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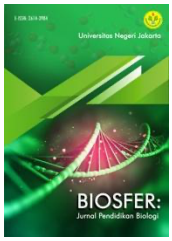

Predicting student's pro-environmental behavior based on antecedent's factors: A confirmatory study

Erian Fatria[1*], Agus Priadi[2], Eka Apriyanti[3]

[1] Early Childhood Education, Faculty of Science, Social and Education, Universitas Prima Nusantara Bukittinggi, Indonesia
[2] English Literature, Faculty of Communication and Languages, Universitas Bina Sarana Informatika, Indonesia
[3] Population and Environmental Education, Postgraduate Program, Universitas Negeri Makassar, Indonesia

*Corresponding author: erianfatria93@gmail.com

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ABSTRACT

Climate change disasters because of environmental degradation have become a threat to every component of the Earth's environment. These disasters are strongly suspected to be caused by harmful behaviors toward the environment, including among student groups. Therefore, efforts are needed to promote and empower pro-environmental behavior (PEB) in society. The purpose of this study is to provide information and confirm pro-environmental behavior (PEB) based on antecedent factors of environmental instructional leadership (EIL) and environmental personality traits (EPT), mediated by the New Environmental Paradigm (NEP). A quantitative research method with a causal study approach was carried out involving 47 Environmental Health students who selected using multistage random sampling. Four research instruments were used, consisting of statements adapted from previous research. Data analysis techniques employed were path analysis. The results confirmed that EIL had a direct effect on NEP and PEB, but the effect was not significant. Meanwhile, EPT had a very significant direct effect on NEP and PEB. The NEP variable was found to be a good mediator in bridging the influence of EIL and EPT on PEB. If pro-environmental behavior among students is to improve and its variability minimized, these antecedent factors can be empowered through environmental education and learning strategies, prioritizing NEP based on empirical findings.

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INTRODUCTION

Climate change is characterized by long-term changes in temperature and rainfall trends, as well as other components such as pressure and humidity levels across regions on the Earth's surface. Additionally, irregular weather patterns, the melting of ice and snow in mountain and polar regions, and the rising sea levels are clear evidence of the impact of global climate change (Abbass et al., 2022; Fatria, Priadi, SN, et al., 2024; Fawzy et al., 2020). Climate change has become humanity's greatest challenge, largely caused by human activities (anthropogenic) and driven by habitat destruction, pollution, overexploitation of natural resources, and uncontrolled human population growth (Apriyanti et al., 2025; Fatria, Judijanto, et al., 2024; Sriwulantari et al., 2024; Whitburn et al., 2020). Previously, natural sources like volcanic eruptions, forest and land fires, and seismic activities were considered the main sources of greenhouse gases such as CO_2, CH_4, N_2O, and H_2O, which contribute significantly to climate change (Abbass et al., 2022; Sriwulantari et al., 2024). Based on disaster data, Indonesia, as part of the Asia-Pacific region, has experienced the highest number of disasters and is the most at-risk country, making it one of the most vulnerable to climate change (Tarmana et al., 2023). Climate change disasters pose the greatest threat to all sectors of human life, such as health, agriculture and food security, social welfare, clean water and energy availability, tourism, and more (Gansser & Reich, 2023; Islam et al., 2015; Xu et al., 2023). Therefore, efforts to promote and empower conservation behavior to address climate change issues must focus on changing societal behavior to become more environmentally responsible (Amalia et al., 2024; Fatria et al., 2019; Fatria, Priadi, SN, et al., 2024; Sulphey et al., 2023). Understanding the antecedent factors that can predict and encourage pro-environmental behavior (PEB) needs to be confirmed and communicated as a consideration for making decisions or policies in combating climate change (Akintunde, 2017; Arıkan & Günay, 2021; Lim et al., 2022; Matakupan et al., 2019; Panno et al., 2018; Rothermich et al., 2021)

Various models predicting an individual's pro-environmental behavior have been confirmed by research regarding the direct and indirect factors influencing it across various fields such as education, management, psychology, health, natural sciences, and others (Ahmad et al., 2022; Broomell et al., 2015; Cahyana et al., 2019; Ertz et al., 2016; Habibie, 2020; Ruepert et al., 2016; Wu et al., 2021). Several environmental education models, such as those by Hines et al., (1987), Hungerford & Volk (1990), Bergman (2016), and Putrawan et al., (2020) use various variables to predict an individual's pro-environmental behavior, such as naturalistic intelligence, leadership, locus of control, ecological knowledge, sensitivity, investment and personal commitment, attitude, personality, intention to act, and more. However, to address environmental degradation, particularly related to climate change disasters, environmental instructional leadership, personality traits related to environmental characteristics, and the new environmental paradigm seem to offer an explanation for pro-environmental behavior based on scientific inquiry (Afsar et al., 2016; Dyr & Prusik, 2020; Hopwood et al., 2021; Priadi et al., 2018; Qazi et al., 2020; Ramírez-Altamirano et al., 2024; Singh et al., 2020; Su et al., 2020; Q. C. Wang et al., 2023; Wu et al., 2021).

