

Profile and correlation analysis of environmental literacy domains at Adiwiyata school

Nur Ita Rahmawati ^{a,1}, Ali Mustofa ^{a,2}, Imas Cintamulya ^{a,3*}

^a Biology Education, Teaching and Educational Science Faculty, PGRI Ronggolawe University, Tuban – Indonesia

¹ nuritarahmawati53@gmail.com; ² alimustofa0507@gmail.com; ³ cintamulya66@gmail.com *

* Corresponding author: cintamulya66@gmail.com

Submission : 20/04/2024

Revision : 07/08/2025

Accepted : 17/08/2025

ABSTRACT

Global environmental issues such as global warming, air pollution, and ecosystem degradation are becoming increasingly urgent to address through Education, including environmental literacy. This study aims to identify the environmental literacy profiles of students in Adiwiyata schools and to analyze the relationships among the domains of environmental literacy, which include knowledge, attitudes, and pro-environmental behavior. The research used a descriptive quantitative method with a sample of 47 ninth-grade students from two Adiwiyata schools. The instrument used was an environmental literacy questionnaire consisting of three indicators: environmental knowledge, pro-environmental attitudes, and environmentally responsible behavior. The results showed that students' pro-environmental attitudes (81.6) and behaviors (74.3) were categorized as high, while environmental knowledge remained very low (16.1). Overall, students' environmental literacy score reached 76.4%, which is considered high. These findings indicate that while students demonstrate positive attitudes and behaviors toward the environment, their environmental knowledge requires greater attention in the implementation of the Adiwiyata program. The study recommends integrating technology-based learning and practical activities in accordance with constructivist Theory and the TPACK framework to enhance the overall effectiveness of environmental Education. In addition, environmental literacy is significantly influenced by pro-environmental attitudes and behaviors, while knowledge alone is not sufficient to encourage changes in attitudes or actions. These findings underscore the importance of action competence as a key element of environmental literacy. True environmental literacy includes the ability to take concrete action in response to environmental issues.

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



Keywords: Adiwiyata, Environmental literacy, Domain environment literacy

Introduction

Nowadays, environmental issues are starting to attract international attention. Global warming, ozone depletion, and the extinction of species that pose a threat to life are some examples of serious environmental problems. In addition, human actions that continue to over-exploiting nature have an impact on environmental quality (Pahru et al., 2021). These impacts also arise due to human activities in the excessive use of natural resources without practicing sustainable conservation (Nasution, 2016). Air pollution, a decrease in green open space, and wasteful behaviors, all of which are now widely recognized, can have detrimental effects (Iskandar, 2013). Human behavior that is irresponsible towards the environment can trigger the global warming phenomenon, which has an impact on increasing temperatures, rainfall, floods, the decline in agricultural production, and the threat of deadly diseases, which will become a big problem for life in the future (Bahrudin, 2017). One specific instance was in September 2015, when a land fire engulfed the island of Sumatra in a protracted smoke cloud that harmed inhabitants' economic infrastructure, caused illness, and interfered with school instruction (Rotari, 2017). Human activity is mostly to blame for the changes in nature that take place; thus, environmental Education initiatives must help people adopt a more balanced perspective on how to use natural resources.

Education plays an important role in shaping students' character and making use of their surroundings in a balanced manner (Goldman et al., 2014). Education can cultivate literacy and environmental awareness in students to foster an appreciation for the environment (Burchett, 2015). 'Environmental literacy' in Education describes a person's capacity to comprehend, evaluate, and engage with sustainability and environmental challenges (Annan-Diab and Molinari, 2017). It includes critical thinking abilities, ecological knowledge, and attitudes that encourage pro-environmental behavior (Hayati, 2020; Nasution, 2016). Environmental literacy, according to Rieckmann (2017), encompasses social and cultural understandings that impact human interactions with the environment in addition to scientific knowledge. Giving students the tools they need to make sustainable decisions and help address global environmental issues like biodiversity loss and climate change is crucial (Annan-Diab and Molinari, 2017; Rieckmann, 2017). Therefore, it is essential to incorporate environmental literacy into the curriculum to foster a sense of environmental responsibility and understanding in the next generation (Hayati, 2020).

The issue of environmental literacy in Education is becoming increasingly important in an attempt to raise a generation that is concerned about environmental sustainability. In addition to understanding ecosystems and caring for the environment, environmental literacy also includes the skills and mindsets needed to behave sustainably (Bergman, 2016; Burchett, 2015; Saribas et al., 2017). According to research, teaching that incorporates environmental literacy can improve students' understanding of environmental concerns and motivate them to adopt sustainable activities (Annan-Diab and Molinari, 2017; Liu et al., 2015; Too and Bajracharya, 2015). For students to understand the impact of their activities on the environment and develop more effective solutions, it is imperative to incorporate environmental literacy into the education curriculum (Rieckmann, 2017; Zidny et al., 2020).

