

THE INFLUENCING FACTORS OF PRO-ENVIRONMENTAL BEHAVIORAL INTENTION OF HIGHER EDUCATIONAL INSTITUTIONS (HEIS) STUDENTS ON ENERGY CONSERVATION

Xiaolin Zhang

A Thesis Submitted in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy
Program in Management
Rattanakosin International College of Creative Entrepreneurship
Rajamangala University of Technology Rattanakosin
Academic Year 2026
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Xiaolin Zhang

2026

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ABSTRACT

The objectives of this study were (1) to investigate the relationships between university leadership, sustainability-oriented education and higher educational institution students' pro-environmental behavioral intention in Shanxi Province, (2) to verify the relationships between environmental values, environmental beliefs, personal norms and pro-environmental behavioral intention among them, and (3) to test the mediating roles of environmental values, environmental beliefs and personal norms in shaping students' behavioral intention.

The study employed a quantitative study approach by using a cross-sectional survey design. Data were collected through a structured questionnaire administered to students from higher education institutions in Shanxi Province, China. The questionnaire was developed based on established measurement scales covering university leadership, sustainability-oriented education, environmental values, environmental beliefs, personal norms, and pro-environmental behavioral intention. A total of 864 valid responses were obtained. Descriptive statistics, reliability and validity tests, confirmatory factor analysis, and structural equation modeling were used to analyze the data and test the proposed hypotheses.

Major findings: (1) On the issue of university leadership and sustainability-oriented education, these factors significantly influenced students' pro-environmental behavioral intention, demonstrating the importance of institutional support in promoting sustainability-related behaviors in higher education settings; (2) On the issue of environmental values, environmental beliefs, and personal norms, these factors showed significant positive relationships with pro-environmental behavioral intention, confirming the explanatory power of the Value–Belief–Norm framework in understanding students' environmental decision-making processes; and (3) On the issue of environmental values, environmental beliefs, and personal norms, these factors played mediating roles in the relationship between institutional factors and pro-environmental behavioral intention, indicating that institutional support mechanisms could strengthen students' psychological motivations toward environmental responsibility. These findings highlighted the importance of integrating institutional governance and sustainability-oriented education with psychological mechanisms to promote environmentally responsible behavior among higher education students.

Keywords: Pro-environmental behavioral intention, University leadership, Sustainability-oriented education, Higher education institutions

Advisor's Signature .....

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Xiaolin Zhang
February 2026

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List of Abbreviation and Glossary

Abbreviation / Glossary	Explanation
AGFI	Adjusted Goodness-of-Fit Index
AVE	Average Variance Extracted
$\chi 2$	Chi-square
χ^2/df	Chi-Square to Degrees of Freedom Ratio
CFI	Comparative Fit Index
CR	Composite Reliability
CFA	Confirmatory Factor Analysis
CITC	Corrected Item–Total Correlation
EB	Environmental Belief
EV	Environmental Values
GFI	Goodness-of-Fit Index
HTMT	Heterotrait–Monotrait
KMO	Kaiser–Meyer–Olkin
NFI	Normed Fit Index
PEBI	Pro-Environmental Behavioral Intention
PN	Personal Norms
RMSEA	Root Mean Square Error of Approximation
SST	Social Support Theory
SE	Sustaibability-oriented Education
SEM	Structural Equation Modeling
SRMR	Standardized Root Mean Square Residual
TLI	Tucker-Lewis Index
UL	University Leadership
VBN	Value-Belief-Norm theory

CHAPTER 1
INTRODUCTION

This chapter introduces the overall foundation of the study by presenting the study background, conceptual context, and structural orientation of the thesis. The chapter begins with background of the study, where the broader sustainability challenges related to rising energy demand and increasing electricity consumption in higher education institutions are discussed, followed by the problem statement and study gap that identify the key issues and theoretical gaps motivating this study. It then explains the significance of the study, including both theoretical significance and practical significance, to highlight the value of examining students' pro-environmental behavioral intention in the context of energy conservation. Based on these foundations, the chapter presents the statement of study questions and the statement of study objectives, which clarify the main focus and direction of the study. The chapter also introduces the methodology, outlining the quantitative study approach adopted to investigate the proposed relationships. To ensure conceptual clarity, definitions of terms are provided for the key constructs examined in the study. The scope of the study is further clarified through the delimitation of the thesis, followed by the outline of thesis which briefly explains the structure of the entire dissertation. Finally, the chapter ends with the conclusion that summarizes the main content of the chapter and prepares the foundation for the literature review presented in the next chapter.