Simply put, pro-environmental behavior refers to actions generally considered ways to protect the environment from various threats or to reward sustainable environmental practices (Afifah et al., 2021; Asghar & Nazneen, 2016; Keshavarz & Karami, 2016). Pro-environmental behavior is typically conceptualized as human actions to reduce environmental impact (including climate change disasters) caused by human activities, and as behaviors that improve the quality of the environment to achieve sustainable development goals (Akintunde, 2017; Bronfman et al., 2015; Fatria, Judijanto, et al., 2024; Pothitou et al., 2016; Putrawan et al., 2019; Shafiei & Maleksaeidi, 2020). Pro-environmental behavior refers to various environmental actions related to climate change, including further exploration of the environment, developing eco-friendly products, separating waste for recycling, reusing unused items, and actively participating in activities to improve environmental quality (Ahmad et al., 2022; Azrai et al., 2024; Faraz et al., 2021; Fatria et al., 2019; Matakupan et al., 2019; Omarova & Jo, 2022). However, this behavior is not strongly exhibited by student groups in the research location, marked by a lack of interest in climate actions, low zero-waste actions, excessive waste accumulation, energy and water resource wastefulness, and low active participation in greening activities. A significant research gap exists regarding some reports on the green behavior of Generation Z students, who should be more concerned with climate action and conservation, resource efficiency, responsible consumption and production, recycling actions, and actively promoting eco-friendly technology applications to protect the environment and mitigate climate disasters (Akrofi et al., 2019; Fatria et al., 2025; Kolenatý et al.,

2022; Maleknia & Namdari, 2025; Rooney-Varga et al., 2020; Salguero et al., 2024; Sriwulantari et al., 2024).

The state of the art was carried out by comparing this research with previous studies to identify differences and advancements in the studies conducted to understand its contributions to scientific knowledge. Research conducted by Nadiroh et al., (2019) successfully confirmed that instructional leadership in providing guidance, support, and direction to students regarding conservation efforts and environmental protection significantly influences students' ecological behavior. The more transformational the instructional leadership of an educator, the more ecological behavior increases among their students (Apriyanti et al., 2025; Li et al., 2020; Ren et al., 2024). This implies that an instructional leader has the opportunity to shape the learning environment and influence students' learning outcomes, including their behavioral domain formation (Fatria, 2023; Fatria, Priadi, & Fransiska, 2024; Olsen, 2023). Instructional leadership perceived by students as transformational indicates that the educator inspires and motivates students. By inspiring them, students are challenged to achieve high standards, communicate their achievements optimistically, and find meaning in the tasks they carry out (Demajosita et al., 2018). Instructional leadership policies become an educational institution's parameter in improving students' learning outcomes, including becoming more environmentally responsible (Mala et al., 2021; Pebriantika et al., 2020). Through various strategies, instructional leaders can enhance student engagement and commitment, leading to improved performance and a comprehensive focus on pro-environmental behavior (Cahyana et al., 2019; Maftuhah et al., 2024; Wahyuni et al., 2020).

Research by Hidalgo-Crespo et al., (2023) confirmed pro-environmental behavior through the Big 5 personality predictors. Utilizing a trait-oriented approach to predict environmentalism shows promise, as the personality domain encapsulates fundamental, enduring traits of individuals that serve as predictors for attitudes and behaviors, including pro-environmental behavior. This study proved that personality traits can orient behavior beneficial to the environment, such as purchasing eco-friendly products and waste management, which contribute to environmental sustainability (Hidalgo-Crespo et al., 2023). Another study by Panno et al., (2021) showed that personality traits could explain or predict an individual's actions in addressing climate change disasters. The more accurate a person's personality is regarding the environment, the more likely their behavior will be pro-environmental (Apriyanti et al., 2025; Lisboa et al., 2024; Militaru et al., 2024; Qazi et al., 2020). Other empirical findings highlight the important role of personality profiles in shaping the energy-saving behaviors of hotel guests and offer new perspectives for understanding the heterogeneity of energy-saving behaviors in the industrial world (Wang et al., 2023). Various scientific studies have also discovered a potential in environmental education to orient personalities toward humanistic values. Fundamental principles of environmental education and environmental citizenship are essential in addressing environmental disasters (including climate change disasters) and enhancing the efficiency of forming environmental personality orientations (Anufrieva et al., 2020; Fatria, 2020; Garner & Revelle, 2024; Hines et al., 1987; Kim & Hall, 2021; Poškus, 2023; Priadi & Fatria, 2024).

Investigations Gansser & Reich (2023) have revealed the importance of the New Environmental Paradigm (NEP) and environmental concern as antecedent factors influencing sustainable behavior, confirming the theory of planned behavior (TPB). It is expected that individuals will find it easier to change their sustainable behaviors when preceded by a paradigm shift. The New Environmental Paradigm (NEP) is a widely used tool for measuring human concern for the environment (Gareiou & Zervas, 2021; Ntanos et al., 2019; Tarinc et al., 2023; X. Wang & Sun, 2021). The New Ecological Paradigm scale is a measure of the endorsement of a pro-ecological worldview. This scale is extensively used in environmental education, direct nature trips, and other regions with differing behaviors or attitudes that are believed to be explained by underlying values and worldviews (López-Bonilla & López-Bonilla, 2016; Putrawan, 2015; Sulphey et al., 2023). Some literature defines NEP conceptually as an individual's view of the environment based on the sustainability of life activities, with indicators such as: ecological balance, environmental crisis, anti-liberty, growth limits, and anti-anthropocentrism (Arcury et al., 1986; Chua et al., 2016; Gansser & Reich, 2023; Geller & Lasley, 1985; Hawcroft & Milfont, 2010). It seems that the NEP variable can directly predict its influence on an individual's PEB and also mediate environmental instructional leadership and personality traits. The urgency of conducting this research is related to environmental degradation and hydrometeorological disasters that have been occurring frequently in recent times, which also indicate the poor pro-environmental behavior among