One of the educational programs in Indonesia to address environmental issues is the Environmental Education program. This program aims to instill a sense of responsibility, knowledge, attitudes, and awareness regarding the influence of human behavior on the environment (Afrianda et al., 2019). This education was developed as the Environmental Care and Culture School (ECCS) program. Today, this program is known as Adiwiyata (Azhar et al., 2016). With this program, it is hoped that students will improve their character and care for the environment. One implementation of a caring attitude towards the environment is by fostering a clean-living culture. Clean living behavior and care for the environment play an

important role in achieving a better standard of living (Rahman & Patilaiya, 2018; Suprpto & Arda, 2021). Numerous factors impact the environmental activities that students engage in at school. These include pupils' awareness, knowledge, and comprehension of the significance of environmental protection (Afrianda et al., 2019). Therefore, environmental literacy and an environmentally conscious attitude need to be instilled in students (Prastyo and Hartono, 2020). Environmental literacy can be integrated into environmental learning in various ways, one of which is the Adiwiyata program (Mitarlis et al., 2017; Wardani, 2020).

Students' understanding of the environment reflects their caring behavior and awareness of the environment (Dasrita et al., 2015; Mukminin et al., 2014). Research by Munawar et al. (2019) reports that there is a positive correlation between life knowledge and environmental awareness in Adiwiyata High School students. This research aims to determine the environmental literacy profile of students studying at Adiwiyata School and to determine the relationship between students' environmental literacy domains. Through this research, the contribution of the Adiwiyata program can be measured by students' environmental literacy, which will be the basis for developing strategies to improve the Adiwiyata program.

Methods

This study employed a quantitative descriptive method. The population consisted of ninth-grade students from two Adiwiyata schools. A total of 47 students were selected as research subjects using purposive sampling. The research instrument was an environmental literacy questionnaire adapted from Szczytko et al. (2019). The questionnaire measured three domains: ecological knowledge, pro-environmental attitudes, and pro-environmental behavior. The ecological knowledge domain included 15 items in a yes/no format. In contrast, the attitude and behavior domains each consisted of 12 Likert-scale statements with five response options: *strongly agree*, *agree*, *neutral*, *disagree*, and *strongly disagree*. The scoring system was as follows: for the knowledge domain, a correct answer (*yes*) was scored as one and an incorrect answer (*no*) as 0. For the attitude and behavior domains, the Likert scale ranged from 5 (*strongly agree*) to 1 (*strongly disagree*). To determine students' environmental literacy levels, a score transformation was conducted across the three domains: knowledge, pro-environmental attitude, and pro-environmental behavior. Each domain had a different number of items and maximum scores, as shown in Table 1. The knowledge domain included 15 items with a maximum score of 15. Both the attitude and behavior domains consisted of 12 items each, with a possible score range of 12 to 60. Therefore, the total maximum environmental literacy score was 135.

Table 1. Domains of Environment literacy

Number	Environmental Literacy Domains	Number of Items	Score Range	Minimum Score	Maximum Score
1	Knowledge	15	0-15	0	15
2	Pro-Environment Attitude	12	12-60	12	60
3	Pro-Environment Behavior	12	12-60	12	60
Totals Score					135

(McBeth and Volk, 2009)

The scores obtained by each student in the three domains were summed and then transformed into percentages using the following formula:

$$\text{Environmental Literacy Percentage} = \frac{\text{Score Obtained}}{\text{Maximum Score}} \times 100$$

The resulting percentage scores were then categorized according to the environmental literacy level ranges adapted from McBeth & Volk (2009), as shown in Table 2. The classification of environmental literacy levels is as follows:

Table 2. Environmental literacy categories

Score Range	Category
22,2%-48,1%	Low
48,2%-74,1%	Medium
74,2%-100%	High

To find out the relationship between students' environmental literacy domain results, use a correlation analysis test with the IBM SPSS Statistics 28 for Windows application.

Results and Discussion

The results of the environmental literacy score consist of 3 domains, including Environmental knowledge, Pro-Environmental attitude, and Pro-Environmental Behavior, as shown in Figure 1.

