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Children as Agents of Sustainability: A Pathway to Teaching Environmental Literacy Based on Preschool Teachers' Perspectives at Sumatra

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ABSTRACT

This explanatory sequential mixed-methods study investigates the perspectives of 89 early childhood teachers in Sumatra, Indonesia, regarding environmental literacy. Quantitative data were collected via an online questionnaire distributed through Google Forms, followed by qualitative data gathered through in-depth interviews conducted via Zoom. Descriptive statistics were used to analyse the quantitative data, while a thematic approach was applied to the qualitative findings. Three major themes emerged. First, teachers demonstrated a strong commitment to fostering environmental knowledge through experiential learning. They highlighted the importance of engaging children's five senses and promoting active, reflective thinking to develop environmentally responsible behaviour that encompasses personal, social, and institutional dimensions. Second, key motivational factors for teaching environmental literacy included early instillation of environmental awareness, the cultivation of sustainable habits, nurturing care and love for nature, preparing environmentally conscious future generations, and supporting sustainability-oriented education initiatives. Third, the effectiveness of environmental literacy education was found to depend on both internal and external factors. Internally, teachers utilised strategies such as outdoor and play-based learning, project-based learning (PJBL), habit formation through place-based education, and digital media integration. Externally, successful implementation relied on collaboration with parents and communities, alongside institutional and governmental support. The study also revealed that teachers draw from ethnocentric, anthropocentric, and ecocentric perspectives when teaching about nature, indicating a strong sense of environmental place attachment. These insights underscore the need for contextually grounded teacher training, flexible curriculum development, and the production of locally relevant educational resources to enhance environmental literacy in early childhood education.

Keywords: Environmental Literacy, Environmental Education, Environmental Knowledge, Environmental Affect

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INTRODUCTION

Children begin to develop their environmental knowledge, positive affect, skills, and behaviors during early childhood education. These four aspects are part of what is known as Environmental Literacy (EL). EL is a concept that helps individuals become more aware of

environmental issues and take positive action to protect the environment. The ultimate goal is to support a sustainable way of life on Earth (Lee, 2023). EL comprises four main components: cognitive knowledge, skills, affect, and behavior (Hollweg et al., 2011; Hasanah & Smita, 2025; Hasyim et al., 2022). This study aims to explore early childhood teachers' perspectives, experiences, and strategies in teaching these four components.

Through in-depth interviews with teachers, this study not only identifies the EL concepts they use but also explores their real-life experiences in integrating EL into classroom teaching. Masykuroh (2023) emphasizes that teachers' perspectives can help evaluate the effectiveness of current teaching practices and guide the improvement of future instruction. In the context of EL, these perspectives can serve as a foundation for policymakers and educators to develop teaching tools that promote sustainable living (Spiteri, 2021). With this in mind, this study also aims to support effective teaching and contribute to building a more sustainable future.

This study explores the perspectives of early childhood teachers in Sumatra, a region known for its rich biodiversity. Sumatra is home to a wide variety of plant and animal species, including several that are endangered. Its forests contain around 10,000 plant species and over 200 mammal species, including 22 Asian mammals found nowhere else in the Indonesian archipelago (Claudino-Sales, 2019). This makes Sumatra a region that significantly contributes to life on Earth. Unfortunately, the island is currently facing a range of serious environmental issues. For instance, research by Prastio et al. (2023) highlights complex challenges such as deforestation, forest fires, haze, land-use changes, and their impacts on local communities. By examining the perspectives of early childhood teachers in Sumatra, this study aims to provide insights into whether these issues are already known and taught to young children, what efforts are being made to address them, and how effectively teachers are able to deliver environmental education to their students.

Most previous research on EL has focused on teaching tools, particularly textbooks used in elementary schools (Cristovão et al., 2022; Curdt-Christiansen, 2020; Maulidina et al., 2024). However, studies examining early childhood teachers' perspectives of EL remain limited, despite their potential to provide important insights. In international contexts, Cristovão et al. (2022) have shown that involving early childhood teachers in environmental decision-making can enhance environmental literacy. Similarly, Spiteri (2022) emphasizes that such involvement fosters systemic thinking about critical environmental issues. Therefore, the EL competencies that teachers possess play a key role in building comprehensive environmental knowledge in young children.

In Indonesia, research on EL among early childhood teachers has mainly focused on ecological knowledge. For example, Masykuroh (2023) found that teachers possess strong pedagogical skills and are able to design curricula that support environmental literacy learning. Similarly, Ismawati et al. (2024) showed that collaborative learning approaches in teaching create a holistic and enjoyable learning environment for young children. Meanwhile, Asmayawati and Yetti (2024) discovered that incorporating local wisdom can be an effective approach to introducing EL to young learners. Together, these three studies highlight key strategies for promoting EL in early childhood education, including strong teacher pedagogy, engaging environmental learning methods, and the integration of local cultural knowledge. However, while these studies offer valuable insights, they do not fully explore the direction of EL teaching, what motivates teachers to teach it, or the factors that contribute to successful environmental literacy learning for children.

Meanwhile, research on EL in the context of education in Sumatra has largely focused on environmental sustainability, often combined with ecological wisdom. Examples of such studies include those by Ilhami (2019) and Zulyetti (2024), which explore local wisdom in West Sumatra, and by Anggraini et al. (2021), which examines local wisdom in South Sumatra. However, these studies have largely overlooked teachers' perspectives. Most were conducted at higher levels of education than the early childhood level explored in this study, and they also differ in terms of research objectives and methodologies.

Finally, based on the facts described, this study is necessary. Some of the reasons are considering the role of children as agents of determining life in the future, especially those who live in tropical forest areas, such as Sumatra, Indonesia. Unfortunately, the approach to environmental literacy in these locations remains limited. To overcome this, preschool teachers' perspective is considered to play a role in determining it, and the teacher's view provides valuable information in determining competency achievement (Latifah et al., 2023). Based on this, this study contributes to meaningful learning and environmental sustainability in Sumatra. To address this gap, the present study explores early childhood teachers' perspectives on EL through three main research questions, outlined below:

RQ1: How is EL implemented effectively in teaching young children in Sumatra?
RQ2: What factors motivate teachers to incorporate EL into early childhood education in Sumatra?
RQ3: How do teachers perceive successful practices in teaching EL to young children in Sumatra?

