

Eco-pedagogical content's impact on EFL learners' environmental attitudes and behaviors: A structural equation modeling study

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ABSTRACT

Increasing scholarly attention has been directed to integrating environmental issues into educational contexts across academic disciplines. Within this context, foreign language classrooms offer valuable opportunities to incorporate environmental content into language learning. This study examines the impact of integrating environmental issues into English as a Foreign Language (EFL) instruction on students' environmental attitudes and behaviors. The study involved 562 EFL learners. A quantitative research design was adopted, and three hypotheses were tested using Structural Equation Modeling. The proposed model assumes that the presence of environmental issues in language instruction positively influences environmental attitudes and environmental behavior, and that environmental attitudes also positively affect environmental behavior. The findings reveal that the inclusion of environmental topics into EFL instruction significantly strengthens students' environmental attitudes and behaviors, both directly and indirectly. In addition, gender-based analyses indicate that female students scored significantly higher across all three scales. Similarly, students who had previously taken a course related to environmental issues exhibited significantly higher levels of environmentally responsible behavior compared to those who had not. Overall, these findings emphasize the potential of foreign language classrooms to function as interdisciplinary spaces that foster environmental awareness, positive attitudes, and environmentally responsible behaviors.

1. Introduction

The deterioration of ecosystems caused by human activities threatens all living organisms (Konvalova et al., 2021; Kazazoglu, 2025). Raising environmental awareness through education is crucial to address these challenges. Programs focusing on sustainability have the potential to enhance individuals' relationships with nature (Cristovao et al., 2022) and promote ecologically responsible behavior. Eco-pedagogy encourages critical reflection on environmental issues and promotes not only knowledge but also transformative action (Hofreiter et al., 2007; Stern et al., 2014) while eco-education fosters environmental awareness and positive attitudes toward the environment (Hauschild et al., 2012). Language classrooms are practical spaces for integrating ecological issues into curriculum (Hassan, 2020; Konvalova et al., 2021; Özönur, 2021; Ushioda, 2013; Zahoor & Janjua, 2020). Integrating eco-pedagogical principles into language learning is particularly valuable, as language classrooms offer a natural setting for discussions of real-life issues

(Brown, 1991; Cates, 1997). In English as a Foreign Language (EFL) settings, where learners engage with international content and perspectives, incorporating ecological themes not only improves linguistic competence but also helps to develop global citizenship and environmental responsibility (Konvalova et al., 2021; Özönur, 2021; Zahoor & Janjua, 2020). Despite the discussions on environmental awareness, studies examining the integration of environmental issues into language education remain limited (Coşkun, 2024; Özönur, 2021). As a result, climate change education (CCE) is often addressed superficially and lacks sufficient depth (Winter et al., 2022). Although environmental topics are important, they are rarely included in EFL settings in Turkey (Coşkun, 2024; Gürsoy, 2010; Gürsoy & Sağlam, 2011; Konvalova et al., 2021). Research shows that teachers recognize value of environmental education (EE) but struggle to implement it because of the resource and curriculum constraints (Bhusal, 2021; Essa & Harvey, 2022). Given the key role of education in fostering environmentally responsible individuals, integrating environmental issues into teaching is essential. In this

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context, this study examines the observable outcomes of students' engagement with environmental issues such as increased interest, critical reflection and shifts in environmental perspectives. Environmental education (EE) not only fosters ecological awareness but also supports language learning by connecting classroom content with real-world challenges (Hauschild et al., 2012). Thus, integrating environmental themes into language classrooms can strengthen both language proficiency and learners' critical engagement with global environmental issues.

Studies highlight EE's benefits on students' environmental literacy and attitudes (Aminrad et al., 2013; Mifsud, 2011), but its impact on language teaching is still limited (Gürsoy, 2010). This study explores the impact of incorporating environmental issues into EFL instruction on students' attitudes and behaviors through a conceptual model that tests the three proposed hypotheses (H).

2. Theoretical framework

2.1. Eco-pedagogy

As an educational philosophy, eco-pedagogy emerged from critical pedagogy, particularly in the Freirean philosophy, which considers education as a tool for social transformation and the development of critical consciousness (Misiąszek, 2020). It aims to re-educate individuals as global citizens to care for and act upon the needs of the Earth (Omiyefa et al., 2015). Eco-pedagogy promotes eco-awareness, social justice, and transformative action by positioning learners as active individuals who can critically engage with environmental issues, question the ideology of consumerism and accept the interconnectedness of all life forms (Hung, 2017; Kahn, 2008). It criticizes the policies that focus mainly on economic growth, and its main aim is to prepare ecological citizens who not only possess environmental awareness but also act against injustice and unsustainability (Rivers & Weber, 2011).