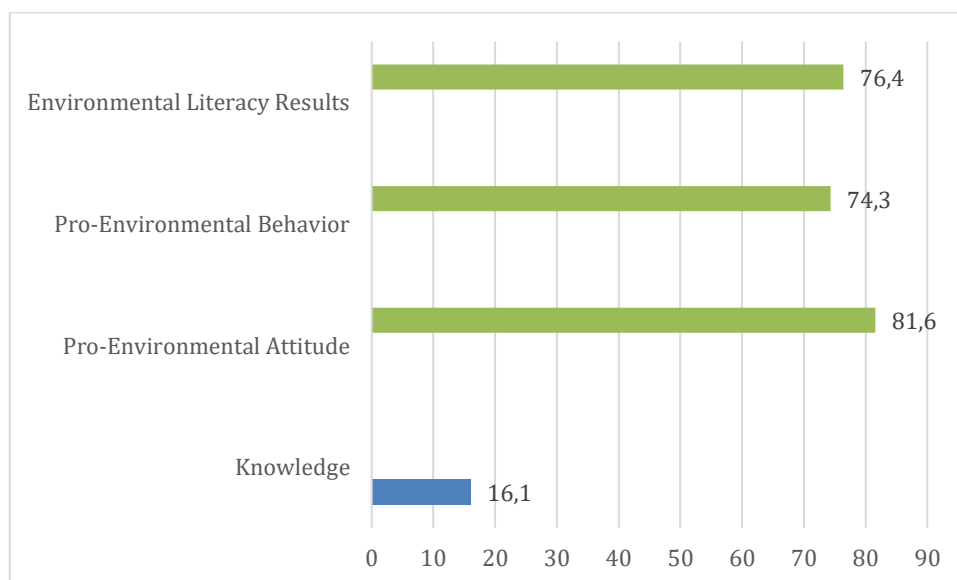


Figure 1. Environmental Literacy Results

The results shown in Figure 1 indicate that students' pro-environmental behavior scored 74.3, reflecting the extent to which they practice environmentally friendly actions in their daily lives. This score falls into the high category, suggesting that some students already demonstrate habits or actions that support environmental conservation. Meanwhile, pro-environmental attitudes received a score of 81.6, indicating a positive Tendency among students toward environmental preservation issues. This score shows that, in general, students possess favorable attitudes toward the environment, although there is still room for improvement in developing stronger and more committed attitudes. On the other hand, environmental knowledge scored significantly lower, at just 16.1, which reflects students' limited understanding of basic environmental concepts and information. This disparity suggests that although students show pro-environmental attitudes and behaviors, their factual

understanding remains weak. Therefore, it is crucial to strengthen the knowledge component within environmental Education to ensure that attitudes and behaviors are built upon a deep and sustainable understanding.

One reason why students exhibit high levels of pro-environmental behavior and attitudes despite having low environmental knowledge may be attributed to the strong Influence of social and cultural environments. Many students engage in environmentally friendly actions because they were raised in settings that instill such habits from an early age, whether through family norms or community values (Graltan et al., 2004; Igei et al., 2024). In this context, the behavior demonstrated does not necessarily stem from a deep understanding, but rather from habituation or social control (Effendi et al., 2020; Hua & Mi, 2023). For example, students may be accustomed to throwing trash in the proper place because they were taught to do so from a young age by their parents or due to supervision from teachers at school. However, this behavior is not necessarily accompanied by an understanding of the long-term impacts of waste on ecosystems and environmental health (Jaime et al., 2023; Maddox et al., 2011). This indicates that positive behavior does not always align with cognitive understanding, highlighting the importance of an educational approach that fully integrates knowledge, attitudes, and skills.

Education and programs designed to increase environmental knowledge can help in increasing students' Environmental Literacy (Indrawan et al., 2022; Samidjo et al., 2023). For example, programs like ECOCIDADANIA, which combine nature walks with citizen science, have been shown to increase students' knowledge, skills, and environmental awareness. These activities also strengthen social relationships and promote individual and collective well-being (Silva et al., 2023). Tools like the Environmental Education Kit (EE-Kit) can be used to teach students about environmental issues. These kits have been found to improve environmental literacy by providing structured and interactive learning experiences (Jannah et al., 2013).

In Indonesia, one program to increase environmental awareness is through Environmental Education (PLH) in the Education system, which plays a role in instilling knowledge about developing environmental harmony and balance, or the Adiwiyata school program. Adiwiyata is referred to as the Green School abroad. The "Greening The Curriculum" initiative at the Green School refers to a curriculum that incorporates environmental content into its lessons and considers environmental issues in its discussions (Casmana et al., 2023). Adiwiyata is an attempt to create a decent and ideal program or container to learn different norms and ethics that may serve as the foundation for people to create a flourishing existence in accordance with the principles of sustainable development (Rachmawati et al., 2022). The Adiwiyata program can increase students' understanding and awareness of environmental problems (Mustofa and Sueb, 2023). However, a school with Adiwiyata School status is not enough to foster environmental literacy.

Several reasons may explain why Adiwiyata status alone is not sufficient to build comprehensive environmental literacy. One of the main reasons is that the implementation of the program tends to be formalistic, without being accompanied by fundamental changes in the school culture. In addition, the Adiwiyata Program often focuses more on the physical or outward appearance of the school – such as cleanliness and greening – while failing to deeply address the cognitive, affective, and environmental skill aspects that students are supposed to develop (Kamil et al., 2020; Megawati et al., 2022). In addition, the lack of a strong evaluation and monitoring system for the effectiveness of the Adiwiyata program is also a contributing factor that hinders the achievement of comprehensive environmental literacy goals (Anggraini & Karyanto, 2019). Some schools may not optimally integrate environmental literacy into their curriculum. For example, at SMP N 2 Sragen, the role of teachers in facilitating learning that emphasizes the development of environmental literacy is still less than optimal (Anggraini & Karyanto, 2019).