Theoretical Review

The recent buzz on children as agents of sustainability shows a growing recognition of their potential as agents of social actors in realising sustainable living. Studies emphasise that when engaged through transformative education and participatory experiences, children can develop a sense of responsibility that empowers them to contribute to sustainable practices in their homes, schools, and communities (Maulidina et al., 2024). Research has highlighted the importance of fostering ecological empathy, critical thinking, and collaborative action among children, suggesting that intentional engagement in sustainability efforts can catalyse promising changes in how communities address environmental challenges (Ismawati et al., 2024). One way to realise this is by integrating sustainability education into the curriculum, which will later provide a direction for learning. In doing so, learning and teaching activities offer opportunities to enhance children's roles as agents of change in sustainable development. However, it is important to remember that children often face barriers to becoming meaningfully involved in setting and implementing global goals. Therefore, deliberate efforts are required to involve children in accountability and decision-making processes (Walker et al., 2019). To facilitate this, a reference is required for teaching EL.

The concept of EL makes children environmentally literate, including the aspects presented in Table 1. This was based on the concept introduced by Hollweg et al. (2011). Previous studies have proven that teaching EL at an early age has a significant impact on children's cognitive, social, and emotional development. This means that it has been proven to increase children's understanding of environmental issues, pro-environmental attitudes, and social and emotional skills (Kabylbek et al., 2024; Masykuroh, 2023). The results of other studies also contribute to increased academic achievement in science (Lee, 2023), mathematics (Gavaza et al., 2017) and literacy, and strengthen children's relationship with nature through direct outdoor experiences (Häggström & Schmidt, 2020). Thus, EL in early childhood education not only supports the formation of environmentally conscious characters but also enriches the learning experience holistically.

Tabel 1. Environmental Literacy (EL)

Types	Example
Environmental knowledge	(1) Knowledge of physical and ecological systems; (2) social, cultural, and political systems; (3) environmental issues; (4) solutions to environmental problems; and (5) citizen participation and action strategies.
Environmental affect	(1) sensitivity to the environment; (2) attitudes, attention, and views towards the environment; (3) personal responsibility; (4) control and perception; and (5) motivation and intention.
Environmetal cognitive	(1) identify environmental issues, (2) ask relevant questions, (3) analyze environmental issues, (4) investigate environmental issues, (5) evaluate

	and make personal judgments about environmental issues, (6) use evidence and knowledge to solve problems, (7) create and evaluate plans to address environmental issues.
Environmental behaviour	(1) helping to prevent or solve environmental problems, (2) encouraging others to take the right action regarding environmental problems, (3) using financial support to help restore or solve environmental problems, (4) pressuring political or governmental institutions to take positive action regarding the environment, and (5) supporting regulations designed to improve or preserve the environment.

The roots of all successes in EL learning are certainly inseparable from the teacher's view on how to teach it. Teachers' perceptions of a learning activity provide initial information that can be used as a basis for evaluating the activity, including the direction of EL (Kouam, 2025). Based on the results of previous studies, teachers' perceptions and roles in promoting EL have been proven to be effective. According to (BR, 2024), their training, perspectives, and practices significantly influence the effectiveness of environmental education, highlighting the need for comprehensive support and development programs to increase students' capacity to foster sustainable behaviour. Therefore, teachers' perceptions of EL will facilitate knowledge of materials, tools, methods, and many other things that can be followed up in learning pedagogy.

METHODS

Research design

This study employed an explanatory sequential mixed-methods approach, as outlined by Creswell and Creswell (2018). This research design consists of two phases: a quantitative phase followed by a qualitative phase. The primary aim is to use qualitative data to explain or expand upon the results of the quantitative findings (Rapp & Kauf, 2018). In this study, we applied the approach to explore the perspectives of teachers in Sumatra, Indonesia, on how to teach various dimensions of Environmental Literacy (EL). In the first phase, quantitative data were collected through an anonymous online survey, and the responses were analyzed using descriptive statistics. In the second phase, semi-structured interviews were conducted, and the qualitative data were analyzed through content analysis. This approach enabled us to gain a deeper understanding of the findings and offered a more comprehensive view of the teachers' perspectives.

Participants

This study involved 89 early childhood teachers as participants. The participating institutions were selected based on two main factors: their willingness to take part in the study and their geographic representation across different areas of Sumatra, Indonesia. Participants were chosen using purposive sampling, guided by specific criteria to ensure the validity of the findings. These criteria included: (1) having more than five years of experience teaching young children, (2) holding a bachelor's or master's degree in education, and (3) representing their respective provinces within the island of Sumatra. A detailed overview of participant demographics is provided in Table 1.

Table 1. Demographic information of the participants (N = 89).

Demographic	Value	Frequency	Percentage
Gender	Male	14	15.7%
	Female	75	84.27%
Age	20-23	11	12.36%
	24-27	26	29.21%
	28-31	32	35.96%
	32-35	16	17.98%
	>35	4	4.49%
School type	State school	27	30.34%

	Private school	62	69.66%
Educational Background	Bachelor's degree	56	62.92%
	Master's degree	33	37.08%
School location	Aceh	9	10.1%
	Sumatera Utara	13	14.6%
	Riau	9	10.1%
	Bangka Belitung	7	7.9%
	Sumatera Barat	9	10.1%
	Jambi	11	12.4%
	Bengkulu	8	9.0%
	Sumatera Selatan	9	10.1%
	Kepulauan Riau	8	9.0%
	Lampung	6	6.7%

The researchers did not include real names or specific school locations to protect participants' privacy and comply with research ethics. Data collection was conducted from November 2024 to February 2025. Of the 89 participants, only 10 teachers responded positively and agreed to take part in the second phase of the study, which involved qualitative research. As noted by Maghfiroh et al. (2024), this type of response rate is common and does not compromise the reliability of the findings. These 10 participants were selected for in-depth interviews, and their details are presented in Table 2.