Developing environmental literacy (EL) is a core principle of eco-pedagogy. EL is the capacity to understand environmental systems, critically evaluate eco-related issues, and make responsible decisions. This is closely related to eco-critical thinking, where learners are not only taught about environmental challenges, but are encouraged to critically question their causes, implications, and possible solutions (Misiąszek, 2020). Through this approach, eco-pedagogy aims to promote transformative learning by cultivating individuals who are not only informed but also empowered to act in the future.

2.2. Eco-pedagogy in teaching English as a foreign language

In English as a foreign language teaching context, eco-pedagogy provides a meaningful structure that supports both language development and environmental education. Integrating eco-pedagogical principles into language teaching not only facilitates linguistic competence but also raises students' awareness of ecological issues (Chuku, 2020; Hauschild et al., 2012). The eco-pedagogical approach to English language teaching aligns with task-based, content-based, and communicative language teaching methodologies, all of which emphasize the use of authentic materials to enhance language competence.

Environmental topics provide meaningful and authentic content that can support communicative competence while fostering awareness of sustainability and social responsibility (Nkwetisama, 2011; Veselinovska & Kirova, 2013). These themes offer real contexts for practicing both micro-skills (e.g., vocabulary development) and macro-skills (e.g., reading comprehension, essay writing) (Kazazoglu, 2025; Babcock, 1993). In this sense, EFL classrooms can function as spaces where environmental issues become meaningful contexts for communication, reflection, and critical engagement rather than merely thematic additions to instructional content.

Classroom activities such as critical readings and problem-solving tasks encourage learners to engage with global issues like climate

change and sustainability while using English in purposeful ways (Chuku, 2020; Veselinovska & Kirova, 2013).

By addressing genuine environmental challenges, EFL instructors make a connection between language learning and social responsibility (Hauschild et al., 2012). For example, lessons focusing on recycling or pollution can both improve language proficiency and promote environmentally responsible behaviors. In doing so, English functions as a tool for communication and critical environmental citizenship.

Integrating environmental issues into the language curriculum can strengthen learners' motivation to act sustainably (Crookes, 2021; Micalay-Hurtado & Poole, 2022). Embedding eco-pedagogical principles in EFL education and using English as a communicative tool is a relevant approach within language teaching and directly linked to eco-principles.

2.3. Empirical studies

The concepts of attitude and behavior have been explored in psychology, sociology, education, and economics, leading to various definitions. Attitude is often described as a learned tendency to respond to objects, individuals, or issues in a positive or negative way (Eilam & Trop, 2012). It encompasses beliefs, emotions, and behaviors (Liu et al., 2018). Environmental attitudes involve concern for the environment and the motivation to take action, shaped by social, cultural, and economic factors (Pe'er et al., 2007). As Stern (2000) emphasized, these attitudes can influence behaviors and are often linked to individuals' broader beliefs (Stern, 2000).

Environmental behavior refers to active responses to environmental issues, ranging from personal actions like reducing consumption to public efforts and supporting green policies (Stern, 2000). Such behavior can be intentional or unintentional, depending on environmental awareness. High environmental literacy, often developed through environmental education, leads to positive environmental attitudes and responsible behaviors; therefore, a dynamic relationship exists between environmental literacy, attitudes, and behavior (Pe'er et al., 2007).

Knowledge can transform attitudes and behaviors, as reflected in eco-pedagogy, which seeks to cultivate critical environmental awareness and foster environmental advocacy (Zsóka et al., 2013). This transformation is critical because individuals with negative environmental attitudes are less likely to engage in eco-friendly behaviors. Therefore, integrating environmental issues into education can positively influence students' attitudes and behaviors, contributing to the prevention of environmental problem (Gürsoy, 2010; Liu et al., 2018). Studies show that including environmental topics in textbooks, class discussions, and assignments enhances environmental knowledge and awareness (Laaloua & Tamer, 2022). However, debates continue about whether environmental education directly leads to behavior change (Pooley & O'Connor, 2000; Uğulu et al., 2013).

Few studies have explored foreign language learners' environmental awareness (Coşkun, 2024; Gültekin, 2017; Gürsoy, 2010), while most have focused on the extent to which global issues are covered in textbooks (Bhusal, 2021; Yalçınkaya & Çetin, 2018). This highlights a critical gap in language education amid the ongoing climate crisis and emphasizes the pedagogical and social responsibilities of language teachers to integrate environmental issues into their instruction (Coşkun, 2024).

Despite growing global research on students' environmental perceptions and behaviors, studies specifically focusing on attitudes of English preparatory students remain limited. This scarcity can be attributed, in part, to the view that English language teaching primarily focuses on language competence rather than broader educational aims (Boon, 2022). The author argues that language teachers often perceive the climate crisis as beyond their teaching responsibilities, avoid covering environmental topics and view them as politically sensitive and conflicting with the perceived neutrality of language teaching.

3. Conceptual model, hypotheses and research questions

3.1. Conceptual model

A conceptual model was developed to assess the influence of environmental issues embedded in EFL instruction on learners' environmental attitudes and behaviors.

