. N. (2018). Penerapan Model Problem Based Learning untuk Meningkatkan Kemampuan Berpikir Kritis Mahasiswa. *Jurnal Pendidikan (Teori dan Praktik)*, 3(1), 7. <https://doi.org/10.26740/jp.v3n1.p7-12>
- Supena, I., Darmuki, A., & Hariyadi, A. (2021). The Influence of 4C (Constructive, Critical, Creativity, Collaborative) Learning Model on Students' Learning Outcomes. *International Journal of Instruction*, 14(3), 873-892. <https://doi.org/10.29333/iji.2021.14351a>
- Timm, J. M., & Barth, M. (2021). Making Education for Sustainable Development Happen in Elementary Schools: The Role of Teachers. *Environmental Education Research*, 27(1), 50-66. <https://doi.org/10.1080/13504622.2020.1813256>
- UNESCO. (2017). *Education for Sustainable Development Goals: Learning Objectives*. UNESCO. <https://unesdoc.unesco.org/ark:/48223/pf0000247444>
- Wahyuddin, Ernawati, Satriani, S., & Nursakiah. (2022). The Application of Collaborative Learning Model to Improve Student's 4Cs Skills. *Anatolian Journal of Education*, 7(1), 93-102. <https://doi.org/10.29333/aje.2022.718a>
- Wardani, I. S., & Fiorintina, E. (2023). Building Critical Thinking Skills of 21st Century Students through Problem Based Learning Model. *JPI (Jurnal Pendidikan Indonesia)*, 12(3), 461-470. <https://doi.org/10.23887/jpiundiksha.v12i3.58789>
- Warsah, I., Morganna, R., Uyun, M., Hamengkubuwono, H., & Afandi, M. (2021). The Impact of Collaborative Learning on Learners' Critical Thinking Skills. *International Journal of Instruction*, 14(2), 443-460. <https://doi.org/10.29333/iji.2021.14225a>
- Wulandari, R. (2020). *Menuju Wajah Baru Pendidikan Sejarah*. Lappera Pustaka Utama.

Author's Biography



Nur Asiyah. She was born in Kediri, Indonesia, on September 22, 2002. She is currently an undergraduate student in the Elementary School Teacher Education Program, Faculty of Education, at PGRI Adi Buana University Surabaya.
Email: isa22nurasiyah@gmail.com

	Dr. Imas Srinana Wardani, S.Pd., M.Pd.  She was born in Surabaya, Indonesia, on March 9, 1977. She earned her bachelor's degree in Biology Education from the State University of Surabaya. She then completed her master's degree in Basic Education at the State University of Surabaya and obtained her doctoral degree from the Indonesia University of Education. Since 2010, she has been a lecturer at PGRI Adi Buana University Surabaya, where she continues to teach and conduct research in the field of education. Email: imas@unipasby.ac.id
	Erlin Ladyawati, S.Pd., M.Pd.  She was born in Kediri, Indonesia, on April 19, 1983. She earned her bachelor's degree in Mathematics Education from PGRI Adi Buana University Surabaya. In 2008, she obtained her master's degree in Mathematics Education from the State University of Surabaya. From 2008 to 2023, she served as a lecturer in the Mathematics Education Study Program. Since 2023, she has been a lecturer in the Elementary School Teacher Education Study Program at PGRI Adi Buana University Surabaya. Email: erlin@unipasby.ac.id