Table 2. Participants in Qualitative Data Collection

Participant	**Gender**	**Educational Background**	**Teaching Experience**	**Origin**
Participant 1	Female	Master of Education	6 years	Aceh
Participant 2	Female	Master of Education	9 years	Sumatera Utara
Participant 3	Female	Bachelor of Education	5 years	Riau
Participant 4	Female	Bachelor of Education	8 years	Bangka Belitung
Participant 5	Male	Master of Education	5 years	Sumatera Barat
Participant 6	Male	Bachelor of Education	7 years	Jambi
Participant 7	Female	Bachelor of Education	7 years	Bengkulu
Participant 8	Female	Bachelor of Education	9 years	Sumatera Selatan
Participant 9	Female	Bachelor of Education	11 years	Kepulaua Riau
Participant 10	Female	Bachelor of Education	14 years	Lampung

Data Collection Techniques

During the quantitative data collection process, we distributed a survey link using Google Forms. Despite some criticisms, online surveys have become increasingly popular compared to traditional methods due to their lower cost and faster, more efficient processing (Nushi & Orouji, 2020). This method was especially useful for our study because it allowed researchers to easily distribute the questionnaire and collect teachers' responses remotely. We sought help from our professional network, particularly those currently teaching in various educational institutions. The survey link was shared through multiple online platforms to reach a wide range of participants. Using this strategy, we aimed to gather a wide range of responses about how teachers introduce Environmental Literacy (EL) to young children. The survey instrument was developed based on the competencies and indicators of EL proposed by Hollweg et al. (2011).

Qualitative data were collected through in-depth interviews using probing questions, conducted online via Zoom. This method was chosen to explore participants' responses in a deeper and more contextual way. It was especially useful for examining teachers' attitudes, perspectives, and experiences (Usman & Yusuf, 2020). Probing questions also allowed the

researchers to clarify unclear responses, gather more detailed information, and capture emotional and social aspects that quantitative methods might miss. In-depth interviews also offered flexibility, giving participants the freedom to express their thoughts openly (Basuki et al., 2025), resulting in rich and comprehensive data. In this study, the interviews focused on understanding why teachers choose to teach EL and the meaningful experiences that shape their teaching approaches.

Data Analysis

The researchers analyzed the quantitative data using descriptive statistics to understand how teachers perceive the teaching of EL to young children. They calculated percentages and average scores for each item, grouped under four main themes: Environmental Knowledge (EK), Environmental Attitudes (EA), Cognitive Skills (CS), and Environmental Behavior (EB). For the qualitative data, thematic analysis was conducted following the five-step process outlined by Creswell and Creswell (2018).

RESULTS AND DISCUSSION

Quantitative: Survey Results on Teachers' Perspectives in EL Instruction

Table 3 shows that teachers responded very positively to EL when integrated with EK. Nearly 46% of teachers "strongly agreed" and 33% "agreed" with teaching materials that introduce the relationship between living beings and their environment. Teachers also showed strong support for introducing basic concepts of waste management through the 3R approach (Reduce, Reuse, Recycle), with 63% strongly agreeing and 24% agreeing. The highest level of agreement was observed in the use of social and cultural approaches, such as *gotong royong* (community cooperation), with 71% of respondents strongly agreeing. Teachers also expressed strong support for activities such as greening school spaces and promoting environmental awareness through art and mini parades. These responses indicate a clear preference for collaborative and creative teaching methods. However, not all activities received high levels of agreement. For instance, only 27% of teachers strongly agreed and 16% agreed with introducing traditional rice planting methods. This suggests that some activities may be considered less relevant to current educational contexts. Despite this, most of the activities listed in the table indicate that teachers not only understand the importance of ecological knowledge but also support practical, contextual, and engaging learning methods.

Table 3. Activities for Teaching Ecological Knowledge (EK)

Types of EK	Sub-categories	Mean	Level of Agreement				
			1	2	3	4	5
Knowledge of physical and ecological systems	Introducing observable natural phenomena, such as different types of weather, weather changes, and the seasons in Indonesia	4.33	2	5	11	15	56
	Introducing components of ecological and physical systems, such as water (the concept of flow), soil (as planting media), and sunlight (as a source of warmth and for drying)	3.96	3	9	14	26	37
	Introducing the relationship between living beings and their environment, such as how humans depend on food from plants or animals, and how plants require water, soil, and sunlight to grow	4.54	1	2	7	17	62
	Introducing different types of animals and their natural habitats, such as land, sea, and air	4.45	2	1	4	30	52
	Introducing basic concepts of waste management (reduce, reuse, and recycle)	4.69	0	0	2	24	63
Knowledge of	Introducing the roles of teachers, friends, and	4.14	3	4	11	30	41

social, cultural, and political systems	family members in environmental protection						
	Introducing traditional rice planting methods	3.61	8	11	16	27	27
	Introducing the concept of *gotong royong* (community cooperation) through collaborative activities such as cleaning the classroom or school yard together	4.71	0	3	2	13	71
	Introducing plant care through tree-planting activities	4.08	2	7	12	29	39
Knowledge of environmental issues	**Introducing the issue of littering and scattered waste**	4.44	1	1	8	27	52
	Introducing common sources of air pollution, such as vehicle emissions and unpleasant odors.	4.61	1	0	5	21	62
	Introducing the concept of clean and polluted water	4.33	1	2	7	36	43
	Introducing various types of natural disasters resulting from environmental degradation caused by deforestation, such as floods and damaged roads	4.73	0	0	6	12	71
Knowledge of solutions to various environmental problems	Introducing solutions to waste management issues	4.70	0	0	7	13	69
	Introducing solutions to water-related issues	4.67	0	1	5	16	67
	Introducing solutions to deforestation and the loss of vegetation	4.64	1	0	6	16	66
	Introducing solutions to air pollution and unpleasant odors	4.73	1	0	2	16	70
Knowledge of citizen participation and environmental action strategies	Participating in environmental policymaking through petitions or advocacy efforts	4.02	2	0	27	25	35
	Introducing environmental awareness campaigns and green movement initiatives	4.71	0	0	5	14	64
	Introducing community-based environmental activities, such as school greening programs	4.73	0	1	6	9	73
	Introducing the concept of voting, such as raising hands or placing stickers, to make decisions about environmental activities.	4.56	1	1	2	28	57
	Introducing expressions of environmental appreciation through art, such as songs, drawings, and mini parades	4.84	0	0	2	10	77

Level of agreement: 1= Strongly disagree; 2= Disagree; 3= Neutral; 4= Agree; 5= Strongly agree.

