

Structural Relationships between Ecological Awareness and Inclusive Character among Elementary School Students in Coastal Langkat Regency

Putri Aura Salsabila¹, Yusrizal², Fira Astika Wanhar³, Fatmawati⁴, Edy Surya⁵

^{1,2,3,4}Sekolah Tinggi Keguruan dan ilmu Pendidikan Amal Bakti, Medan, Indonesia

⁵Universitas Negeri Medan, Medan, Indonesia

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ABSTRACT

Ecological education may connect environmental responsibility with inclusive values, yet relationships between ecological and inclusive-character dimensions remain underexplored among elementary students in coastal communities. This study examined structural relationships among ecological knowledge, ecological attitudes, ecological behaviour, inclusive knowledge, inclusive feelings, and inclusive behaviour. A quantitative survey involved 85 fifth-grade students from four elementary schools in coastal Langkat Regency, Indonesia. Data were collected through closed-ended questionnaires and analysed using partial least squares structural equation modelling (PLS-SEM) with SmartPLS 4.0. Ecological knowledge ($\beta = 0.415$, $p < 0.001$) and ecological attitudes ($\beta = 0.242$, $p = 0.016$) showed significant positive relationships with ecological behaviour. Ecological behaviour was significantly related to inclusive knowledge ($\beta = 0.280$, $p = 0.006$), but not to inclusive feelings ($\beta = 0.200$, $p = 0.067$). Inclusive knowledge ($\beta = 0.398$, $p < 0.001$) and inclusive feelings ($\beta = 0.417$, $p < 0.001$) showed significant positive relationships with inclusive behaviour. These findings provide preliminary evidence of structural associations, not causation or developmental change. They may inform integrated environmental and inclusive learning practices. Longitudinal studies, experimental interventions, and larger multisite samples are needed.

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Corresponding Author:

Yusrizal

Sekolah Tinggi Keguruan dan ilmu Pendidikan Amal Bakti, Medan, Indonesia

Email: yusrizaldns@gmail.com

1. INTRODUCTION

Environmental degradation has increasingly emphasized the importance of developing environmental awareness from an early age. Elementary school is a strategic educational setting for developing ecological knowledge, attitudes, and behaviours because children are in a formative stage in which knowledge, values, and everyday habits are

continuously developed. Environmental education has been shown to contribute to improvements in students' environmental knowledge, attitudes, intentions, and behaviours, although the magnitude of these effects can vary according to educational approaches and contextual conditions [1]. Therefore, environmental learning at the elementary level should move beyond the transmission of ecological information and provide opportunities for students to develop environmentally responsible behaviours through meaningful learning experiences. This developmental perspective also highlights the importance of examining how environmental learning relates to other dimensions of character formation, including students' understanding of social inclusion and their emotional responses to differences among individuals.

Ecological knowledge represents an important cognitive foundation for environmentally responsible behaviour because students need to understand environmental problems, their causes, and the consequences of human actions before they can make informed behavioural decisions. Empirical research has demonstrated a significant relationship between environmental knowledge and pro-environmental behaviour, particularly when knowledge is accompanied by environmental attitudes and sensitivity [2]. Environmental education interventions have likewise demonstrated that strengthening students' environmental knowledge and concern can contribute to the development of more environmentally responsible actions [3]. These findings suggest that ecological knowledge should not be considered an isolated learning outcome but as one component of a broader process through which students develop ecological behaviour.

Ecological attitudes constitute another important dimension of ecological awareness because students' behavioural responses to environmental issues are influenced not only by what they know but also by how they perceive, value, and respond to environmental conditions. Research examining students' knowledge, attitudes, and behaviours has indicated that these dimensions are interconnected, while other studies have shown that attitudes can function as an important mechanism linking environmental knowledge with environmentally responsible behaviour [4]. In addition, evidence from Indonesian students indicates that environmental knowledge, environmental responsibility, values, and environmental education are associated with pro-environmental behaviour [5]. Thus, understanding the formation of ecological behaviour requires consideration of both cognitive and affective dimensions of ecological awareness. Within elementary education, this relationship is particularly relevant because children develop environmental responsibility through repeated opportunities to understand environmental problems, evaluate their consequences, and participate in actions that benefit their surroundings.

The importance of this issue becomes more pronounced in coastal communities, where students live in environments that are directly connected to marine and coastal ecosystems. Coastal areas provide authentic contexts in which environmental problems can be experienced through everyday activities and community practices. Research on marine environmental education in Indonesian coastal areas has emphasized the importance of considering students' characteristics and local environmental contexts when designing environmental learning systems [6]. More recently, research involving elementary schools in a coastal area of Indonesia demonstrated that contextual problem-based learning and

learning motivation can contribute to the development of students' ecological awareness [7]. These findings indicate that coastal schools provide a meaningful context for examining how ecological knowledge and attitudes may be translated into ecological behaviour. In the present study, the coastal setting of Langkat Regency serves as the geographical and educational context in which the proposed relationships are examined, rather than as a separate variable in the structural model. The context provides relevance for studying ecological awareness because students' environmental experiences are situated within coastal surroundings, while the hypothesized relationships concern the associations among ecological knowledge, ecological attitudes, ecological behaviour, and the dimensions of inclusive character.

