REVIEW ARTICLE

Profile, challenge, and opportunity of environmental literacy research in Indonesia: A systematic literature review

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Abstract: Systematic overview of environmental literacy research in Indonesia is a crucial aspect for determining effective strategies for strengthening environmental literacy, unfortunately, this is not widely available, especially regarding research published in Indonesia. This research aims to reveal the profile, challenges, and opportunities for strengthening environmental literacy in Indonesia. SLR was used in this research by analyzing 36 articles that met the requirements collected from journals registered by Sinta in 10 years. The articles were then analyzed using a content analysis observation sheet. This research showed fluctuations and stagnation in the number of publications. Variations in design, subjects, instruments, and data analysis techniques are also revealed. Important research results also provide interesting findings in environmental literacy profiles, types of schools, and educational curricula. Based on this, researchers in Indonesia have the challenge of increasing the number of environmental literacy research published in Indonesia. This challenge becomes an opportunity to conduct qualitative and mixed-method research involving students at various education levels. Triangulation data analysis is also important. Furthermore, implementing the Adiwiyata curriculum and innovative learning using local wisdom has the potential to strengthen students' environmental literacy. This research provides an overview for other researchers to formulate effective strategies to improve environmental literacy.

Keywords: challenges; environmental literacy; opportunities; profile; Indonesia

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Introduction

Environmental literacy is integrated knowledge, attitudes, and behavior to prevent and solve environmental problems (Kaya & Elster, 2019). It is also one of the most important aspects of efforts to achieve Sustainable Development Goals (SDGs). Hollweg et al. (2011) divide environmental literacy into four domains, namely knowledge, attitudes, cognitive skills, and behavior. By being environmentally literate, a person will have these four domains to improve the welfare of individuals, communities, and the global environment (Kaya & Elster, 2019) so that environmental sustainability in the future can be maintained. Therefore, strengthening environmental literacy, one of which is through environmental education, really needs to be done systemically and sustainably.

Considering the urgency of environmental literacy for life sustainability and balance, various environmental literacy studies have been carried out in various countries. In China, Clayton et al. (2019) conducted research on the influence of learning experiences in nature on students' environmental literacy levels. The research recommends that environmental education should be based on students' closeness to nature. Goulgouti et al. (2019) conducted research on environmental literacy levels in Greece. The research revealed that the level of environmental literacy of prospective teachers in Greece

varies in each domain. Kidman and Casinader (2019) conducted research in Australia which showed that teachers' environmental literacy was influenced by their inquiry abilities in the learning process. Research Veisi et al. (2019) conducted in Iran shows that environmental literacy, especially in the knowledge domain, still needs to be improved.

Specifically in Indonesia, various studies have been carried out to strengthen environmental literacy through education. The Education for Environmental Sustainable Development (EESD) approach is seen as capable of increasing students' environmental literacy (Wilujeng et al., 2019). Lubis et al. (2022) apply Problem-based Learning (PBL) based on local wisdom that is oriented toward socio-scientific issues. This research revealed that the treatment provided had a positive impact on students' environmental literacy. Likewise, the implementation of student worksheets based on PBL and local wisdom showed similar results (Suryawati et al., 2020). Furthermore, efforts to implement guided inquiry-based modules (Amiroh et al., 2021), integration of learning material with environmental pollution topics (Suryanti et al., 2018), and green project-based learning (Kamil et al., 2020) are also able to increase students' environmental literacy.

With the various efforts that have been made to strengthen environmental literacy, in fact, variations in environmental literacy levels have been found in various regions in Indonesia. The environmental literacy of students in West Sumatra (Putra et al., 2021) and Yogyakarta (Yasaroh et al., 2023) is in the high category. Santoso et al. (2021) found that the environmental literacy level of students in Central Java, Indonesia was in the adequate category but the cognitive skills were still in the low category. Similar things were revealed by Aini et al. (2021) and Pangestu et al. (2023) who conducted research in East Java. Meanwhile, in Bali, Hermawan et al. (2022) found different results where students' environmental literacy in Bali, Indonesia was in the medium category. It was also revealed that environmental literacy empowerment has not been carried out in an integrated domain, which is shown by the absence of a significant correlation between the knowledge and attitude domains. This finding is supported by Miftahuddin et al. (2023) who stated that students' environmental literacy in West Kalimantan is in the medium category. It is further explained that the cognitive skills domain has a low category.

The various research results presented previously show that several efforts have been made to reveal the profile and strengthen environmental literacy with varying results. There are positive results regarding the level of environmental literacy. However, if we look at each environmental literacy domain in detail, we will see that there are weaknesses in strengthening environmental literacy in Indonesia. These weaknesses can also be factually confirmed by the still high level of environmental pressure due to the development of the human population. Currently, the world is experiencing a very rapid increase in global population over the last decade, especially in developing countries (Choudhary et al., 2020), including Indonesia. This increase has an impact on decreasing the Earth's carrying capacity and increasing pressure on an environment that is prone to exploitation. As evidence of these concerns, climate change is increasingly negatively impacting all life on Earth (Abbass et al., 2022). In addition, ongoing pressure on the environment will make it easier for disease pandemics to occur in the future as a continuation of the COVID-19 pandemic.

