

Perceptions, Attitudes, and Readiness toward Environment-Based Education: An Exploration of Indonesian In-Service Elementary School Teachers

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Abstract. This study explores elementary school teachers' perceptions, attitudes, and readiness toward implementing environment-based education, a pedagogical approach that integrates environmental awareness and sustainability into classroom practices. It also compares these variables based on teachers' participation in relevant training or prior experience and examines the relationships between them. A quantitative survey approach was employed involving 161 public elementary school teachers from North Sumatra, Indonesia. Data were gathered using structured self-report questionnaires and analyzed through descriptive statistics, the Mann-Whitney U test, and Spearman's Rho correlation analysis to identify differences and associations between key factors. The findings reveal that teachers generally hold high to very high levels of perception, positive attitudes, and readiness for environment-based education. Teachers who had participated in training or had prior experience showed significantly higher scores in aspects such as self-efficacy, availability of teaching documents, and willingness to implement environment-based learning. Strong correlations were found among key variables, particularly between teaching resources, institutional policy, and teacher confidence. These results emphasize the importance of professional development and institutional support in fostering effective environmental education practices among teachers. The study offers valuable insights for policymakers, curriculum developers, and school administrators aiming to strengthen environmental education initiatives in primary schools.

Keywords: Elementary School Teachers; Environment-Based Education; Environmental Pedagogy; Sustainability Education; Teacher Perceptions.

1. Introduction

Environmental issues have become a global concern, influencing various aspects of human life, including education (Georgiou et al., 2020; Wanchana et al., 2020). As environmental degradation intensifies, education systems worldwide are increasingly integrating environmental awareness into their curricula to foster sustainable behaviours and ecological responsibility among students (Nation & Feldman, 2021). Environment-based education (EBE) has emerged as a crucial approach to cultivating environmental literacy, encouraging students to understand, appreciate, and take action toward environmental conservation (Hamilton & Marckini-Polk, 2023; Putra et al., 2021). Environment-based education aligns with the broader goals of Education for Sustainable Development (ESD) as promoted by UNESCO, emphasizing critical thinking, problem-solving, and real-world applications of environmental knowledge (Oe et al., 2022; Zhou & Lee, 2022). However, the successful implementation of EBE largely depends on the perceptions, attitudes, and readiness of teachers, who serve as the primary agents in translating environmental concepts into classroom instruction.

The integration of environmental themes into Indonesia's national curriculum reflects a growing recognition of the role of education in promoting sustainability and ecological awareness from an early age. Rather than emphasizing the severity of environmental degradation, current efforts highlight the importance of educational intervention in fostering students' understanding of environmental responsibility and sustainable practices (Mahanani et al., 2022; Mulyadi et al., 2023). The success of these initiatives, however, is contingent upon the preparedness and instructional capacity of teachers to deliver environment-based education (EBE) effectively. Despite increasing academic attention to EBE, there remains a paucity of research focusing specifically on the perceptions and classroom practices of in-service elementary school teachers in Indonesia. Existing studies have predominantly examined preservice teacher populations or generalized teacher samples (Wakhidah & Erman, 2022; Yani et al., 2021), resulting in limited insight into the practical enactment of EBE in real educational settings. Addressing this research gap is essential for the formulation of targeted professional development strategies that support the effective integration of environmental education in primary classrooms.

1.1. Problem Statement

Environment-based education aims to provide students with a comprehensive understanding of environmental issues while fostering sustainable practices and attitudes. However, its successful implementation relies heavily on teachers' perceptions, attitudes, and readiness (Chang & Kidman, 2023; Kang et al., 2024; Petkou et al., 2021; Vukelić, 2022). While previous research has extensively explored the perspectives of general and preservice teachers regarding environmental education (Nation & Feldman, 2021; Seikkula-Leino et al., 2021; Yani et al., 2021), studies explicitly focusing on in-service elementary school teachers in Indonesia remain scarce. This lack of research leaves a gap in understanding how elementary school teachers, who work directly with young students, interpret, engage with, and prepare for environment-based education.

A critical challenge in implementing environment-based education is teachers' perception of its relevance in elementary education (Liao et al., 2022). Many teachers may struggle to see the direct connection between environmental issues and core elementary subjects. Additionally, self-efficacy in teaching environment-based education varies among teachers, as some may feel ill-equipped due to a lack of adequate training and professional development opportunities (Georgiou et al., 2020; Ko & Lee, 2003). Another major issue is the availability of teaching documents and resources, which often determines whether teachers can effectively integrate environmental topics into their lesson plans (Baan, 2023; Masturin et al., 2022). Moreover, teachers' prior experience in implementing environment-based learning plays a significant role in shaping their confidence and teaching strategies (Baan, 2023; Li et al., 2021). Institutional factors, such as school policies regarding environmental education, further influence teachers' willingness to engage with the approach (Baan, 2023; Wright et al., 2021).

In terms of attitude, two primary dimensions influence teachers' commitment to environment-based education, such as their attitude toward environment-based education itself and their engagement with this pedagogical approach (Croft, 2018; Ko & Lee, 2003). Engagement, which includes motivation and belief in the importance of environmental education, determines whether teachers actively incorporate environmental topics into their instruction or view it as an additional burden. Finally, teachers' readiness to implement environment-based education is crucial (Liao et al., 2022). Readiness is reflected in their willingness to implement environment-based education despite challenges such as limited institutional support, insufficient resources, and time constraints (Baan, 2023; Corpuz et al., 2022; Tran, 2024). Understanding these factors is essential in developing strategies to enhance teachers' capacity to deliver high-quality environment-based education.