the public, including students. Therefore, this research is beneficial in providing knowledge about antecedent factors that can predict and enhance students' pro-environmental behavior based on a confirmatory model. This study also contributes as a consideration for educational institutions in formulating strategies to transform students' pro-environmental behavior by adopting the empirical findings of this research. This study aims to provide information on the mediation role of NEP between environmental instructional leadership and environmental personality traits in orienting students' pro-environmental behaviors, particularly in addressing global climate change disasters.

METHODS

Research Design

Based on the issues and objectives outlined above, the research method used in this study is a quantitative approach through surveys (confirmatory in nature) conducted on students with a causal analysis approach and path analysis data analysis technique. Path analysis can be applied to this problem to determine which variables influence behavior formation and whether the influence of each factor is significant or not (Saadah et al., 2024). The advantage of path analysis is its ability to estimate parameters, making it possible to identify all potential cause-and-effect relationships in the latent variables used in the model, as well as to analyze the total effects of an exogenous variable and break them down into direct and indirect effects (Iba & Wardhana, 2024). The variables in question are Environmental Instructional Leadership (IEL) (X_1); Environmental Personality Traits (EPT) (X_2); New Environmental Paradigm (NEP) (X_3); and Pro-Environmental Behavior (PEB) (X_4). The NEP variable acts as a mediator, bridging the indirect influence between environmental instructional leadership and environmental personality traits on pro-environmental behavior.

Based on the theoretical framework obtained, the research hypotheses developed in this study are as follows: (1) Environmental instructional leadership has a direct influence on pro-environmental behavior; (2) Environmental personality traits have a direct influence on pro-environmental behavior; (3) A new environmental paradigm has a direct influence on pro-environmental behavior; (4) Environmental instructional leadership has a direct influence on the new environmental paradigm; (5) Environmental personality traits have a direct influence on the new environmental paradigm; (6) Environmental instructional leadership has an indirect influence on pro-environmental behavior through the new environmental paradigm; and (7) Environmental personality traits have an indirect influence on pro-environmental behavior through the new environmental paradigm.

Based on these hypotheses, a hypothetical research model can also be constructed by integrating several models for adoption and confirmation, such as those by Colquitt et al. (2009); Fishbein & Ajzen (2010); Cahyana et al. (2019); Kollmuss & Agyeman (2002); Setyaningrum & Putrawan (2017); and Sulphey et al. (2023), as illustrated in Figure 1.

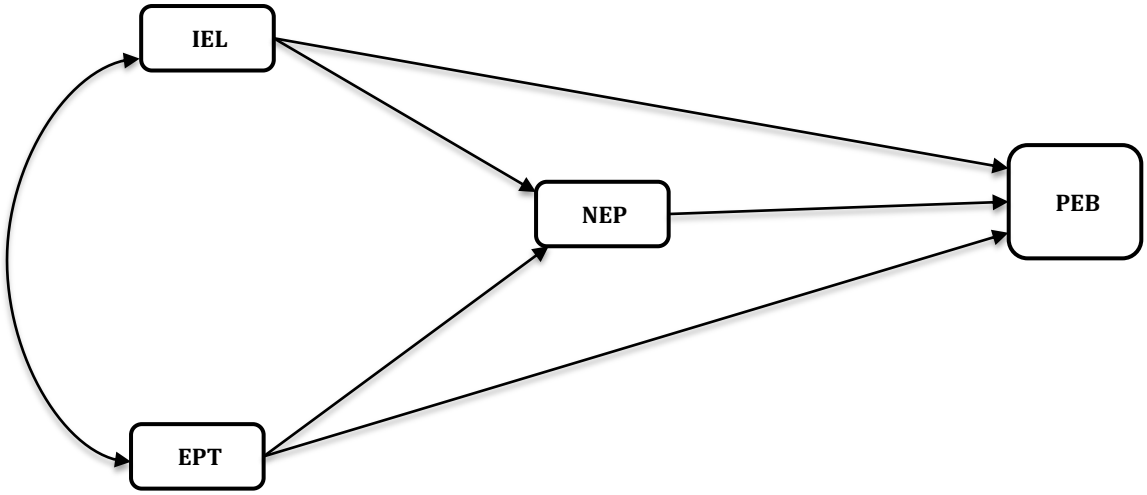

Figure 1. Hypothetical Research Model

Population and Samples

The population of this study includes all students at Universitas Prima Nusantara Bukittinggi, Indonesia. The sampling technique used is multistage random sampling, with the following steps: First,

the Faculty of Nursing and Public Health is selected using purposive sampling. Then, in the second step, the environmental health concentration program is selected using cluster random sampling, with inclusion criteria including students with divergent thinking styles (natural sciences) who have taken the environmental quality analysis course. A group of environmental health concentration students in their third and fifth semesters is selected (with inclusion criteria met). A total of 50 students from this program are chosen as respondents through cluster random sampling, and finally, 47 students are selected as the research sample through simple random sampling. The demographic characteristics of the respondents can be presented in Table 1 below.