Research results and factual findings in the field show that the environmental literacy of Indonesian society still needs to be improved with appropriate and effective strategies. One way to formulate appropriate and effective strategies can be done through the education sector. The first step in this effort can be taken by systematically exploring the environmental literacy research in Indonesia. Efforts to systematically explore environmental literacy research have been carried out previously by Husamah et al. (2024). The research reveals important findings in global environmental literacy research. The Scopus database was used to collect articles for this research. Unfortunately, similar research that focuses on analyzing environmental literacy research with specific databases in Indonesia has not been carried out holistically. Specific exploration with databases in Indonesia needs to be carried out to describe environmental literacy research conducted in Indonesia. This research will strengthen previous research because not all Indonesian researchers publish their work in journals included in the Scopus database. Therefore, this research aims to systematically explore environmental literacy research published in Indonesia. This research will lead to exploring the profile, challenges, and opportunities for strengthening environmental literacy in Indonesia. This will then provide an existing condition for other researchers, both national and international, to conduct environmental literacy research in Indonesia with various variables.

Method

This is a Systematic Literature Review (SLR). SLR aims to collect evidence to answer predetermined questions (Pollock & Berge, 2018). This process involves identifying, evaluating, and critically analyzing activities of various information that is available to answer predetermined research questions (Snyder, 2019). The five stages of this research are: 1) question formulation, 2) locating studies, 3) study selection and evaluation, 4) analysis and synthesis, and 5) reporting and using the results.

The first stage was carried out to formulate the focus of the environmental literacy research articles that

would be reviewed. At this stage the research question (RQ) is formulated which consists of RQ1: What is the trend in the number of environmental literacy research published in Indonesia? RQ2: What are the trends in environmental literacy research design in Indonesia? RQ3: What are the trends in environmental literacy research subjects in Indonesia? RQ4: What are the trends in environmental literacy research instruments in Indonesia? RQ5: What are the trends in environmental literacy research data analysis techniques in Indonesia? RQ6: What are the important results of the profile, challenges, and opportunities for further environmental literacy research in Indonesia?

The second stage was carried out to obtain relevant research articles related to the problem formulation that had been prepared. This process begins with determining the database, the publication period of the research article, and determining research keywords. Previous research conducted by Husamah et al. (2024) used the Scopus database. Meanwhile, this research uses the Science and Technology Index (Sinta) database. Sinta is an indexation database for scientific publications in Indonesia which can be accessed on the page https://sinta.kemdikbud.go.id/journals. Apart from complementing previous research, the selection of the Sinta database aims to obtain environmental literacy research data that is specific to Indonesia and carried out by Indonesian researchers. In addition, the research of Husamah et al. (2024) also indicated that not much environmental literacy research by Indonesian researchers has been published in journals with the Scopus database further strengthening the choice of the Sinta database in this research to get a broader picture of environmental literacy research in Indonesia.

This research was conducted in May-September 2023. The period used is ten years starting from January 2012 to December 2022. This was done to obtain broader and more representative information regarding the problems formulated. From all journals registered with Sinta, the scope of the relevant journal is selected. The selection was made using several keywords, namely: *"pendidikan biologi"*, "biology education", *"pembelajaran biologi"*, "biology learning", *"pendidikan IPA"*, *"pendidikan sains"*, "science education", *"pembelajaran IPA"*, "science learning", *"pendidikan lingkungan"*, and "environmental education".

After finding relevant journals, in the third stage research articles are selected according to the established criteria. The criteria used are: 1) the research article contains the keyword *"literasi lingkungan"* or "environmental literacy" in the title, 2) the article contains the relationship between environmental literacy and education, 3) the full research paper can be accessed, and 4) the article is written in Indonesian or English. Based on the established criteria, 36 articles were found which will then be analyzed. The flow of article selection uses the PRISMA model as shown in Figure 1.