However, ecological development should not be viewed exclusively from an environmental perspective. Elementary education also has a responsibility to develop students' ability to respect differences, participate with others, and demonstrate behaviours that support inclusive social relationships. Inclusive character encompasses cognitive understanding, affective responses, and behavioural expressions toward others. Research involving elementary school students has shown that attitudes toward peers with disabilities are influenced by personal and contextual factors, including how peers with disabilities are represented to classmates [8]. This indicates that the development of inclusive character requires educational experiences that shape not only students' understanding but also their perceptions and social responses toward others. Accordingly, inclusive character in this study is examined through three related dimensions: inclusive knowledge, inclusive feelings, and inclusive behaviour, representing students' cognitive understanding of inclusion, affective responses toward others, and observable expressions of inclusive conduct, respectively.

The affective dimension of inclusive character is particularly important because knowledge about inclusion does not automatically guarantee positive interpersonal behaviour. Empathy and the social climate of the school can influence students' attitudes toward peers with disabilities. A study of students in primary and middle schools found positive relationships among inclusive climate, empathy, and attitudes toward classmates with disabilities, with empathy playing a mediating role [9]. Similarly, research involving primary school students demonstrated that students' perceptions of teacher behaviour and the quality of student–teacher relationships were associated with their attitudes toward peers with learning difficulties [10]. These findings suggest that inclusive character is shaped through social interaction and emotional processes as well as through formal knowledge. For elementary school students, everyday opportunities to cooperate, share responsibilities, and respond to the needs of others may provide important social experiences through which inclusive understanding and positive emotional dispositions develop.

The relationship between inclusive knowledge, inclusive feelings, and inclusive behaviour can therefore be conceptualized as a multidimensional developmental process. Students require knowledge to understand inclusive principles, affective dispositions to value and empathize with others, and opportunities to translate these understandings and feelings into observable behaviour. Recent research on primary students has shown that empathy is associated with attitudes toward peers with disabilities and that friendship quality

can play an important role in this relationship [11]. Furthermore, a recent social-emotional learning intervention demonstrated that activities designed to develop empathy, perspective-taking, and relationship skills can improve primary school students' attitudes toward peers with disabilities and support social participation in inclusive classrooms [12]. These findings support the importance of considering both cognitive and affective pathways in the development of inclusive behaviour. They also provide a basis for examining whether ecological behaviour is associated with inclusive knowledge and inclusive feelings, which may subsequently be related to students' inclusive behaviour.

The theoretical connection between ecological behaviour and inclusive character can be understood through the social processes involved in responsible action. Environmentally responsible behaviour may involve recognizing shared needs, protecting resources that benefit a wider community, cooperating with others, and accepting responsibility for the consequences of individual and collective actions. These practices have conceptual similarities with the social competencies required for inclusion, particularly recognizing the needs of others, respecting shared spaces, participating in collective activities, and considering the well-being of individuals with different characteristics. Through such experiences, students may encounter situations that encourage them to understand the importance of collective responsibility and develop sensitivity toward others. Ecological behaviour may therefore be associated with inclusive knowledge because responsible participation in shared environments can provide experiences relevant to understanding mutual obligations and the needs of diverse community members. It may also be associated with inclusive feelings because cooperation, consideration, and shared responsibility can create opportunities for empathy and concern for others. These proposed mechanisms establish a theoretical rationale for the hypothesized relationships without assuming that environmentally responsible behaviour necessarily produces inclusive knowledge or positive feelings.

Although previous studies have separately examined ecological awareness and inclusive character, limited empirical research has examined how ecological dimensions may be structurally connected with the cognitive, affective, and behavioural dimensions of inclusive character among elementary school students, particularly in coastal communities. This gap is important because environmental learning can involve cooperation, shared responsibility, participation, and concern for the conditions experienced by others. Nevertheless, the extent to which ecological behaviour is connected with inclusive knowledge and inclusive feelings remains insufficiently understood. In particular, the relationships among ecological behaviour, inclusive knowledge, and inclusive feelings have not been sufficiently clarified within an integrated structural framework focused on elementary school students in a coastal Indonesian context. The present study addresses this gap by examining the proposed associations among six constructs rather than treating ecological awareness and inclusive character as entirely separate domains.

The originality of this study lies in its proposed integration of ecological knowledge, ecological attitudes, ecological behaviour, inclusive knowledge, inclusive feelings, and inclusive behaviour within a single structural model. Rather than assuming that environmental awareness and inclusive character are directly equivalent, the model

examines ecological behaviour as a potential connecting dimension between ecological awareness and the cognitive and affective dimensions of inclusive character. Its application to elementary school students in the coastal area of Langkat Regency, Indonesia, further provides a context-specific examination of these relationships. This approach extends the discussion of character development by investigating whether environmentally responsible actions are statistically associated with students' understanding of inclusion and their feelings toward others.

Therefore, this study proposes an ecological structural model of inclusive character formation among elementary school students in the coastal area of Langkat Regency, Indonesia. Specifically, the study aims to examine the relationships between ecological knowledge and ecological behaviour, ecological attitudes and ecological behaviour, ecological behaviour and inclusive knowledge, ecological behaviour and inclusive feelings, inclusive knowledge and inclusive behaviour, and inclusive feelings and inclusive behaviour. By testing these six hypothesized relationships, the study seeks to clarify the structural associations between ecological awareness and inclusive character. The findings are expected to contribute theoretically to a more integrated understanding of ecological and inclusive character development and provide an empirical basis for educators and researchers to consider environmental responsibility, social understanding, and affective development together when examining character formation in elementary education. The six hypotheses examined in this study are presented in Figure 1.