1.1 Background of the Study

1.1.1 Problem Statement

The accelerating growth of global urbanization, digitalization and industrial transformation has led to a sharp rise in worldwide energy demand, placing unprecedented pressure on energy systems and intensifying sustainability challenges across regions (Dzwigol et al., 2024; Gajdzik et al., 2024). According to the International Energy Agency, global electricity consumption continues to increase at nearly 2.5 percent annually, driven by the expansion of building operations, digital infrastructures and residential energy

requirements (Castro et al., 2024). Within this broader context, higher education has become a central arena for advancing sustainability objectives. The United Nations Sustainable Development Goals, particularly SDG 7 on affordable and clean energy and SDG 12 on responsible consumption, highlight universities as key actors that are expected both to reduce their own environmental footprints and to cultivate environmentally responsible citizens who can support long term transitions toward energy efficiency (Raman et al., 2024; Seilkhan et al., 2024). Higher education for sustainable development therefore positions universities as catalysts that integrate knowledge, values and behavioral competencies, making energy conservation an essential dimension of their contribution to national and global sustainability agendas (Shih et al., 2025; Žalėnienė & Pereira, 2021). This positioning also highlights the significance of examining students' energy conservation intention, as universities are not only major institutional consumers of electricity but also formative environments where young adults develop long-term environmental values, behavioral norms, and consumption habits (Li et al., 2024). Understanding how these intentions are shaped provides readers with actionable insights into how behavioral change can be cultivated alongside technological and policy interventions, thereby extending the relevance of the study beyond campus settings to broader societal transitions.

Higher education institutions are among the most energy intensive public sectors, as they operate complex facilities, including laboratories, academic buildings, libraries and student residences, that require continuous electricity for lighting, heating, cooling, ventilation and digital learning tools (Laporte & Cansino, 2024). Campus buildings account for a large proportion of total university energy consumption, and student residential habits together with electronic lifestyles are significant contributors to overall electricity demand (Jasim et al., 2025). These features make campus electricity conservation a critical and measurable entry point for improving institutional energy performance. In many systems, electricity use in higher education rises faster than the average growth of public sector consumption, which reinforces the need to understand how students use energy in everyday campus life and how institutions can shape this behavior.

In China, the urgency of reducing campus electricity consumption is further amplified by the country's broader sustainability objectives. National electricity demand

reached approximately 8.7 trillion kWh in 2023 and continues to rise steadily, driven by rapid digital expansion and increasing living standards (Shen et al., 2024; Zhuo et al., 2022). Empirical studies indicate that Chinese universities consume considerably more electricity per capita than other public institutions because of high density dormitory living, extended use of personal devices and extensive dependence on air conditioning and electric heating (Jia et al., 2021; Liu et al., 2021). During peak seasons, electricity consumption in student dormitories often exceeds 12 to 16 kWh per person per day, which is higher than many international benchmarks (Wang et al., 2025). These patterns have prompted national policy frameworks to call for managerial and behavioral interventions within educational settings to support the "Double Carbon" strategy, which combines structural decarbonization with changes in everyday behavior (Mihai et al., 2024).

Within China, Shanxi Province represents a particularly critical context for examining energy saving behavior. As one of the country's most coal dependent and carbon intensive regions, Shanxi has long served as a strategic energy base, with electricity generation and heavy industry closely tied to coal exploitation. This development model has created substantial pressure to reduce carbon emissions while maintaining economic stability, and it has turned energy conservation into a central policy priority at both provincial and sectoral levels (Jing & Rasiah, 2025; Zhang et al., 2022). While the expansion of renewable energy is widely recognized as a critical supply-side solution for reducing carbon emissions, it cannot fully address inefficiencies in electricity consumption patterns in the short term (Sohaib et al., 2025). Demand-side interventions, such as promoting energy-saving behaviors, are therefore necessary to complement structural transitions by reducing unnecessary consumption, smoothing peak demand, and improving overall system efficiency (Nebey, 2024). In this sense, behavioral change and energy structure transformation should be viewed as mutually reinforcing rather than substitutive strategies. Universities in Shanxi operate under the combined influences of national "Double Carbon" commitments and provincial decarbonization requirements, while at the same time accommodating dense student populations and increasingly digital lifestyles. The focus on students is particularly relevant because they constitute the primary users of campus facilities and are directly involved in daily electricity consumption through dormitory living, classroom activities, and digital learning practices (Mohammed et al., 2025). Their repeated and routine energy-use decisions collectively form a substantial