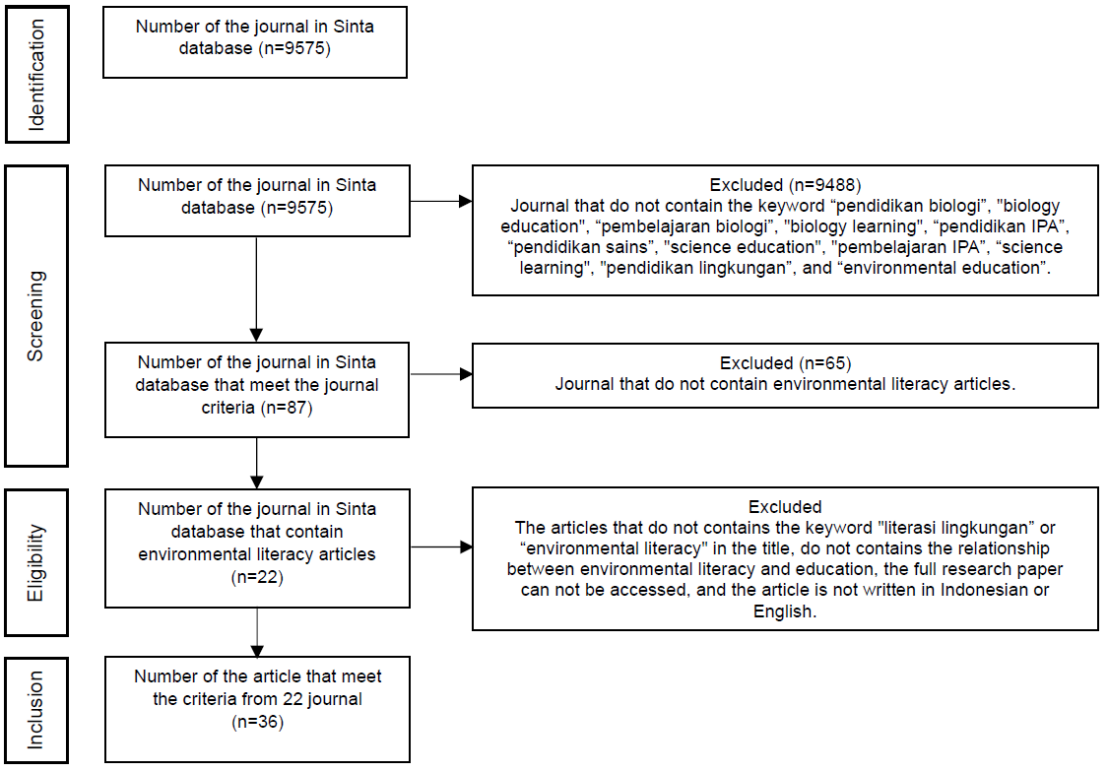

Figure 1. The PRISMA Model of Article Selection

The instrument used to carry out data analysis is a content analysis observation sheet adapted from

Susetyarini and Fauzi (2020). The instrument consists of five aspects, namely: 1) general research design, 2) quantitative research design, 3) research subjects, 4) research instruments, and 5) data analysis techniques. In this research, aspects of important research results were added. This addition was made due to the need to answer the problem formulation.

Results and Discussion

The research results are described in each RQ including the number of studies, research design, research subjects, research instruments, data analysis techniques, and important research results.

Number of Publication

The research results show that there were no environmental literacy research publications in Indonesia from 2012 to 2016. Environmental literacy research publications in Indonesia began in 2017. The number of environmental literacy research publications from 2017 to 2019 are fluctuating. Meanwhile, the number of publications increased from 2019 to 2021 and stagnated in 2022. Details of the trend in the number of studies are presented in Figure 2.

The findings provide an overview of the sensitivity of researchers and the general public to environmental issues developing in Indonesia. Susetyarini and Fauzi (2020) explained that research is believed to be the most effective way to deal with various issues both currently being faced and in the future. In the context of environmental literacy, environmental literacy research can provide information about challenges and alternative solutions to environmental problems currently and potentially faced in the future.

The 2022 Environmental Performance Index (EPI) places Indonesia in 164th place out of 180 countries in the world (Wolf et al., 2022). EPI is a quantitative indicator that aims to measure a country's environmental performance including economic resources, government, human resources, and regulations aspects to improve environmental sustainability. Based on the EPI report and the urgency of research in dealing with environmental problems, the amount of environmental literacy research in the past 10 years can be categorized as very insufficient. Therefore, it is necessary to increase the number of environmental literacy research in Indonesia published in the registered journal Sinta. Publication in the registered journal Sinta is currently one of the most effective ways to disseminate information because Sinta can be accessed easily, both by the academic community and the general public in Indonesia.

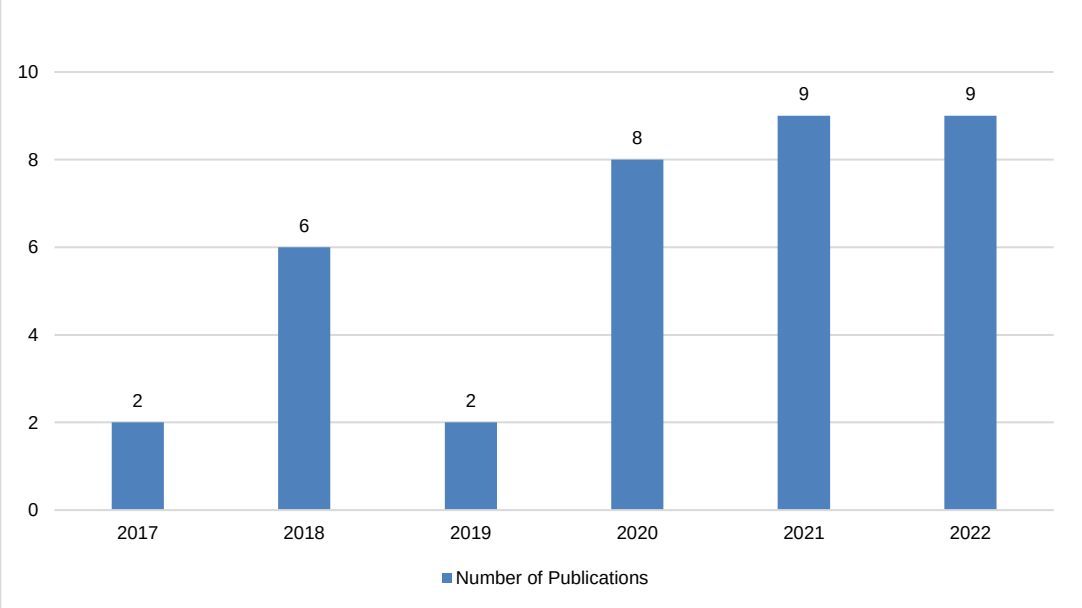

Figure 2. Number of Publications

Research Design

Quantitative research dominates environmental literacy research in the education sector as presented in Figure 3. Meanwhile, not much qualitative and mixed-method research has been carried out. These results are in line with the findings of Aikens et al. (2016) which revealed that quantitative research dominated research on education and environmental sustainability until 2015 in Africa, Central and South

America, Eastern Europe, and Northern and Western Asia. Meanwhile, recent findings also show the same thing that the majority of environmental education research was conducted quantitatively in Turkey, Taiwan, Canada, Philippines, Slovenia, Thailand, Japan, Spain, and Indonesia (Masalimova et al., 2023).

