

## ORIGINAL ARTICLE

# Structural Model of Relationships in Students' Perception of Environmental Education and Sustainable Development (Case Study: Management, Economics and Accounting Students)

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## ABSTRACT

As industrial activity expands and environmental constraints become increasingly apparent, the need to foster pro-environmental behavior at both individual and societal levels has become more urgent. The environment is a dynamic system that both shapes human well-being and is shaped by human actions, and it has therefore emerged as a central concern for researchers and policymakers. It is now widely recognized that sustainable development and long-term economic growth cannot be achieved without a healthy and high-quality environment. In this context, university students represent a particularly influential group whose active engagement is essential to environmental improvement. This study examines students' environmental perceptions and identifies the factors influencing their environmental attitudes and behaviors. The research adopts an applied, descriptive-survey design. Data were collected through a researcher-developed questionnaire administered to students enrolled in management, economics, and accounting programs at Payame Noor University in Markazi Province. Structural Equation Modeling (SEM) using LISREL software was employed to analyze the relationships among environmental education, environmental perception, environmental attitudes, and environmental behavior. The results show that environmental education is the strongest predictor of both environmental perception and behavior. It significantly enhances students' understanding of environmental issues and sustainable development, thereby strengthening their environmental perceptions. Moreover, environmental perception has a positive and significant effect on environmental behavior and mediates the impact of environmental education on pro-environmental actions. Environmental education also exerts a direct effect on behavior in addition to its indirect influence through perception. In contrast, individual characteristics such as age, gender, and parental education exhibit weak and statistically insignificant effects.

## KEYWORDS

Environment, Environmental Education, Sustainable Development.



## Introduction

Environmental degradation, climate change, and the depletion of natural resources have become major global concerns, threatening human well-being and economic stability. Industrial development, urban expansion, and unsustainable consumption patterns have intensified environmental pressures, making the need for behavioral change more urgent than ever. Sustainable development emphasizes the balanced integration of economic growth, social equity, and environmental protection, with environmental quality serving as a fundamental prerequisite.

Education is widely recognized as one of the most effective tools for fostering environmental awareness and encouraging pro-environmental behavior. Environmental education enhances individuals' understanding of environmental problems, strengthens their sense of responsibility, and promotes positive attitudes toward environmental protection. Universities, in particular, play a critical role in this process by shaping students' knowledge, values, and behavioral patterns.

University students represent a strategic group in society, as they are future managers, policymakers, and economic actors. Their environmental perceptions and attitudes can significantly influence organizational practices and public decision-making in the long run. Despite the growing emphasis on environmental education, empirical evidence regarding its effectiveness in shaping students' environmental behavior—especially through mediating factors such as perception and attitude—remains limited.

This study seeks to address this gap by examining the relationships among environmental education, environmental perception, environmental attitude, and environmental behavior among university students. By employing Structural Equation Modeling, the study provides a comprehensive framework for understanding how environmental education contributes to sustainable behavioral outcomes.

## Methodology

The present study is applied in purpose and

descriptive—survey in nature. The statistical population consisted of students enrolled in management, economics, and accounting programs at Payame Noor University in Markazi Province. Data were collected through a researcher-developed questionnaire designed to measure environmental education, environmental perception, environmental attitude, and environmental behavior.

Content validity was confirmed through expert evaluation, and reliability was assessed using Cronbach's alpha coefficient, which indicated satisfactory internal consistency. Structural Equation Modeling (SEM) with LISREL software was used to test the hypothesized relationships among the study variables and to evaluate both direct and indirect effects.

## Results

The results indicate that environmental education has a strong and significant effect on students' environmental perception. Environmental perception, in turn, positively and significantly influences environmental behavior, confirming its mediating role. Additionally, environmental education exerts a direct and significant effect on environmental behavior, suggesting partial mediation. Both environmental education and environmental perception were found to significantly influence students' environmental attitudes. In contrast, individual characteristics such as age, gender, and parental education showed weak and statistically insignificant effects.

## Conclusion

The findings underscore the central role of environmental education in shaping students' environmental perceptions, attitudes, and behaviors. By enhancing environmental awareness and understanding, universities can contribute effectively to sustainable development. The insignificant role of individual characteristics suggests that educational interventions are more influential than demographic factors. Strengthening environmental education curricula can therefore play a key role in fostering pro-environmental behavior among future professionals and decision-makers.

«مقاله پژوهشی»

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### چکیده

بدون وجود محیط‌زیست با کیفیت، رشد اقتصادی و توسعه پایدار قابل تصور نیست. این مقاله تلاشی است جهت بررسی ادراک دانشجویان از محیط‌زیست. در این پژوهش که از نوع توصیفی-پیمایشی و کاربردی است، داده‌ها با استفاده از پرسشنامه محقق‌ساخته گردآوری شده، روایی آن به تایید چند نفر از اعضاء هیئت علمی مرتبط رسیده و پایایی آن به کمک ضریب آلفای کرونباخ تایید شده است. جامعه آماری شامل دانشجویان رشته‌های مدیریت، اقتصاد و حسابداری دانشگاه پیام نور استان مرکزی است. تحلیل داده‌ها با بهره‌گیری از مدل‌یابی معادلات ساختاری (SEM) و نرم‌افزار LISREL انجام گرفته است. یافته‌های این پژوهش نشان می‌دهد که آموزش محیط‌زیست به‌عنوان مهم‌ترین عامل تعیین‌کننده ادراک و رفتار محیط‌زیستی دانشجویان عمل می‌کند و آموزش محیط‌زیست نقش معناداری بر ادراک دانشجویان دارد. ضریب این متغیر در این تحقیق ۰/۶۲ بدست آمده است. همچنین، ادراک دانشجویان خود نقش مثبت و معناداری بر رفتار محیط‌زیستی آن‌ها دارد، که بیانگر نقش کلیدی ادراک به‌عنوان متغیر میانجی در انتقال نقش آموزش محیط‌زیست به رفتارهای زیست‌محیطی است. ضریب آموزش محیط‌زیست به رفتار محیط‌زیستی ۰/۲۸ و معنادار بوده است، به این معنی که آموزش محیط‌زیست علاوه بر نقش غیرمستقیم از طریق ادراک، نقش مستقیمی نیز بر رفتار محیط‌زیستی دانشجویان دارد. همچنین، مسیرهای آموزش محیط‌زیست و ادراک به نگرش محیط‌زیستی دانشجویان نیز با ضریب ۰/۵ معنادار است، که نشان‌دهنده این است که آموزش‌های محیط‌زیستی و درک دانشجویان نه تنها رفتار، بلکه نگرش آن‌ها نسبت به مسائل زیست‌محیطی را نیز بهبود می‌بخشد.