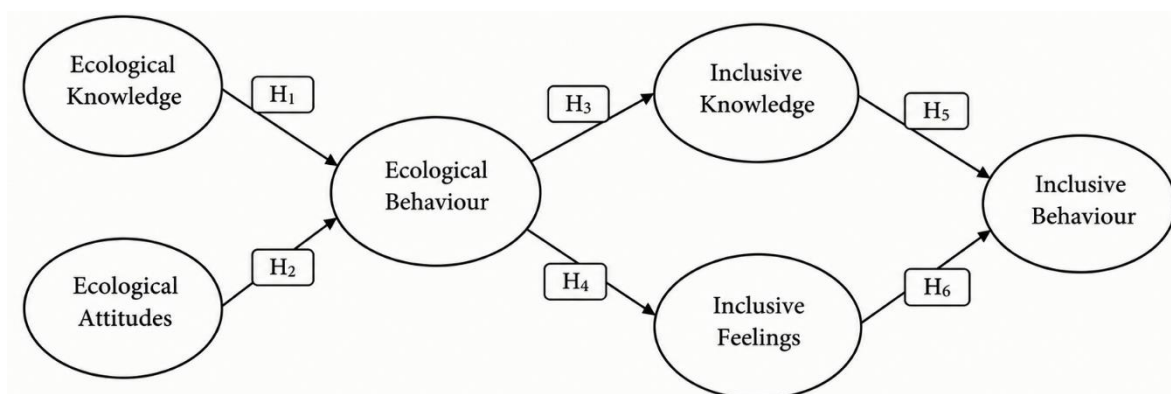


Figure 1. Analysis model hypothesis

H₁: Ecological Knowledge significantly affects Ecological Behaviour.

H₂: Ecological Attitudes significantly affect Ecological Behaviour.

H₃: Ecological Behaviour significantly affects Inclusive Knowledge.

H₄: Ecological Behaviour significantly affects Inclusive Feelings.

H₅: Inclusive Knowledge significantly affects Inclusive Behaviour.

H₆: Inclusive Feelings significantly affect Inclusive Behaviour.

2. METHOD

2.1. Research Design and Study Context

This study employed a quantitative research approach using a survey design. The study examined the structural relationships among ecological knowledge, ecological

attitudes, ecological behaviour, inclusive knowledge, inclusive feelings, and inclusive behaviour among fifth-grade elementary school students in the coastal area of Langkat Regency, Indonesia. The coastal setting served as the geographical and educational context of the study rather than as a separately measured variable in the structural model. The participants consisted of 85 fifth-grade students from four elementary schools located in the study area. The data were collected using structured, closed-ended questionnaires with predetermined response options. The study used primary data obtained directly from students through questionnaire administration.

The research period, specific school selection procedures, participant recruitment process, and demographic characteristics of the participants should be reported to ensure transparency and reproducibility. These details are not specified in the available study description and therefore require confirmation from the original research records.

2.2. Population, Participants, and Sampling Procedure

The participants consisted of 85 fifth-grade elementary school students from four elementary schools in the coastal area of Langkat Regency, Indonesia. The unit of analysis was the individual student, and the sample included participants from all four schools. The sampling technique, the number of eligible students in each school, the distribution of participants across schools, and the inclusion criteria should be specified according to the procedures actually implemented during data collection.

Participant characteristics should also be reported, including age, gender, and school affiliation. The number of students recruited from each school should be presented to clarify the distribution of the sample and the extent to which the participating schools contributed to the dataset. These details are important for assessing the characteristics and contextual coverage of the sample.

The adequacy of the sample size for PLS-SEM should be justified in relation to the complexity of the specified model, the number of predictors of each endogenous construct, the expected effect sizes, the significance level, and the desired statistical power. An a priori power analysis or another appropriate, theoretically justified sample-size assessment should be reported where available. The sample of 85 students should not be considered sufficient solely on the basis of a general PLS-SEM rule of thumb.

2.3. Research Instruments and Measurement of Variables

Data were collected using two questionnaire instruments. The first instrument measured students' ecological awareness, while the second assessed their inclusive character.

The ecological awareness questionnaire covered three main aspects: ecological knowledge, ecological attitudes, and ecological behaviour [13]. It consisted of 12 statements rated using a Likert scale. This instrument was designed to provide a structured and measurable assessment of students' level of ecological awareness. For the structural model, ecological awareness was operationalized through three distinct constructs: Ecological Knowledge, Ecological Attitudes, and Ecological Behaviour. Each construct was represented by four indicators, resulting in 12 indicators across the three constructs.

Ecological knowledge represented the cognitive dimension of environmental understanding, Ecological Attitudes represented students' evaluative and affective orientations toward the environment, and Ecological Behaviour represented environmentally responsible actions.

The instrument description should clarify whether the ecological awareness questionnaire was adopted from an existing instrument, adapted from an existing instrument, or newly developed based on the cited framework [13]. If adaptation was undertaken, the original instrument, the modifications made to its items, and the procedures used to ensure age-appropriate wording for fifth-grade students should be described.

Table 1 presents the scoring system for the ecological awareness questionnaire. Positively worded statements were scored from 1 to 4, whereas negatively worded statements were reverse-scored to maintain a consistent direction of interpretation.

Table 1. Ecological awareness assessment scale

Positive Statement		Negative Statement	
Criteria	Score	Criteria	Score
Always	4	Always	1
Often	3	Often	2
Rarely	2	Rarely	3
Never	1	Never	4

The inclusive character instrument was developed based on Thomas Lickona's character education framework, which comprises three dimensions: moral knowledge, moral feelings, and moral behaviour [14]. The questionnaire consisted of 12 statements, each measured using a four-point Likert scale.