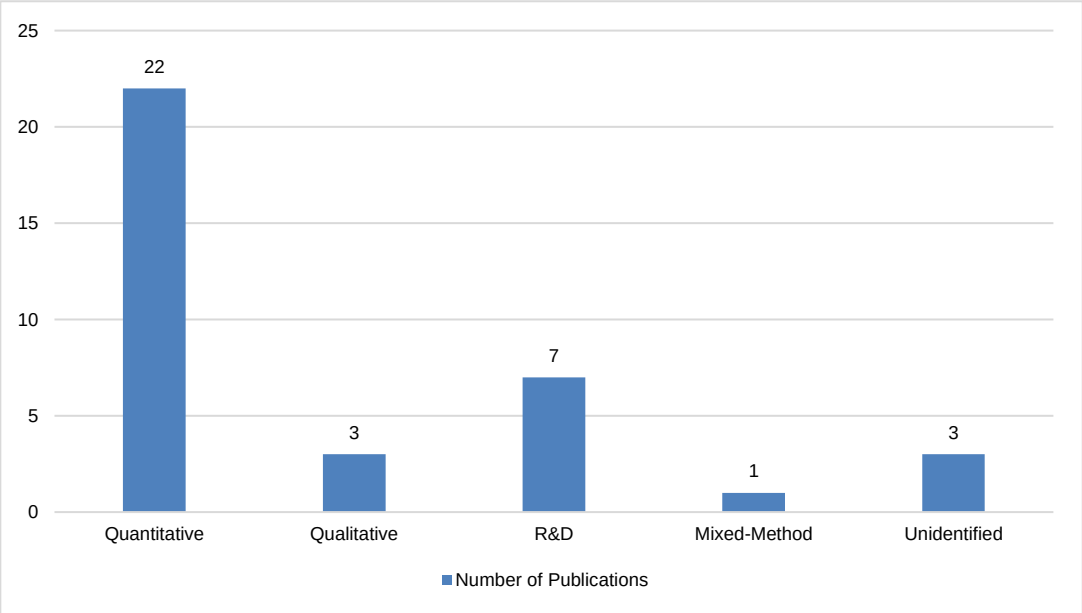

Figure 3. Research Design

The results of this research indicate that environmental literacy research with qualitative designs and mixed methods has the opportunity to be carried out. This research has the potential to reveal in more detail the social, cultural, and political aspects of environmental literacy. This was reinforced by (Lichtman, 2023) who stated that qualitative research is a strong method for conducting research in the education sector. Furthermore, it was also explained that through qualitative research, researchers can expand and deepen the specifics of the variables studied. This can reveal detailed aspects, especially in multicultural countries like Indonesia, that quantitative research cannot reveal.

Of the types of quantitative and Research and Development (R&D) design, survey research designs have the largest number found in environmental literacy research publications as presented in Figure 4. This is suspected because through survey research researchers can photograph, describe, and explain current phenomena in the field (Wagner et al., 2020) so that it can provide an overview of environmental literacy in society. Apart from that, other reasons such as time efficiency and budget are also factors that influence the number of environmental literacy survey research carried out. Furthermore, the cumulative number of R&D designs is close to survey research. This shows that efforts have been made to innovate to empower environmental literacy in Indonesia through the development of learning-related products.

Research Subject

The majority of environmental literacy research subjects involve students from primary, secondary, and higher education levels as presented in Figure 5. In this case, there is also research involving students across educational levels so that. In more detail, students at the high school level dominate as environmental literacy research subjects. Unfortunately, several studies do not clearly state the research subject.

Empowerment of environmental literacy, especially in education, should be carried out among students. In general, students in Indonesia are teenagers who, according to the World Health Organization (WHO), have an age range of 10-19 years. Strengthening environmental literacy which includes all the domains is very effective in this age range. This is because knowledge and attitudes first develop during adolescence (Kågesten & van Reeuwijk, 2021). Strengthening the knowledge domain and environmental literacy attitudes during adolescence will facilitate the development of student's cognitive skills and environmental care behavior. This convenience occurs because the knowledge domain has a positive correlation with cognitive skills and environmental care behavior (Hermawan et al. 2022).