Therefore, the Adiwiyata program implemented in schools must adapt to developments in information and communication technology (Desfandi et al., 2019). Efforts that can be made to support the Adiwiyata program are by implementing digital learning and practical activities (Megawati et al., 2023; Prasetyo et al., 2020). The use of digital media can reduce paper use and encourage the use of digital media, not only teaching students about reducing paper waste but also training students in digital literacy (Buchanan et al., 2019). In addition, involving students in practical activities such as tree planting, recycling, and other environmental projects can increase their understanding of the importance of environmental conservation (Faizah & Kamal, 2024).

This idea is strongly supported by Constructivist Learning Theory, as proposed by educational theorists such as John Dewey and Jean Piaget. According to this theory, students learn more effectively when they are actively engaged in real-life experiences (Chieu et al., 2004; Kang et al., 2010). Dewey emphasized that education should be rooted in experiential learning, where students interact directly with their environment (Tafrova-Grigorova, 2016). Therefore, engaging students in hands-on environmental projects aligns well with this approach, as it helps develop a deeper understanding and awareness of the environment. Moreover, the integration of digital media in learning can further enhance this process (O'Neil et al., 2020). Referring to the TPACK (Technological Pedagogical Content Knowledge) framework, effective learning with technology requires a balanced understanding of content, pedagogy, and technological tools. In the context of the Adiwiyata program, using digital tools not only reduces paper usage but also strengthens students' digital literacy, a critical skill in today's world (Aleman-Saravia and Deroncele-Acosta, 2021; Kacoroski et al., 2016). Together, the constructivist theory and TPACK framework reinforce the importance of combining practical experience with technology to promote meaningful, future-oriented environmental education.

The overall environmental literacy result showed a score of 76.4, which represents the combined value of all components of environmental literacy, namely knowledge, attitude, and pro-environmental behavior. This score indicates that, in general, students' level of environmental literacy falls into the relatively high category. This means that although there are weaknesses in certain aspects, such as knowledge of students, they demonstrate a fairly strong level of engagement and awareness regarding environmental issues. The score serves as an indication that environmental Education efforts have had a positive impact. However, further reinforcement is needed in weaker areas to achieve a more optimal level of environmental literacy.

The correlation test results show the relationship between four variables, Knowledge (X1), Pro-Environmental Attitude (X2), Pro-Environmental Behavior (Y), and Environmental Literacy (Z) described in Table 3.

Table 3. Correlation Results Among Environmental Literacy Domains

Correlations		Knowledge (X1)	Pro-environmental attitude (X2)	Pro-environmental behavior (Y)	Environmental literacy (Z)
Knowledge (X1)	Pearson Correlation	1	.284	.260	.553**
	Sig. (2-tailed)		.053	.078	.000
	N	47	47	47	47
Pro-environmental attitude (X2)	Pearson Correlation	.284	1	.067	.790**
	Sig. (2-tailed)	.053		.657	.000
	N	47	47	47	47
Pro-environmental behavior (Y)	Pearson Correlation	.260	.067	1	.630**
	Sig. (2-tailed)	.078	.657		.000
	N	47	47	47	47
Environmental literacy (Z)	Pearson Correlation	.553**	.790**	.630**	1
	Sig. (2-tailed)	.000	.000	.000	
	N	47	47	47	47

****.** Correlation is significant at the 0.01 level (2-tailed).

The results of the Pearson correlation analysis, as shown in Table 3, indicate that there is a significant relationship among the three domains of environmental literacy (knowledge, pro-environmental attitude, and pro-environmental behavior) and overall environmental literacy. Firstly, there is a significant correlation between environmental knowledge (X1) and environmental literacy (Z), with a correlation coefficient of $r = 0.553$ and $p = 0.000$. This suggests that the higher an individual's environmental knowledge, the higher their level of environmental literacy. However, the correlations between knowledge and pro-environmental attitude (X2) ($r = 0.284$; $p = 0.053$) and between knowledge and pro-environmental behavior (Y) ($r = 0.260$; $p = 0.078$) are not statistically significant at the 95% confidence level. This means that increased knowledge does not always directly impact improvements in attitudes or behavior toward the environment. These results indicate that pro-environmental attitudes and actions do not automatically develop simply because someone has environmental knowledge. Knowledge is only one of many complex factors that influence environmental behavior, such as social norms, emotional involvement, and perceptions of behavioral control (Frick et al., 2004; Geiger et al., 2019).

Furthermore, the most notable result is the correlation between pro-environmental attitude (X2) and environmental literacy (Z), which shows a very strong and significant correlation ($r = 0.790$; $p = 0.000$). This indicates that a positive attitude toward the environment is a crucial predictor in shaping overall environmental literacy. However, the correlation between attitude and pro-environmental behavior ($r = 0.067$; $p = 0.657$) is not significant, suggesting that a positive attitude does not always manifest in real-life pro-environmental actions.