For the purposes of this study, these dimensions were operationalized as Inclusive Knowledge, Inclusive Feelings, and Inclusive Behaviour. Inclusive knowledge represented students' understanding of inclusion and respect for individual differences. Inclusive Feelings represented their affective responses, including empathy, care, and acceptance toward others. Inclusive behaviour represented observable or self-reported behavioural tendencies associated with respecting differences and participating in inclusive social interactions. Each construct was measured using four indicators, resulting in 12 indicators across the three constructs.

The adaptation of Lickona's framework should be described in terms of how the original moral dimensions were translated into the specific content of inclusive character. In particular, the manuscript should explain how the questionnaire items represented inclusive understanding, affective responses toward others, and inclusive conduct in the context of elementary education. This clarification is necessary because the original moral dimensions and the inclusive constructs used in this study are conceptually related but not automatically equivalent.

Table 2 presents the response options and scoring procedure for the inclusive character questionnaire. Positively worded statements were scored from 1 to 4, whereas negatively worded statements were reverse-scored.

Table 2. Inclusive character assessment scale

Positive Statement		Negative Statement	
Criteria	Score	Criteria	Score
Strongly agree	4	Strongly agree	1
Agree	3	Agree	2
Disagree	2	Disagree	3
Strongly Disagree	1	Strongly Disagree	4

The questionnaire development and adaptation procedures should also document the content-validity assessment, including whether experts reviewed the relevance, clarity, and suitability of the items for fifth-grade students. Where expert review was conducted, the number and relevant expertise of the reviewers, the review procedure, and any resulting item revisions should be reported. If no expert review was undertaken, this procedure should not be claimed.

2.4. Validity and Reliability Assessment

The questionnaire data were analyzed to assess validity and reliability using the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach with SmartPLS 4.0 software. The analysis comprised two stages: evaluation of the measurement model and assessment of the structural model. The measurement model was evaluated to establish the adequacy of the indicators and the reliability and validity of the constructs before interpreting the hypothesized structural relationships. The structural model was subsequently assessed to examine the six hypothesized relationships among the six constructs.

Table 3. Convergent validity and construct reliability

Variable	Aspect	Item	Outer Loading	AVE	CR	CA
Ecological Awareness	Ecological Knowledge	EK1	0.853	0.769	0.930	0.899
		EK2	0.880			
		EK3	0.866			
		EK4	0.907			
	Ecological Attitudes	EA1	0.897	0.773	0.932	0.902
		EA2	0.874			
		EA3	0.854			
		EA4	0.891			
	Ecological Behaviour	EB1	0.872	0.731	0.916	0.877
		EB2	0.830			
		EB3	0.879			
		EB4	0.837			
Inclusive Character	Inclusive Knowledge	IK1	0.911	0.789	0.937	0.911
		IK2	0.888			
		IK3	0.875			
		IK4	0.878			
	Inclusive Feelings	IF1	0.908	0.795	0.939	0.914
		IF2	0.868			
		IF3	0.908			
		IF4	0.882			
	Inclusive Behaviour	IB1	0.852	0.718	0.910	0.868
		IB2	0.828			
		IB3	0.890			
		IB4	0.817			

Measurement model evaluation focused on convergent validity and construct reliability. Convergent validity was assessed based on outer loading values greater than 0.70 and Average Variance Extracted (AVE) values exceeding 0.50. Construct reliability was evaluated using Composite Reliability (CR) and Cronbach's Alpha (CA), with values above 0.70 indicating satisfactory internal consistency [15]. Table 3 reports the outer loadings, AVE, CR, and CA values obtained for the six constructs.

The analysis results indicate that the measurement model demonstrates good convergent validity and construct reliability. The outer loading values range from 0.817 to 0.911, indicating that all indicators adequately represent their respective constructs and exceed the recommended threshold of 0.70. The Average Variance Extracted (AVE) values range from 0.718 to 0.795, indicating that each construct explains more than 50% of the variance in its indicators and therefore meets the recommended criterion for convergent validity. Furthermore, the Composite Reliability (CR) values range from 0.910 to 0.939, while Cronbach's Alpha (CA) values range from 0.868 to 0.914. These values are all above the recommended threshold of 0.70, demonstrating high internal consistency and confirming that all constructs have satisfactory reliability and are suitable for further analysis.

Discriminant validity was also examined to determine whether the six constructs were empirically distinguishable. The manuscript reports the Fornell–Larcker criterion and the heterotrait–monotrait ratio (HTMT). The Fornell–Larcker assessment requires comparing the square root of each construct's AVE with its correlations with the other constructs, while HTMT values are evaluated against an appropriate threshold. Table 4 presents the reported discriminant-validity results.

Table 4. Discriminant validity

Variable	Aspect	Fornell–Larcker	HTMT
Ecological Awareness	Ecological knowledge → Ecological Attitudes	0.515	0.571
	Ecological knowledge → Ecological Behaviour	0.554	0.624
	Ecological Attitudes → Ecological Behaviour	0.468	0.527
Inclusive Character	Inclusive Knowledge → Inclusive Feelings	0.380	0.417
	Inclusive knowledge → Inclusive Behaviour	0.584	0.656
	Inclusive Feelings → Inclusive Behaviour	0.597	0.670

The reported HTMT values range from 0.417 to 0.670, remaining below the commonly used threshold of 0.85. These values provide preliminary evidence of discriminant validity among the reported construct pairs. However, the Fornell–Larcker results should be presented as a complete construct correlation matrix with the square roots of AVE on the diagonal. The pairwise values currently shown in Table 4 are insufficient on their own to verify the Fornell–Larcker criterion. Accordingly, the complete output should be checked before making a definitive conclusion about discriminant validity.