1.2. Related Research

The role of teachers in the successful implementation of environment-based education (EBE) has been the focus of numerous studies, particularly concerning teacher-related factors such

as perceptions, attitudes, and readiness. A consistent finding across the literature is the significance of teacher self-efficacy in shaping effective environmental instruction. The development of confidence in one's ability to deliver EBE has been shown to influence not only teaching practices but also levels of student engagement and learning outcomes (Georgiou et al., 2020; Pullu & GÖmleksiz, 2023; Yemini et al., 2025). This highlights the centrality of psychological preparedness in facilitating meaningful environmental learning experiences. In addition to self-efficacy, the provision of professional development has been identified as a crucial enabler of teacher readiness. The enhancement of pedagogical competence through training and workshops contributes to increased preparedness and instructional quality in EBE settings (Pegalajar-Palomino et al., 2021; Tran, 2024). These findings reinforce the importance of sustained institutional investment in teacher capacity-building to ensure successful curricular integration of environmental themes.

Much of the existing literature, however, has concentrated on preservice teachers or undifferentiated teacher populations. Investigations into the attitudes and perceptions of university-level teacher candidates have emphasized the influence of initial teacher education on their disposition toward EBE (Azba Zafar et al., 2024; Özdil & Yalçın Çelik, 2022). Nevertheless, limited attention has been given to the continuity or transformation of these perspectives once teachers enter the profession. Similarly, broader studies on general teaching populations often overlook the distinct pedagogical conditions and curricular demands specific to elementary education (Wakhidah & Erman, 2022; Yani et al., 2021), creating a need for more differentiated analysis.

Research situated in the Indonesian context has begun to uncover context-specific challenges associated with EBE implementation. Constraints such as inadequate teaching materials, limited administrative support, and inconsistent teacher motivation have emerged as key barriers (Baan, 2023; BR, 2024). However, these studies rarely isolate the experiences of elementary school teachers, leaving a critical gap in understanding the dynamics of EBE in early education settings. Moreover, findings from international studies suggest that prior exposure to environmental training and project-based learning significantly influences teachers' engagement with EBE (Acosta Castellanos & Queiruga-Dios, 2022; Ayaz et al., 2021; Cincera et al., 2021; Töre & Uzun, 2024; Wanchana et al., 2020). This underscores the necessity of investigating whether such background factors contribute to variation in perceptions, attitudes, and readiness among elementary school teachers.

In response to these gaps, the current study offers a targeted examination of the perceptions, attitudes, and readiness of in-service elementary school teachers in Indonesia regarding environment-based education. Through an analysis of these variables and their interrelationships, this research aims to provide empirical evidence that informs policy development and teacher preparation programs, thereby supporting the advancement of environmental-based education at the primary level.

1.3. Research Objectives

This study aims to achieve the following objectives:

- To explore elementary school teachers' perceptions, attitudes, and readiness to implement environment-based education.
- To compare participants' profiles regarding environment-based education (whether they have attended relevant training/courses and whether they have prior experience in implementing environment-based education) and how these factors influence their perceptions, attitudes, and readiness.
- To examine the correlation between teachers' perceptions, attitudes, and readiness in implementing environment-based education.

2. Theoretical Framework

This study is conceptually grounded in three interrelated constructs, such as perception, attitude, and readiness, which provide a comprehensive basis for analysing elementary school

teachers' engagement with environment-based education (EBE). Each construct reflects a different psychological or behavioural dimension, yet their interdependence contributes to a deeper understanding of how teachers experience and enact EBE in classroom settings.

2.1. Perception of Environment-Based Education

Perception is conceptualised as the cognitive appraisal and interpretative process through which teachers make sense of environment-based education. It involves recognising the relevance of EBE to the broader curriculum and its potential to enhance student environmental awareness (Dolenc Orbanić & Kovač, 2021; Ko & Lee, 2003). The perception of curricular compatibility plays a critical role in legitimising EBE within classroom priorities, thus influencing teachers' motivation to integrate environmental content. The construct also encompasses self-efficacy, which pertains to teachers' confidence in their ability to deliver EBE effectively. The development of self-efficacy is closely linked to prior teaching experiences, professional development, and the availability of pedagogical resources, all of which contribute to reducing perceived instructional challenges (Georgiou et al., 2020; Li et al., 2021). High levels of self-efficacy encourage experimentation and innovation in environmental teaching strategies.

Institutional factors such as school policy and resource availability further modulate perception by providing an enabling or constraining environment. The existence of supportive policies and adequate teaching materials normalises EBE, signalling organisational commitment and thereby positively influencing teachers' cognitive orientation (Baan, 2023; Wright et al., 2021). Conversely, the lack of institutional support can contribute to the perception of EBE as an optional or burdensome add-on, reducing motivation for implementation.

2.2. Attitude toward Environment-Based Education

Attitude constitutes the affective dimension of teachers' orientation toward EBE, reflecting their beliefs, feelings, and motivation regarding environmental education (Ko & Lee, 2003). It involves the internalisation of values associated with environmental stewardship and the perceived importance of sustainability in education. Positive attitudes have been shown to facilitate greater willingness to incorporate environmental themes into pedagogical practice. The formation of attitude is influenced by both personal convictions and external social factors such as community norms and institutional culture. Alignment between individual values and school priorities fosters emotional engagement and promotes pedagogical openness to EBE (Croft, 2018). Teachers' belief in the efficacy and impact of environmental education further strengthens attitudinal commitment, which is critical for sustained instructional effort.

Professional development programs and collaborative teaching experiences contribute significantly to attitude formation by providing opportunities for reflection, skill-building, and shared purpose (Pegalajar-Palomino et al., 2021). These experiences cultivate a sense of ownership and optimism, which mediate the relationship between cognitive perception and behavioural readiness, enabling the transition from positive beliefs to active engagement (Croft, 2018; Ko & Lee, 2003).