The conceptual model offers a structure that visually shows the relationships among key concepts. The model is grounded in prior studies suggesting that learning environmental topics fosters environmental awareness, concern, and pro-environmental behaviors (Kollmuss & Agyeman, 2002; Bhusal, 2021; Putri, 2018; Bradley et al., 1999; Schultz, 2001; Coşkun, 2024; Kazazoğlu, 2025).

3.2. Hypotheses

Based on the model and existing literature, the study proposes the following hypotheses:

H1: Presence of environmental issues (PEIs) positively influences environmental behaviors (EB).

H2: Presence of environmental issues (PEIs) positively influences environmental attitudes (EA).

H3: Environmental attitudes (EA) positively influence environmental behavior (EB).

3.3. Research questions

To test these hypotheses, the following research questions were developed:

RQ1. Does the inclusion of environmental issues in EFL instruction influence students' environmental attitudes?

RQ2. To what extent do perceived environmental issues (PEIs) in EFL lessons influence students' environmental behaviors (EB)?

RQ3. To what extent do students' environmental attitudes (EA) influence their environmental behaviors (EB)?

3.4. Additional research question on group differences

In addition to testing the conceptual model, this study also explores whether students' perceptions of environmental issues (PEIs), environmental attitudes (EA), and environmental behaviors (EB) differ across demographic variables and following research question is posed:

RQ4. Do students' perceptions of PEIs, EA, and EB differ by gender, parental education, residence, income, and prior environmental education?

4. Methodology

4.1. Data collection tools and procedure

This study employed a quantitative research design developing three scales: PEI, EA and EB to test the three hypotheses to assess the impact of the presence of environmental issues on learners' attitudes and behaviors. A conceptual model was developed to examine the relationships between the study variables measured by the scale items. This study was conducted at the School of Foreign Languages of a state university. Initially, feedback from three language specialists informed revisions to improve clarity and content, followed by a pilot study with 121 students, which resulted in the final scales. Reliability analysis showed coefficients of 0.87 (PEIs), 0.84 (EA) and 0.79(EB).

To examine participants' perceptions and behaviors related to environmental issues, three validated scales were administered: Presence of Environmental Issues (PEIs) with 6 items, Environmental Attitudes (EA) with 5 items and, and Environmental Behavior (EB) with 4 items assessing perspectives on, interest in, and critical thinking about global issues. All scale responses were rated on a 5-point Likert scale, ranging

from 'strongly disagree' to 'strongly agree', with *neutral* as the midpoint. Higher scores indicate stronger agreement with the statements.

The measurement instruments used in this study were developed and validated through a multi-stage process. The items of the Presence of Environmental Issues scale were generated based on an extensive review of the literature on environmental education in language teaching (e.g., Arikan, 2009; Cates, 1990; Gürsoy & Sağlam, 2011; Jacobs & Cates, 2012; Perez-Rodriguez et al., 2017) as well as instructors' opinions to ensure content relevance. The Environmental Attitude and Environmental Behavior scales were adapted from previously validated instruments (Fernández-Manzanal et al., 2007; Boubonari et al., 2013; Bozoğlu et al., 2016).

Prior to the main data collection, the questionnaire was pre-tested with 15 volunteer participants to evaluate the clarity and comprehensibility of the items, and minor revisions were made based on their feedback. Subsequently, a pilot study was conducted with 121 participants to assess the psychometric properties of the scales. Item correlation matrices were examined and no items with very low ($r < 0.20$) or excessively high correlations ($r > 0.90$) were identified. Therefore, all items were retained. Following the pilot stage, exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) were conducted to examine and validate the factor structure of the scales, providing evidence for construct validity and reliability before testing the structural relationships among the variables. Descriptive statistics analyzed demographic data and environmental perceptions, while factor analysis and reliability testing were conducted to measure the latent variables. For the fourth question, non-parametric tests ($p \leq .05$) were applied for group comparisons based on gender, place of stay, parental education, self-perceived income, and prior environmental education.

In addition to the three scales, structural equation model was developed to test the three hypotheses.

4.2. Structural equation model (SEM)

SEM was chosen to test the hypothetical conceptual model and examine both direct and indirect effects between observed and latent variables (Bayram, 2010). Widely used in social sciences, SEM accounts for measurement errors and includes two components: the measurement model, which assesses latent constructs, and the structural model, which estimates relationships among them. (Bayram, 2010; Byrne, 2010). The analysis was conducted using AMOS to test the model, following a two-step approach: measurement model evaluation (CFA) and structural model testing. SEM tested hypothesized relationships after confirming validity and reliability. Model fit was evaluated using χ^2 significance, Comparative Fit Index (CFI), Goodness of Fit Index (GFI), Root Mean Square Error of Approximation (RMSEA), and Standardized Root Mean Squared Residual (SRMR). An RMSEA < 0.08 , SRMR < 0.05 , and GFI/CFI > 0.95 were considered satisfactory (Byrne, 2010; Hu & Bentler, 1999).