### واژه‌های کلیدی

محیط زیست، آموزش محیط زیست، توسعه پایدار.

## Introduction

Environmental perception refers to an individual's understanding of ecological issues such as pollution, climate change, and natural resource conservation, and is shaped by personal experiences, knowledge, values, beliefs, and culture (Eshtagh, 2018). This perception differs from environmental reality; environmental reality encompasses the objective and measurable conditions of the environment, such as air pollution, biodiversity loss, and natural resource degradation, which exist independently of individuals' perspectives and feelings (Marques et al., 2020). Modifying environmental perception plays an important role in changing behaviors and decision-making, and can foster positive attitudes and behaviors such as attention to recycling (Velempini, 2025).

Iran, with its high biodiversity including the Zagros and Alborz mountain ranges, deserts, Hyrcanian forests, and the coasts of the Caspian Sea and the Persian Gulf, holds regional and global significance in the environmental domain. However, the country faces challenges such as drought, air and water pollution, declining water resources, and habitat destruction, which make environmental education essential (Talebi & Kamandi, 2023). Industrial and densely populated areas such as Markazi Province and the city of Arak, due to severe air pollution and environmental issues, require special educational measures.

In this study, environmental education is defined as a collaboration between content and educational methods that engages students in environmental study and action. The research model includes two predictor variables (environmental importance and environmental concern), four mediating variables (environmental culture, environmental activities, participation in activities, and environmental warning), and one criterion variable (attention to recycling).

Using a questionnaire and structural equation modeling in LISREL software, the researchers examined the importance and concerns of Payame Noor University students in Markazi Province regarding the environment, their environmental behaviors, and the impact of predictor and mediating

variables on attention to recycling. The questionnaire was distributed among students in economics, management, and accounting to collect their views, attitudes, and environmental behaviors, and to analyze the role of environmental perception in voluntary environmental behaviors.

## Research Methodology

Environmental initiatives began over 200 years ago with the aim of preserving endangered species, and over time, the reasons for environmental protection have become more diverse. Since the 1970s, signs such as ozone layer depletion, global warming, acid rain, and the pollution of natural resources have shown that environmental protection requires responsible behavior and collective cooperation at local, national, and international levels (Ausubel et al., 1995).

Environmental Education (EE) is defined as an interactive process between content and educational methods that engages students in environmental study and encourages them to change behavior and take action. Despite positive attitudes among students in various countries toward the environment, their practical participation in environmental activities remains low (Sullivan et al., 2024). This gap between theoretical awareness and practice can be reduced through ethical and civic education, group discussions, case analysis, and teamwork (Asgaripoor et al., 2020).

UNESCO (1987, 2015) has defined environmental education as a process of promoting knowledge, skills, attitudes, and commitment in individuals for informed decision-making and responsible action. The Tbilisi Declaration also introduced environmental education as a process for developing a population that is aware and concerned about the environment, possessing the ability to solve current problems and prevent future ones (Shafiei-Makvand & Barati, 2021).

Research has shown that environmental education can strengthen individuals' environmental values and attitudes and encourage them toward more responsible behaviors. Liu and Guo (2018) found that

environmental education significantly correlates with environmental values. The 1992 Gallup International Survey showed that national welfare correlates with less citizen concern about the environment, but global concern about climate change and human impacts on nature continues (Dunlap et al., 1992).

Volunteering in environmental conservation is one of the important criteria for evaluating the effectiveness of ecological education, but volunteer participation is less than 1% of the population in many countries, except for some countries such as the Netherlands, Denmark, and the United States (Salehi & Ghaemi-Asl, 2013). Studies indicate that students who engage in problem-solving and critical thinking can become real agents of change in environmental conservation (Riordan & Klein, 2010).

Theoretical discussions also suggest that environmental education and Education for Sustainable Development (ESD) should be viewed as separate entities or as complementary to one another. Schultz (2002) emphasized the importance of cultural attitudes and beliefs in environmental behaviors and stated that environmental improvements should be carried out regardless of costs. Research in Romania showed that individuals' attitudes and consumption behaviors are similar to European

attitudes, and similar factors such as attitudes toward climate change, reducing greenhouse gas emissions, and using alternative energy affect students' behavior (Nistor, 2009).

Uddin (2024) links environmental education to sustainable development and emphasizes the reasonable use of resources with justice and sustainability in mind. Kelly and colleagues (2013) showed that environmental educators, in collaboration with specialists, museums, zoos, and urban planners, present new teaching methods that involve youth and adults outside the classroom.

The role of higher education institutions in sustainable development and environmental conservation is also prominent. Educational, research, and development programs at universities can help create a culture of environmental responsibility (Jadhav et al., 2014). Furthermore, colleges and universities should actively participate in sustainability movements so that community education is realized in practice (Acosta-Castellanos, 2024).

In summary, environmental education is a key tool for improving environmental attitudes and behaviors, and achieving sustainable development requires coordination among education, volunteering, and social and educational policies.

Domestic studies related to the research topic are briefly presented in Table 1.