This occurs because perceived behavioral control is a key factor that causes positive attitudes toward the environment, which are not always followed by concrete actions. Even though someone may want to behave in an environmentally friendly manner, they may feel that they lack the ability, time, money, or knowledge to do so. This is in line with Ajzen's Theory of Planned Behavior (1991), which states that perceptions of control over actions greatly influence a person's decision to act. For example, someone who understands the

importance of recycling and wants to do so may be hindered by a lack of access to recycling facilities in their environment. In addition, social and cultural norms also play a major role in shaping behavior. Often, individual actions are more influenced by social expectations than personal values. When the surrounding environment does not exhibit pro-environmental behavior, a person may feel reluctant to stand out. For example, an individual who wants to reduce plastic use may feel awkward bringing their food containers if those around them are not doing the same. The norms prevailing in a community can act as a barrier to the implementation of environmental values in daily life.

In addition, the correlation between pro-environmental behavior (Y) and environmental literacy (Z) is also significant, with a correlation coefficient of $r = 0.630$; $p = 0.000$, indicating that tangible actions to support environmental sustainability are an essential component of environmental literacy competence. Action competence in environmental literacy emphasizes that understanding and positive attitudes alone are not enough—learners or individuals must be able to take concrete and effective steps to address environmental issues. Thus, true environmental literacy, according to Roth, is not just about “knowing” and “caring,” but also about “acting” (Roth, 1992). Overall, these findings affirm that while knowledge is important, attitude and behavior contribute more significantly to the development of environmental literacy.

Conclusion

Based on the research findings, the level of environmental literacy among students in Adiwiyata schools is generally categorized as high, with a total score of 76.4%. However, there is a noticeable imbalance among the literacy domains: environmental knowledge remains very low (16.1), while environmental attitudes (81.6) and pro-environmental behavior (74.3) fall within the high category. This indicates that although students demonstrate considerable concern and positive behavior toward the environment, their foundational knowledge of environmental concepts and issues is still insufficient. This discrepancy suggests that the success of the Adiwiyata program has not fully addressed the cognitive aspect of student development. Therefore, a more comprehensive educational approach is needed, particularly in strengthening students' conceptual understanding of environmental issues. A constructivist-based learning strategy, integrated with digital technology through the TPACK framework, may offer a solution to address this gap. By combining real-world experiences with digital-based learning, students are not only taught to care and act. However, they are also guided to understand the environmental challenges faced by the world today deeply. The results of the correlation analysis show that environmental knowledge has a significant relationship with overall environmental literacy, but does not directly influence pro-environmental attitudes or behaviors. This finding confirms that positive attitudes toward the environment are not always manifested in concrete actions, due to various factors such as perceived behavioral control and social norms. Pro-environmental attitudes have the strongest relationship with environmental literacy, while concrete actions toward the environment are also proven to be an important component in forming comprehensive environmental literacy. Therefore, true environmental literacy encompasses not only cognitive and affective aspects, but also concrete and effective action competencies.