share of campus electricity demand, making them a critical group for demand-side management and behavioral intervention. Moreover, as future professionals and decision-makers, students' current behavioral patterns may extend into long-term societal practices, amplifying the broader impact of energy-saving interventions targeted at this group (Mochi et al., 2025). The campus electricity behavior of students in Shanxi, therefore, has implications that extend beyond institutional management, as it reflects how young people in a high carbon region respond to sustainability signals and energy policies. This context provides an empirically rich and theoretically meaningful setting for exploring how institutional support and psychological mechanisms interact in shaping energy saving intention.

Despite rising awareness of environmental issues, a persistent intention–action gap characterizes student energy use. Survey evidence shows that students generally acknowledge the importance of sustainability, yet their willingness to adopt electricity saving practices remains limited (Fytopoulou et al., 2024; Li et al., 2024). This reluctance can be attributed to multiple interacting factors, including convenience-oriented lifestyles, low perceived personal impact on overall energy consumption, limited financial incentives for reducing electricity use, and the diffusion of responsibility within shared institutional environments (Hardmeier et al., 2024). Students may also perceive energy consumption as a collective or institutional issue rather than an individual responsibility, leading to weaker motivation for behavioral change. In addition, habitual reliance on digital devices and climate control systems reinforces patterns of high energy use, making it difficult to translate environmental awareness into consistent action (McCarthy et al., 2024). Studies in Chinese universities report that more than 60 percent of students seldom unplug idle devices, nearly 70 percent frequently overuse air conditioning or heating and less than 30 percent actively participate in energy saving initiatives promoted by institutions (Sun et al., 2025). These patterns suggest that informational campaigns and technical reminders alone cannot mobilize sustained behavioral change. Instead, they point to the importance of deeper psychological and institutional factors that condition the relationship between environmental awareness and actual behavior.

The rapid diffusion of energy intensive digital technologies on campus further complicates attempts to reduce electricity consumption. Widespread use of laptops, smartphones, online learning platforms, high performance study equipment and shared

digital services has steadily increased the baseline electricity load of university environments. Some regions report more than 20 percent growth in dormitory electricity demand in recent years, indicating that energy saving interventions must take into account the evolving digital lifestyle of students and the convenience norms associated with permanent connectivity (Jasim et al., 2025). These challenges are especially visible in energy intensive provinces such as Shanxi, where increases in campus electricity use indirectly reinforce the carbon intensity of the regional power system. At the same time, the normalization of continuous connectivity and digital dependence has made electricity consumption increasingly embedded in daily routines, reducing students' sensitivity to energy use and its environmental consequences (Huang et al., 2023). As a result, sustainability awareness often remains at a conceptual level, while actual behavior continues to be guided by comfort, convenience, and technological reliance.

Against this backdrop, the question of why students fail to adopt electricity saving behaviors despite extensive sustainability discourse becomes central. This issue is not only important for explaining the observed intention action gap, but also for revealing how institutional design, educational processes, and psychological mechanisms can be aligned to produce meaningful behavioral change (Benzehaf et al., 2025). Such understanding enables more targeted and effective interventions, moving beyond general awareness campaigns toward strategies that directly address the underlying drivers of energy use behavior. Addressing this question requires attention to two interconnected dimensions. The first dimension involves institutional influences that form the external environment in which students interpret behavioral expectations and gain access to resources (Fu et al., 2022). Within this environment, university leadership, particularly at the level of department heads, plays an important role in shaping student behavior. In the present study, university leadership refers to the capacity of department heads to communicate sustainability priorities, guide everyday behavioral expectations and provide support for energy conservation initiatives through regular administrative practices (Haider et al., 2022). Decisions regarding the use of facilities, communication about responsible electricity consumption and example setting all function as signals that shape how students interpret the importance of conserving energy. A key difficulty is that the emphasis placed on sustainability varies considerably across departments, which results in uneven exposure to sustainability norms among students (Sidiropoulos, 2022).