2.3. Readiness to Implement Environment-Based Education

Readiness is defined as the behavioural intention and practical preparedness of teachers to implement EBE effectively (Baan, 2023). It reflects a combination of motivational willingness, perceived competence, and access to conducive environmental conditions. High readiness levels are essential for translating positive perceptions and attitudes into classroom practice.

A critical determinant of readiness is the availability of resources, including instructional materials, time allocation, and professional development opportunities. These factors influence teachers' capacity to plan and execute environment-based lessons, thereby impacting their confidence and willingness to engage (Masturin et al., 2022; Pegalajar-Palomino et al., 2021). Institutional recognition and supportive school policies further enhance readiness by legitimising environmental education as a priority.

Ultimately, readiness represents the culmination of cognitive appraisal, affective commitment, and contextual facilitation. It embodies the enactment of pedagogical intention and the operationalisation of educational values, reflecting teachers' capacity to respond to environmental challenges through curriculum integration (Baan, 2023; Georgiou et al., 2020). Understanding readiness enables targeted interventions to overcome barriers and optimise the effectiveness of EBE initiatives.

The integration of perception, attitude, and readiness provides a conceptual framework that illustrates the interrelationship among cognitive understanding, affective orientation, and behavioural preparedness in environment-based education. The presence of high self-efficacy and perceived relevance is likely to contribute to the development of positive attitudes, subsequently enhancing the implementation readiness level. Furthermore, the existence of institutional support, such as school policy and the availability of instructional materials, significantly influences both attitudinal disposition and practical engagement. This synthesis enables a comprehensive interpretation of the psychological and contextual dimensions that collectively determine teachers' engagement with environment-based education in elementary school settings.

3. Method

3.1. Research Design

This study was grounded in a post-positivist research paradigm, which assumes that reality can be measured and understood through objective and systematic investigation, while acknowledging the potential for researcher bias and measurement limitations (Creswell, 2009). This paradigm was chosen because it aligns with the study's intent to identify patterns, measure constructs, and explore relationships among variables through empirical, quantitative data. Accordingly, the research employed a descriptive and correlational design to explore in-service elementary school teachers' perceptions, attitudes, and readiness toward environment-based science education in Indonesia. Descriptive research identifies and analyzes existing conditions, established practices, and emerging trends without manipulating variables (Donald et al., 2010). It serves as an initial phase in quantitative research, offering insights into variables that may warrant further investigation.

In this study, the descriptive design was utilized to profile teachers based on their socio-demographic and background characteristics, as well as their perceptions, attitudes, and readiness related to environment-based science education. Meanwhile, the correlational design was applied to examine the relationships among these variables, particularly how teachers' perceptions, attitudes, and readiness are interrelated. This approach facilitates the understanding of associations without inferring causation or directionality (Ikhlās & Dela Rosa, 2023; Sargeant et al., 2024).

3.2. Participant

This study employed a survey method with a practical random sampling approach, involving 161 in-service elementary school teachers from public schools in North Sumatra, Indonesia. The intended population scope included teachers working in accredited public elementary schools with adequate facilities across the province. However, due to practical constraints, the sampling was limited to schools that had an existing partnership with the researchers and expressed willingness to participate. This resulted in a purposive inclusion of schools, followed by random distribution of instruments to available teachers by school principals or designated contacts. Although the sampling did not employ a complete registry-based randomization, efforts were undertaken to enhance representativeness through the inclusion of schools from varied geographical zones and teacher backgrounds. This approach enabled a degree of variation in demographic and professional characteristics while maintaining feasibility in field administration. The scope of generalizability, therefore, is most applicable to teachers in similarly profiled public elementary schools within North Sumatra.

Table 1 presents an overview of the participants' demographic and professional profiles. The majority were female (85.1%) and fell within the late establishment age group (35–44 years; 34.2%) as defined by Super (1980). Most held a bachelor's degree (89.4%), and 60.2% had academic backgrounds outside of elementary education. Additionally, 67.7% were classroom teachers, with 32.3% having between 16 and 25 years of teaching experience (Huberman, 1989). In terms of employment status, 49.1% were Civil Servants. Regarding environment-based education, 53.4% had attended relevant training, and 66.5% had prior teaching experience with environmental content.

Table 1. Profile of Participants

Profile	N	Percentage
Gender		
1. Male	24	14.9
2. Female	137	85.1
Age		
1. Early Establishment (24 – 34)	42	26.1
2. Late Establishment (35 – 44)	55	34.2
3. Maintenance (45 – 54)	38	23.6
4. Late Maintenance / Pre- Retirement (55 – 59)	26	16.1
Highest Educational Attainment		
1. Bachelor Degree	144	89.4
2. Master Degree	17	10.6
Field of Study		
1. Elementary Education	64	39.8
2. Non-elementary Education	97	60.2
Teachers' Status		
1. Classroom Teacher	109	67.7
2. Subject Teacher	22	13.7
3. Principal Teacher	30	18.6
Years of teaching		
1. Entry - Survival & Discovery (1 – 3 years)	18	11.2
2. Stabilization (4 – 6 years)	25	15.5
3. Diversification - Early Stage (7 – 15 years)	43	26.7
4. Diversification - Later Stage (16 – 25 years)	52	32.3
5. Serenity- Career Maturity & Satisfaction (26 – 33 years)	20	12.4
6. Disengagement (34 – 38 years)	3	1.9
Employment Status		
1. Civil Servant	79	49.1
2. Government Contract Employee	34	21.1
3. Honorary Teacher	48	29.8
Have participated in Environment-Based Education Training/Course		
1. Yes	86	53.4
2. No	75	46.6
Have Experience in Teaching Environment-Based Education		
1. Yes	107	66.5
2. No	54	33.5
Total (N)	161	100

3.3. Instrument

In this study, two parts of instrumentation have been administered. Table 2 presents the instruments used, the origin study that pioneered those questionnaires, and how reliable each content is based on the Cronbach Alpha coefficient. Part I contains the profile of the participants such as gender, age, highest educational attainment, field of study, teachers'

status, years of teaching and employment status as well as related to the environment-based education profile like have attended the environment-based education courses or not and have experience in teaching environment-based education or not.