**Table 1.** Domestic Studies on the Research Topic

| Results                                                                                                                                                                                                                                                                                                                                                                          | Method      | Author                    | Research Title                                                                                                                    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| The importance of public environmental education in solving environmental problems and achieving sustainable development goals is so great that it has been addressed in the country's Fourth Economic, Social, and Cultural Development Plan in the form of public environmental education.                                                                                     | Documentary | Abbaspour et al., 2006    | The role of environmental education in the country's sustainable development and its prospects                                    |
| The statistical findings of this study showed that the average student awareness regarding the basics of the standard is low to medium and regarding the importance of the applications and general objectives of the ISO 14000 series of standards is medium to high. No significant difference was observed between the two genders regarding awareness in different sections. | Survey      | Ali Taleshi et al., 2012  | Investigating the role of environmental standards in achieving sustainable development with respect to students' awareness levels |
| The findings of the study showed that modern environmental attitudes have a positive effect on creating environmental protection behavior, but environmental education and knowledge do not play a significant role in the emergence of                                                                                                                                          | Survey      | Salehi & Ghaemi-Asl, 2013 | Investigating the relationship between environmental education and environmental protection behaviors (Case                       |

| Results                                                                                                                                                                                                                                                                                                                                                                                                | Method      | Author                          | Research Title                                                                                                               |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------|
| environmental behavior. In the remainder of the article, the possible reasons for this are examined.                                                                                                                                                                                                                                                                                                   |             |                                 | study: Girls' high school students in Babol city)                                                                            |
| The findings emphasize that environmental education plays an important role in improving environmental attitudes and awareness at elementary ages. Therefore, this education can be considered as a solution to prevent environmental degradation.                                                                                                                                                     | Survey      | Asgaripour et al., 2020         | Investigating the effectiveness of environmental education on environmental attitudes and awareness among preschool students |
| Environmental awareness should become part of public knowledge, and by reforming the country's educational system and the system of management laws and regulations, and by reforming the various uses of land and resources, by establishing precise environmental standards for sustainable development, the preservation of natural resources can be guaranteed for present and future generations. | Survey      | Shaffiei-Makvand & Barati, 2021 | The role of education in environmental management and sustainable development of cities                                      |
| The results of this study indicate that to achieve sustainable development, it is necessary to promote environmental ethics, and this cannot be achieved except by institutionalizing environmental education.                                                                                                                                                                                         | Documentary | Talebi & Kamandi, 2023          | The special place of environmental education in Iran's sustainable development                                               |

Based on the existing literature and research, this study is necessary because our aim is to understand what students should know, what they should do in their daily activities, and how their behavior toward the environment is manifested.

This study employed a quantitative research method. In terms of research hypotheses, structural equation modeling (SEM) was used to determine the relationships between the perception, attitude, and behavior variables. A questionnaire was used as the survey instrument. The survey structure was as follows: individual environment, external environment, and social environment, consisting of 31 questions and four factors to identify the students' status. The statistical population consisted of 358 students from Payame Noor University of Arak in the fields of accounting, management, and economics. Based on Cochran's formula and considering the population size, 193 students completed the questionnaire.

The questionnaire designed for data collection consisted of four sections. In the first section, personal information and individual characteristics were identified using four questions (gender, age, student education level, and family education); in the second section, we

attempted to measure students' perceptions (questions A1–A20); in the third section, we attempted to identify students' attitudes toward the environment (voluntary activities, nature conservation, warning) and their perception of the recycling phenomenon (questions B1–B4); in the final section, students responded to questions about their concerns regarding environmental behavior and provided feedback on environmental education (questions C1–C7).

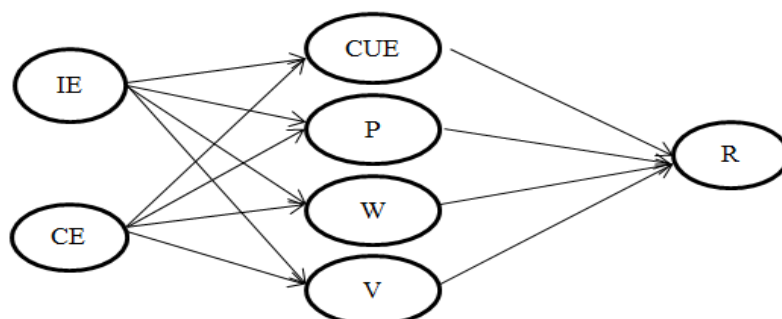
To obtain more information about students' perceptions of the environment and sustainable development, we restructured the 31 questions based on seven variables that can measure environmental behavior and attitudes.

To measure students' perceptions of environmental education, a Likert-scale questionnaire was used, ranging from 1 (strongly disagree) to 5 (strongly agree), and was completed in person. To determine the dimensions of environmental education and identify the impact, behavior, and commitment of students, Exploratory Factor Analysis (EFA) was performed on the data. Using independent samples t-tests, the hypotheses were tested using SPSS statistical analysis software. LISREL 8.7 software was used to determine the relationships and correlations among variables.

## Research Findings

The study focused on students' perceptions of environmental education and sustainable

development and the role of their attitudes toward environmental education on their behavior, as shown in Diagram 1 and Table 2.



**Diagram 1:** Conceptual Model of the Research – Relationship between Variables

**Table 2.** Variables in the Conceptual Research Model

|                                                                   |   |                                                                                                                      |     |
|-------------------------------------------------------------------|---|----------------------------------------------------------------------------------------------------------------------|-----|
| Alarmist attitude about the environment (mediating variable)      | W | Importance of the environment (predictor variable meaning students' perception of the importance of the environment) | IE  |
| Voluntary activities and non-harmful actions (mediating variable) | V | Concerns about the environment (predictor variable as students' concerns about the environment)                      | CE  |
| Attention to recycling (criterion variable)                       | R | Environmental culture (mediating variable)                                                                           | CUE |
|                                                                   |   | Participation in various activities related to the environment (mediating variable)                                  | P   |

This study examines the environmental behavior of students at Payame Noor University of Arak and the causal relationships between their perceptions and attitudes toward the environment and their environmental behavior using Structural Equation Modeling (SEM), which considers environmental importance and concerns about the environment.

The validity of the questionnaire was confirmed by several faculty members, and Cronbach's alpha reliability analysis was used

to measure the environmental reliability of the scales used in the study, which included students' perceptions of scientific education, their attitudes toward environmental education, and their behaviors related to environmental education scales. The Cronbach's alpha coefficient in the reliability analysis and general validation of the scales was 0.863. As shown in Table 3, this analysis was used to evaluate the reliability of the scales, and items with low reliability scores were removed.