Sustainability-oriented education constitutes the second institutional mechanism relevant to student electricity conservation. In this context, the term refers to learning processes that equip students with environmental knowledge, analytical skills and practical problem solving abilities related to responsible energy use (Çam-Tosun & Söğüt, 2024). Courses, workshops and experiential programs can help students understand the environmental consequences of electricity consumption and the social benefits of reducing unnecessary use (Pietrapertosa et al., 2021). However, sustainability education is often fragmented or confined to particular disciplines, which weakens its capacity to shape everyday energy use and limit excessive reliance on energy intensive comfort practices (Bertossi & Marangon, 2022). These institutional features are particularly consequential in regions such as Shanxi, where effective sustainability education can contribute simultaneously to individual behavior change and to broader regional decarbonization efforts.

The second dimension involves internal psychological mechanisms that influence the extent to which students are willing to align their daily behavior with energy saving goals. Environmental values refer to the moral importance that students assign to protecting natural resources and avoiding unnecessary consumption (Yang et al., 2024). In practice, many students still treat electricity conservation as a matter of convenience rather than moral responsibility, which weakens the impact of values on intention (Alvi et al., 2024). Environmental beliefs describe students' understanding of how excessive energy use contributes to environmental degradation and increases pressure on campus and regional energy systems (Han et al., 2022). Students frequently underestimate the cumulative impact of individual electricity use, which reduces the motivational strength of these beliefs (Janmaimool & Chontanawat, 2021). Personal norms refer to the internal sense of moral obligation that motivates students to switch off unnecessary devices, use air conditioning responsibly and participate in conservation initiatives (Lucas Mangas et al., 2021). These norms are often weak or unstable, and many students rely on external supervision, such as dormitory regulations, rather than self regulation in managing their electricity use.

Taken together, university leadership and sustainability-oriented education as institutional variables, and environmental values, environmental beliefs and personal norms as psychological mechanisms, form a comprehensive set of factors that shape

student electricity saving behavior. Each factor presents distinct challenges, including inconsistent leadership signals, insufficient integration of sustainability into education, limited moral internalization, weak awareness of environmental consequences and underdeveloped personal responsibility. These challenges demonstrate the need for an analytical framework that captures both institutional influences and internal motivational processes in order to understand and improve students' intentions to conserve energy, especially in high carbon regions such as Shanxi.

Although awareness of these influences is increasing, empirical studies that examine the combined impact of university leadership, sustainability oriented education and value belief norm based psychological factors on student electricity saving intention remain scarce. Much of the existing literature continues to focus on general environmental behavior rather than specific energy use patterns, which limits the applicability of findings in settings where electricity consumption is both high and precisely measurable (Lange, 2023; Tian & Liu, 2022). Furthermore, the pathways through which leadership practices and educational structures shape environmental values, beliefs and personal norms are not yet well understood. This has hindered the development of targeted interventions that align structural influences with psychological readiness.

For these reasons, a comprehensive examination of how institutional conditions and internal psychological mechanisms jointly shape students' electricity saving intentions is necessary. Such examination is essential for designing effective campus energy management strategies, strengthening student engagement in sustainability transitions and supporting national as well as provincial goals for energy efficiency and carbon reduction. The higher education environment in Shanxi, characterized by structured governance, concentrated digital behaviors and a strong regional dependence on carbon intensive energy, provides an optimal setting for this investigation. By addressing these gaps, the present study seeks to advance understanding of student energy saving behavior through a combined institutional and psychological analytical lens, offering insights that are relevant to both theoretical development and practical policy design in Chinese higher education.

1.1.2 Research Gap

Electricity saving behavior in higher education represents a strategically important component of sustainable development because it directly affects institutional energy performance, shapes long term behavioral patterns among young adults and contributes to regional decarbonization efforts (Kazeem et al., 2023). This importance becomes especially pronounced in energy intensive provinces such as Shanxi, where high carbon dependence and persistent pressure to reduce emissions amplify the need to understand the drivers of electricity saving behavior (Chen et al., 2025). Despite increasing scholarly interest in university students' pro environmental behavioral intention, significant theoretical and empirical gaps remain. These gaps reveal the need for a more coherent and contextually grounded framework that captures both institutional influences and psychological mechanisms.