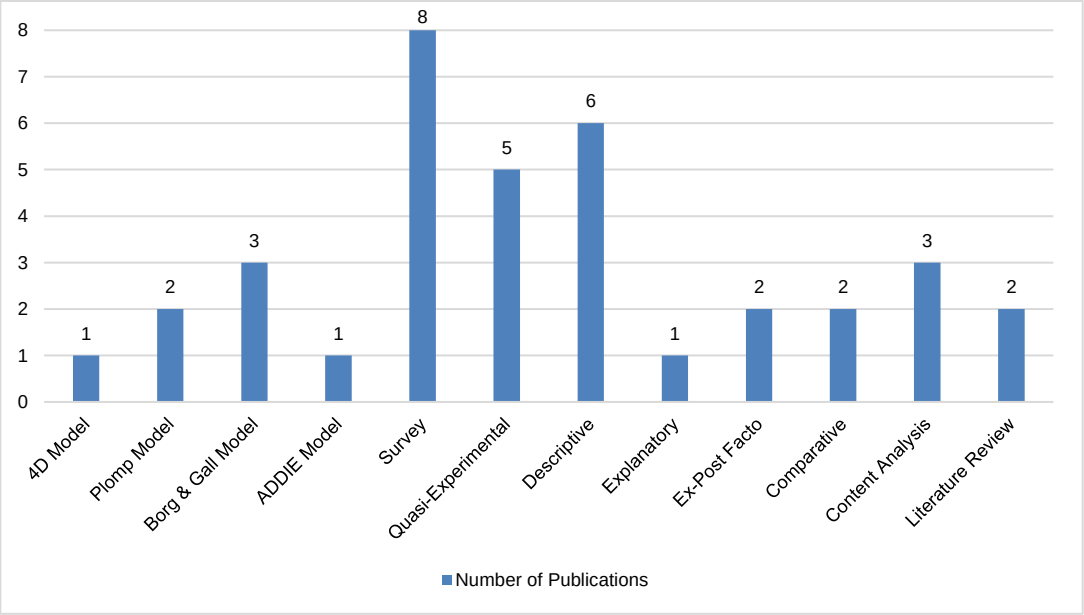

Figure 4. Types of R&D and Quantitative Design

On the other hand, the number of environmental literacy studies involving elementary school students is very small. This is an opportunity to conduct environmental literacy research on elementary school students. Efforts to strengthen environmental literacy in elementary school students are very necessary to support the achievement of sustainable living and environmental balance. Ardoin and Bowers (2020) revealed that environmental education in early childhood provides opportunities for them to explore, build understanding, and foster sensitivity to the environment. Therefore, it is necessary to continue empowering environmental literacy in early childhood and adolescence so that this knowledge, attitudes, skills, and behavior can be carried over into adulthood and even old age.

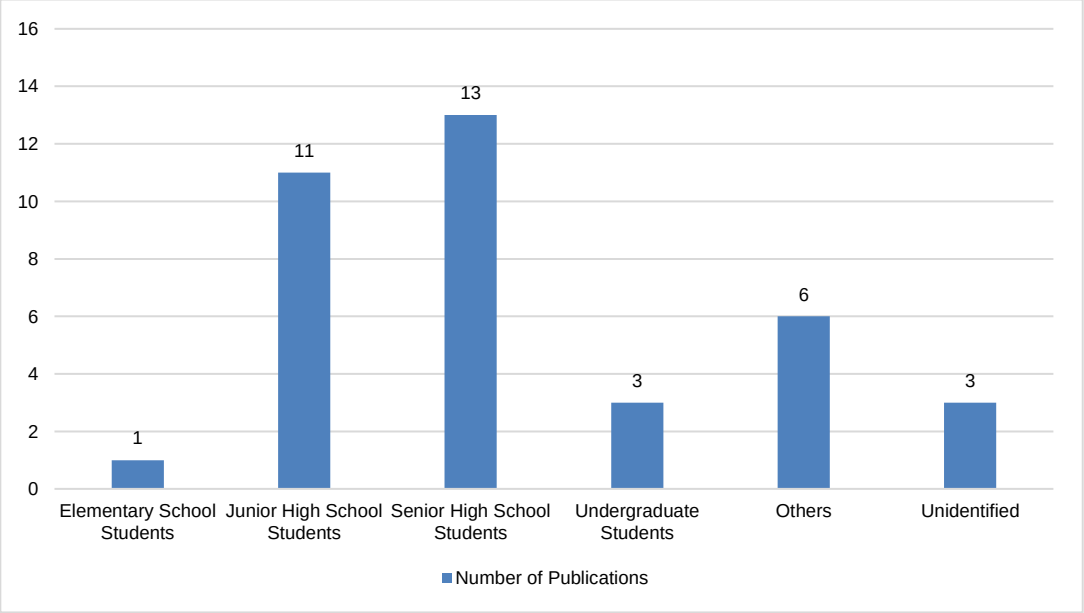

Figure 5. Research Subject

Research Instrument

Research instruments are an important component for researchers to collect research data. The research instrument data used is presented in Figure 6. Some studies use more than one instrument, for example using tests and questionnaires at the same time. Some use tests, questionnaires, and interview sheets in their research. The use of more than one instrument in research shows that the data

collected has various amounts and types. This also provides an overview of the complexity of the research findings that were subsequently revealed. However, some studies do not clearly describe the research instruments used.

Specifically, regarding test instruments and questionnaires, several studies use the Environmental Literacy Instrument (ELI) and the Middle School Environmental Literacy Survey (MSELS). In addition, some researchers independently develop instruments used to collect environmental literacy data. Unfortunately, not all research that develops instruments independently clearly describes the validity and reliability of the instruments used. The validity and reliability of research instruments a crucial aspects of data collection (Ahmed & Ishtiaq, 2021). This needs to be a concern for future research so that it includes the validity and reliability of instruments, especially for research with quantitative designs.