Table 4 shows that most teachers responded positively to using sensory experiences to introduce environmental topics. Specifically, 52% of teachers strongly agreed and 36% agreed that engaging children's five senses is an effective way to build their emotional sensitivity or affective competence toward the environment. Teachers also showed strong support for simple caring actions. About 57% strongly agreed and 38% agreed that activities like picking up trash and watering plants are meaningful ways to stimulate the development of children's affection for the environment. In the area of responsibility, teachers supported developing affective attitudes through self-regulation. Nearly 70% strongly agreed and 28% agreed with encouraging children to build affective attitudes through self-regulation activities. Regarding self-control, 57% of teachers strongly agreed that involving children in efforts to protect sustainable life is essential. They believe that fostering affective development plays a key role in

shaping children's active engagement with environmental issues. However, preferences varied depending on the method of affective learning. While 67% strongly agreed and 21.2% agreed that storytelling and mini parades are effective for developing environmental awareness, some methods received less support. For example, only 29.1% of teachers strongly agreed with using fictional characters who love nature to promote environmental values. This suggests that teachers generally prefer hands-on, real-life experiences over symbolic or imaginative approaches when teaching environmental care.

Table 4. Activities for Teaching Environmental Affect (EA)

Types of EA	**Sub-categories**	**Mean**	**Level of Agreement**				
			1	**2**	**3**	**4**	**5**
Environmental Sensitivity	Observing aspects of the environment, such as weather changes, plants, or scattered trash	4.49	1	0	11	19	58
	Recognizing emotional responses such as happiness, sadness, or frustration when observing a clean or polluted environment	4.71	1	1	4	11	72
	Exploring the environment through the senses—by touching, smelling, seeing, and hearing elements of nature	4.80	2	0	0	10	77
	Demonstrating environmental care by watering plants and picking up litter in the school garden	4.78	0	0	3	14	72
Attitudes, Concern, and Perspectives on the Environment	Expressing affection and concern for animals, plants, and recreational areas	4.55	0	1	10	18	62
	Recognizing nature as a companion to be protected rather than exploited	4.87	0	0	3	6	80
	Feeling upset or sad when seeing people litter or step on plants	4.69	1	0	2	20	68
	Showing a willingness to help care for the garden or keep the classroom clean	4.57	1	1	1	29	57
	Feeling proud or happy after helping to clean the playground or tidy the garden	4.47	0	1	5	34	49
Personal Responsibility	Practicing daily habits such as properly disposing of trash and watering plants	4.87	0	1	2	5	81
	Participating in classroom responsibilities, such as sweeping the floor or caring for plants.	4.07	6	3	12	26	42
	Acknowledging when one's actions harm the environment and taking responsibility to fix them	4.61	0	3	6	14	66
	Playing mindfully to avoid damaging green spaces at school	4.88	0	0	0	11	79
Perceived Control and Understanding of Environmental Issues	Demonstrating and understanding how small actions can help protect the environment	4.56	0	1	1	34	53
	Voluntarily taking part in school environmental initiatives	4.56	1	3	4	18	63
	Giving reminders to manage negative affect when others show disregard for the environment	4.31	3	3	5	30	48
	Listening to stories about environmental destruction	4.38	0	1	8	36	44
	Observing and evaluating environmental damage at school and taking part in its restoration	4.63	1	1	5	16	66

Motivation and Intention to Take Environmental Action	Developing interest and joy while playing in nature	4.60	0	0	6	24	59
	Listening to stories about nature-loving characters (real or fictional)	3.98	3	5	12	40	29
	Giving praise during environmental care activities	4.44	1	2	4	32	50
	Instilling ecological values through children's own positive statements and reflections	4.84	0	0	1	12	76
	Motivating students to use eco-friendly lunch containers.	4.79	1	0	1	13	74
	Sharing with parents about environmental activities, such as participating in mini parades.	4.82	1	1	1	7	79
	Highlighting the importance of joining environmental volunteer programs like "Clean Friday" to improve school surroundings	4.56	1	1	5	22	60

Level of agreement: 1= Strongly disagree; 2= Disagree; 3= Neutral; 4= Agree; 5= Strongly agree

Based on Table 5, teachers showed strong agreement with actions that can help develop children's critical thinking skills (CS) about the environment. These skills include analytical thinking, personal judgment, and investigating solutions to environmental pollution. A total of 58.3% of teachers strongly agreed, and 28.3% agreed, that asking Higher-Order Thinking Skills (HOTS) questions like "why" and "how" is an effective way to encourage children to think critically. Teachers also supported activities like observing plants that are not watered and comparing them to plants that are well cared for. These kinds of activities show that direct observation is seen as a practical and effective method for helping children understand cause-and-effect relationships. Meanwhile, in activities involving the analysis of environmental problems around children, 71% of teachers strongly agreed with their effectiveness. They also stated that providing information about polluted environments and their harmful effects on health helps stimulate children to think critically. Additionally, 63% of teachers strongly agreed that teaching materials should explain the relationship between harmful behaviors and their environmental consequences. This indicates that teachers support efforts to help children understand their ecological responsibilities. However, some actions—such as asking abstract questions like "What can we use to replace plastic or electricity?"—received lower levels of support. This suggests that such cognitively complex questions may be too difficult for young children to understand and should be avoided in early childhood education.