4.3. Setting, participants and demographic information

Demographic information is presented in Table 1.

562 (339 females, 223 males) English language learners enrolled in a preparatory programme at a School of Foreign Languages (SoFL) participated in the study. SoFL aims to bring students to B1+ language proficiency for departmental entry. Students came from diverse backgrounds, with English levels ranging from beginner to intermediate. The program includes 24 h of instruction per week and uses a commercially published EFL coursebook as the primary instructional material, in which eco-pedagogical and environmental themes appear to receive limited attention. Convenience sampling was used. About 56% lived in dormitories. Regarding parental education, most mothers were primary school (32.2%) or high school (31.7%) graduates; fathers were mainly high school (35.1%) or university (27.8%) graduates. The majority (66.5%) reported medium economic status, and 34% had taken an environmental course.

Table 1
Demographic information (N = 562)

	N	%
Gender		
Female	339	60.3
Male	223	39.7
Place of stay		
Dormitory	315	56.0
House	247	44.0
Parental Education		
Mother		
Primary	181	32.2
Secondary	112	19.9
High school	178	31.7
Higher	91	16.2
Father		
Primary	105	18.7
Secondary	104	18.5
High school	197	35.1
Higher	156	27.8
Self-Perceived income		
Low/very low	36	6.4
Medium	374	66.5
High/very high	152	27.1
Taking Environmental Course		
Yes	191	34
No	371	66

5. Analysis and results

5.1. Presence of Environmental Issues Scale (PEIs)

Table 2 shows the descriptive statistics for the six items assessing students' perceptions of how English preparatory education contributes to their awareness, interest, and critical thinking regarding environmental issues.

5.2. Environmental Attitude (EA) and Environmental Behavior (EB) Scales

Table 3 presents the items and response distributions for the environmental attitude and environmental behavior scales.

5.3. Validity and reliability analyses

Confirmatory Factor Analysis (CFA) was conducted to validate the construct structure of each scale, followed by assessments of internal consistency and convergent validity (Figs. 1–4).

Table 2
Descriptive statistics for PEIs scale

	Items	Mean	Median	Standard deviation
1	The English textbooks we use increase my awareness of environmental issues.	2.94	3.00	0.99
2	The supplementary materials (worksheets, digital resources, etc.) used in the English preparatory program increase my environmental awareness.	2.80	3.00	0.99
3	English teachers' in-class activities increase my interest in environmental issues.	3.05	3.00	1.04
4	My perspective on environmental issues changes while learning English.	2.38	2.00	1.03
5	English preparatory education increases my interest in global environmental issues.	2.44	2.00	1.04
6	English preparatory education improves my ability to think critically about environmental issues.	2.98	3.00	1.03

Table 3
Descriptive statistics for EA and EB scales

	Items	Mean	Median	Standard deviation
EA				
EA1	We must protect plants and animals, even if it is expensive.	4.30	5.00	0.96
EA2	Environment lessons should be practical.	4.15	4.00	0.98
EA3	Those who pollute the environment should be fined.	4.34	5.00	0.98
EA4	Newspapers, magazines, and television should have more programs on environmental issues.	4.20	4.00	0.91
EA5	Environmental courses should be compulsory.	3.66	4.00	1.24
EB				
EB1	I usually read publications on environmental issues.	2.90	3.00	1.08
EB2	I take care to buy recyclable packaged products in my daily life.	3.12	3.00	1.05
EB3	I pay attention to separate collection of household waste in my daily life.	3.35	3.00	1.15
EB4	I take care to consume products that do not contain substances harmful to the ozone layer.	3.28	3.00	1.06

5.4. Construct reliability and validity

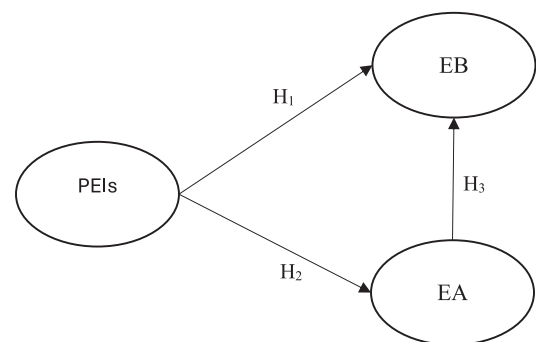
Prior to testing the structural relationships, the validity and reliability of the measurement model were examined. Confirmatory factor analysis (CFA) was conducted to assess the construct validity of the scales. Convergent validity was evaluated through factor loadings, composite reliability (CR), and average variance extracted (AVE). The reliability and convergent validity of the scales were examined.