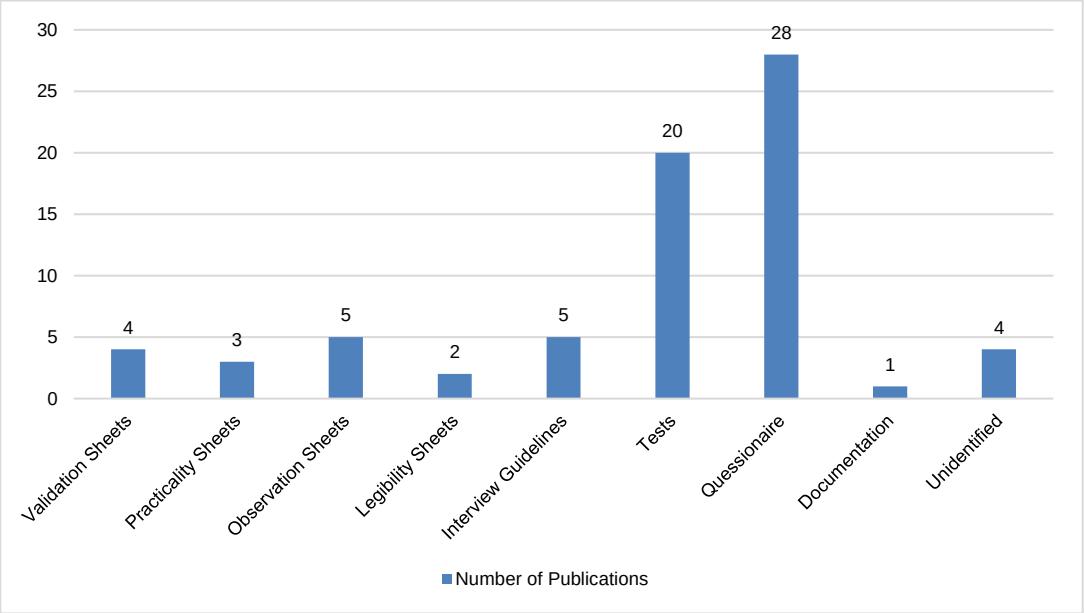

Figure 6. Research Instrument

Research Data Analysis Method

Descriptive data analysis techniques are the most widely used in environmental literacy research followed by using percentages and t-tests as presented in Figure 7. This is in line with the types of research which are dominated by survey, descriptive, quasi-experimental, and R&D. An interesting finding was that most studies used more than one data analysis technique. For example, that simultaneously carries out descriptive analysis, t-test, and n-gain. There is also research that combines ANOVA, t-test, and n-gain. This shows that after obtaining a central tendency regarding data, researchers continue data analysis using inferential statistics to reveal differences in the treatment given both in the quasi-experimental research process and in the context of product implementation as a result of R&D.

In terms of a quasi-experimental design, especially using humans as subjects, it is recommended to use ANCOVA (Susetyarini & Fauzi, 2020). This is because research subjects cannot be completely randomized, especially research subjects involving students so randomization occurs at the class level. In addition, control over human research subjects is difficult. These two things make human research subjects vulnerable to influence from various variables other than the treatment given in the research. By using ANCOVA in these conditions, researchers can control these external variables which can influence the research variables (Susetyarini & Fauzi, 2020). Hedges et al. (2023) explains that ANCOVA can identify differences that occur between groups by paying attention to the corrected average based on the subject's characteristics shown through the pre-test results.

Furthermore, in line with the potential to reveal environmental literacy using mixed-methods designs, data analysis with triangulation needs attention. The social, cultural, and political factors that are very diverse in Indonesia and influence environmental literacy require valid data analysis. This aims to ensure that the conclusions drawn and generalized do not have the potential to be biased. In this case, triangulation techniques help increase the credibility and validity of research conducted by utilizing various data sources for further justification (Bans-Akutey & Tiimub, 2021; Hammerton & Munafò, 2021; Heesen et al., 2019).