2.5. Structural Model Assessment and Hypothesis Testing

After the measurement model was assessed, PLS-SEM was used to evaluate the structural relationships specified in the research model. The structural model included six hypothesized relationships: H1, Ecological Knowledge → Ecological Behaviour; H2, Ecological Attitudes → Ecological Behaviour; H3, Ecological Behaviour → Inclusive

Knowledge; H4, Ecological Behaviour → Inclusive Feelings; H5, Inclusive Knowledge → Inclusive Behaviour; and H6, Inclusive Feelings → Inclusive Behaviour.

The structural relationships should be evaluated using the estimated path coefficients, their statistical significance, and confidence intervals obtained through bootstrapping, where applicable. The number of bootstrap resamples, significance level, and confidence-interval procedure should be reported according to the settings actually used in SmartPLS 4.0. The results should then be used to determine whether each of the six hypotheses is supported.

Because this study examines relationships using survey data, the estimated paths should be interpreted as structural associations rather than definitive evidence of causation. The interpretation should also account for the sample size and the cross-sectional nature of the data, if the questionnaires were administered at a single time point.

2.6. Ethical Considerations

Because the participants were fifth-grade students, the research procedures should address informed consent, voluntary participation, confidentiality, and the protection of participants' identities. The manuscript should specify whether permission was obtained from the relevant schools and whether parental or guardian consent and student assent were secured, as applicable to the approved research protocol. Any ethics approval or exemption should be reported with the relevant institutional details, if applicable. These procedures must be described on the basis of the actual arrangements implemented during the study.

3. RESULTS

This section presents the descriptive statistics and structural model results used to examine the hypothesized relationships between ecological awareness and inclusive character among fifth-grade elementary school students in the coastal area of Langkat Regency, Indonesia. The findings include the distribution of the observed scores and the statistical significance of the six hypothesized structural relationships.

Table 5. Descriptive statistics analysis

Variable	Aspect	N	M	SD	Kurt	Min	Max
Ecological Awareness	Ecological Knowledge	85	9.929	3.531	-1.060	4	16
	Ecological Attitudes	85	9.929	3.542	-1.034	4	16
	Ecological Behaviour	85	9.929	3.443	-1.035	4	16
Inclusive Character	Inclusive Knowledge	85	9.929	3.578	-1.020	4	16
	Inclusive Feelings	85	9.929	3.592	-0.928	4	16
	Inclusive Behaviour	85	9.929	3.411	-0.952	4	16

Note. M = mean; SD = standard deviation; Kurt = kurtosis; Min = minimum; Max = maximum.

The descriptive statistical analysis was conducted to provide an overview of the distribution and characteristics of the observed scores for each construct included in the proposed model. The analysis covered the number of participants, mean scores, standard deviations, kurtosis, and minimum and maximum values. These descriptive indicators were examined as an initial step to understand the general characteristics of the data before proceeding to the measurement and structural model analyses. The results of the descriptive statistical analysis are presented in Table 5.

The descriptive statistics indicate that the six research aspects were assessed across 85 students, with all variables showing an observed score range from 4 to 16. The reported mean scores are identical across all six aspects, at 9.929, whereas the standard deviations range from 3.411 to 3.592. The reported kurtosis values are negative, ranging from -1.060 to -0.928. Overall, these statistics provide an initial overview of the observed scores before the measurement and structural model analyses. The identical means require verification against the original dataset and scoring procedure before substantive interpretation. In addition, skewness values should be calculated from the original data if the distributional characteristics are to be discussed comprehensively.

The measurement model assessment is reported in the Method section. The structural model analysis subsequently examined the six hypothesized relationships using PLS-SEM bootstrapping. Figure 2 illustrates the estimated structural relationships among Ecological Knowledge, Ecological Attitudes, Ecological Behaviour, Inclusive Knowledge, Inclusive Feelings, and Inclusive Behaviour. The statistical results for the hypothesized relationships are presented in Table 6.

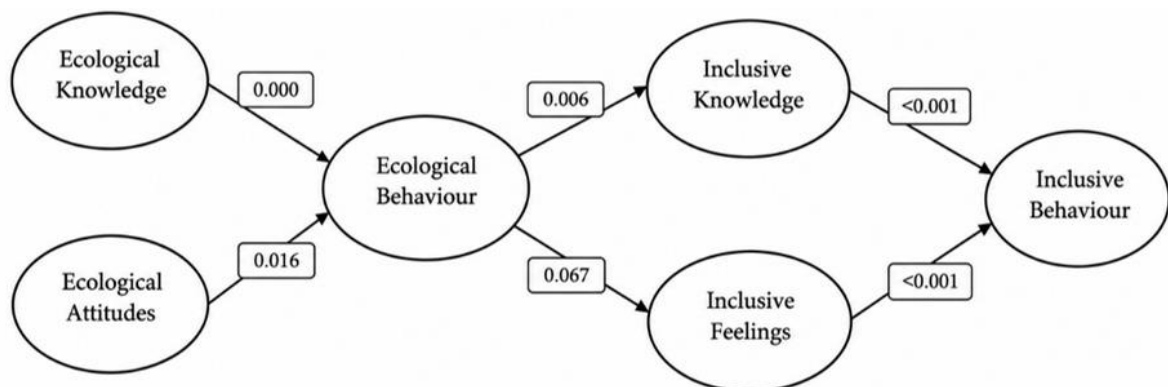


Figure 2. Structural model results

The structural model illustrates the hypothesized relationships among Ecological Knowledge, Ecological Attitudes, Ecological Behaviour, Inclusive Knowledge, Inclusive Feelings, and Inclusive Behaviour. The significance of each hypothesized relationship was evaluated using the PLS-SEM bootstrapping procedure based on the original sample (O), sample mean (M), standard deviation (SD), t-statistics, and p-values. The detailed results of the hypothesis testing, including the magnitude and statistical significance of each structural relationship, are presented in Table 6.