**Table 3.** Standardized Parameter Estimates

| Assumptions | Routes       | Standard estimated values of parameters | T Values | Results      |
|-------------|--------------|-----------------------------------------|----------|--------------|
| H1          | (IE) → (CUE) | 0.2                                     | 2.36     | Approved     |
| H2          | (IE) → (P)   | 0.12                                    | -0.20    | Not Approved |
| H3          | (IE) → (W)   | 0.3                                     | 4.46     | Approved     |
| H4          | (IE) → (V)   | 0.33                                    | 4.74     | Approved     |
| H5          | (CE) → (CUE) | 0.4                                     | 8.34     | Approved     |

| Assumptions | Routes      | Standard estimated values of parameters | T Values | Results      |
|-------------|-------------|-----------------------------------------|----------|--------------|
| H6          | (CE) → (P)  | 0.61                                    | 8.39     | Approved     |
| H7          | (CE) → (W)  | 0.65                                    | 9.49     | Approved     |
| H8          | (CE) → (V)  | 0.35                                    | 8.48     | Approved     |
| H9          | (CUE) → (R) | 0.11                                    | 1.28     | Not Approved |
| H10         | (P) → (R)   | -0.30                                   | -1.24    | Not Approved |
| H11         | (W) → (R)   | -0.13                                   | -0.26    | Not Approved |
| H12         | (V) → (R)   | 0.64                                    | 4.96     | Approved     |

After reliability analysis, Exploratory Factor Analysis (EFA) was performed, and the structural equation model (Table 4) was obtained after removing items with factor loadings below 0.45.

**Table 4.** Structural Model Fit Indices

| Criteria | Excellent fit                  | Acceptable fit                     | Model |
|----------|--------------------------------|------------------------------------|-------|
| RMSEA    | $0 < \text{RMSEA} < 0.05$      | $0.05 \leq \text{RMSEA} \leq 0.10$ | 0.057 |
| NFI      | $0.95 \leq \text{NFI} \leq 1$  | $0.90 \leq \text{NFI} \leq 0.95$   | 0.91  |
| NNFI     | $0.97 \leq \text{NNFI} \leq 1$ | $0.95 \leq \text{NNFI} \leq 0.97$  | 0.955 |
| CFI      | $0.97 \leq \text{CFI} \leq 1$  | $0.95 \leq \text{CFI} \leq 0.97$   | 0.956 |
| GFI      | $0.95 \leq \text{GFI} \leq 1$  | $0.90 \leq \text{GFI} \leq 0.95$   | 0.92  |
| AGFI     | $0.90 \leq \text{AGFI} \leq 1$ | $0.85 \leq \text{AGFI} \leq 0.90$  | 0.87  |

RMSEA: Root Mean Square Error of Approximation; NFI: Normed Fit Index; NNFI: Non-Normed Fit Index; CFI: Comparative Fit Index; GFI: Goodness of Fit Index; AGFI: Adjusted Goodness of Fit Index

Table 5 presents the analysis of the dynamic and concerns and their participation in effects of students' environmental importance environmental issues.

**Table 5.** Results of Exploratory Factor Analysis

| $\alpha$ | Percentage variance | Special values | Uploads                                                                                 | Factors |
|----------|---------------------|----------------|-----------------------------------------------------------------------------------------|---------|
| 0.6      | 6.05                | 1.036          | The importance of the environment                                                       | IE      |
|          |                     |                | 0.652 I believe that environmental issues have been exaggerated.                        | IE1     |
|          |                     |                | 0.553 I never worry about issues like water or sea pollution.                           | IE2     |
|          |                     |                | 0.671 I don't believe that the extinction of animals and plants will destroy the world. | IE3     |
| 0.698    | 8.23                | 1.068          | Concern about the environment                                                           | CE      |
|          |                     |                | 0.698 I am concerned about the impact of air pollution on my family.                    | CE1     |
|          |                     |                | 0.722 I feel sad to see that factory waste is polluting the environment.                | CE2     |
|          |                     |                | 0.627 Environmental pollution worries me.                                               | CE3     |
|          |                     |                | 0.516 I am afraid that environmental pollution will make the world uninhabitable.       | CE4     |
| 0.621    | 5.99                | 1.269          | Environmental culture                                                                   | CUE     |
|          |                     |                | 0.865 I will check and turn off lights that are unnecessarily on.                       | CUE1    |
|          |                     |                | 0.786 I will use the back of the papers when I study.                                   | CUE2    |

| $\alpha$ | Percentage variance | Special values | Uploads         | Factors                                                                                                  |
|----------|---------------------|----------------|-----------------|----------------------------------------------------------------------------------------------------------|
| 0.680    | 6.36                | 1.10           | 0.402           | I will warn people who pollute nature. CUE3                                                              |
|          |                     |                | Participation P |                                                                                                          |
|          |                     |                | 0.723           | I will not harm the environment, either directly or indirectly, in my business or private life. P1       |
|          |                     |                | 0.583           | I will not show any violence or aggression towards the environment in which I live and what is in it. P2 |
|          |                     |                | 0.596           | I will do my best to make the environment in which I live more beautiful and habitable. P3               |

Information feedback, utilizing the rapid communications of the 21st century, is very fast and plays an important role, especially through sharing news, solutions, and advice to improve students' environmental education. For this reason, the environmental culture variable (CUE) is increasing, and at the same time, recycling behavior (R) is also increasing (e.g., automated correspondence, environmental products, electric car driving, cycling, etc.).

For the concern about the environment factor (CE), environmental concerns were obtained as follows:

1. Youth perception of the environment and its protection
2. Efforts to institutionalize environmental care
3. Concern for the future

4. Understanding the reality that few young people emphasize their own health or the health of the environment in which they live

Students' participation in environmental protection (P) is improving, but at the same time, their behavior is worsening. The results in the table above provide a clear picture of students' information about their role in daily events that can help or harm the environment. Today, mass media (television, radio, newspapers, the internet, etc.) aggressively display environmental problems, natural impacts, and the role of human behavior against the environment. Another study variable, voluntary activities (V) among students, has a positive effect on R (recycling rate) and the development of specific student behavior, but their attitudes remain weak.