Furthermore, Part II includes 35 items regarding three variables that are the focus of this study: perception, attitude, and readiness toward implementing environment-based education (Baan, 2023; Croft, 2018; Ko & Lee, 2003). The perception variable consisted of five content or sub-variables such as relevance of learning and environment (4 items), self-efficacy in teaching environment-based education (7 items), availability of teaching documents for implementing environment-based learning (4 items), experience in implementing environment-based learning (4 items), and school policy on implementing environment-based learning (6 items). Meanwhile, the attitude variable has two contents, such as attitude toward environment-based education (4 items) and engagement in implementing environment-based education (2 items). Lastly, the readiness variable is seen from how willing the participant is to implement environment-based education in their learning process (4 items). The questions of the scale in this part were answered using a five-point Likert scale, such as 1-Strongly Disagree, 2-Disagree, 3-Neutral, 4-Agree, and 5-Strongly Agree.

Table 2. Instruments Related to Perception, Attitude and Readiness in Implementing Environment-Based Education

Variables	Content	No of Items	α coefficient
Perception	Relevance of Learning and Environment (RLE)	4	0.860
	Self-Efficacy in Teaching Environment-Based Education (SE)	7	0.916
	Availability of Teaching Documents for Implementing Environment-Based Learning (ATDL)	4	0.887
	Experience in Implementing Environment-Based Learning (EXP)	4	0.885
	School Policy on Implementing Environment-Based Learning (SP)	6	0.898
	Attitude	Attitude toward Environment-Based Education (AEBE)	4
	Engagement (ENG)	2	0.860
Readiness	Teachers' Willingness to Implement Environment-Based Learning (WILL)	4	0.726

3.4. Data Collection

This study was conducted as a collaboration between the Center of Excellence for Future Innovative Science Education and the Primary School Teacher Education Department at Universitas Negeri Medan. The participants were in-service teachers affiliated with schools that partnered with the Primary School Teacher Education Department. These schools were selected based on their strong accreditation status and adequate educational facilities.

The data were collected using an online questionnaire distributed via Google Forms. The survey was shared through WhatsApp groups consisting of partner school principals, who were then requested to disseminate the questionnaire to teachers within their respective institutions. Before completing the questionnaire, participants were required to provide agreement through a consent form integrated into the online survey. The estimated time required to complete the questionnaire was approximately 15 - 30 minutes.

3.5. Data Analysis

Descriptive statistics including mean, standard deviation, frequency, and percentage, were utilized to analyze the data related to respondents' profiles, as well as their perceptions, attitudes, and readiness to implement environment-based education. Additionally, normality tests, such as the Kolmogorov-Smirnov test and the Shapiro-Wilk test, were conducted to determine whether the data followed a normal distribution. Performing a normality test is an

essential preliminary step before conducting further inferential statistical analyses (Knief & Forstmeier, 2021). However, after conducting the normality test, the results indicated that the data were not normally distributed. Therefore, non-parametric tests were used as alternative statistical methods. The Mann-Whitney U test was applied to see whether there was a difference in mean rank between teachers who had experience in implementing environment-based education or not and had attended training/courses in environment-based education or not toward their perception, attitudes, and readiness in implementing environment-based education. To examine the relationships between the studied variables, Spearman's Rho correlation test was employed. This non-parametric test is suitable for assessing the strength and direction of associations between ordinal or non-normally distributed data, providing insights into the interconnections among teachers' perceptions, attitudes, and readiness toward environment-based education.

4. Findings

This section presents the quantitative findings regarding teachers' perceptions, attitudes, and readiness to implement environment-based education. The results include descriptive statistics on teachers' perceptions, attitudes, and readiness, comparative analyses based on participants' profiles of environment-based education toward these three variables and correlation analyses examining the relationships among these three variables.

4.1. Description of Teachers' Perceptions, Attitudes, and Readiness to Implement Environment-Based Education

This section addresses the first research question: "What are the levels of perception, attitude, and readiness among in-service elementary school teachers in implementing environment-based education?" Table 3 provides the descriptive statistics for each variable associated with this research aim. The results show that, overall, teachers report high to very high levels across all three dimensions, perception, attitude, and readiness, indicating a generally strong disposition toward implementing environment-based education.

Table 3. Teachers' Perceptions, Attitudes, and Readiness to Implement Environment-Based Education

Item	Mean	SD	Description
Perception			
Relevance of Learning and Environment (RLE)	4.23	0.41	Very High
Self-Efficacy in Teaching Environment-Based Education (SE)	4.02	0.44	High
Availability of Teaching Documents for Implementing Environment-Based Learning (ATDL)	3.96	0.51	High
Experience in Implementing Environment-Based Learning (EXP)	3.94	0.48	High
School Policy on Implementing Environment-Based Learning (SP)	3.99	0.46	High
Attitude			
Attitude toward Environment-Based Education (AEBE)	4.23	0.43	Very High
Engagement in implementing environment-based education (ENG)	3.98	0.67	High
Readiness			
Teachers' Willingness to Implement Environment-Based Learning (WILL)	4.11	0.41	High

For perception toward environment-based education, the highest-report aspect is the relevance of learning and environment ($M = 4.23$, $SD = 0.41$), categorized as very high, suggesting that teachers strongly acknowledge the importance of linking environmental issues with learning. Other perception components, including self-efficacy in teaching environment-

based education ($M = 4.02$, $SD = 0.44$), availability of teaching documents for implementing environment-based learning ($M = 3.96$, $SD = 0.51$), experience in implementing environment-based learning ($M = 3.94$, $SD = 0.48$), and school policy on implementing environment-based learning ($M = 3.99$, $SD = 0.46$), all fall into the high category, indicating positive perceptions across different dimensions related to implementing environment-based education.