The standardized regression weights ranged between 0.67 and 0.81 for PEI, 0.67 to 0.77 for EA and 0.61 to 0.84 for EB. The internal consistency was used to evaluate reliability. Cronbach's alpha and Composite Reliability (CR) were reported. Cronbach's alpha and CR values for scales were found to be higher than 0.70. The Cronbach's alpha values for the scales ranged from 0.79 to 0.87. These results indicate strong internal consistency and reliability. These values indicate acceptable reliability (Hair et al., 2010). We also checked the Average Variance Extracted (AVE) for convergent validity. The AVE was found to be greater than 0.50 and CR > AVE, indicating adequate convergent validity (Hair et al., 2010).

Discriminant validity was assessed by comparing the square roots of AVE values with the inter-construct correlations following the Fornell-Larcker criterion (Table 5).

The square roots of the AVE values for each construct were greater than the correlations between the constructs, indicating that each construct was empirically distinct from the others. Therefore, the results support the discriminant validity of the measurement model.

In addition, to examine the potential impact of common method bias resulting from the use of self-report Likert-type measures, Harman's

**Fig. 1.** A conceptual model was developed to assess the influence of environmental issues embedded in EFL instruction on learners' environmental attitudes and behaviors

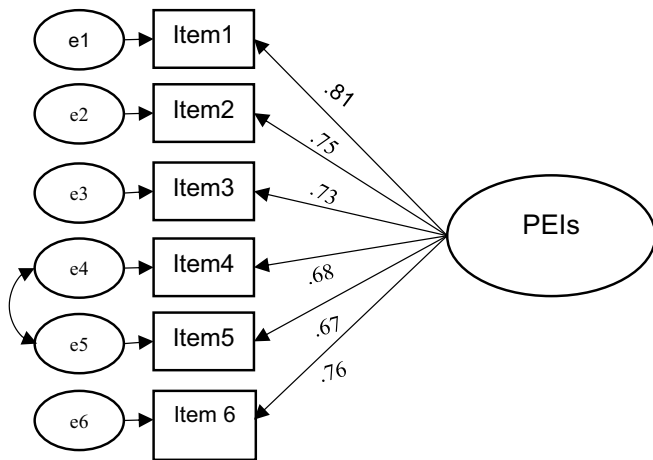


Fig. 2. Confirmatory Factor analysis of PEIs
Confirmatory Factor Analysis (CFA) was conducted to validate the construct structure of each scale, followed by assessments of internal consistency and convergent validity.

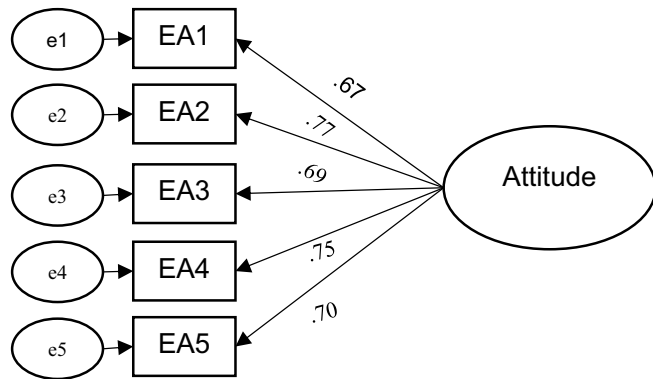


Fig. 3. Confirmatory factor analysis of EA

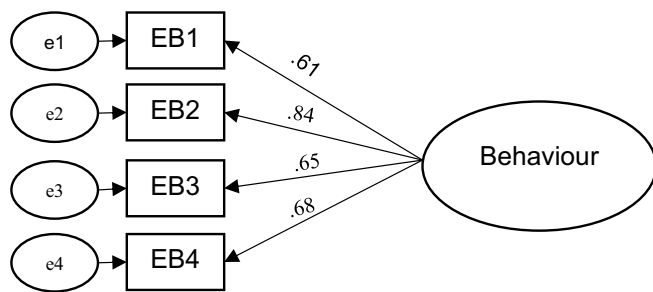


Fig. 4. Confirmatory factor analysis of EB

single-factor test was conducted. The results showed that multiple factors emerged and that the first factor did not account for the majority of the variance, indicating that common method bias was not a serious threat to the validity of the results.

5.5. Goodness of fit

Goodness-of-fit assessed using five main indices were found to be adequate for all scales. These results indicate a good fit. The reliability and validity of the scales were confirmed by the goodness of fit indices (Table 6).

5.6. Inferential analysis by gender

The Mann-Whitney U test showed significant differences, with female students scoring higher across PEIs, EB, and EA scales in Table 7.

Since the scores did not follow a normal distribution, the Mann-Whitney U Test was used to examine whether the scores differed by gender. The results reveal significant differences with female students scoring higher on all three scales (PEIs, EB, and EA) at $p = .008$, $p < .001$, and $p < .001$, respectively.