Table 5. Activities in Teaching Cognitive Skill (CS)

Types of CS	**Sub-categories**	**Mean**	**Level of agreement**				
			1	**2**	**3**	**4**	**5**
Identifying environmental issues	Identifying environmental problems at school through storytelling	4.37	1	1	5	39	43
	Drawing or creating stories about environmental issues in the surrounding area	4.53	3	3	4	13	66
	Demonstrating the impact of environmental damage in the school environment or around their home.	4.06	4	3	15	29	38
	Observing signs of climate change through unpredictable weather patterns or natural disasters	4.70	0	0	3	21	65
Asking relevant questions	Why is the air dirty and full of smoke?	4.57	1	0	5	24	59
	What can we use to reduce air pollution, and what can replace plastic and electricity?	3.76	7	7	20	21	34

	What happens if trash is thrown away carelessly?	3.81	5	5	23	25	31
Analyzing environmental issues	Demonstrating that smoke from factories and vehicles contributes to air pollution	4.47	0	2	7	26	51
	Identifying behaviors that do not keep the school clean	**4.42**	1	2	5	32	49
	Explaining the health risks associated with polluted environments.	4.73	1	0	3	14	71
	Explaining the relationship between environmentally harmful behaviors and their negative consequences	4.63	0	0	2	29	58
Investigating environmental issues	Practicing asking "Why" and "How" questions	4.85	0	0	1	11	77
	Conducting simple experiments to observe how water pollution affects plant growth	4.42	3	3	3	25	55
	Identifying proper waste disposal methods through storytelling, pictures, or videos	4.40	0	1	8	34	46
	Sharing personal experiences in keeping the home environment clean	4.53	1	2	4	24	58
Evaluating and making personal judgments about environmental issues	Evaluating the actions of individuals or groups who protect the environment	4.53	1	1	5	25	57
	Distinguishing between images of clean and polluted environments	4.29	1	3	5	40	40
	Sharing positive actions taken—by oneself or others—that contribute to protecting the environment	4.43	1	1	5	34	48
Using evidence and knowledge to solve problems	Observing plants that are not watered and comparing them to well-cared-for ones	4.86	0	0	4	2	65
	Naming plants that can be grown at school	4.60	0	0	6	24	59
	Engaging in simple activities such as watering plants or cleaning the school garden	4.52	2	3	3	20	61
Making personal judgments about environmental issues	Evaluating tree-planting activities and observing their growth weekly at school	4.55	0	2	2	30	55
	Creating simple posters or drawings to promote proper waste disposal	4.53	0	2	4	28	55
	Explaining how bringing a reusable water bottle can help reduce plastic waste	4.81	0	1	0	14	74

Level of agreement: 1= Strongly disagree; 2= Disagree; 3= Neutral; 4= Agree; 5= Strongly agree.

Table 6. Activities in Teaching Environmental Behaviour (EB)

Types of EB	**Sub-categories**	**Mean**	**Level of Agreement**				
			1	**2**	**3**	**4**	**5**
Helping to prevent or solve environmental problems	Reusing old items to create decorative crafts	4.10	0	7	15	29	38
	Encouraging the use of eco-friendly transportation	4.45	0	1	8	30	50
	Turning off taps and lights after use	4.66	0	0	0	30	59
	Encouraging children to walk instead of using vehicles	4.86	0	0	1	9	69
Encouraging others to take the right	Sorting organic and non-organic waste	4.78	0	1	0	17	71
	Explaining the importance of disposing of waste properly	4.70	0	0	3	21	65

actions on environmental issues	Raising awareness about the use of single-use plastics to reduce waste	4.24	1	2	6	45	35
Providing financial support for environmental restoration or solutions	Donating usable second-hand items to the waste bank	4.74	0	0	2	19	68
	Contributing cloth bags and personal water bottles for charity activities	4.36	2	2	3	37	45
	Bringing handmade decorations for school made from reused materials from home	4.53	0	0	5	32	52
Advocating for stronger government or political action on environmental issues	Delivering environmental messages to leaders through role-play activities on Earth Day	4.43	3	3	7	16	60
	Sharing opinions with decision-makers like principals and teachers about school environmental policies	4.12	1	3	15	35	35
	Contributing ideas in class discussions—such as raising a hand to suggest ways to keep the classroom clean	4.72	0	0	4	17	68
	Expressing a desire for a cleaner school environment by creating short videos	4.48	4	1	3	21	60
Supporting policies or regulations that promote environmental protection and sustainability	Showing support for eco-friendly school policies by bringing a personal water bottle from home and using environmentally friendly transportation every Friday	4.71	1	1	2	15	70
	Complying with the rule to tidy up the classroom before going home	4.65	0	0	4	23	62
	Learning to support and follow rules through play-based activities	4.58	0	0	6	25	58
	Explaining the impact of protecting or damaging the environment based on the rules they have learned	4.45	0	1	5	36	47

Level of agreement: 1= Strongly disagree; 2= Disagree; 3= Neutral; 4= Agree; 5= Strongly agree.

Based on Table 6, teachers showed strong agreement on how to shape environmental behavior (EB) in children. For example, 69% of teachers strongly agreed and 18% agreed that encouraging children to walk instead of using vehicles is a good way to reduce air pollution. Simple behaviors, such as turning off taps and lights after use, also received strong support—59% of teachers strongly agreed and around 30% agreed. This clearly shows that teachers are committed to building habits that teach children to conserve energy resources. In terms of promoting social responsibility, 71% of teachers strongly agreed and 17% agreed that sorting organic and non-organic waste should be part of children's daily routines. Teachers also viewed community participation as important. For example, donating reusable items to waste banks and bringing cloth bags or water bottles for charity events were seen as effective learning experiences. This highlights the importance of integrating circular economy principles with character education to strengthen children's environmental awareness. Teachers also supported involving children in school-level decision-making. Activities such as sending messages to leaders through role-play or expressing ideas during class discussions help children develop a sense of agency. Eco-friendly school rules—such as bringing personal water bottles and cleaning the classroom—also received strong approval. This indicates that teachers believe structural support is essential in shaping environmentally responsible behavior in children.