In terms of attitude, teachers demonstrate a very high level of positive attitude toward environment-based education ($M = 4.23$, $SD = 0.43$). Meanwhile, their engagement in implementing environment-based education ($M = 3.98$, $SD = 0.67$) is rated high, reflecting a strong level of belief and motivation in applying environmental principles in their teaching practices. For readiness, the willingness to implement environment-based learning ($M = 4.11$, $SD = 0.41$) is categorized as high, indicating that most teachers perceive themselves as ready and willing to integrate environmental aspects into their teaching.

4.2. Comparative Analyses Based on Participants' Profiles of Environment-Based Education Toward Perception, Attitude and Readiness

This section addresses the second research question, which explores whether teachers' professional profiles, specifically, participation in environment-based education (EBE) training or prior teaching experience, are associated with differences in their perceptions, attitudes, and readiness to implement EBE. To examine these differences, non-parametric Mann-Whitney U tests were conducted to compare mean ranks across groups: (1) teachers who had participated in EBE training vs. those who had not, and (2) teachers with prior teaching experience in EBE vs. those without. This approach allows for analyzing whether these background variables significantly influence how teachers perceive, value, and are prepared for integrating environmental-based education into their instructional practices.

The following subsections (4.2.1 and 4.2.2) present the statistical findings and interpretations of these comparisons. These analyses serve to identify potential influential factors that contribute to teachers' readiness and engagement, thus directly supporting the achievement of the second research aim.

4.2.1. Teachers' Perceptions, Attitudes, and Readiness in Implementing Environment-Based Education Based on Environment-Based Education Courses

This section addresses the second research question: "How do teachers' perceptions, attitudes, and readiness differ based on whether they have participated in environment-based education (EBE) training or courses?" Table 4 presents the results of the Mann-Whitney U test comparing these variables between teachers who had and had not received EBE training. The findings indicate that participation in EBE training is associated with significantly higher levels of self-efficacy ($U = 2358.5$, $p = 0.001$), availability of teaching documents ($U = 2109.5$, $p < 0.001$), implementation experience ($U = 2410.5$, $p = 0.002$), and perceptions of supportive school policies ($U = 2535.0$, $p = 0.010$). These differences suggest that teachers who receive formal training are better equipped, both in terms of internal confidence and access to external resources, for implementing environment-based learning.

In terms of readiness, a significant difference was also found in teachers' willingness to implement EBE ($U = 2527.5$, $p = 0.009$), further reinforcing the role of training in enhancing practical motivation and preparedness. However, no significant differences were found for the perceived relevance of learning and the environment, attitude toward EBE, or engagement, indicating that both trained and untrained teachers may share similar values and beliefs about the importance of environmental education, even if they differ in confidence and capacity.

Table 4. Result of Mann-Whitney U Test for Perception, Attitude and Readiness Based on Environment-Based Education Courses

Variable	Have participated in EBE Training/Course	N	Mean rank	U	Z Score	Asymp Sig.
Perception						
	1. Yes	86	83.07	3047.0	-0.685	0.494

Variable	Have participated in EBE Training/Course	N	Mean rank	U	Z Score	Asymp Sig.
Relevance of Learning and Environment	2. No	75	78.63			
Self-Efficacy in Teaching	1. Yes	86	91.08	2358.5	-3.181	0.001**
Environment-Based Education	2. No	75	69.45			
Availability of Teaching Documents for Implementing Environment-Based Learning	1. Yes	86	93.97	2109.5	-4.165	0.000***
Experience in Implementing Environment-Based Learning	2. No	75	66.13			
School Policy on Implementing Environment-Based Learning	1. Yes	86	90.47	2410.5	-3.077	0.002**
	2. No	75	70.14			
	1. Yes	86	89.02	2535.0	-2.566	0.010*
	2. No	75	71.80			
Attitudes						
Attitude toward Environment-Based Education	1. Yes	86	82.85	3065.5	-0.591	0.555
	2. No	75	78.87			
Engagement	1. Yes	86	84.30	2941.0	-1.078	0.281
	2. No	75	77.21			
Readiness						
Teachers' Willingness to Implement Environment-Based Learning	1. Yes	86	89.11	2527.5	-2.616	0.009**
	2. No	75	71.70			

* = p <0.05
 ** = p <0.01
 *** = p <0.001

4.2.2. Teachers' Perceptions, Attitudes, and Readiness in Implementing Environment-Based Education Based on Experiences in Teaching Environment-Based Education

This section addresses the second research question: "How do teachers' perceptions, attitudes, and readiness differ based on their prior experience in teaching environment-based education?" Table 5 presents the results of the Mann-Whitney U test comparing responses between teachers with and without such experience. The analysis reveals that teachers who had prior experience in teaching environment-based education reported significantly higher levels of self-efficacy (U = 2359.5, p = 0.040) and willingness to implement EBE (U = 2342.0, p = 0.030). They also demonstrated significantly greater practical experience in implementing environmental content (U = 2386.5, p = 0.045), which is expected and supports the idea that hands-on experience reinforces pedagogical confidence and implementation readiness.