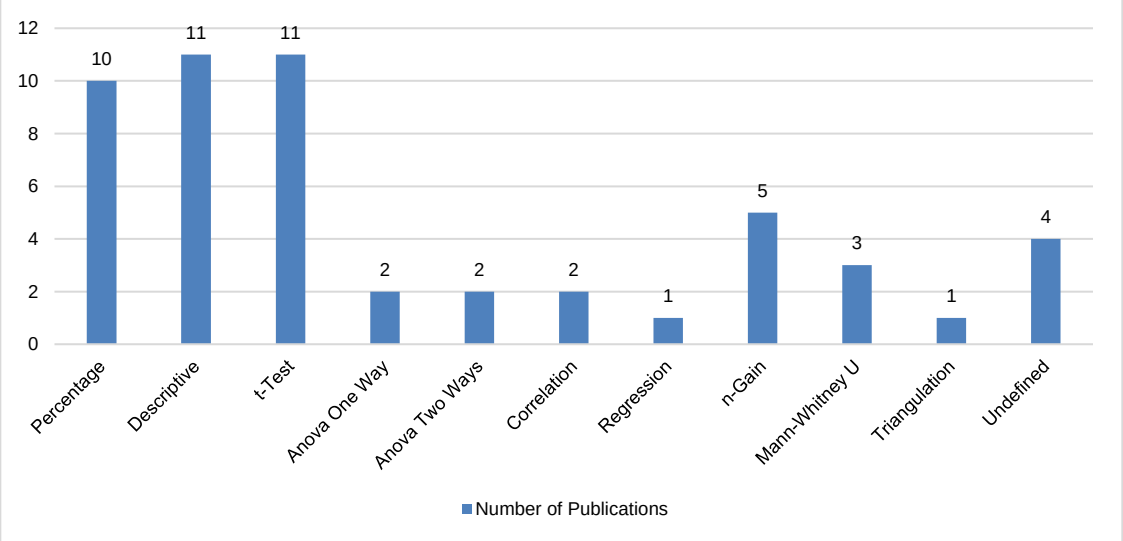

Figure 7. Research Data Analysis Method

Important Results of Profile, Challenges, and Opportunities

Analysis of environmental literacy research results over 10 years in Indonesia shows several important findings as presented in Table 1. These findings are categorized into aspects including environmental literacy profile, type of school, and educational curriculum. The environmental literacy profile in this case includes the level of environmental literacy both overall and for each domain. The profile also includes factors that influence environmental literacy, including gender, self-efficacy, and parental employment. In terms of school type, environmental literacy research in Indonesia reveals the level of environmental literacy in Adiwiyata and non-Adiwiyata schools. Adiwiyata schools are schools that have successfully implemented environmental care and cultural movements (Kementerian Lingkungan Hidup dan Kehutanan Republik Indonesia, 2019). Meanwhile, in the educational curriculum aspect, environmental literacy research in Indonesia focuses on learning models, learning tools, and teaching materials.

The level of environmental literacy in Indonesia shows varying characteristics. The results revealed that research subjects had varied environmental literacy categories ranging from very good to poor. If explored further in each domain of environmental literacy, knowledge, cognitive skills, attitudes and behavior, similar variations were also found. This variation is also strengthened by the inconsistency of categories in each domain. For example, Santoso et al. (2021) revealed that the attitude and behavior domain was categorized as good, knowledge was categorized as sufficient, while cognitive skills were categorized as poor. Yusup (2021) added that the attitude domain was categorized as good, while behavior was categorized as sufficient.

Furthermore, regarding factors influencing environmental literacy, the gender factor reveals various results. Research by Santoso et al. (2020) states that there is no difference in the level of environmental literacy between male and female students. Contradicting this research, Waqidah et al. (2020) revealed that female students have better environmental literacy than male students. Furthermore, a more detailed analysis was carried out by Mardiani et al. (2021) which revealed that there were no significant differences in the domain of knowledge and skills between male and female students, but significant differences occurred in the domain of attitudes and behavior. In line with the gender factor, parental employment factors also reveal different results. There is research that reveals that parents' work has a significant effect on environmental literacy, on the other hand, there is also research that states the opposite. Meanwhile, the self-efficacy factor has a positive correlation with students' environmental literacy.

Different results for the same influencing factor indicate that there are actually other factors that have not been revealed and have an influence on environmental literacy. In this case, Spínola (2021) explains that various political and socio-cultural factors influence environmental literacy. Political and socio-cultural factors have many derivative factors which have not been specifically explored for the past 10 years by researchers who published their research results in Indonesia. Based on this, research opportunities with various approaches to explore various political and socio-cultural factors that influence environmental literacy are wide open. This opportunity is also part of the recommendations of previous research.

From the perspective of school type, all research states that the environmental literacy of students in Adiwiyata schools is higher than students in non-Adiwiyata schools. However, when looking at each domain, there are no significant differences in the knowledge domain between the two types of schools. These findings illustrate that the Adiwiyata program has a positive impact on students' environmental literacy through integrating the concept of environmental care with school activities. This is an important

finding and it would be better if all schools implemented the Adiwiyata curriculum. This should be a special concern for the Indonesian government as part of its environmental education policy. In line with this, Darmawan and Dagamac (2021) stated that education policies should be able to increase students' awareness of environmental problems in Indonesia.

In line with the implementation of the concept of environmental care in schools, some environmental literacy studies analyze the role of educational curricula in increasing environmental literacy. First, it was revealed that innovative learning models have a positive influence on environmental literacy. These learning models are PBL (Mauludah et al., 2018; Siddiq et al., 2020), PjBL (Farida et al., 2017; Suryawati et al., 2020), and BE-RAISE (Hermawan et al., 2022). Apart from that, learning using outdoor learning and virtual laboratory methods is also able to increase students' environmental literacy (Syamsiah et al., 2021). Second, STEM-based student worksheets and modules based on local environmental potential can increase students' environmental literacy (Wahyuni et al., 2022). In terms of culture-based learning and local potential, Sriyati et al. (2022) supports the results of this research by revealing that culture-based teaching materials are quite effective in increasing environmental literacy. Interestingly, Aini's research shows a contradiction by revealing that learning with local content does not have a significant impact on environmental literacy (Aini et al., 2021). These different findings provide opportunities for further research to be carried out with various approaches and methods regarding the influence or relationship between learning with local culture and environmental literacy. This is also something interesting and important to do because Indonesia is a multicultural country.