Table 6. Structural model results and hypothesis testing

Hypothesis	Relationship	O	M	SD	T	P	Decision
H1	Ecological knowledge → Ecological Behaviour	0.415	0.413	0.101	4.109	<0.001	Supported
H2	Ecological Attitudes → Ecological Behaviour	0.242	0.245	0.101	2.399	0.016	Supported
H3	Ecological behaviour → Inclusive Knowledge	0.280	0.280	0.103	2.725	0.006	Supported
H4	Ecological behaviour → Inclusive Feelings	0.200	0.203	0.110	1.830	0.067	Not supported
H5	Inclusive knowledge → Inclusive Behaviour	0.398	0.396	0.082	4.848	<0.001	Supported
H6	Inclusive Feelings → Inclusive Behaviour	0.417	0.416	0.073	5.728	<0.001	Supported

Note. O = original sample coefficient; M = bootstrap sample mean; SD = bootstrap standard deviation; T = t-statistic; P = p-value.

The table reports the coefficients and significance values supplied in the original results. The label “structural model results” should be retained only if these values represent the direct path coefficients from the relevant SmartPLS output.

The hypothesis testing results indicate that Ecological Knowledge has a significant positive relationship with Ecological Behaviour, supporting H1. Ecological Attitudes also demonstrate a significant positive relationship with Ecological Behaviour, supporting H2. Furthermore, Ecological Behaviour has a significant positive relationship with Inclusive Knowledge, supporting H3. In contrast, the relationship between Ecological Behaviour and Inclusive Feelings is not statistically significant at the 5% significance level ($p = .067$); therefore, H4 is not supported. Both Inclusive Knowledge and Inclusive Feelings demonstrate significant positive relationships with Inclusive Behaviour, supporting H5 and H6, respectively.

Taken together, the results indicate that ecological knowledge and ecological attitudes are statistically associated with ecological behaviour. Ecological behaviour is also significantly associated with inclusive knowledge, but its relationship with inclusive feelings is not statistically significant. Both inclusive knowledge and inclusive feelings are significantly associated with inclusive behaviour. These findings reveal different patterns across the cognitive, affective, and behavioural dimensions of the proposed model.

The reported results should be supplemented with confidence intervals for the structural path coefficients and relevant explanatory-power statistics, such as the R^2 values of the endogenous constructs, if available from the original SmartPLS analysis. These additional statistics would provide a more comprehensive assessment of the estimated relationships and the explanatory capacity of the model.

4. DISCUSSION

This study examined the structural relationships between ecological awareness and inclusive character among elementary school students in the coastal area of Langkat Regency, Indonesia. Five of the six hypothesized relationships were statistically significant,

whereas the relationship between Ecological Behaviour and Inclusive Feelings was not significant. The findings suggest that ecological knowledge and attitudes are associated with ecological behaviour, while the relationships between ecological behaviour and inclusive character differ across cognitive and affective dimensions. These results provide a basis for discussing how environmental responsibility and inclusive character may be related without assuming that the observed associations establish causal relationships.

The relationship between ecological knowledge and ecological behaviour can be interpreted through the role of knowledge in helping students recognize environmental problems and understand the consequences of their actions. The positive and statistically significant relationship observed in this study suggests that higher ecological knowledge is associated with higher ecological behaviour within the proposed model. Research involving school children has shown that environmental knowledge can become part of a hierarchical process in which knowledge contributes to attitudes and subsequently to everyday environmental practices [17]. This suggests that students who understand environmental problems may be better equipped to recognize the relevance of environmentally responsible actions, particularly when such knowledge is connected to situations that they encounter in their daily lives. Nevertheless, the cross-sectional design does not establish whether knowledge precedes behaviour or whether students who engage in environmentally responsible activities also develop greater ecological knowledge.

The role of ecological attitudes is also important because behavioural development involves more than cognitive understanding. Positive environmental attitudes can provide motivational and affective support for translating environmental knowledge into action. Previous research has demonstrated that environmental education can strengthen students' environmental attitudes and that behavioural responses are more likely to emerge when educational experiences connect knowledge with concern, motivation, and practical opportunities for action [18]. Similarly, research in Indonesian schools has indicated that environmental education programs can be associated with improvements in students' environmental knowledge, attitudes, and behaviour, suggesting that environmental learning is more meaningful when these dimensions are developed simultaneously [19]. The significant positive relationship between Ecological Attitudes and Ecological Behaviour in the present study is consistent with this perspective. Students who express more positive environmental attitudes also tend to report higher ecological behaviour within the model. However, the observed relationship should not be interpreted as proof that attitudes independently cause behavioural change.