**Table 6.** Results of Exploratory Factor Analysis for Volunteer Attitude

| $\alpha$ | Percentage variance | Special values | Factorial load | Factors                                                                                                                                                                           |
|----------|---------------------|----------------|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 0.796    | 11.96               | 8.26           |                | Volunteer activities V                                                                                                                                                            |
|          |                     |                | 0.741          | I will be an active member of nature and environmental organizations. V1                                                                                                          |
|          |                     |                | 0.729          | I will work voluntarily for nature and humanity. V2                                                                                                                               |
|          |                     |                | 0.671          | I will participate in tree planting activities. V3                                                                                                                                |
|          |                     |                | 0.669          | I will participate in environmental cleanup campaigns. V4                                                                                                                         |
|          |                     |                | 0.61           | I will take action against those who pollute nature with local authorities. V5                                                                                                    |
|          |                     |                | 0.611          | I will put away consumer product waste for recycling. V6                                                                                                                          |
|          |                     |                | 0.456          | I will use products made from non-renewable resources such as underground oil, coal, natural gas, and minerals economically because we cannot replace them with new resources. V7 |
|          |                     |                | 0.455          | I will eliminate unnecessary consumption to ensure that pollution is eliminated at its source. V8                                                                                 |

As an important factor, the volunteer role can help maximize the outcomes of student volunteers' work in the environmental field. Respondents believe that strong will and motivation to do good for people and protect the community's environment are related to moral

values; and a high level of citizenship in terms of duty, respect for moral and legal norms of human-environment relations, and promotion of collective interests are considered a priority for society.

The main product of organic education is a

volunteer personality involved in solving environmental problems. Volunteering has grown since the 1970s, especially in the last two decades, starting from the United States, Canada, Australia, and European Union countries and others, accompanied by executive green policies from governments and the advancement of ecological education in national educational systems.

Universities are unable to play their role without the formation of ecological dimensions of contemporary human personality, without allocating ecological culture based on positive attitudes toward the environment and belief in sustainable development, and without the possibility of actually building a "green society" and connecting human rights to a healthy and balanced environment (Akinsemolu & Onveaka, 2025). Regarding the

ecological personality of respondents, they participate in organizations and voluntary activities to acquire positive and sustainable attitudes toward the environment.

Students state that education of beliefs and attitudes toward environmental issues is created more through education, formation of ecological awareness, and especially through organizing environmental protection activities and practical applications (Acosta-Castellanos, 2024).

The warning attitude (W) about the environment is increasing, but students' behavior scores are decreasing, even when they are aware of the negative impacts of activities they perform in their daily routine, such as water consumption, air pollution, waste, energy waste, wasted paper, damage to trees and flowers in parks (Table 7).

**Table 7.** Results of Exploratory Factor Analysis for Warning Attitude

| $\alpha$ | Percentage variance | Special Values | Factorial load |                                                                      | Factors |
|----------|---------------------|----------------|----------------|----------------------------------------------------------------------|---------|
| 0.526    | 7.01                | 1.42           |                | Warning attitude                                                     | W       |
|          |                     |                | 0.865          | I will warn those who damage trees and flowers in parks and gardens. | W1      |
|          |                     |                | 0.506          | I will warn those around me to avoid any unnecessary consumption.    | W2      |
|          |                     |                | 0.632          | I will fight those who endanger nature.                              | W3      |

In Table 7, the status of the reuse, recycling, and reprocessing variable (R) shows that the new green lifestyle for this century entails alignment with international standards. The

new market orientation and adaptation to healthy and green eco-biological products encourage the younger generation and guide them toward a new lifestyle and behavior.

**Table 8.** Results of Exploratory Factor Analysis for Recycling Variable

| $\alpha$ | Percentage variance | Special Values | Factorial load |                                                                    | Factors |
|----------|---------------------|----------------|----------------|--------------------------------------------------------------------|---------|
| 0.786    | 11.02               | 2.7            |                | Recycling (reuse)                                                  | R       |
|          |                     |                | 0.844          | I buy ecological products even if they are more expensive.         | R1      |
|          |                     |                | 0.836          | I buy products with recyclable packaging.                          | R2      |
|          |                     |                | 0.753          | I buy products from companies that support environmental projects. | R3      |
|          |                     |                | 0.744          | I prefer to use products made from renewable raw materials.        | R4      |

The most important actions regarding reuse (R) are as follows:

For R1, the highest value of 0.844 was obtained because green and ecological products, even if expensive, are preferred due to being biological and healthy. In recent years, buying Iranian products has been strongly emphasized by the government and the public.

This encourages customers to buy products manufactured in Iran and strengthen domestic market demand.

For R2, the results are 0.836. Regarding this variable, the market and products should be aligned with quality standards, and specific product packaging should follow standards. Consequently, students recognize the location

and method of recyclable packaging of paper, plastic, or steel. Regarding R3 and R4, the results are lower. This may be because these concepts are new in the market, organizations do not yet have responsibilities in environmental issues, and they are not engaged in environmental education. The review of the

role of organizations from only producer to educator is starting, and ultimately, students are encouraged to buy from these types of producers. R4 is important because we consider the choice of paper and plastic essential, but the lower results in students' environmental behavior reflect the reality of the country.

**Table 9.** Importance of Factors

| Standard deviation | Average |                                   | Factors      |
|--------------------|---------|-----------------------------------|--------------|
| 0.94529            | 3.2009  | The importance of the environment | IE           |
| 0.60552            | 4.2212  | Concern about the environment     | CE           |
| 0.56588            | 4.1916  | Environmental culture             | CUE          |
| 0.53821            | 4.3564  | Participation                     | P            |
| 0.59491            | 3.9104  | Volunteering                      | V            |
| 0.64095            | 4.16    | Warning                           | W            |
| 0.82832            | 3.4949  | (Recycle) Reuse                   | R            |
| 0.54361            | 3.7111  | Perception                        | (Perception) |
| 0.43403            | 4.1546  | Attitude                          | (Attitude)   |

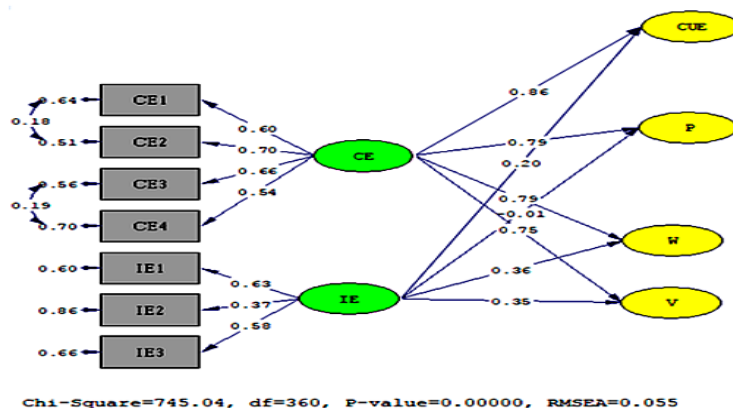
As shown in Table 9, students' attitude toward the environment has a higher value of 4.1546 compared to their behavior, which is 3.4949. This means that they are deeply involved in various activities to protect nature.