References

- Afrianda, R., Yolida, B. and Marpaung, R. R. (2019). Pengaruh program adiwiyata terhadap literasi lingkungan dan sikap peduli lingkungan. *Jurnal Bioterdidik*, 7(1), 32–42. [https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/10.1016/0749-5978(91)90020-T)
- Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, 50(2), 179–211. pp. [https://doi.org/https://doi.org/10.1016/0749-5978\(91\)90020-T](https://doi.org/https://doi.org/10.1016/0749-5978(91)90020-T)
- Aleman-Saravia, A. C. and Deroncele-Acosta, A. (2021). Technology, pedagogy and content (TPACK framework): Systematic literature review. *Proceedings - 2021 16th Latin American Conference on Learning Technologies, LACLO 2021*, 104–111. pp. <https://doi.org/10.1109/LACLO54177.2021.00069>
- Anggraini, W. and Karyanto, P. (2019). School and teachers' role to empowerment of environmental literacy in prominent middle school based on adiwiyata program. *Journal of Physics: Conference Series*, 1233(1). <https://doi.org/10.1088/1742-6596/1233/1/012084>
- Annan-Diab, F. and Molinari, C. (2017). Interdisciplinarity: Practical approach to advancing education for sustainability and for the Sustainable Development Goals. *The International Journal of Management Education*, 15(2), 73–83. <https://doi.org/10.1016/j.ijme.2017.03.006>
- Azhar, A., Basyir, M. D. and Alfitri, A. (2016). Hubungan pengetahuan dan etika lingkungan dengan sikap dan perilaku menjaga kelestarian lingkungan. *Jurnal Ilmu Lingkungan*, 13(1), 36. p. <https://doi.org/10.14710/jil.13.1.36-41>
- Bahrudin, M. D. F. (2017). Pelaksanaan program adiwiyata dalam mendukung pembentukan karakter peduli lingkungan di SMA Negeri 4 Pandeglang. *Jurnal Pendidikan Geografi*, 17(1), 25–37. <https://doi.org/10.17509/gea.v17i1.5954.g4719>
- Bergman, B. G. (2016). Assessing impacts of locally designed environmental education projects on students' environmental attitudes, awareness, and intention to act. *Environmental Education Research*, 22(4), 480–503. <https://doi.org/10.1080/13504622.2014.999225>
- Buchanan, J., Pressick-Kilborn, K. and Maher, D. (2019). Promoting environmental education for primary school-aged students using digital technologies. *Eurasia Journal of Mathematics, Science and Technology Education*, 15(2). <https://doi.org/10.29333/ejmste/100639>
- Burchett, J. H. (2015). *Environmental literacy and its implications for effective public policy formation*. Baker Scholar Projects. https://trace.tennessee.edu/utk_bakerschol/27
- Casmana, A. R., Dewantara, J. A., Timoera, D. A., Kusmawati, A. P. and Syafrudin, I. (2023). Global citizenship: preparing the younger generation to possess pro-environment behavior, mutual assistance and tolerance awareness through school engagement. *Globalisation, Societies and Education*, 21(1), 15–32. <https://doi.org/10.1080/14767724.2021.2013167>
- Chieu, V. M., Milgrom, E. and Frenay, M. (2004). Constructivist learning: Operational criteria for cognitive flexibility. *Proceedings - IEEE International Conference on Advanced Learning Technologies, ICALT 2004*, 221–225. <https://doi.org/10.1109/icalt.2004.1357407>
- Dasrita Zulfan; Amin, Bintal; Siregar, Yusni Ikhwan, Y. S. (2015). Kesadaran lingkungan siswa sekolah Adiwiyata. *Dinamika Lingkungan*, 2 (1), 61–64. <https://doi.org/10.31258/dli.2.1.p.61-64>
- Desfandi, M., Maryani, E. and Disman, D. (2019). Implementation of Adiwiyata Program in the effort to create environmental cultured school in Banda Aceh. *Sumatra Journal of Disaster, Geography and Geography Education*, 3(2), 1–8. <https://doi.org/10.24036/sjdge.v3i2.205>
- Effendi, M. I., Sugandini, D., Sukarno, A., Kundarto, M. and Arundati, R. (2020). The theory of planned behavior and pro-environmental behavior among students. *Journal of Environmental Management and Tourism*, 11(1), 35–43. pp. [https://doi.org/10.14505/jemt.v11.1\(41\).05](https://doi.org/10.14505/jemt.v11.1(41).05)
- Faizah, H. and Kamal, R. (2024). Jurnal basicedu. *Jurnal Basicedu*, 8(1), 466–467. pp. <https://journal.uui.ac.id/ajie/article/view/971>
- Frick, J., Kaiser, F. G. and Wilson, M. (2004). Environmental knowledge and conservation behavior: Exploring prevalence and structure in a representative sample. *Personality and Individual Differences*, 37(8), 1597–1613. pp. <https://doi.org/10.1016/j.paid.2004.02.015>
- Geiger, S. M., Geiger, M. and Wilhelm, O. (2019). Environment-specific vs. general knowledge and their