In contrast, for other variables, such as perceived relevance of environmental learning, the availability of teaching documents, supportive school policies, attitudes toward EBE, and engagement, no significant differences were found between the two groups. This suggests that while both experienced and inexperienced teachers may share similar values and beliefs about environmental education, prior teaching experience primarily enhances practical confidence and motivation. For other measured variables, including the perceived relevance of learning and the environment, availability of teaching documents, perception of school policy, attitude toward environment-based education, and engagement, no significant differences were found between teachers with and without prior experience in teaching environment-based education.

Table 5. Result of Mann-Whitney U Test for Perception, Attitude and Readiness Based on Experience in Teaching Environment-Based Education

Variable	Have Experience in Teaching Environment-Based Education	N	Mean rank	U	Z Score	Asymp Sig.
Perception						
Relevance of Learning and Environment	1. Yes	107	81.68	2816.0	-0.297	0.767
	2. No	54	79.65			
Self-Efficacy in Teaching Environment-Based Education	1. Yes	107	85.95	2359.5	-2.054	0.040*
	2. No	54	71.19			
Availability of Teaching Documents for Implementing Environment-Based Learning	1. Yes	107	85.59	2398.0	-1.937	0.053
	2. No	54	71.91			
Experience in Implementing Environment-Based Learning	1. Yes	107	85.70	2386.5	-2.006	0.045*
	2. No	54	71.69			
School Policy on Implementing Environment-Based Learning	1. Yes	107	82.61	2716.5	-0.678	0.498
	2. No	54	77.81			
Attitudes						
Attitude toward Environment-Based Education	1. Yes	107	84.93	2468.5	-1.645	0.100
	2. No	54	73.21			
Engagement	1. Yes	107	84.94	2467.5	-1.690	0.091
	2. No	54	73.19			
Readiness						
Teachers' Willingness to Implement Environment-Based Learning	1. Yes	107	86.11	2342.0	-2.167	0.030*
	2. No	54	70.87			

* = $p < 0.05$

4.3. Correlation Analyses of Teachers' Perceptions, Attitudes, and Readiness to Implement Environment-Based Education

The correlation analysis highlights significant relationships between teachers' perceptions, attitudes, and readiness to implement environment-based education (See Table 6). The strongest correlation is found between the availability of teaching and learning documents (ATLD) and experience in implementing environment-based education (EIBE) ($\rho=0.766$, $p<0.01$), indicating that teachers with greater access to educational resources tend to have more experience in implementing environmental education. Additionally, a strong correlation is observed between school policy (SP) and experience in implementing environment-based education ($\rho=0.747$, $p<0.01$), suggesting that a supportive institutional environment enhances teachers' involvement in environmental education practices. Another strong association exists between the relevance of learning and environment (RLE) and attitude toward environment-based education (AEBE) ($\rho=0.736$, $p<0.01$), demonstrating that teachers who perceive environmental learning as relevant are more likely to hold positive attitudes toward it.

Table 6. Correlation ρ Spearman Test Between the Variables

Variables	2	3	4	5	6	7	8
Perception							
1. RLE	.598**	.329**	.302**	.270**	.736**	.357**	.465**
2. SE		.655**	.620**	.455**	.581**	.365**	.542**
3. ATLD			.766**	.604**	.351**	.375**	.590**
4. EIBE				.747**	.291**	.421**	.590**
5. SP					.305**	.327**	.494**
Attitudes							
6. AEBE						.295**	.490**
7. ENG							.429**
Readiness							
8. WILL							

** = $p < 0.01$

Several moderate to strong correlations further reinforce these findings. Self-efficacy (SE) shows a significant correlation with both ATLD ($\rho = .655, p < 0.01$) and EIBE ($\rho = .620, p < 0.01$), suggesting that teachers with higher confidence in their abilities tend to have better access to teaching resources and more experience in implementing environmental education. Moreover, a notable relationship between school policy (SP) and willingness (WILL) ($\rho = .494, p < 0.01$) highlights that institutional support plays a role in motivating teachers to participate in environment-based education initiatives. Other notable associations include self-efficacy with school policy ($\rho = .455, p < 0.01$) and RLE with school policy ($\rho = .270, p < 0.01$), suggesting that teachers who perceive learning as relevant and feel confident in their abilities are more likely to align with school policies on environmental education.

Weaker but significant correlations also emerge in the analysis. The relationship between attitude toward environment-based education (AEBE) and engagement (ENG) ($\rho = .295, p < 0.01$) indicates that a positive attitude toward environmental education has some influence on teacher engagement, albeit to a lesser extent. Similarly, the association between RLE and school policy ($\rho = .270, p < 0.01$) suggests that perceptions of learning relevance contribute to institutional alignment, even if the correlation is weaker. Overall, the correlation analysis underscores the importance of key factors such as teaching resources, institutional policies, and teacher confidence in shaping perceptions, attitudes, and readiness toward environment-based education. Ensuring access to relevant teaching materials, fostering a supportive school environment, and enhancing self-efficacy can contribute to greater teacher engagement and willingness to integrate environmental education into their teaching practices.

5. Discussion

The descriptive analysis of teachers' perceptions, attitudes, and readiness to implement environment-based education suggests a generally high to very high self-assessment across all measured dimensions. These findings indicate that teachers acknowledge the significance of integrating environmental themes into education and consider themselves both competent and motivated to implement such practices.

The results indicate that teachers hold a positive perception of environment-based education, with the highest-rated aspect being the relevance of learning and environment, classified as very high. This finding underscores teachers' strong recognition of the importance of linking environmental issues with learning. Such awareness aligns with previous research emphasizing that effective environmental education requires a strong conceptual understanding of the relevance between curriculum content and environmental challenges (Dolenc Orbanić & Kovač, 2021; Liao et al., 2022).