As observed in Table 9, students' attitude toward the environment has a higher value of 4.1546 compared to their behavior, which is 3.4949. This indicates that they are deeply involved in various activities to protect nature.

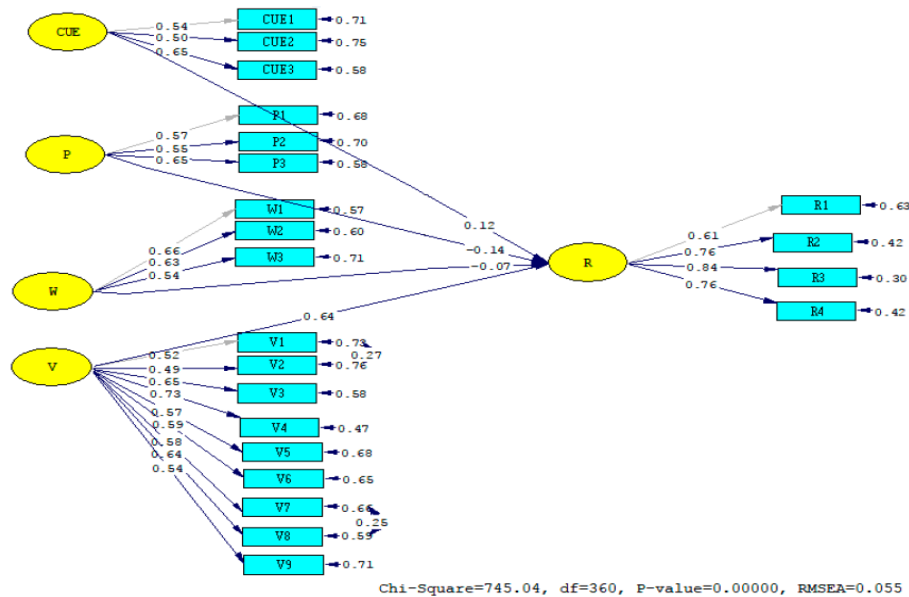
Students' perception score regarding environmental problems and the importance of

nature for life is higher, but their behavior score is lower, because they believe that the aggressive information of mass media about environmental problems, marine disasters, and pollution is exaggerated as an environmental issue and not important to them.

By transferring the database and using LISREL software, modeling and establishing correlations between environmental concerns (CE), environmental culture (CUE), warning (W), and volunteering (V) were made possible (Diagram 2).



**Diagram 2.** Correlation between Environmental Importance (IE) and Environmental Concern (CE) with Mediating Variables



**Diagram 3.** Correlation between Students' Environmental Behavior and Recycling

Diagram 3 shows the correlation between students' culture (CUE), participation (P), warnings and concerns with the latent variables of students' perception (W) and voluntary actions (V) with the recycling factor (R). The results indicate that the students studied have a high environmental culture due to strong environmental education.

The correlation coefficient between environmental culture (CUE) and students' participation in recycling activities (R) was 0.12. Even among students who have environmental knowledge and culture, their attitude toward recycling is more due to the lack of waste collection centers near homes. Even if they know that this problem prevents selective waste collection, according to the conducted research, this issue continues. Another reason mentioned by respondents is that they do not trust responsible authorities and think that collected waste is transferred to landfills or they simply do not know where they can collect waste separately. The low values for recycling bags (R2) and renewable materials (R4) may be because market alignment with international standards takes time and changing students' mindsets is very difficult.

The correlation coefficient between student participation (P) and the recycling factor (R) was -0.14. This result indicates that students are not very willing to participate in recycling

actions; even when they know that there are smart containers for waste collection in the city, they wait to receive rewards or think that this is not their duty.

The correlation coefficient between the warning factor (W) and recycling (R) was -0.07, which is very low. Respondents are not aware of the harms and health problems caused by waste, and therefore this issue is not important to them.

However, the largest correlation of 0.64 was obtained between volunteers (V) and the recycling factor (R), indicating the connection between the generation active in cleanup activities, nature conservation, lifestyle change, and having a green life.

The highest value for the volunteer factor (V) among items V1–V9 was related to the statement “I will use products made from non-renewable resources such as underground oil, coal, natural gas, and minerals economically because we cannot replace these resources with new ones.” This shows that the new generation has a new perspective and is ready to become aware and responsible citizens.

The correlation value of 0.64 is the highest value indicating the influence of students in recycling activities, and for the reuse variable, the largest value was for item R1, equal to 0.64, which shows that students are informed and even if product prices are higher, they buy

ecological products.

This article presents new information as follows:

- The studied students scored high in environmental behavior (EB), especially in voluntary activities (V);
- They have environmental culture (CUE), but are unwilling to participate in direct activities such as reuse (R) in specific places and choices; they believe they should be personally compensated for this;

- They are highly involved in voluntary activities and are not interested in being pressured or forced to perform their civic duties.

In this model, Environmental Education (EE) and students' personal characteristics (PD) are modeled as exogenous variables, and students' perception, environmental attitude, and environmental behavior are modeled as endogenous variables. Perception also plays a mediating role.