5.7. Inferential analysis by environmental course

Mann-Whitney U test analysis showed that students, previously taken a course related to environmental issues, scored higher in environmental behavior than those who had not (Table 8).

5.8. Structural Equation Model (SEM) results

Following the two-step SEM approach described in Section 4.2, the structural model was employed to test the hypothesized model. For RQ2, SEM confirmed that the presence of environmental issues (PEIs) positively influences environmental attitudes (EA) and behaviors (EB). Multivariate normality was assessed using Mardia's coefficient. The results indicated a critical ratio (c.r.) of 28.07, which exceeds the recommended threshold of 5, suggesting a violation of multivariate normality. Therefore, the Asymptotically Distribution-Free (ADF) estimation method was employed in the CFA and SEM analyses to obtain robust parameter estimates.

The model showed an acceptable fit index ($\chi^2/df = 1.495$, RMSEA = 0.03, SRMR = 0.04, GFI = 0.96, CFI = 0.95), with direct positive effects of environmental issues on both attitudes ($\beta = 0.25$, $p < .01$) and behaviors ($\beta = 0.32$, $p < .01$). Additionally, environmental attitudes positively impacted behavior ($\beta = 0.36$, $p < .01$), and PEIs also indirectly influenced EB through EA. All hypotheses were supported by these findings. SRMR values less than 0.05 and GFI, CFI values larger than 0.95 are generally considered satisfactory (Hu & Bentler, 1999). The model showed an acceptable level of model fit to data.

Fig. 5 shows that more environmental content in language courses positively impacts students' environmental attitudes ($\beta = 0.25$; $p < .01$) and behavior ($\beta = 0.32$; $p < .01$). Environmental attitudes directly and positively affect environmental behavior ($\beta = 0.36$; $p < .01$). At the same time, PEIs indirectly and positively affects EB. All estimated coefficients are significant, and all hypotheses were supported (Table 9).

6. Discussion and conclusion

The study investigated the impact of exposure to environmental issues in an EFL context on students' attitudes and behaviors. Using Mann-Whitney U tests and SEM with the PEIs scale, the study shows how

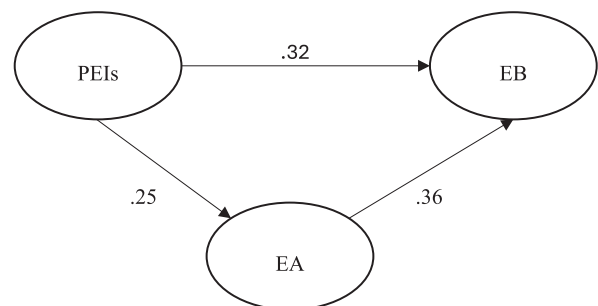


Fig. 5. SEM

exposure to environmental content in language education directly and positively influences students' attitudes, behaviors, and actions. Both analyses confirm that integrating environmental topics into language education fosters pro-environmental behavior, reinforcing its importance in EFL curricula. The inclusion of environmental topics is shown to be a driving force for awareness and engagement with sustainability efforts. Including more environmental content in foreign language education appears to be a critical driver for enhancing students' awareness and proactive engagement.

Mean scores range from 2.38 to 3.05, indicating a general tendency toward neutral to slightly positive perceptions, with a standard deviation of around 1, indicating moderate variability in responses. The highest-rated item (3), "English teachers' in-class activities increase my interest in environmental issues," with a value of 3.05, indicates that classroom practices are seen as relatively beneficial in raising environmental interest. Item 1 and item 6 suggest that preparatory education and textbooks enhance environmental awareness and critical thinking.

The SEM model highlights that fostering positive attitudes enhances students' environmental engagement, leading to responsible behaviors and reinforcing the role of language education in promoting sustainability. The high reliability of the scales, particularly PEIs (see Table 4), supports their effectiveness in measuring environmental attitudes, behaviors, and perceptions. All model coefficients are significant, supporting H1, H2, and H3 and affirming that environmental topics in English instruction form a consistent, measurable construct. These results suggest that increasing environmental content in foreign language education can positively impact environmental attitudes and behaviors.

Studies (Liu et al., 2018; Kazazoglu, 2025; Bozoglu et al., 2016; Abbas et al., 2014) also highlight a strong link between environmental knowledge and attitudes, which is consistent with the findings of this study. Pe'er et al. (2007) found that students educated on environmental issues are more knowledgeable and have stronger attitudes. While most studies align with these findings, some studies (Evans et al., 2007; Paco & Lavrador, 2017) reported weaker or nonsignificant relationships, suggesting factors like age may influence results, with younger students showing inconsistencies due to developmental differences.