Table 1
Data of Demographic Characteristics of the Research Respondents

No	Variable	Category	Frequency	Percentage
1.	Gender	Men	13.00	27.65%
		Women	34.00	72.34%
	Number		**47.00**	**100%**
2.	Age	20 Years Old	4.00	8.51%
		21 Years Old	41.00	87.23%
		22 Years Old	2.00	4.25%
	Number		**47.00**	**100%**

Instrument

The pro-environmental behavior instrument is adapted from Cahyana et al., (2019) with modifications to statement items directed at climate actions. The reliability coefficient of the instrument is 0.837, meaning it is of very high reliability with a high level of trust. The instrument consists of 17 items measured on the PEB scale, with positive statements scored as 5 for always, 4 for often, 3 for sometimes, 2 for rarely, and 1 for never, and negative statements scored as 1 for always, 2 for often, 3 for sometimes, 4 for rarely, and 5 for never. The indicators used in this instrument include: (1) Energy conservation and pro-conservation behavior; (2) Maintaining environmental cleanliness; (3) Active participation in climate action; and (4) Supporting a zero-waste lifestyle. The unique indicator of this instrument is action in climate change, which is highly relevant to Sustainable Development Goal (SDG) 13.

The environmental instructional leadership instrument is adapted from Cahyana et al., (2019) with modifications to statement items related to the environmental context. The reliability coefficient is 0.842, meaning it is highly reliable. The instrument consists of 18 items based on the dimensions are as follows: (1) Individual Consideration, with indicators: (a) Motivating students to use environmentally friendly materials, (b) Encouraging students to conserve the use of stationery and learning materials, (c) Guiding students toward environmentally friendly activities, (d) Advocating for campus environmental cleanliness. (2) Intellectual Stimulation, with indicators: (a) Providing innovative solutions for handling hydrometeorological disasters, (b) Enhancing students' creativity in decision-making related to climate disasters, (c) Motivating students to plant protective trees, (d) Encouraging students to solve waste-related problems. (3) Inspirational Motivation, with indicators: (a) A vision aligned with Sustainable Development Goals, (b) Motivating students to participate in biodiversity conservation in response to climate change, (c) Building communication for achieving a green campus, (d) Achieving long-term climate action goals. (4) Idealized Influence or Charisma, with indicators: (a) Encouraging students to implement climate change adaptation and mitigation programs, (b) Setting an example by complying with environmental sustainability regulations, (c) Assisting in decision-making to address global warming, (d) Encouraging students to use eco-friendly technology, (e) Instilling positive values of education for sustainable development and climate change education, (f) Inspiring students to overcome resource and energy crises. For positive statements, the scale is scored as 5 for always, 4 for often, 3 for sometimes, 2 for rarely, and 1 for never, and for negative statements, the scale is reversed.

The personality traits instrument is adapted Putrawan & Ningtyas (2020) with modifications for environmental personality traits. The reliability coefficient is 0.870, meaning it has very high reliability. The instrument consists of 19 items based on five factors: (1) Conscientiousness, with indicators: (a) Reliable in handling climate change issues, (b) Enjoys participating in environmental conservation organizations, (c) Highly ambitious in protecting flora and fauna. (2) Agreeableness, with indicators: (a)

Calm when facing natural disasters, (b) Enjoys collaborating to address environment-related diseases, (c) Feels sympathy for climate disaster victims. (3) Neuroticism, with indicators: (a) Nervous when dealing with environment-related disease outbreaks, (b) Emotional when witnessing environmental destruction, (c) Vigilant in facing hydrometeorological disasters. (4) Openness, with indicators: (a) Highly curious about the causes of environmental damage, (b) Respectful when dealing with differences in opinions. (5) Extraversion, with indicators: (a) Talkative in environmental forums, (b) Enjoys socializing with environmental activists, (c) Passionate about utilizing environmental health technology.

The NEP instrument is adapted from Putrawan et al., (2020). With a reliability coefficient of 0.801, indicating very high reliability. The instrument consists of 20 items based on dimensions such as (1) Growth Limits, with indicators: (a) The necessity of nature conservation, (b) Conservation of water and mineral resources, (c) Protection of natural resources that are highly limited in quantity. (2) Anti-Anthropocentrism, with indicators: (a) Prioritizing equal rights to life, (b) Considering oneself as part of the ecosystem, (c) Playing a role in preserving the environmental ecosystem. (3) The Fragility of Nature, with indicators: (a) Maintaining the balance of terrestrial environments, (b) Maintaining the balance of aquatic and coastal environments. (4) Anti-Exceptionalism, with indicators: (a) Recognizing that humans are not exempt from natural laws, (b) Limiting excessive consumption. (5) Anti-Bio-Crisis, with indicators: (a) Avoiding actions that cause biodiversity crises, (b) Caring for terrestrial and marine ecosystems to achieve sustainable development goals.