Qualitative Findings: Results From Teacher Interviews

Factors That Encourage the Implementation of EL Activities

In Excerpt 1, the teacher emphasized the importance of fostering positive affect toward the environment in children as early as possible. This can begin with simple daily habits, such as throwing trash in the proper place, planting trees, and sorting waste by category. The teacher cautioned that if these habits are not introduced early, children may grow up with negative attitudes toward the environment, which can be difficult to change once they are formed.

> Excerpt 1: Instilling environmental awareness from an early age
> I strongly believe that introducing environmental values to children is very important. If they become accustomed to throwing trash in the proper place from a young age, it will shape their habits into adulthood. As they grow older, they will view littering as inappropriate and behavior. (Datum 1)
>
> Children start learning from simple things, and their curiosity is especially strong at a young age. Therefore, this stage of life is an ideal time to begin instilling environmental awareness and encouraging an environmentally responsible lifestyle. (Datum 2)
>
> Once children become adults, it becomes very difficult to change their habits. That's why we start teaching them to sort waste from an early age, even in simple ways—such as separating organic and plastic waste. As you can see, we provide two trash bins in each classroom, each with a different color to help the children remember which type of waste goes in which bin. (Datum 3)

Building on the idea of instilling environmental values in children from an early age, in Excerpt 2, the teacher shared several follow-up actions. The teacher explained how students can be encouraged to take real action through simple daily habits during their time at school—such as using reusable water bottles, participating in communal clean-up activities, and taking care of plants.

> Excerpt 2: Building environmentally friendly habits
> From the beginning, we teachers have set rules for both the students and their parents. For example, children are required to bring their own water bottles from home and avoid bringing packaged food from outside. These rules are intended to help reduce plastic use and minimize reliance on single-use plastics. (Datum 4)
>
> Datum 5
> Every Friday, we organize a cleaning activity that involves the children, even if it's just picking up trash and sweeping. This helps them build environmentally friendly habits and behaviors.
>
> Datum 6
> In my class, I divide the children into groups, with each group responsible for watering the plants. I create a watering schedule for them to follow before class begins. Over time, they begin doing it on their own, without needing any reminders, and it eventually becomes a habit.

The teacher also discussed the emotional development of children in relation to environmentally friendly behavior. The goals are to help children feel regret when they harm plants or animals, to nurture their love for nature by explaining the important roles all living things—especially in relation to human life—play in the ecosystem, and to present simple experiments that encourage children to develop positive attitudes toward the environment.

> Excerpt 3: Developing a sense of love and care for nature

There was a time when one group of students forgot to water their plant, and eventually, it dried up and died. Some of them felt guilty and wanted to replace it. A similar situation happened with the fish in our small aquarium. The children's responses showed that they had begun to develop a sense of love and care for living beings. (Datum 7)

We often teach children to love all living beings by explaining the important roles each creature plays in nature. For example, we regularly remind them not to pick the flowers around the school (Datum 8)

We created experiments that children could observe directly. One example was a soil experiment comparing a container with a small plant to one without. One container held soil and a small plant, while the other contained only soil. The children observed that when water was poured into both, the water in the planted container was absorbed more quickly, and the soil remained intact—unlike in the other container. Through this activity, we help children understand the importance of caring for nature, such as plants. (Datum 9)

Teachers also stated that EL education helps shape a generation of responsible young people. One approach is to encourage students to become social actors or environmental heroes, as illustrated in Excerpt 4. These efforts include storytelling and direct participation in environmental clean-up activities, which are believed to foster a harmonious relationship between students, their social environment, and the physical world around them.

Excerpt 4: Preparing a generation that is environmentally responsible
The main goal of early childhood education is to build simple daily habits that reflect individual, social, and spiritual values. That's why we prepare children to become social actors who care about those who work to keep the environment clean—by telling stories about the kindness and hard work of sanitation workers. As a result, they learn to take responsibility for their own trash and to care for plants and animals around them. (Datum 10)

Some time ago, in celebration of Earth Day, the children participated in cleaning up the schoolyard and engaging in green activities. They practiced picking up scattered trash and took part in various other actions. Additionally, each week, they were given the responsibility to ensure that their plants were growing well.

Excerpt 5: Supporting sustainable education programs
I teach children to get used to turning off water taps and lights after use. This aims to instill the habit of conserving resources from an early age and to support the SDGs program actively promoted by the government. (Datum 12)

Our school adopts a "green early childhood education (*PAUD hijau*)" concept as part of our effort to support United Nations programs and government directives. That's why we hold weekly activities, such as the mini waste bank program. The aim is to help children understand that waste can still be processed and collected into something useful. We also provide rewards for those who manage to collect a large amount of waste. (Datum 13)

In addition, the teacher explained that another reason for teaching environmental values—beyond those previously mentioned—is to support the SDGs movement, as shown in Excerpt 5. The excerpt highlights that encouraging children to save energy and water, along with engaging them in other practical environmental actions, reflects the school's commitment to adopting green, eco-friendly practices.

Teachers' Perspectives on Successful Strategies for Teaching EL
Teachers' Creativity (Internal Factor) in Applying Various Teaching Approaches

Excerpt 6 highlights teachers' perspectives on how to implement EL learning through outdoor activities. Based on the findings, children can be taken on visits to a friend's house, polluted riverbanks, waste collection sites, or zoos. Through these real-world experiences, teachers believe that children will learn to appreciate physical labor, develop empathy toward other living beings, and better understand their relationship with plants and animals in the environment.

> Excerpt 6: **Outdoor learning**
> Children remember lessons better when they experience them directly. Therefore, the fastest and most effective way to teach them is through hands-on activities. For example, they will better understand how to care for plants if they are taken outside to water the plants themselves and visit gardens. By doing this, they learn that plants can wilt if they are not watered properly.