Kuhlemeier et al. (1999), in their study, found that students' environmental knowledge was fragmented and often inaccurate, and their environmentally responsible behaviors were generally lacking. Although knowledge presented a weak correlation with attitudes and behaviors, the authors noted that students who were more willing to make sacrifices were more likely to engage in environmentally responsible actions. A similar result was found by Arshad et al. (2021), in that university students generally demonstrated high environmental awareness, concern, and behavior, but had relatively low environmental attitudes. Biological sciences students scored highest across all dimensions, while arts, social sciences, and environmental sciences

Table 4
Construct reliability and validity results for PEIs, EA, and EB scales

Construct	Item	Factor loading	Cronbach alpha	CR	AVE
The Presence of Environmental Issues (PEIs)	PEI1	0.808	0.87	0.87	0.54
	PEI2	0.750			
	PEI3	0.729			
	PEI4	0.681			
	PEI5	0.673			
	PEI6	0.766			
Environmental Attitudes (EA)	EA1	0.677	0.84	0.84	0.52
	EA2	0.775			
	EA3	0.688			
	EA4	0.756			
	EA5	0.703			
Environmental Behavior (EB)	EB1	0.612	0.79	0.79	0.50
	EB2	0.844			
	EB3	0.657			
	EB4	0.682			

Table 5
Correlations

Scales	PEIs	EA	EB
PEIs	0.735		
EA	0.174**	0.721	
EB	0.341**	0.409**	0.707

Square roots of AVE have shown diagonally (in bold).

** $p < .001$.

Table 6
Goodness of fit indexes for CFA model

Scales	X ² /df	p	RMSEA	SRMR	GFI	CFI
PEI	3.042	0.002	0.06	0.04	0.98	0.96
EA	3.639	0.003	0.07	0.04	0.97	0.91
EB	0.234	0.791	0.00	0.01	0.99	1.00

Table 7
Mann-Whitney U test results for gender

Scale	Gender	N	Mean	Standard deviation	p value
PEIs	Female	339	2.84	0.77	0.008
	Male	223	2.64	0.82	
EB	Female	339	3.32	0.73	0.000
	Male	223	2.92	0.95	
EA	Female	339	4.33	0.68	0.000
	Male	223	3.82	0.79	

Table 8
Mann-Whitney U test for taking environmental course

Scale	Course	N	Mean	Standard deviation	p value
PEIs	Yes	191	2.80	0.77	0.335
	No	371	2.74	0.82	
EB	Yes	191	3.27	0.73	0.007
	No	371	3.10	0.95	
EA	Yes	191	4.17	0.68	0.388
	No	371	4.10	0.79	

Table 9
Coefficient and supported hypotheses

Scales	β	p	Conclusion
PEIs → EB	0.325	<0.000	Supported
PEIs → EA	0.253	<0.000	Supported
EA → EB	0.367	<0.000	Supported

p-value indicates a significant relationship between PEIs and EB, EA and EB. SEM quantifies and confirms the structure proposed in the conceptual model.

students showed lower scores, especially in attitude. Interestingly, while awareness and concern positively influenced behavior, attitude had a negative effect, indicating a complex relationship between knowledge, feelings, and actions.

Additionally, the current study examined the relationship between PEIs, EB, and EA with gender, residence, income, parental education, and prior environmental education. No significant relationships were found, except for gender and previous environmental coursework. In our study, females consistently scored higher on all scales, indicating stronger environmental attitudes and behavior and a more positive perception of environmental issues.

These findings align with studies (Bush & Clayton, 2023; Ogunbode & Arnold, 2012), suggesting that females prioritize environmental concerns more, potentially due to socialization (McCrigh, 2010), empathy, or values related to care and sustainability. Women often view environmental issues as collective welfare concerns (Bush & Clayton,

2023) and are often socialized to value caretaking or nurturing roles, including care for the environment. Studies show gender-related differences in environmental attitudes and behaviors, sometimes favoring females (Alp et al., 2008) or males (Eagles & Demare, 1999; Sönmez & Yerlikaya, 2017; Sousa et al., 2021).

These results suggest that gender-responsive strategies in EFL-based environmental education may enhance engagement, and future research should explore underlying factors and tailored pedagogical approaches for bridging gender differences. A limited number of students with prior environmental coursework scored higher on EB (Table 8), supporting studies on the limited integration of environmental education in Turkish curricula (Demir & Yalçın, 2014; Kahyaoglu, 2016; Mete, 2006). This also indicates that prior exposure to environmental topics fosters proactive environmental actions. This aligns with studies by Bradley et al. (1999), Liefänder and Bogner (2014), and Bogner and Wiseman (2004), who found that outdoor and nature-based projects develop stronger environmental attitudes and enhance engagement in responsible actions beyond the classroom.

However, some studies show contrasting findings. For example, Erhabor and Don (2016) found that Nigerian university students' environmental knowledge and positive attitudes did not necessarily lead to pro-environmental behaviors, such as recycling. While our study showed a positive relationship between exposure to environmental issues and students' attitudes, it did not assess specific behaviors. This limits our understanding of whether increased awareness leads to specific types of action. In the Nigerian context, the gap may stem from factors such as age, context, or the environmental content delivered. Future research could examine which specific topics like consumption or recycling are most effective in fostering behavioral change.