Procedure

The preparation phase of this research starts by directly observing the low pro-environmental behavior among students, which is suspected to be the root cause of the current climate change disaster. Students' behaviors include energy wastage, littering, using motor vehicles and non-environmentally friendly technologies, and a lack of interest in recycling products and climate action. The researchers formulate the problem and conduct a literature review, including investigating scientific publications in reputable journals related to antecedent factors influencing pro-environmental behavior. Various models of environmental education are used as the basis for conducting confirmatory studies through path analysis. It is hypothesized that environmental instructional leadership and environmental personality traits can explain students' pro-environmental behavior, mediated by NEP. Conceptual and operational constructs of each latent variable are developed, considering the latest available sources. The models of Hines et al., (1987), Hungerford & Volk (2005), Fishbein & Ajzen (2010), Kollmuss & Agyeman (2002) and Colquitt et al., (2009) are used to determine the research hypotheses. Instruments in the form of opinionnaires are used to gather student opinions, adapted from instruments developed by Cahyana et al., (2019), Putrawan & Ningtyas (2020), and Putrawan et al., (2020) which have very high reliability, so the researchers did not need to recalibrate the instruments. The research is conducted from October 2024 to December 2024. Data collection is done at Universitas Prima Nusantara Bukittinggi, located at Jl. Kusuma Bhakti No.99, Kubu Gulai Bancah, Mandiangin Koto Selayan, Bukittinggi, West Sumatra. The instruments are distributed to students in the Environmental Health concentration, and the results are tabulated and analyzed with SPSS to explain empirical findings based on the constructed model grounded in theory and research hypotheses.

Data Analysis Techniques

The influence of environmental instructional leadership and environmental personality traits on pro-environmental behavior through the mediation of NEP among students at Universitas Prima Nusantara Bukittinggi, Indonesia is tested using path analysis. Before performing correlation and path coefficient tests, all variable data undergo descriptive statistical testing, including central tendency measures (mean, median, mode) and dispersion measures (variance and standard deviation). Prior to testing the hypothesis with inferential statistics, prerequisite tests are conducted, including normality using the Kolmogorov-Smirnov estimate, homogeneity using Bartlett's test, and significance and linearity tests. All tests are performed using SPSS software. Following this, hypothesis testing is carried out by examining the path coefficients and correlation coefficients (zero-order correlation and partial) and by reviewing the empirical model obtained.

RESULTS AND DISCUSSION

1. Research Data Description

The research data, based on the instruments completed by 47 students majoring in Environmental Health at Universitas Prima Nusantara Bukittinggi, Indonesia was processed using descriptive statistics and inferential statistics. Descriptive statistics are presented in the table below, providing information about the minimum score, maximum score, mean, median, mode, standard deviation, and variance for each variable used. The description of the measures of central tendency and dispersion is presented in Table 2 .

Table 2
Descriptive Statistics for Each Research Variable.

Descriptive Statistics	Pro-Environmental Behavior	Environmental Instructional Leadership	Environmental Personality Traits	New Environmental Paradigm
N	47.00	47.00	47.00	47.00
Mean	63.98	68.30	72.28	81.17
Std. Deviation	7.49	11.39	8.322	9.51
Minimum	49.00	47.00	56.00	57.00
Maximum	82.00	87.00	92.00	99.00

Prerequisite Testing and Hypothesis Testing

This research was conducted following scientific procedures, and the analysis process was carried out carefully. Prerequisite testing for path analysis data included normality, homogeneity, significance, and linearity tests between the pro-environmental behavior, environmental instructional leadership, environmental personality traits variables and NEP. Normality testing used the Kolmogorov-Smirnov test. The results showed that the residuals for all data pairs were normally distributed. The homogeneity test was conducted using Bartlett's test, and the results indicated that all sample data came from populations with homogeneous variances. Significance and linearity tests were also conducted, yielding significant and linear results. After the data passed the prerequisite tests, the next step was to conduct confirmatory model testing using path analysis. Based on the theoretically constructed hypothetical model, path analysis diagrams were obtained, and coefficients for each path were calculated

a. Structure 1

Based on the data calculations to create the regression equation model between environmental instructional leadership and environmental personality traits on pro-environmental behavior, the following regression equation was obtained: $\hat{X}_4 = 23.116 + 0.169X_1 + 0.406X_2$. For more details, the regression calculation for environmental instructional leadership and environmental personality traits on pro-environmental behavior can be seen below (Table 3).

Table 3
Path Coefficient Output of Environmental Instructional Leadership and Environmental Personality Traits on Pro-Environmental Behavior.

Model		Unstandardized Coefficients		Standardized Coefficients	t-cal	t-tab		Correlations		
		B	Std. Error	Beta		.05	.01	Zero-order	Partial	Part
1	(Constant)	23.116	8.462		2.732					
	IEL	.169	.086	.257	1.978^{ns}	2.014	2.689	.416	.286	.240
	EPT	.406	.117	.450	3.464**	2.014	2.689	.541	.463	.421

a. Dependent Variable: PEB; * Significant in α =0.05;** Very Significant in α =0.01