The findings can also be interpreted in relation to the role of the school as a social and educational environment. Environmental behaviour is not formed exclusively through individual cognition; it can be reinforced through classroom practices, school routines, social norms, and opportunities for students to participate in environmentally responsible activities. Research using a PLS-based model among university students similarly demonstrated that environmental behaviour can develop through the contribution of environmental intelligence, knowledge, and attitudes [20]. Although the participants and educational level differ from those in the present study, the underlying implication is relevant: educational institutions can provide the social conditions through which environmental understanding is

associated with observable behaviour. In elementary education, this process may be particularly important because students are still developing habits, social responsibility, and value-based patterns of action. The present findings are compatible with this interpretation, although school practices and classroom climate were not directly examined as explanatory variables in the proposed model.

The connection between ecological behaviour and inclusive knowledge suggests that environmental action may also provide opportunities for students to develop broader forms of social understanding. Environmental activities frequently involve cooperation, shared responsibility, collective problem-solving, and awareness of how individual actions affect other people and the surrounding community. Primary school research has shown that students' knowledge, attitudes, and behaviours toward environmental issues are closely related to the ways environmental concepts are understood and experienced in educational settings [21]. From this perspective, environmental learning may provide a context in which students do not merely acquire information about nature but also learn to recognize interdependence, responsibility, and the consequences of collective behaviour. Such experiences can create a foundation for understanding inclusive values that extend beyond environmental concerns. The significant positive relationship between Ecological Behaviour and Inclusive Knowledge observed in this study is consistent with this proposed connection. Students reporting higher ecological behaviour also tend to report higher inclusive knowledge. However, because cooperative environmental activities and students' experiences of shared responsibility were not directly measured, the proposed social mechanism remains an interpretation rather than an empirically established explanation of the relationship.

The relationship between ecological behaviour and inclusive feelings requires a more nuanced interpretation. Behavioural engagement with environmental issues may provide opportunities for cooperation and social responsibility, but these experiences do not automatically produce affective responses such as empathy, emotional sensitivity, or concern for others. The development of inclusive feelings may depend more strongly on direct interpersonal experiences, perspective-taking, emotional learning, and the social climate in which students interact. Research on environmental literacy has similarly emphasized that the relationships among environmental knowledge, attitudes, awareness, and behaviour are not necessarily linear or uniform across contexts [22]. In the present study, the estimated relationship between Ecological Behaviour and Inclusive Feelings was positive but did not reach statistical significance ($\beta = 0.200$, $p = .067$). The result therefore does not provide sufficient evidence to support H4 at the 5% significance level. It does not, however, establish that the relationship is absent in all educational contexts. The affective dimension of inclusive character may require educational experiences that explicitly address interpersonal relationships and emotional understanding rather than relying solely on environmental activities.

This interpretation is particularly relevant because inclusive character involves both cognitive and affective processes. Children need opportunities not only to understand inclusion but also to develop emotional responses that support acceptance and respect toward people who are different from themselves. Research on children and adolescents indicates

that inclusive environments are influenced by social norms, empathy, intergroup contact, and social perspective-taking, all of which contribute to how young people respond to social inclusion and exclusion [23]. Consequently, environmental behaviour may provide a useful context for developing responsibility and cooperation, but the development of inclusive feelings may require additional pedagogical components specifically designed to cultivate empathy and perspective-taking. This explanation should be understood as a plausible interpretation of the non-significant finding rather than a conclusion directly tested by the current model. Future research could examine whether empathy, peer relationships, or inclusive classroom climate helps explain the relationship between ecological behaviour and inclusive feelings.

The subsequent relationship between inclusive knowledge and inclusive behaviour can be understood through the relationship between moral understanding and action. Knowledge about inclusion provides students with cognitive standards for recognizing fairness, respect, participation, and appropriate treatment of others. However, knowledge becomes socially meaningful when students have opportunities to apply these principles in everyday interactions. Research based on the moral knowing, moral feeling, and moral action framework has demonstrated that these dimensions are closely associated with students' moral development, with behavioural action representing an important component of character formation [24]. The significant positive relationship between Inclusive Knowledge and Inclusive Behaviour in the present study is consistent with the interpretation that understanding inclusive principles is associated with students' reported inclusive conduct. This supports the relevance of providing opportunities to practice inclusive principles in everyday school interactions, although the present results do not establish that knowledge alone produces behavioural change.

The role of inclusive feelings in relation to inclusive behaviour can similarly be discussed through affective mechanisms. Feelings such as empathy, concern, acceptance, and sensitivity toward others may be associated with students' responses to peers in supportive and respectful ways. Evidence from primary and middle school students in China shows that empathy is associated with attitudes toward peers with disabilities and can partially mediate the relationship between an inclusive school climate and peer attitudes [25]. This indicates that affective processes are particularly relevant to the translation of inclusive values into interpersonal responses. The positive and statistically significant relationship between Inclusive Feelings and Inclusive Behaviour in the present study is consistent with this broader perspective. Students reporting more positive inclusive feelings also tend to report higher inclusive behaviour. Nevertheless, the current analysis does not establish that inclusive feelings mediate or independently cause inclusive behaviour.

The importance of affective development is further supported by intervention research in inclusive education. Recent evidence indicates that social-emotional learning activities can improve primary school students' attitudes toward peers with disabilities by strengthening social awareness and relationship skills [26]. Similarly, an intervention using disability-themed picture books improved primary school children's attitudes toward peers with disabilities across cognitive, emotional, and behavioural dimensions, demonstrating the potential of structured learning experiences to connect knowledge, emotions, and behaviour

in inclusive education [27]. These findings suggest that the development of inclusive character may be strengthened when students are provided with concrete opportunities to understand differences, consider other people's perspectives, and practice supportive behaviours. The intervention findings provide relevant pedagogical context, but they should not be interpreted as direct evidence that the same intervention mechanisms operated among the participants in the present survey study.