> Excerpt 6: **Outdoor learning**
> It can be difficult for young children to understand the idea that throwing trash on the ground can lead to flooding. To help them grasp this concept, I ask them to observe it directly, as seeing it for themselves leaves a stronger impression than just listening to a story. So, when it rains, I take the children outside for a short time to watch how trash is carried by the water, flows into the river, and blocks the drains.
>
> When children visit the zoo and waste collection sites, they often feel sad when they see animals confined in cages. These experiences lead them to believe that animals living freely in the wild are happier and healthier. Their sense of empathy also grows as they watch sanitation workers handling and sorting waste produced by the community.

Another interesting aspect, as shown in Excerpt 8, is the use of project-based learning. The teacher explained that this approach can be implemented in simple ways. For example, children can engage in gardening by using unused plastic containers as planting pots. In addition, role-playing activities—where children take on the roles of characters connected to their local environment—can also be incorporated.

> Excerpt 8: **Play-based learning combined with project-based learning (PJBL)**
> Children plant seeds in pots made from recycled items, such as large plastic drink bottles. They are instructed to care for the plants daily by watering them and recording their growth. Once the plants begin to grow, they decorate the pots with drawings of animals and plants. Throughout the project, the children are also encouraged to memorize and sing environmental songs, such as one about throwing trash away. Singing helps them remember the messages more easily, and they often sing the songs spontaneously while working on the project.
>
> One effective way to teach children to care for the environment is through role-playing or musical drama activities, which are later performed at the end of the school term. In short, this involves creating a performance project. Some children take on roles such as trees, animals, forest rangers, or loggers, and each child performs their role according to the given instructions.

In Excerpt 9, the teacher's explanation appears to reflect an approach that has recently gained attention among experts in place-based learning as a means of instilling ecological values. The excerpt illustrates how the teacher applies this approach by modeling specific environmentally responsible behaviors.

Excerpt 9: **Habit formation and role modeling through place-based education**
Young children are great imitators. This is the principle we hold in instilling environmental values they need to understand, as we, as teachers, are role models who are listened to and imitated, especially in practicing ecological wisdom. Therefore, we must demonstrate commendable behavior, even in simple matters like disposing of waste properly or turning off the classroom lights when natural light is sufficient.

As a teacher, I am responsible for behaving well and setting a good example for my students, especially since young children are in a developmental stage where they naturally imitate others. Even a small gesture—such as saying "thank you" when a child throws trash into the bin—can make them feel appreciated and acknowledged.

Taking young children on morning walks around the school to observe local plants is an effective way to introduce them to the diversity of flora and fauna. During these walks, simply naming the plants and encouraging the children to gently touch them creates a positive and memorable experience that they are likely to remember and imitate.

Meanwhile, to complement the various approaches presented, teachers also proposed incorporating technology through digital media in teaching EL, as shown in Excerpt 10. The digital media used includes simple tools that help teachers explain the lesson material. For example, short videos shown via a projector and educational apps feature content related to ecological values.

Excerpt 10: The use of technology and digital media
Nowadays, it is particularly challenging for children to grasp concepts if they are explained only through storytelling. Therefore, as teachers, we need to innovate by incorporating visual examples, such as short videos. These videos can depict polluted rivers resulting from frequent disposal of factory waste, among other issues. (Datum 23)

We teach certain value-based lessons using simple educational apps. In developing the content, we work with a team that utilizes digital tools. This method has proven to be highly effective in instilling values, especially environmental values. Moreover, the children feel like they are playing a game rather than studying. (Datum 24)

The external factors influencing the success of EL learning.

. In Excerpt 11, the teacher explains that the school has implemented collaborative activities with key stakeholders to support the development of students' EL competencies. These efforts include working with parents and inviting environmental activists and community groups to participate.

Excerpt 11: Collaborative activities with parents and the community
We encourage parents to take part in the learning process because we consider ourselves a team. Therefore, during special events like Earth Day, we invite parents to join their children in planting activities.

Another initiative we have implemented for years is involving parents in organizing a bazaar. In this event, parents, assisted by their children, are encouraged to sell simple products made from recycled materials

Our school also frequently invites people who are actively involved in environmental efforts to speak in our classrooms. This gives students the opportunity to meet these individuals in person and hear their stories first-hand. We once invited the school's cleaning staff to share their personal experiences directly with the children.

Teachers also reported that government support is an important factor in promoting EL in the classroom. This support includes the allocation of funding, the provision of teaching resources, training, and EL curriculum guidelines. These efforts are intended to help schools encourage educators to integrate EL more effectively into the kindergarten curriculum. Teachers' perspectives on this topic are presented in Excerpt 12.

> Excerpt 12: Government support
> We believe that if the government continues to emphasize that EL to children is a mandatory part of education, various elements within schools will begin to implement and prioritize it. In addition, the government can provide training for teachers on EL, including effective teaching methods, instructional approaches, the development of teaching materials, and more. (Datum 28)
>
> The government needs to allocate specific funding for EL education, particularly for the development of pedagogical tools that teachers can use. I believe that if the government provides a comprehensive EL curriculum guideline that aligns with children's cultural backgrounds and is suitable for implementation in schools, it can help accelerate the development of EL competencies in young children. (Datum 29)

DISCUSSION

Early childhood teachers in Sumatra possess a set of discursive frameworks that reflect varied perspectives on nature. Some view nature as a resource to be managed for social welfare (ethnocentric), others regard it as an object of study (anthropocentric), while some perceive it as a spiritual entity with intrinsic moral value (ecocentric). Individuals who embody these perspectives tend to hold strong commitments to pursuing and fostering a sustainable life (Prastio et al., 2023). These three perspectives suggest that the teachers have a strong sense of place—an essential factor in teaching EL and a vital asset in environmental education (Maulidina et al., 2024). According to the findings, this strong connection is cultivated through several strategies: place-based education, personal investment, interdisciplinary knowledge, environmental psychology, and professional development. Collectively, these elements enhance teachers' effectiveness in promoting EL among young children. This view is supported by Ghorbanzadeh and Nordberg (2024), who found that local residents in Ostrobothnia, Finland, developed a strong sense of place through their environmental interactions and cultural practices. In line with these findings, the teachers in this study were found to nurture a similar sense of place in their students.