Based on the path analysis calculations for Structure I, it was confirmed that environmental instructional leadership has a direct influence on students' pro-environmental behavior; however, the effect is not significant. This suggests that if students want to develop positive pro-environmental behavior, they must have a positive perception of lecturers' instructional leadership in the teaching or environmental education process (particularly in instilling environmental values and norms on campus). Lecturers' environmental instructional leadership can help explain and predict students' pro-environmental behavior. Therefore, this antecedent variable should be considered to minimize variations in students' pro-environmental behavior (Cahyana et al., 2019; Nadiroh et al., 2019; Ren et

al., 2024). Additionally, as confirmed in Table 3 above, environmental personality traits have a highly significant direct influence on students' pro-environmental behavior. This implies that if students want to have positive pro-environmental behavior, they must have accurate environmental personality traits, especially in dealing with climate change disasters. Environmental personality traits can explain and predict the occurrence of students' pro-environmental behavior. Therefore, this antecedent variable can be considered to minimize variations in students' pro-environmental behavior. Honest and humble personality traits can lead to alignment with environmentalism. The same logic applies to the positive relationship between personality alignment and pro-environmental behavior. This is also associated with high levels of empathy and openness (Desrochers et al., 2019; Hopwood et al., 2021; Soutter et al., 2020). Personality factors will determine an individual's actions and role in protecting and preserving the environment (Hakim & Endangsih, 2021; Pratiwi et al., 2019)

b. Structure II

Based on the data calculations to create the regression equation model between environmental instructional leadership and environmental personality traits on NEP, the following regression equation was obtained: $\hat{X}_3 = 47.537 + 0.176X_1 + 0.299X_2$. For more details, the regression calculation for environmental instructional leadership and environmental personality traits on NEP can be seen below (Table 4).

Table 4

Path Coefficient Output of Environmental Instructional Leadership and Environmental Personality Traits on NEP.

Model		Unstandardized Coefficients		Standardized Coefficients	t-cal	t-tab		Correlations		
		B	Std. Error	Beta		.05	.01	Zero-order	Partial	Part
1	(Constant)	47.537	12.263		3.876					
	IEL	.176	.124	.211	1.419^{ns}	2.014	2.689	.303	.209	.197
	EPT	.299	.170	.262	3.763**	2.014	2.689	.336	.257	.245

a. Dependent Variable: NEP; * Significant in α =0.05;** Very Significant in α =0.01

Based on the path analysis calculations for Structure II, it was confirmed that environmental instructional leadership has a direct influence on students' NEP; however, the effect is not significant. This implies that if students want to develop a positive NEP, they must have a positive perception of lecturers' instructional leadership in the learning or environmental education process. Lecturers' environmental instructional leadership can help explain and predict the enhancement of students' NEP. Therefore, this antecedent variable should be considered to minimize variations in students' NEP. Instructional leadership in the classroom, as perceived by students as either transformational or transactional, can influence variations in students' new environmental paradigm. More transformational instructional leadership, as assessed by students, can help them develop a strong new environmental paradigm, leading to students who are more environmentally conscious (Demajosita et al., 2018). Additionally, it was also confirmed that environmental personality traits have a highly significant direct influence on students' NEP. This implies that if students want to have a positive NEP, they must have accurate environmental personality traits. Environmental personality traits can explain and predict the possession of a positive NEP. Therefore, this antecedent variable can be considered to minimize variations in students' NEP. Every student has different personality traits that reflect thinking, feeling, and actions that respond to the situations they experience, including environmental issues, which ultimately shape their personal new environmental paradigm. The diversity of students' personalities will show varied responses to environmental conditions, whether it involves maintenance, management, or preservation of the environment (Hidalgo-Crespo et al., 2023; Lisboa et al., 2024; Puspita et al., 2021).

c. Structure III

Based on the data calculations to create the regression equation model between NEP and pro-environmental behavior, the following regression equation was obtained: $\hat{X}_4 = 35.603 + 0.305X_3$. For more details, the regression calculation for NEP on pro-environmental behavior can be seen below (Table 5).

Table 5
Path Coefficient Output of NEP on Pro-Environmental Behavior.

Model		Unstandardized Coefficients		Standardized Coefficients	t-cal	t-tab		Correlations		
		B	Std. Error	Beta		.05	.01	Zero-order	Partial	Part
1	(Constant)	35.603	8.607		4.136					
	NEP	.305	.105	.443	3.319**	2.012	2.687	.443	.443	.443

a. Dependent Variable: PEB; * Significant in α =0.05;** Very Significant in α =0.01

Based on the path analysis calculations for Structure III, it was confirmed that NEP has a highly significant direct influence on students' pro-environmental behavior. This implies that if students want to have positive pro-environmental behavior, they must have a good or positive NEP. NEP possessed by students can explain and predict the occurrence of pro-environmental behavior, and therefore, this antecedent variable can be considered to minimize variations in pro-environmental behavior. It is important to consider pro-environmental activities wherever we are and the parameters that determine them, as this issue involves the change in an individual's ecological paradigm (Berze et al., 2022; Chaudhary & Sharma, 2021). A summary of the hypothesis testing is shown in Table 6.

Table 6
Summary of Path Coefficient Significance Test Results between Variables (IEL, EPT, NEP, and PEB).