No significant differences were found for parental education, residence, and income, and this aligns with the study of Sousa et al. (2021) and Varoglu et al. (2017), which found no significant effect of cohabitation, education, or income on environmental knowledge, attitudes, or behaviors of university and eighth-grade students. In contrast, Bozoglu et al. (2016) and Michalos et al. (2009) reported that these factors influence environmental attitudes and behavior, whereas Ogunbode and Arnold (2012) found that parental education affected environmental knowledge but not gender.

Worsley and Skrzypiec (1998) identified environmental concern as the primary factor affecting environmental attitudes among senior and secondary students in South Australia, along with two independent key components shaping the attitudes: optimism and pessimism. Their findings suggest that secondary students' environmental attitudes are influenced by a combination of concern for the environment and their perceptions of environmental issues, and that female students were less optimistic about environmental issues and less supportive of scientific solutions. On the contrary, Musser and Diamond (1999) and Uyeki and Holland (2000) found a negative correlation between income and environmental attitudes, indicating that individuals with lower income levels tend to exhibit greater environmental sensitivity.

Variations in results across studies may be attributed to differences in educational levels, sociocultural contexts, and demographic factors such as age and gender. Despite such discrepancies, the importance of environmental education in promoting sustainable attitudes and behaviors remains evident and calls for continued investigation. Importantly, environmental education should not be directly transplanted across countries, as each country possesses unique ecological challenges, sociocultural values, and educational priorities. To ensure meaningful engagement, local environmental realities should be considered when developing curricula; models and surveys should be adapted to the realities of a country. For instance, the marine pollution topic may have limited relevance for learners residing in landlocked regions. By aligning content with learners' lived experiences and immediate surroundings, environmental education can foster stronger cognitive and emotional connections, encouraging more context-sensitive behaviors.

7. Implications

To address the growing environmental challenges, this study emphasizes that there is urgent need to incorporate environmental issues into curricula. Educational policies and practices must be reorganized to prepare students for the complex effects of the climate crisis. The results imply that incorporating green topics in curricula can promote sustainability by positively influencing students' knowledge, attitudes, and behaviors.

Based on the findings of this study, several implications can be identified for EFL curriculum development, language teaching practices, and the implementation of sustainability-related initiatives in Schools of Foreign Languages.

- **EFL Curriculum Integration:** Curriculum developers and EFL educators should integrate environmental themes into language teaching materials and classroom tasks. Sustainability-related topics can be embedded into reading, writing, speaking, and listening activities to simultaneously develop linguistic competence and environmental awareness.
- **Institutional Reflection in Language Programs:** Schools of Foreign Languages and EFL preparatory programs may periodically evaluate how environmental topics are incorporated into their curricula. Such reflection may help institutions strengthen the integration of sustainability-related themes in language education.
- **Authentic Language Learning through Environmental Issues:** Environmental challenges provide meaningful real-world contexts for language learning. Using authentic multimedia materials such as documentaries, podcasts, news articles, and digital storytelling can support both language development and global awareness.
- **Experiential and Project-Based Learning:** in EFL classrooms can incorporate project-based and experiential activities related to environmental topics, such as debates on climate issues, research presentations, eco-storytelling, and collaborative sustainability projects conducted in English.
- **Contribution to Global Educational Goals:** Integrating environmental themes into EFL instruction may also support broader educational objectives, including the United Nations Sustainable Development Goals, particularly Goal 4 (Quality Education) and Goal 13 (Climate Action), by promoting environmental awareness through language learning.

8. Limitation and further research

Although the study employed convenience sampling and sample size was relatively large ($N = 562$), findings were collected from a single university, which may limit the findings to be generalized. However, it still offers insights for universities integrating environmental topics into English preparatory programs. Therefore, the results should be interpreted with caution when extending conclusions to other universities or educational levels. Using stratified or multi sampling procedures would be beneficial for future research. No specific components of environmental education were included; these could be explored in the future studies. Due to time constraints, no experimental component was included; future studies should implement environmental teaching practices in classroom settings and test their effects experimentally.

CRedit authorship contribution statement

Ayşenur Yıldırım Eroğlu: Results and discussion section, Data collection tools and administration. **Sevim İnal:** Research outline, writing and revisions. **Mine Aydemir Dev:** Data analysis and interpretation of the findings.

Informed consent

Written informed consent for publication was obtained from all participants prior to application.

Ethics approval and consent to participate

All participants were informed about the purpose, scope, and voluntary nature of the study. Prior to participation, they provided their informed consent in accordance with ethical research standards.

Ethical approval and informed consent were obtained prior to the study. The protocol number and date of the ethics committee approval can be provided upon request.

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Declaration of competing interest

The authors confirm that there are no competing interests.

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Data availability

Data will be made available on request.

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