- role in pro-environmental behavior. *Frontiers in Psychology*, 10(APR). <https://doi.org/10.3389/fpsyg.2019.00718>
- Goldman, D., Yavetz, B. and Pe'er, S. (2014). Student teachers' attainment of environmental literacy in relation to their disciplinary major during undergraduate studies. *International Journal of Environmental and Science Education*, 9(4), 369–383. <https://doi.org/10.12973/ijese.2014.222a>
- Gralton, A., Sinclair, M. and Purnell, K. (2004). Changes in attitudes, beliefs and behaviour: a critical review of research into the impacts of environmental education initiatives. *Australian Journal of Environmental Education*, 20(2), 41–52. pp. <https://doi.org/10.1017/S0814062600002196>
- Hayati, R. S. (2020). Pendidikan lingkungan berbasis experiential learning untuk meningkatkan literasi lingkungan. *Humanika: Kajian Ilmiah Mata Kuliah Umum*, 20(1), 63–82. <https://doi.org/10.21831/hum.v20i1.29039>
- Hua, Y. and Mi, J. (2023). Will attitudes corrected by social norms have a more powerful impact on pro-environmental behavior? Evidence from a process model moderated by self-construal. *Journal of Environmental Management*, 345. <https://doi.org/10.1016/j.jenvman.2023.118603>
- Igei, K., Kurokawa, H., Iseki, M., Kitsuki, A., Kurita, K., Managi, S., Nakamuro, M. and Sakano, A. (2024). Synergistic effects of nudges and boosts in environmental education: Evidence from a field experiment. *Ecological Economics*, 224. <https://doi.org/10.1016/j.ecolecon.2024.108279>
- Indrawan, I. P. O., Lepiyanto, A., Juniari, N. W. M., Intaran, I. N. and Sri, A. A. I. R. (2022). Penumbuhan literasi lingkungan di sekolah dasar. *Jurnal Ilmiah Pendidikan Profesi Guru*, 5(1), 21–31. pp. <https://doi.org/10.23887/jippg.v5i1.47385>
- Iskandar, Z. (2013). Psikologi lingkungan: metode dan aplikasi. Bandung: Refika Aditama.
- Jaime, M., Salazar, C., Alpizar, F. and Carlsson, F. (2023). Can school environmental education programs make children and parents more pro-environmental? *Journal of Development Economics*, 161. <https://doi.org/10.1016/j.jdeveco.2022.103032>
- Jannah, M., Halim, L., Meerah, T. S. M. and Fairuz, M. (2013). Impact of environmental education kit on students' environmental literacy. *Asian Social Science*, 9(12 SPL ISSUE), 1–12. pp. <https://doi.org/10.5539/ass.v9n12p1>
- Kacoroski, J., Liddicoat, K. R. and Kerlin, S. (2016). Children's use of iPads in outdoor environmental education programs. *Applied Environmental Education and Communication*, 15(4), 301–311. pp. <https://doi.org/10.1080/1533015X.2016.1237903>
- Kamil, P. A., Putri, E., Ridha, S., Utaya, S. and Utomo, D. H. (2020). Promoting environmental literacy through a green project: A case study at adiwiyata school in Banda Aceh City. *IOP Conference Series: Earth and Environmental Science*, 485(1). <https://doi.org/10.1088/1755-1315/485/1/012035>
- Kang, L. O., Brian, S. and Ricca, B. (2010). Constructivism in pharmacy school. *Currents in Pharmacy Teaching and Learning*, 2(2), 126–130. pp. <https://doi.org/10.1016/j.cptl.2010.01.005>
- Liu, S.-Y., Yeh, S.-C., Liang, S.-W., Fang, W.-T. and Tsai, H.-M. (2015). A national investigation of teachers' environmental literacy as a reference for promoting environmental education in Taiwan. *The Journal of Environmental Education*, 46(2), 114–132. <https://doi.org/10.1080/00958964.2014.999742>
- Maddox, P., Doran, C., Williams, I. D. and Kus, M. (2011). The role of intergenerational influence in waste education programmes: The THAW project. *Waste Management*, 31(12), 2590–2600. pp. <https://doi.org/10.1016/j.wasman.2011.07.023>
- McBeth, W. and Volk, T. (2009). The national environmental literacy project: A baseline study of middle grade students in the United States. *Journal of Environmental Education*, 41(1), 55–67. pp. <https://doi.org/10.1080/00958960903210031>
- Megawati, S., Niswah, F., Mahdiannur, M. A. and Segara, N. B. (2022). A-G-I-L scheme as social system to build characters caring for the environment through the Adiwiyata program. *IOP Conference Series: Earth and Environmental Science*, 950(1). <https://doi.org/10.1088/1755-1315/950/1/012070>
- Megawati, S., Yusriadi, Y., Rahaju, T., Kurniawan, B., Mahdiannur, M. A. and Hidayat, M. F. (2023). Adiwiyata green school program implementation analysis: a portrait from the elementary schools in Surabaya, Indonesia. *Journal of Namibian Studies: History Politics Culture*, 33, 508–531. <https://doi.org/10.1088/1755-1315/950/1/012070>
- Mitarlis, Ibnu, S., Rahayu, S. and Sutrisno. (2017). Environmental literacy with green chemistry oriented in 21st century learning. *AIP Conference Proceedings*, 1911(December 2017).