Table 1. Important Research Result

No.	Authors (Year)	Important Results
1	Saputro & Ardhiansyah (2018); Rosdiana et al. (2020); Ulfah et al. (2020); Husamah et al. (2020); Santoso et al. (2021); Nugraha et al. (2021); Yusup (2021); Hermawan et al. (2022)	Students' environmental literacy and its domains need to be improved.
2	Santoso et al. (2020)	There is no significant difference between the environmental literacy profiles of male and female students.
3	Waqidah et al. (2020)	Female students have higher environmental literacy than male students.
4	Mardiani et al. (2021)	a. The results study showed no significant difference in knowledge and cognitive skills between male and female students, but there were significant differences in attitudes and behavior. b. There was no significant difference in knowledge, attitudes, and cognitive skills between students whose parents work. However, there were significant differences in behavior between students whose parents' jobs were different. c. There is a significant relationship between male students in the aspects of knowledge, attitudes, behavior, and cognitive skills, but not significantly related to female students' behavior. d. There was no significant interaction between male and female students and their parents' different environmental literacy occupations.
5	Wulandari & Sulistiyowati (2017); Waqidah et al. (2020); Herlina et al. (2021)	There are differences in environmental literacy between Adiwiyata and non-Adiwiyata school students.
6	Farida et al. (2017); Mauludah et al. (2018); Nurmayanti & Atun (2018); Siddiq et al. (2020); Suryawati et al. (2020); Syamsiah et al. (2021); Nurwidodo et al. (2021); Hermawan et al. (2022); Angreani et al. (2022)	Innovative learning models and methods increase students' environmental literacy.
7	Kusumaningrum (2018); Susilowati et al. (2018)	Environmental literacy can be grown through science learning that is oriented towards pedagogy for sustainability.
8	Dewi & Listyarini (2022); Nafsih & Usmeldi (2022); Watoni et al. (2022); Rofi'ah & Chusna (2022)	Environment-based modules and e-books increase students' environmental literacy.
9	Wilujeng et al. (2019); Hekmah et al. (2019)	Environmentally based student worksheets increase students' environmental literacy.
10	Aini et al. (2021)	The local potential-based learning model does not significantly affect environmental literacy.
11	Putra et al. (2021); Sriyati et al. (2022); Wahyuni et al. (2022)	A learning model based on local potential increases environmental literacy.
12	Anggraini et al. (2018); Marianingsih et al. (2021)	Relevant ecological concepts based on the New Ecological Paradigm (NEP) and aspects of environmental literacy have not been optimally integrated into learning.

This systematic exploration provides an overview of environmental literacy research in Indonesia. This description includes strategies that have been carried out by previous researchers to strengthen environmental literacy with various designs, subjects, instruments, and data analysis techniques. Variations in design, subjects, instruments, and data analysis techniques used give rise to research findings that also vary in terms of profile, influencing factors, and strategies that have been implemented to strengthen environmental literacy. There are also variations that lead to contradictory research results. Interestingly, this provides a more comprehensive view of students' environmental literacy in Indonesia. The results of the SLR analysis carried out by comparing research methods and findings also reveal that there are still challenges in strengthening literacy in Indonesia. For example, a learning approach that can increase environmental literacy in one place, may not necessarily be able to increase environmental literacy in other places in Indonesia. This means that one approach is not enough to strengthen environmental literacy in Indonesia.

With the availability of data about the existing challenges of environmental literacy research in Indonesia, researchers in Indonesia have the opportunity to innovate research with various variables. Apart from the opportunity to increase the number of environmental literacy research publications in Indonesia, more importantly, further research is needed to find strategies for strengthening environmental literacy that are adaptive and effective. Likewise, this research itself, has a limited scope of the article analysis period until 2022. This is because the research was carried out in mid-2023, considering the completeness of the data in one year, so it did not involve publications in the current year. Therefore, there is an opportunity to carry out further SLR to complement the results of this research.

Conclusion

Research conducted using the SLR method shows that within 10 years, there were 36 environmental literacy articles published in the registered journal Sinta. Environmental literacy research began in 2017 and experienced fluctuations until 2020, when it stagnated in 2021 and 2022. Quantitative research designs dominated these studies, followed by R&D. Meanwhile, qualitative and mixed-method research is relatively lacking. Furthermore, as derivatives of quantitative designs, survey, descriptive, and quasi-experimental research are dominant. In practice, high school and junior high school students are the most frequently used environmental literacy research subjects in Indonesia. Questionnaires and tests are the most widely used research instruments and are followed by descriptive and inferential data analysis using t-test and n-Gain. Analysis of research results shows that environmental literacy research in Indonesia focuses on three categories, namely environmental literacy profile, type of school, and educational curriculum. Based on these three categories, the findings obtained vary greatly.

Considering the number of environmental literacy studies published in Indonesia, this provides an opportunity to increase the number of studies as an indicator of increasing public sensitivity to environmental issues, as well as improving their quality. This is very important because environmental literacy is a necessary aspect amidst technological progress and modernization to achieve the SDGs. Qualitative and mixed-method environmental literacy research needs attention because this research has the potential to answer inconsistencies in several previous research results that have been conducted. These two research designs can explore other factors that have not been revealed so far and influence environmental literacy. In line with this, triangulation techniques are also important to carry out data analysis. This technique can provide better information and confirmation because environmental literacy is influenced by many cross-disciplinary aspects.

This SLR shows that students' environmental literacy and its domains still need to be improved. This effort should be carried out starting at the elementary education level, unfortunately not much has been done at this time so it has the potential to be done in the future. Learning integration strategies with local wisdom can be carried out to strengthen students' environmental literacy. This implementation can be carried out by ensuring the relevance of the concept of environmental literacy, the substance of local wisdom, and learning materials amidst Indonesia's existence as a multicultural country. Apart from that, the use of innovative learning models is also an important aspect of strengthening environmental literacy. Furthermore, the implementation of the educational curriculum in Adiwiyata schools needs to be adopted by other schools so that all schools become Adiwiyata.

With the availability of profiles and challenges of environmental literacy research in Indonesia, future research has potential to be conducted with various variables. This is to find the right strategy to strengthen students' environmental literacy. Apart from that, further SLR is also needed to complement the limitations of this study.

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Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Author Contributions

I M. S. Hermawan: writing original draft, methodology, and analysis. **I M. Diarta:** review and editing. **P. A. P. Dharmayanti:** review and editing.

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