The findings regarding self-efficacy indicate that teachers perceive themselves as capable of teaching environment-based education effectively. This supports Bandura's self-efficacy

theory, which suggests that a teacher's belief in their capability directly influences their teaching performance (Bandura, 1997), especially related to environment-based education (Gan et al., 2023; Georgiou et al., 2020). However, despite high self-efficacy ratings, the slightly lower mean score for the availability of teaching documents suggests a potential gap in resources, which may hinder the full realization of environment-based learning in schools.

Teachers' attitudes toward environment-based education are highly positive, with attitudes toward environment-based education rated very high. This finding reflects a strong commitment to fostering environmental consciousness among students, which is crucial for the successful implementation of sustainability-related curricula (Briens et al., 2023; Kang et al., 2024). Moreover, engagement in Implementing Environment-Based Education is categorized as high, indicating that teachers are generally motivated to integrate environmental themes into their teaching practices. Previous studies indicate that high engagement marked by strong belief and motivation significantly propels the integration of environmental themes into teaching practices (Kalsoom et al., 2022). Teachers' willingness to implement environment-based education is classified as high, indicating that most teachers feel prepared to integrate environment-based education into their teaching. Previous empirical evidence demonstrates that educators possess a high willingness for environmental education, which contributes to their readiness to integrate related content into teaching practices (Corpuz et al., 2022).

Furthermore, teachers' involvement in environment-based education (EBE) such as having training and experience in EBE significantly influences their perceptions, attitudes, and readiness to integrate environment-based education into their instructional practices. Professional development and hands-on experience appear to be key factors in shaping educators' confidence and willingness to implement environment-based learning.

Participation in EBE training enhances teachers' self-efficacy in delivering EBE, equipping them with the necessary knowledge and skills to incorporate sustainability topics into their teaching (Brandisauskiene et al., 2020; Pegalajar-Palomino et al., 2021). Educators who have undergone formal training also report greater access to teaching materials and instructional documents, facilitating the integration of environmental themes into their curriculum (Ruthanam et al., 2022). Moreover, trained teachers tend to perceive school policies as more supportive of environment-based learning, suggesting that training not only improves pedagogical preparedness but also enhances awareness of institutional frameworks that promote sustainability education. This aligns with prior studies indicating that professional development programs strengthen teachers' ability to adopt innovative teaching methods, particularly in areas requiring interdisciplinary integration such as environment-based education (Comstock et al., 2022; Kozma et al., 2023).

Readiness to implement environment-based education is also notably higher among teachers who have attended training programs. Their willingness to apply environment-based learning strategies reflects the effectiveness of structured training in fostering a proactive approach to environment-based education (Al Doghan, 2023; Huang & Lai, 2020). However, despite these advantages, training does not appear to significantly alter teachers' fundamental perceptions regarding the relevance of environmental education, nor does it substantially impact their attitudes or engagement levels. This finding suggests that while training can enhance implementation capacity, deeper shifts in mindset may require long-term exposure, contextual reinforcement, or intrinsic motivation (Lombardo et al., 2023; Memari et al., 2024; Salajegheh et al., 2024). Previous studies have similarly noted that teachers' personal beliefs and institutional culture play a crucial role in shaping their attitudes toward environment-based education, beyond the effects of professional training alone (Kavak & Deretarla Gul, 2023; Liao et al., 2022).

Beyond formal training, direct teaching experience in implementing EBE also influences teachers' efficacy and readiness. Teachers with prior experience teaching EBE demonstrate greater confidence in delivering environmental content and are more committed to its implementation. Experience appears to serve as a reinforcing mechanism, as familiarity with

EBE teaching methods enhances teachers' ability to translate theoretical knowledge into practical application (Ayaz et al., 2021; Cincera et al., 2021). Additionally, teachers who have taught EBE courses express a higher willingness to integrate environmental themes into their lessons, suggesting that hands-on engagement fosters a sense of ownership and responsibility toward environment-based education (Töre & Uzun, 2024; Wanchana et al., 2020). This finding is consistent with research emphasizing the importance of experiential learning for teachers, where practice-based exposure leads to increased pedagogical confidence and long-term commitment to innovative instructional approaches.

Despite these positive effects, experience alone does not necessarily influence teachers' perceptions of school policies, attitudes toward environmental education, or overall engagement levels. This may indicate that structural and cultural factors within schools, such as administrative support, curricular priorities, and institutional incentives, play a more significant role in shaping teachers' perspectives on environment-based education (Kumari & Kumar, 2023; Mathews et al., 2023). Studies have highlighted that without systemic reinforcement, individual training or experience may not be sufficient to drive widespread pedagogical change in environment-based education (Linhares & Reis, 2023).

Moreover, the correlation analysis provides valuable insights into the interconnectedness of teachers' perceptions, attitudes, and readiness in implementing environment-based education (EBE). The findings highlight the critical role of institutional support, teaching resources, and self-efficacy in shaping teachers' engagement with environmental education.

A key relationship emerges between access to teaching resources and experience in implementing EBE, underscoring the importance of material availability in fostering pedagogical confidence and sustained practice. Teachers who have access to well-developed instructional documents are more likely to translate theoretical knowledge into classroom implementation, reinforcing the argument that structural support is a crucial enabler of curriculum integration. This finding aligns with previous research emphasizing that the presence of high-quality teaching materials directly influences teachers' ability to adopt innovative educational approaches (El Batri et al., 2022; Ruthanam et al., 2022). Without adequate resources, even the most motivated educators may struggle to implement effective environment-based instruction (Truelove et al., 2021).