- <https://doi.org/10.1063/1.5016013>
- Mukminin, A., Iain, A.-A., Thahah, S. and Jambi, S. (2014). *Strategi Pembentukan Karakter Peduli Lingkungan Di Sekolah Adiwiyata Mandiri*. XIX XIX(02), 227–252. <http://etheses.uin-malang.ac.id/55072/>.
- Munawar, S., Heryanti, E. and Miasryah, M. (2019). Hubungan pengetahuan lingkungan hidup dengan kesadaran lingkungan pada siswa sekolah Adiwiyata. *LENSA (Lentera Sains): Jurnal Pendidikan IPA*, 9(1), 22–29. pp. <https://doi.org/10.24929/lensa.v1i1.58>
- Mustofa, A. and Sueb, S. (2023). Analysis of environmental literacy and awareness to maintain environmental sustainability. *Edubiotik: Jurnal Pendidikan, Biologi Dan Terapan*, 8(01), 50–61. pp. <https://doi.org/10.33503/ebio.v8i01.2528>
- Nasution, R. (2016). Analisis kemampuan literasi lingkungan siswa SMA kelas X di Samboja dalam pembelajaran Biologi. *Proceeding Biology Education Conference*, 13(1), 352–358. <https://jurnal.uns.ac.id/prosbi/article/view/5746/5110>
- O'Neil, J. M., Newton, R. J., Bone, E. K., Birney, L. B., Green, A. E., Merrick, B., Goodwin-Segal, T., Moore, G. and Fraioli, A. (2020). Using urban harbors for experiential, environmental literacy: Case studies of New York and Chesapeake Bay. *Regional Studies in Marine Science*, 33. <https://doi.org/10.1016/j.rsma.2019.100886>
- Pahru, S., Akbar, S. and Hitipeuw, I. (2021). Pelaksanaan program adiwiyata dalam mendukung pembentukan karakter peduli lingkungan. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, 6(1), 119. p. <https://doi.org/10.17977/jptpp.v6i1.14405>
- Prasetyo, W. H., Ishak, N. A., Basit, A., Dewantara, J. A., Hidayat, O. T., Casmana, A. R. and Muhibbin, A. (2020). Caring for the environment in an inclusive school: The Adiwiyata Green School program in Indonesia. *Issues in Educational Research*, 30(3), 1040–1057. <https://search.informit.org/doi/pdf/10.3316/informit.465358475799997>
- Prastyo, I. S. and Hartono. (2020). Jurnal phenomenon. *Phenomenon*, 10(1), 25–35. <https://doi.org/10.21580/phen.2020.10.1.6854>
- Rachmawati, N., Supena, A., Yarmi, G. and RudiCasmana, A. (2022). Analysis of hybrid learning for students with learning disabilities in primary schools providing inclusive education. *Qualitative Report*, 27(10). <https://doi.org/10.46743/2160-3715/2022.5432>
- Rahman, H. and Patilaiya, H. La. (2018). Pemberdayaan masyarakat melalui penyuluhan perilaku hidup bersih dan sehat untuk meningkatkan kualitas kesehatan masyarakat. *JPPM (Jurnal Pengabdian Dan Pemberdayaan Masyarakat)*, 2(2), 251. p. <https://doi.org/10.30595/jppm.v2i2.2512>
- Rieckmann, M. (2017). *Education for sustainable development goals: Learning objectives*. UNESCO publishing. <https://doi.org/10.54675/CGBA9153>
- Rotari, S. (2017). Peran program adiwiyata mandiri dalam meningkatkan kepedulian lingkungan peserta didik. *Citizenship Jurnal Pancasila Dan Kewarganegaraan*, 5(1), 42. p. <https://doi.org/10.25273/citizenship.v5i1.1177>
- Roth, C. E. (1992). *Environmental literacy: Its roots, evolution, and directions in the 1990s*. ERIC Clearinghouse for Science, Mathematics, and Environmental Education. <https://eric.ed.gov/?id=ED348235>
- Samidjo, G. S., Widodo, A. S., Kusumastuti, L. and Suryadin, A. (2023). Literasi lingkungan melalui pendidikan di MTs Muhammadiyah Gantung Belitung Timur, Bangka Belitung. *Warta LPM*, 26(2), 184–196. pp. <https://doi.org/10.23917/warta.v26i2.1437>
- Saribas, D., Kucuk, Z. D. and Ertepinar, H. (2017). Implementation of an environmental education course to improve pre-service elementary teachers' environmental literacy and self-efficacy beliefs. *International Research in Geographical and Environmental Education*, 26(4), 311–326. <https://doi.org/10.1080/10382046.2016.1262512>
- Silva, I. S., Cunha-Saraiva, F., Ribeiro, A. S. and Bártolo, A. (2023). Exploring the acceptability of an environmental education program for youth in rural areas: ECOCIDADANIA project. *Education Sciences*, 13(10). <https://doi.org/10.3390/educsci13i100982>
- Suprpto, S. and Arda, D. (2021). Pemberdayaan masyarakat melalui penyuluhan perilaku hidup bersih dan sehat meningkatkan derajat kesehatan masyarakat. *Jurnal Pengabdian Kesehatan Komunitas*, 1(2), 77–87. <https://doi.org/10.25311/jpkk.Vol1.Iss2.957>
- Szczytko, R., Stevenson, K., Peterson, M. N., Niefeld, J. and Strnad, R. L. (2019). Development and validation of the environmental literacy instrument for adolescents. *Environmental Education*

- Research*, 25(2), 193–210. pp. <https://doi.org/10.1080/13504622.2018.1487035>
- Tafrova-Grigorova, A. (2016). Historical roots and developmentm of constructivism. *Chemistry*, 25(1), 75–106. pp. <https://www.scopus.com/inward/record.uri?eid=2-s2.0-84959420814&partnerID=40&md5=a85dc81b7ad4888927406bfa830d32fd>
- Too, L. and Bajracharya, B. (2015). Sustainable campus: engaging the community in sustainability. *International Journal of Sustainability in Higher Education*, 16(1), 57–71. pp.
- Wardani, D. N. K. (2020). Analisis implementasi program adiwiyata dalam membangun karakter peduli lingkungan. *Southeast Asian Journal of Islamic Education Management*, 1(1), 60–73. <https://doi.org/10.21154/sajiem.v1i1.6>.
- Zidny, R., Sjöström, J. and Eilks, I. (2020). A multi-perspective reflection on how indigenous knowledge and related ideas can improve science education for sustainability. *Science & Education*, 29(1), 145–185. <https://doi.org/10.1007/s11191-019-00100-x>