Indirect and Direct Effect	Path Coefficient	t_{cal}	$t_{table\ (0,05)}$	$t_{table\ (0,01)}$
IEL towards PEB	0.257	1,978^{ns}	2.014	2.689
EPT towards PEB	0.450	3.464**	2.014	2.689
IEL towards NEP	0.211	1.419^{ns}	2.014	2.689
EPT towards NEP	0.262	3.763**	2.014	2.689
NEP towards PEB	0.433	3.319**	2.012	2.687
IEL towards PEB through NEP	0.091	0.606**	2.014	2.689
EPT towards PEB through NEP	0.113	0.754**	2.014	2.689

* = $p < 0,05$; **: $p < 0,01$; ns = non-significant

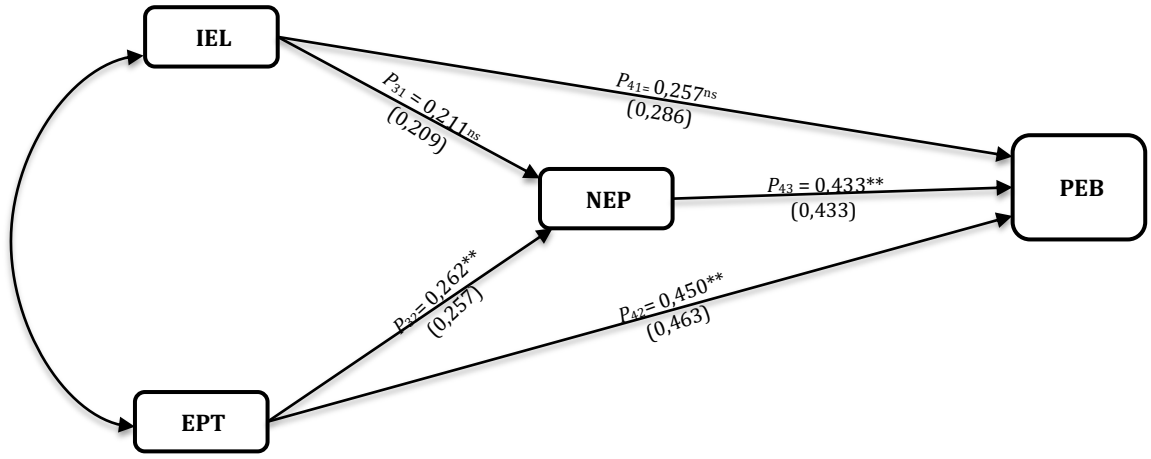

Figure 2. Result of PEB Empirical Model based on IEL and EPT mediated by NEP (* = $p < 0,05$; **: $p < 0,01$)

Based on Table 6 and Figure 2 above, it can be confirmed that environmental instructional leadership has a direct effect on NEP and pro-environmental behavior of students but is not significant, the analysis of students' pro-environmental behavior and environmental paradigm can be predicted through environmental instructional leadership; however, its contribution is not significantly large. The leadership of lecturers may serve only as an external antecedent factor, meaning it remains outside the students' personal variables (students merely assess the leadership of their lecturers). As a result, its impact is not substantial in transforming students' pro-environmental behavior and NEP. Environmental personality traits have a direct and highly significant effect on both NEP and pro-environmental behavior of students, this may occur because personality is an internal antecedent factor inherent in students themselves. These empirical findings prove that environmental personality traits are more likely to be oriented toward various pro-environmental actions and a positive new

environmental paradigm, resulting in a more significant and tangible impact; NEP has a direct and highly significant effect on pro-environmental behavior of students, this proves that the NEP variable, which students personally possess as an internal antecedent factor, is more easily oriented toward pro-environmental actions (Hidalgo-Crespo et al., 2023; Ismail et al., 2023; Lisboa et al., 2024; Poškus, 2023), NEP also describes the extent to which students reject various components of what is referred to as the Dominant Social Paradigm (DSP) (Tonin & Benedetto, 2024). Another finding that can be confirmed is that environmental instructional leadership has an indirect effect on pro-environmental behavior through NEP in a highly significant manner; and environmental personality traits have an indirect effect on pro-environmental behavior through NEP in a highly significant manner. This means that NEP is an appropriate mediator variable to bridge the indirect effect of environmental instructional leadership and environmental personality traits on pro-environmental behavior. This can contribute to knowledge and theory by interpreting that variations in students' pro-environmental behavior can be minimized through antecedent factors such as instructional leadership, environmental personality traits, and NEP. Essentially, predictor variables such as leadership style, personality, and NEP play a role in determining whether pro-environmental behavior will occur or not (Cahyana et al., 2019; Colquitt et al., 2009; Hines et al., 1987; Kollmuss & Agyeman, 2002; Poškus, 2023).

Support for these findings has also been confirmed by Zhou et al., (2022) and Zhao & Liang (2023) who explained that responsible leadership has a significant positive effect on PEB and also provides a practical basis for organizations to stimulate PEB and promote sustainable development. The study by Djuwita & Benyamin (2019) supports this finding, explaining that the environmental education curriculum plays a role in shaping students' PEB, but to develop sustainable PEB learning for students, educational institutions must focus on ways to habituate PEB through innovative learning strategies carried out by teachers. Other findings also explain that transformational leadership describes a process that allows a leader to inspire and motivate team members to achieve their highest levels while increasing job satisfaction, commitment, motivation, and subordinates' behavior related to pro-environmental aspects (Khotob et al., 2024; Zafar et al., 2022). Environmental leaders play an important role in addressing environmental challenges, encouraging conservation, and driving positive changes in how we interact with the planet. This form of leadership involves knowledge, vision, communication skills, and a commitment to balancing human activity with the health of the natural environment (Huang et al., 2024).