**Table 10.** Coefficients Table

| Significance  | t-value | Path coefficient | Path                                                |
|---------------|---------|------------------|-----------------------------------------------------|
| Significant   | 6.75    | 0.62             | Environmental Education → Perception                |
| Significant   | 5.98    | 0.54             | Perception → Environmental behavior                 |
| Significant   | 2.45    | 0.28             | Environmental Education → Environmental behavior    |
| Significant   | 5.12    | 0.5              | Environmental Education → Environmental attitude    |
| Significant   | 4.89    | 0.47             | Perception → Environmental attitude                 |
| Insignificant | 1.3     | 0.12             | Individual characteristics → Perception             |
| Insignificant | 1.05    | 0.1              | Individual characteristics → Environmental behavior |

The results show that environmental education has a significant effect on students' perception, with a path coefficient of  $\beta = 0.62$  and  $t = 6.75$ , indicating a significant strengthening of perception with increased education. Furthermore, students' perception plays an important mediating role in their environmental behavior ( $\beta = 0.54$ ,  $t = 5.98$ ). In addition, environmental education has a direct and significant effect on environmental behavior ( $\beta = 0.28$ ,  $t = 2.45$ ,  $p < 0.05$ ), indicating that its role is exerted both directly and through perception, and thus perception acts as a partial mediation. In contrast, students' individual characteristics such as age, gender, and family education had weak and non-significant effects on environmental behavior ( $\beta \approx 0.10$ – $0.12$ ,  $t < 1.96$ ), indicating the lesser importance of these factors compared to environmental education.

## Conclusion

The environment is an intergenerational issue, and its education to all segments of society is very important. Among these, students are of particular importance. Environmental education and modifying their perception of the environment reduce pressure on the environment in the present and future. Therefore, this research is an attempt to gain

more information about students' perceptions of environmental education and sustainable development.

The findings of this study indicate that environmental education acts as the most important determining factor in students' environmental perception and behavior. The model paths showed that environmental education has a significant effect on students' perception ( $\beta = 0.62$ ,  $t = 6.75$ ,  $p < 0.001$ ), such that increased environmental education strengthens students' understanding of environmental issues and sustainable development. Furthermore, students' perception itself has a positive and significant effect on their environmental behavior ( $\beta = 0.54$ ,  $t = 5.98$ ,  $p < 0.001$ ), indicating the key role of perception as a mediating variable in transferring the role of environmental education to environmental behaviors.

The direct path from environmental education to environmental behavior was also significant ( $\beta = 0.28$ ,  $t = 2.45$ ,  $p < 0.05$ ), meaning that environmental education has a direct role in students' environmental behavior in addition to its indirect role through perception. These findings indicate partial mediation of perception in the relationship between environmental education and environmental behavior, meaning that part of

the role of environmental education is transmitted through perception and another part directly affects behavior.

Additionally, the paths from environmental education and perception to students' environmental attitudes were also significant ( $\beta = 0.50$  and  $\beta = 0.47$ , respectively), indicating that environmental education and students' understanding improve not only behavior but also their attitudes toward environmental issues. In contrast, the paths related to students' individual characteristics including age, gender, and family education had weak and non-significant effects on environmental perception and behavior ( $\beta \approx 0.10\text{--}0.12$ ,  $t < 1.96$ ), indicating that the role of these factors is negligible compared to environmental education.

Overall, the results of this study emphasize the importance of environmental education in universities and its role in shaping students' environmental perceptions, attitudes, and behaviors. The findings indicate that to increase sustainable environmental behaviors among students, designing targeted and effective educational programs with a focus on strengthening students' perception of environmental issues is essential. These results are also consistent with theories of environmental education and sustainable development and highlight the importance of collective participation and responsible education in environmental protection.

The findings of this study show that “environmental education” acts as the main

factor in shaping students' perception, such that students who have been exposed to environmental education have a stronger perceptions of environmental issues. This result is consistent with the study by Boca and Saraçlı (2019), which showed a positive and significant relationship between environmental education, perception, and students' environmental behavior.

Furthermore, it was found that students' perception is an important influential factor in their environmental behaviors; this finding is similar to the results of Genovese's (2022) study, in which students' perception of the environment and their attitudes had a significant relationship with environmental behaviors.

Additionally, the direct path from environmental education to environmental behavior was confirmed, indicating that education not only works through increasing perception but also independently influences environmental behaviors. This matches the study by Estrada-Araoz et al. (2023), which recorded a direct and significant relationship between environmental education and environmental behavior.

In contrast, variables such as students' individual characteristics (age, gender, family education) did not show any significant effect on environmental perception or behavior; this finding aligns with studies such as Alam and Zakaria (2021), which showed that age and gender differences do not play a significant role in students' environmental attitudes.

## REFERENCES

- Abbaspour, M., Kargari, N., & Mostouri, R. (2006). ‘The role of environmental education in national sustainable development and its outlook’. Proceedings of the National Biennial Conference of the Iranian Association of Environmental Experts. [In Persian]  
<https://en.civilica.com/doc/1498163/>
- Acosta-Castellanos, P. M. (2024). “Environmental education for sustainable development in higher education: A systematic review”. *International Journal of Sustainability in Higher Education*, 23(3), 622–634. <https://eric.ed.gov/?id=EJ1331080>
- Akinsemolu, A. A., & Onyeaka, H. (2025). “The role of green education in achieving the sustainable development goals: A review”. *Renewable and Sustainable Energy Reviews*, 210, 115239.  
<https://doi.org/10.1016/j.rser.2024.115239>
- Alam, M. M., & Zakaria, A. F. M. (2021). “A probit estimation of urban bases of environmental awareness: Evidence from Sylhet City, Bangladesh”. *arXiv*.  
<https://arxiv.org/abs/2107.08342>
- Ali Taleshi, M., SudaieiZadeh, H., & Nejad Korki, F. (2012). “Examining the role of environmental standards in achieving