The role of institutional policies is also evident in influencing teacher engagement with environment-based education. A supportive school environment appears to enhance teachers' involvement, indicating that administrative commitment and policy frameworks can serve as catalysts for sustained engagement in environmental education. Schools that actively promote sustainability initiatives, provide clear guidelines, and integrate environmental themes into their broader educational vision create a climate where teachers feel encouraged to incorporate these principles into their teaching (Debrah et al., 2021; Purwianingsih et al., 2022). Prior studies have shown that when institutional leadership prioritizes environment-based education, teachers are more likely to perceive it as a core component of their pedagogical practice rather than an isolated subject (Mora et al., 2022; Okiri & Hercz, 2024).

Additionally, self-efficacy emerges as a crucial factor in shaping teachers' capacity to implement environment-based education. Educators with higher confidence in their teaching abilities tend to have greater access to resources and more experience in delivering environment-based lessons. This relationship suggests that teacher training programs should not only focus on knowledge transmission but also emphasize strategies that enhance educators' belief in their ability to teach environmental concepts effectively. When teachers perceive themselves as competent, they are more likely to seek out materials, navigate institutional structures, and take proactive steps to integrate sustainability into their lessons. This supports the argument that professional development initiatives should include hands-on, experiential learning components that reinforce self-efficacy and foster long-term engagement (Butler, 2022; Cincera et al., 2021; Zhakupova et al., 2022).

Beyond institutional and material factors, the relevance of learning is also strongly linked to teachers' attitudes toward EBE. Teachers who recognize the connection between environmental learning and broader educational goals tend to develop more positive

attitudes toward its implementation. This finding reflects the broader principle that meaningful learning occurs when teachers perceive content as relevant to their professional or societal contexts (Kostøl & Remmen, 2022; Rutsky et al., 2024). If teachers view environment-based education as integral to students' future success and well-being, they are more likely to embrace it with enthusiasm (Ratinen et al., 2023). However, changing perceptions of relevance often requires systemic reinforcement through curriculum restructuring, community engagement, and interdisciplinary approaches that highlight the real-world applicability of environmental concepts.

While attitudes toward environment-based education have a role in influencing teacher engagement, the relationship is comparatively weaker than other factors such as institutional support and self-efficacy. This suggests that while fostering positive attitudes is important, structural and contextual elements may have a more immediate and tangible impact on teachers' willingness to implement environment-based education (Erlandsson et al., 2022; Petkou et al., 2021; Szozda et al., 2022). A positive disposition toward environment-based education alone is insufficient without the necessary support systems in place, a notion that is consistent with prior findings indicating that attitudinal change does not always translate into behavioral change without institutional and practical reinforcement.

6. Conclusion

This study set out to (1) explore elementary school teachers' perceptions, attitudes, and readiness to implement environment-based education; (2) compare these aspects based on teachers' participation in relevant training or prior teaching experience; and (3) examine the relationships among these variables. The findings reveal that Indonesian in-service elementary school teachers generally demonstrate high to very high levels of perception, attitude, and readiness toward implementing environment-based education. Teachers particularly acknowledge the importance of connecting environmental issues with learning and exhibit strong willingness and positive attitudes in integrating environmental principles into their teaching practices. Teachers who had prior training or teaching experience in environment-based education showed significantly higher levels of self-efficacy, resource access, and readiness to implement such education. Furthermore, correlation analyses revealed that the availability of teaching materials, supportive school policies, and teachers' confidence were strongly associated with their experience and willingness to apply environmental education in classrooms. These findings emphasize the importance of institutional support, professional training, and the provision of teaching resources in fostering teachers' engagement and preparedness for environment-based education.

Limitation

This study has several limitations that should be acknowledged. First, the research was conducted in a single province, North Sumatra, Indonesia, and focused solely on public elementary schools categorized as high-performing. While this provides insight into schools with better support and infrastructure, it may not reflect the conditions of schools in other regions or with different characteristics. Second, although participants were selected randomly, the exclusive focus on one geographical area limits the generalizability of the findings to the broader population of elementary school teachers in Indonesia. Third, the study relied entirely on self-reported survey data, which may introduce response bias, such as overestimation or underestimation of actual practices, attitudes, or readiness. The absence of triangulation with qualitative data (e.g., interviews or classroom observations) also limits the depth of understanding regarding the contextual implementation of environment-based education.

Recommendation

Based on the findings of this study, several recommendations are proposed for both educational stakeholders and future researchers. For education policymakers and school

administrators, it is essential to provide sustained and structured training programs on environment-based education, as prior training was shown to significantly enhance teachers' self-efficacy, access to teaching documents, and willingness to implement such approaches. Schools should also work toward creating a more supportive institutional environment by developing clear policies and supplying practical resources that facilitate the integration of environmental topics into the curriculum. Furthermore, collaboration between schools and environmental organizations could enrich teaching materials and foster real-world relevance. For future researchers, it is recommended to extend the study across diverse geographic regions and school types, including rural, private, and underperforming schools, to capture a broader range of perspectives and contextual factors. Additionally, incorporating qualitative or mixed-methods approaches, such as interviews or classroom observations, may provide deeper insight into how teachers' reported perceptions and readiness translate into classroom practices, thereby offering a more holistic understanding of the implementation of environment-based education.

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Conflict of Interest

The Authors declare that there is no conflict of interest.

Declaration of Generative AI-assisted

This manuscript was prepared without the assistance of Generative AI. All intellectual contributions, critical analyses, and final revisions were conducted by the authors. The authors take full responsibility for the accuracy, originality, and integrity of the content presented in this work.

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