Support has also been provided for the findings of the direct effect of personality traits on pro-environmental behavior, which is highly significant. The investigation conducted by Lisboa et al., (2024) explained that personality traits play a fundamental role in shaping an individual's beliefs, attitudes, and values, which in turn influence their behavior and decisions. Kesenheimer & Greitemeyer (2021) revealed that overall, both theoretical reasons and empirical evidence support the idea that certain personality traits are related to PEB, but this relationship is significantly reduced when considering the role of attitudes. Understanding the link between attitudes and personality is highly valuable in promoting PEB and ensuring sustainability. Utilizing a personality-oriented approach to predict environmental behavior shows promise, as the personality domain summarizes the fundamental and enduring traits of individuals that serve as predictors for attitudes and behaviors (Hidalgo-Crespo et al., 2023; Rothermich et al., 2021).

The findings related to the effect of NEP on students' pro-environmental behavior are also reinforced by several studies, including research by Berze et al., (2022) which revealed that NEP is an important instrument in determining an individual's PEB, finding that students with higher scores on pro-environmental behavior are more likely to believe in environmental crises and respect natural rules as part of the NEP dimensions. Sulphey et al., (2023) in their study state that the high predictive power of NEP on intentions and pro-environmental behavior suggests that NEP has a significant positive relationship with PEB, meaning that the more positive an individual's NEP, the better the pro-environmental behavior they will exhibit. Research findings by Chaudhary & Sharma (2021) show that the new environmental paradigm encourages pro-environmental behavior because it focuses on waste recycling and waste reduction. Therefore, when promoting pro-environmental behavior, it is also important to strengthen the environmental paradigm within society, and it can be interpreted that there is a positive correlation between the new environmental paradigm and pro-environmental behavior.

In strengthening the findings regarding the direct influence of environmental instructional leadership on students' NEP, additional support was also found from several studies that confirm the

related transformational environmental leadership facilitates the internal changes, paradigms, and decision-making necessary to implement social responsibility practices and improve sustainable performance (Ramírez-Altamirano et al., 2024). Other findings also confirmed a positive relationship between teacher instructional leadership and students' new environmental paradigm. Instructional leadership perceived by students as transformational indicates that teachers inspire and motivate their students. Through this inspiration, students are motivated to reach high standards, optimistically communicate their anticipated achievements, and find meaning in the tasks they undertake (Demajosita et al., 2018). Support for the findings that environmental personality traits directly influence students' NEP has been confirmed by Puspita et al., (2021) who stated that personality traits have a significant direct effect on the new environmental paradigm. This finding highlights the importance of understanding the psychological factors related to environmental issues over time, leading to a more sustainable environmental paradigm. Environmental personality traits have been shown to contribute theoretically to the PEB model, which is considered a legacy from Colquitt et al., (2009), Hines et al., (1987), and Kollmuss & Agyeman (2002).

Therefore, every level of education should implement environmental education as a foundation for addressing environmental issues and creating individuals in the era of Industry 4.0 who are capable of leading the environment with transformational thinking to solve problems. Systemic thinking here refers to how students view phenomena as a whole, focusing on interconnected frameworks and perspectives oriented toward change rather than static thinking. Thus, environmental education is essential for the younger generation, who are the current generation and future leaders, to ensure they develop positive views on environmental instructional leadership, foster psychological aspects such as environmental personality, and orient their paradigms toward the new environmental paradigm as an effort to appreciate nature and the surrounding environment, which ultimately leads to pro-environmental behavior in line with sustainable development goals. Several limitations of this study include: (1) The number of respondents or research samples may be too small and may not fully represent the broader student population in Bukittinggi. (2) This study faced challenges related to the honesty of respondents in completing the research instrument. Some respondents may have provided inaccurate answers, potentially leading to bias. (3) The research team did not conduct an in-depth analysis of the pro-environmental behavior of all students; instead, findings were solely based on the data collected from the research instrument. (4) Many other antecedent factors in this confirmatory study were not included by the research team due to financial and time constraints.

CONCLUSION

Based on the research findings presented, it can be concluded that the variation of pro-environmental behavior, both positive and negative, among students is influenced by variations introduced by antecedent factors such as environmental instructional leadership, environmental personality traits, and NEP. To improve students' pro-environmental behavior and minimize its variations, these antecedent factors can be empowered through environmental education and learning strategies, prioritizing NEP as the basis of the empirical model produced by this study. Several recommendations can be provided to educational institutions, students, and other researchers, including: (1) For Higher Education Institutions, higher education institutions can utilize the findings of this research to develop their curricula. In every environment-related course, learning outcomes should focus on shaping pro-environmental behavior rather than merely developing concepts and theories. Course content should be comprehensive, reinforcing environmental instructional leadership and the new environmental paradigm while also fostering psychological aspects related to environmental personality traits. (2) For Environmental Health Students, The findings of this research can serve as recommendations for environmental preservation efforts. In the era of the Fourth Industrial Revolution, students should adopt more pro-environmental behavior, particularly in the use of technology, energy consumption, and resource management (responsible consumption and production). They should also contribute positively to climate action, adopt a mindset that encourages direct involvement in environmental conservation, and apply a systems-thinking approach by embracing the principle of think globally and act locally; (3) For Future Researchers It is recommended that future researchers include more variables in pro-environmental behavior models or explore other relevant models incorporating various antecedent factors that can predict pro-environmental behavior.

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