- sustainable development with regard to students' awareness levels". *Environmental Education and Sustainable Development Quarterly*, 1 (2), 45–53. [In Persian] <https://doi.org/20.1001.1.23223057.1391.1.2.5.4>
- Asgaripoor, Afsaneh, Amiri, Mohammad Javad, & Rahimi, Samaneh. (2020). "Evaluation of Environmental Education Effectiveness on Environmental Attitude and Awareness of Students". *Journal of environmental science and technology*, 22(4 (95)), 315-326. [In Persian] <https://sid.ir/paper/409103/en>
- Ausubel, J. H., Victor, D. G., & Wernick, I. K. (1995). "The environment since 1970: Consequences: The nature and implications of environmental change", (1(3), p. 2–15). <https://phe.rockefeller.edu/publication/environment-since-1970/>
- Boca, G. D., & Saraçlı, S. (2019). "Environmental education and students' perception for sustainability". *Sustainability*, 11(6), 1553. <https://doi.org/10.3390/su11061553>
- Dunlap, R. E., Gallup, G., & Gallup, A. (1992). "Health of the planet: Results of a 1992 international environmental opinion survey of citizens in 24 nations". *The George H. Gallup International Institute*. <https://searchworks.stanford.edu/view/2861356>
- Eshtagh, L. (2018). "Environmental psychology". Tehran: *Arjmand Publishing*.
- EstradaAraoz, E. G., Gallegos Ramos, N. A., Paredes Valverde, Y., Quispe Herrera, R., & Mori Bazán, J. (2023). "Examining the relationship between environmental education and proenvironmental behavior in regular basic education students: A crosssectional study". *Social Sciences*, 12\*(5), 307. <https://doi.org/10.3390/socsci12050307>
- Genovese, E. (2022). "University student perception of sustainability and environmental issues". *AIMS Geosciences*. <https://doi.org/10.3934/geosci.2022035>
- HajjHassan, M., Chaker, R., & Cederqvist, A. M. (2024). "Environmental education: A systematic review on the use of digital tools for fostering sustainability awareness". *Sustainability*, 16 (9), 3733. [In Persian] <https://doi.org/10.3390/su16093733>
- Jadhav, A. S., Jadhav, V. V., & Raut, P. D. (2014). "Role of higher education institutions in environmental conservation and sustainable development: A case study of Shivaji University, Maharashtra, India". *Journal of Environment and Earth Science*, 4 (5), 3034. <https://www.iiste.org/Journals/index.php/JEES/article/view/11624>
- Jaime, M., Salazar, C., Alpizar, F., & Carlsson, F. (2023). "Can school environmental education programs make children and parents more proenvironmental?". *Journal of Development Economics*, 161, 103032. <https://doi.org/10.1016/j.jdeveco.2022.103032>
- Kelly, B., & Martha, M. (2013). In M. Martha & M. Kelly (Eds.), "Foundation of environmental education: Across the spectrum: Resources for environmental educators". *North American* [https://www.academia.edu/18958876/Foundation\\_of\\_Environmental\\_Education](https://www.academia.edu/18958876/Foundation_of_Environmental_Education)
- Kougias, K. (2023). "Attitudes and perceptions on education for sustainable development: A Greek case study". *International Journal of Sustainability in Higher Education*, 3(1), 1–15. <https://doi.org/10.1007/s43615-022-00174-w>
- Liu, S., & Guo, L. (2018). "Based on environmental education to study the correlation between environmental knowledge and environmental value". *Eurasia Journal of Mathematics, Science and Technology Education*, 14, 3311–3319. <https://www.ejmste.com/article/based-on-environmental-education-to-study-the-correlation-between-environmental-knowledge-and-5513>
- Marques, V., Ursi, S., Lima Silva, E., & Katon, G. (2020). "Environmental perception: Notes on transdisciplinary approach". *Scientific Journal of Biology & Life Sciences*, 1(2), Article 000511. <https://doi.org/10.33552/SJBL.S.2020.01.000511>
- Minunno, R., Diaz, L., & Gamboni, M. (2020). "Exploring environmental benefits of reuse and recycle within the built environment context". *Resources, Conservation & Recycling*, 159, 104835. <https://doi.org/10.1016/j.resconrec.2020.104835>
- Nistor, L. (2009). "Sociologia mediului înconjurător: Aplicații privind atitudini și comportamente în România". *Presa*

- Universitară Clujeană.
- Riordan, M., & Klein, E. J. (2010). "Environmental education in action: How expeditionary learning schools support classroom teachers in tackling issues of sustainability". *Teaching Education Quarterly*, 37, 119–134. <https://files.eric.ed.gov/fulltext/EJ904904.pdf>
- Salehi, S., & GhaemiAsl, Z. (2013). "Examining the relationship between environmental education and environmental protection behaviors (Case study: Female high school students in Babol)". *Environmental Education and Sustainable Development Quarterly*, 1 (3), 67–79. [In Persian] <https://doi.org/20.1001.1.23223057.1392.1.3.7.2>
- Schultz, P. W. (2002). "Environmental attitudes and behaviors across conservation of the natural environment". *Online Readings in Psychology and Culture*. <https://www.scribd.com>
- ShafieiMakvand, H., & Barati, A. (2021). "The role of education in environmental management and sustainable urban development". *Proceedings of the Fourth International and Fifth National Conference on Civil Engineering, Architecture, Art, and Urban Design*. Tabriz, Iran. [In Persian] <https://civilica.com/doc/1427042>
- Sullivan, A., Gianotti, A. S., Scollins, A., Tornatore, L., Ge, B., & Briones, M. (2024). "Undergraduate experiences with sustainability courses: Insights for diversifying sustainability education". *Journal of Environmental Studies and Sciences*, 14 (3), 548–567. <https://doi.org/10.1007/s13412-024-00938-w>
- Talebi, S., & Kamandi, H. (2023). "The special position of environmental education in sustainable development in Iran". In *Proceedings of the Twelfth International Conference on Agriculture, Environment, Urban and Rural Development*. [In Persian] <https://www.en.symposia.ir/URDCONF12>
- Uddin, M. K. (2024). "Environmental education for sustainable development in Bangladesh: Students' and teachers' perceptions". *Sustainable Development*, 32 (1), 1137–1151. <https://doi.org/10.1002/sd.2728>
- Veleepini, K. (2025). "Assessing the role of environmental education practices towards the attainment of the 2030 Sustainable Development Goals". *Sustainability*, 17(5), 2043. <https://doi.org/10.3390/su17052043>
- Zhang, X., Jung, W., & Asari, M. (2025). "Systematic review of environmental education teaching practices in schools: Trends and gaps (2015–2024)". *Sustainability*, 17 (19), 8561. <https://doi.org/10.3390/su17198561>

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