The findings also have implications for understanding inclusive character as a multidimensional construct rather than a single behavioural outcome. Inclusive knowledge, inclusive feelings, and inclusive behaviour represent related but distinguishable dimensions of character development. A student may understand the principles of inclusion without consistently experiencing strong emotional identification with others, while another student may demonstrate supportive behaviour because of classroom norms or repeated social experiences. The development of inclusive character therefore requires the integration of cognitive, affective, and behavioural learning experiences. This interpretation is consistent with recent research showing that positive attitudes toward peers with disabilities are shaped by multiple contextual and interpersonal factors rather than by knowledge alone [28]. The differing patterns of structural relationships in the present study further support the importance of examining these dimensions separately rather than treating inclusive character as a uniform outcome.

The environmental and inclusive dimensions of the present model can therefore be understood as potentially related rather than completely independent. Environmental learning can encourage students to recognize interdependence, shared responsibility, and the consequences of individual actions, while inclusive education emphasizes respect, participation, empathy, and equitable relationships. Bringing these dimensions together may be particularly meaningful in elementary education because students encounter environmental and social issues through concrete experiences within their schools and communities. The coastal context of Langkat Regency provides the geographical and educational setting for examining these relationships, but the present study does not establish that coastal conditions strengthen or otherwise modify the relationships in the model. The results should therefore be interpreted as findings from students in this particular context rather than evidence of a distinct coastal-context effect. Environmental education research has shown that educational interventions can improve environmental outcomes among children and adolescents, while the effectiveness of such interventions varies according to educational approaches and contextual conditions [29].

From a pedagogical perspective, the findings suggest that environmental education should not be limited to the transmission of ecological information. Learning activities can be designed to connect ecological knowledge with collaborative tasks, reflection, community participation, and socially responsible decision-making. Educators may also consider incorporating explicit inclusive-learning components into environmental activities, such as perspective-taking exercises, cooperative group tasks, and reflection on how environmental decisions affect people with different needs. This recommendation follows from the observed distinction between the significant relationship involving inclusive knowledge and the non-significant relationship involving inclusive feelings. However, the

effectiveness of such integrated activities needs to be examined through further intervention research rather than assumed from the current correlational findings.

The overall contribution of the study lies in examining ecological awareness and inclusive character within the same structural framework. The model indicates that cognitive, affective, and behavioural dimensions should not be treated as interchangeable, because their relationships may differ and may require different educational experiences. This distinction is especially important for inclusive education, where students' attitudes and social acceptance toward peers can be influenced by the interaction between school climate, empathy, and opportunities for meaningful participation. Recent research has likewise emphasized that social participation and inclusive classroom experiences can play an important role in improving students' attitudes toward peers with disabilities [30]. Therefore, future educational programs may benefit from combining environmental learning with explicit activities that foster empathy, perspective-taking, cooperation, and inclusive social interaction.

Several limitations should be considered when interpreting these findings. First, the study involved 85 fifth-grade students from four elementary schools in one coastal area, which may limit the generalizability of the results to other student populations and educational settings. Second, the survey design does not establish temporal order or causal relationships among the constructs. Third, the model did not directly measure potentially relevant factors such as school climate, teacher practices, socioeconomic background, family values, empathy, peer relationships, or participation in environmental education programs. These factors may be associated with both ecological awareness and inclusive character and may provide alternative explanations for some of the observed relationships. Fourth, if the constructs were assessed exclusively through student self-report questionnaires, the results may also be affected by response tendencies and social desirability. Finally, the coastal setting was not modeled as a separate variable, so its specific contribution to the observed relationships remains undetermined.

Future research could address these limitations by recruiting larger samples across multiple geographical settings, examining the role of school and family contexts, and including additional measures of empathy, peer interaction, and inclusive classroom climate. Longitudinal studies could help clarify the temporal relationships among ecological knowledge, ecological attitudes, ecological behaviour, and inclusive character. Intervention studies could also test whether environmental learning activities explicitly integrated with empathy development, perspective-taking, and inclusive cooperation are associated with improvements in both ecological responsibility and inclusive behaviour. Such research would help establish the conditions under which the proposed integration of ecological awareness and inclusive character may be most useful in elementary education.

5. CONCLUSION

This study examined the structural relationships among ecological knowledge, ecological attitudes, ecological behaviour, and inclusive-character dimensions among fifth-grade elementary school students in coastal Langkat Regency, Indonesia. The findings provide preliminary evidence of associations among these dimensions. Ecological

knowledge and ecological attitudes showed significant positive structural relationships with ecological behaviour. Ecological behaviour was significantly and positively related to inclusive knowledge but did not show a statistically significant relationship with inclusive feelings ($p = 0.067$). Both inclusive knowledge and inclusive feelings showed significant positive structural relationships with inclusive behaviour. These findings contribute to understanding the relationships between ecological and inclusive-character dimensions in elementary education, without establishing causal effects or demonstrating changes in character development.

Practically, the findings suggest that educators may consider integrating ecological learning with collaborative activities that encourage environmental responsibility, inclusive knowledge, and respectful social interaction. These implications should be interpreted cautiously because the study did not test an educational intervention or measure developmental changes over time. The relatively small sample of 85 students from four schools in one coastal regency also limits the generalisability of the findings. Future research should employ longitudinal designs, experimental environmental-education interventions, larger multisite samples, and direct measures of inclusive behaviour to examine the robustness of these relationships and determine whether targeted learning activities lead to measurable changes in inclusive-character dimensions.

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