The quantitative findings show that the first category, Environmental Knowledge (EK), received strong support from teachers. They emphasized the importance of hands-on activities and real-life experiences as effective ways to teach children about the environment. Teachers believe that this method helps prepare children to become responsible individuals who are ready to live sustainable lives. This finding is consistent with a study conducted in Sweden by Häggström (2019), where young children were invited to play in a city park. The children enjoyed the activity and also gained environmental awareness and knowledge through the experience. These results suggest that various stakeholders can use this research as a basis to develop more experience-based environmental education programs for young children. Second, in the category of Environmental Attitudes (EA), most teachers agreed that it is important to design learning activities that help children develop positive affection connections with the environment. They particularly emphasized the value of experiences that engage all five senses. This aligns with the idea that sensory perception plays a key role in environmental education, as it helps children appreciate the value of nature and develop a sense of responsibility for their surroundings (Auer, 2008). This approach is further supported by research from Boroumand and Amiri (2024) in Iran, whose study found that incorporating sensory experiences into environmental learning can effectively enhance children's environmental competence. Based on the current findings, teachers also believe that building a strong affective connection to the

environment is essential, as it serves as a foundation for achieving a sustainable way of life. Third, most activities involving real-life experiences—such as planting seeds, watering the school garden, observing climate changes, and creating simple posters about proper waste disposal—received strong support from teachers. These hands-on activities are viewed as effective for fostering both social awareness and cognitive skills, encouraging children to think critically before engaging in inappropriate behaviors (Maulidina et al., 2020). This finding suggests that learning approaches based on direct practice, storytelling, and contextual exploration are considered the most effective for developing Critical Skills (CS) in young children. In essence, this category highlights that teachers not only recognize the importance of environmental literacy but also understand pedagogical strategies that help develop children's critical thinking skills in an engaging and thoughtful way. However, children from different socioeconomic backgrounds may have unequal access to environmental learning experiences (Kabylbek et al., 2024), which can affect the development of their critical thinking. These disparities should be considered in the planning and delivery of environmental education. Fourth, the Environmental Behavior (EB) category shows that teachers strongly support the development of active and practical environmental habits in children. They not only highlight the importance of daily routines that directly impact the environment, but also encourage children's social involvement and participation in activities that lead to positive ecological outcomes. These activities are also seen as a way to build peaceful and socially responsible character in children. This indicates that EB education in early childhood settings in Sumatra is moving toward a holistic approach—one that addresses personal responsibility, social engagement, and institutional support.

Teachers also implement comprehensive EL education to support the Indonesian government's discursive practice initiatives, using pedagogical tools identified by Maulidina et al. (2024). This means that the approach taken by teachers not only imparts knowledge but also fosters children's emotional and ethical connections with the environment. This is evident in how they prepare students to engage with environmental issues from multiple perspectives. In line with this, the integration of various discourses can lead to a more comprehensive form of environmental education that contributes to character development in children (Triyono et al., 2023). To strengthen this effort, Kidman and Casinader (2019) suggest that teachers' environmental literacy should be developed alongside their inquiry literacy to ensure more effective and meaningful teaching outcomes.

The implementation of various EL teaching approaches by teachers reflects a holistic learning model. This means they promote the integration of cognitive, affective, and psychomotor aspects of learning. Overall, their goal is to help children not only understand environmental problems but also develop the right attitudes, practical skills, values, and habits to take active roles in protecting and restoring the environment. This holistic approach has been proven effective. For example, research in Sweden shows that this kind of integration helps bridge gaps between different perspectives and fosters a more inclusive learning experience for children (Häggström & Schmidt, 2020). This is especially important because children are currently in the decentering phase—a critical stage in the development of their future personalities (Maulidina et al., 2020). Meanwhile, in regard to external factors, further action is clearly needed. This is supported by research from Iwaniec and Curdt-Christiansen (2020), which found that in China, the success of EL among children was strongly influenced by the active involvement of parents in shaping their children's environmental attitudes and behaviors. In Thailand, Tharasook et al. (2020), and in Pakistan, Sehar et al. (2025), also found that government policies and institutional support played a key role in improving EL among the public. To build on these findings, stakeholders in Indonesia could consider adopting strategies based on the study by Lukman et al. (2013).

Finally, this study contributes to the development of a policy framework for promoting EL in early childhood education. The findings can also serve as a valuable reference for future research in the field of EL across different contexts. For example, future studies could use these insights to explore new ways to increase public awareness of environmental issues. The study also offers practical recommendations, including context-based teacher training programs,

flexible curriculum design, and the creation of locally relevant learning materials. These contributions are especially important for addressing the specific educational needs of young children in Indonesia. In summary, the findings support national education policies aimed at strengthening environmental literacy from an early age.

This study has a limitation due to the relatively small sample size in each province, which restricts the generalizability of the findings. To address this issue, we recommend conducting further studies that include a larger number of participants in each region. Nevertheless, the findings of this study serve as a reference for the development of EL education across regions. This is supported by the integration of both quantitative data from questionnaires and qualitative data from in-depth interviews, which contributes to a more comprehensive understanding. Future research may also focus on examining the challenges of teaching EL to young children, as there is a lack of previous studies addressing this issue within the context of the study area. Another limitation of this study is the use of online interviews, which involved a relatively small number of participants. Therefore, future studies are encouraged to involve more participants, conduct face-to-face interviews, and include direct field observations. These approaches may enable researchers to obtain documentation or evidence of the activities described by participants, thereby strengthening the validity of the findings.

CONCLUSION

Early childhood educators play a crucial role in preparing future generations who care about and are committed to sustainable living. This means that teachers are actively involved in guiding children to become environmentally conscious individuals. These individuals are expected to possess attitudes and values rooted in ethnocentrism, anthropocentrism, and ecocentrism—nurtured through the development of a sense of place. Furthermore, this study provides a comprehensive understanding of teachers' competencies in EL, including their perspectives, and their awareness and attitudes toward sustainable living.

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