The first gap lies in the insufficient integration of social support theory with the value belief norm framework in the study of energy saving intention. Existing study typically treats institutional support and psychological mechanisms as separate explanatory routes, resulting in fragmented explanations of student behavior (Tran & Lam, 2026). In real higher education settings, this separation can be observed when universities provide energy saving notices, dormitory regulations, publicity campaigns, or sustainability courses, but these external supports do not necessarily translate into students' internal values, environmental beliefs, or personal moral obligations (Du & Pan, 2021). The problem is therefore not that institutions penalize individuals for adopting proper energy saving behaviors. Rather, the practical issue is that institutional encouragement may remain formal, administrative, or symbolic if it is not internalized by students as a meaningful personal responsibility. Social support theory emphasizes informational, emotional, and instrumental support transmitted through organizational structures, whereas the value belief norm theory explains how individuals develop moral cognition through values, beliefs, and personal norms (Aggarwal & Agarwala, 2025). Although conceptually complementary, these theories have rarely been examined together within energy conservation study in higher education. This lack of integrated analysis limits understanding of how institutional support is converted into the cognitive and moral pathways that guide students' electricity saving intention.

The second gap concerns the limited application of social support theory to sustainability contexts, particularly within higher education institutions. While social support theory is widely applied in health behavior, stress coping, and organizational psychology, its potential to explain sustainability related decision making remains underexplored. Higher education environments include complex institutional actors whose leadership practices, administrative signals, and educational interventions may influence students' environmental behavior (Bui et al., 2024). In practice, however, leadership communication, curriculum based sustainability education, and campus energy management are often implemented as separate activities, which weakens their combined influence on students' energy saving decisions (Abo-Khalil, 2024). For example, students may receive general environmental information in classrooms, but lack consistent leadership reinforcement, visible institutional support, or practical opportunities to connect this knowledge with daily electricity use in dormitories and campus facilities. This gap is especially evident in Shanxi, where universities face distinctive sustainability pressures but where institutional support mechanisms remain theoretically understudied. Addressing this gap requires reconceptualizing social support as institutional support and examining how leadership and education function as structured channels that shape students' energy saving intention through environmental values, environmental beliefs, and personal norms.

The third gap involves the incomplete application of the VBN theory to the study of electricity saving behavior. Although numerous studies confirm that environmental values, beliefs and personal norms predict general pro environmental behavior (Hristova et al., 2025), far fewer investigate how these psychological components are formed within institutional environments. Current literature rarely examines how leadership practices, educational structures and sustainability cues influence the development of students' values, beliefs and norms (Nissen, 2025). This omission is important because electricity saving behavior depends heavily on the internalization of responsibility for energy use, especially in carbon intensive regions such as Shanxi where behavioral responses to sustainability pressures carry broader ecological implications. The limited attention to institutional antecedents results in an incomplete understanding of how VBN based psychological mechanisms emerge and operate in energy use contexts.

Taken together, these gaps demonstrate the absence of a comprehensive model that incorporates institutional support, psychological mechanisms and electricity specific behavioral intention in higher education settings, particularly within high carbon regions such as Shanxi. By integrating social support theory with the VBN framework, the present study fills these theoretical and contextual gaps and provides a more complete understanding of the determinants of students' electricity saving intention.

1.2 Significance of the Study

1.2.1 Theoretical Significance

This study makes three specific theoretical contributions to environmental psychology and sustainability education. First, it extends value belief norm theory by identifying institutional antecedents of students' environmental values, environmental beliefs, and personal norms. Traditional value belief norm theory mainly explains how internal moral cognition leads to pro environmental behavioral intention, but it pays less attention to how such cognition is shaped within formal educational environments (Zhang et al., 2025). By introducing university leadership and sustainability oriented education as external antecedents, this study expands the theory from an individual centered psychological model to a context sensitive framework that explains how institutional conditions contribute to the formation of moral and cognitive motivations for energy conservation.

Second, this study advances the application of social support theory in sustainability related behavioral study. Social support theory has commonly been used to explain how emotional, informational, and instrumental support influences individual behavior in interpersonal, health, and organizational contexts (Leow & Leow, 2022). However, its explanatory value in student energy conservation remains insufficiently developed. This study reconceptualizes social support as institutional support in higher education and operationalizes it through university leadership and sustainability oriented education. University leadership reflects guidance, encouragement, communication, and normative reinforcement (Kasalak et al., 2022), while sustainability oriented education reflects knowledge provision, practical learning, and environmental capability building (Pauw et al., 2015). This interpretation broadens the scope of social support theory by

demonstrating how formal institutional support can shape students' sustainability related intentions.

Third, this study contributes an integrated theoretical model that links institutional support with the value belief norm psychological pathway. Rather than treating external support and internal moral cognition as separate explanations, the study clarifies how university leadership and sustainability oriented education influence pro environmental behavioral intention through environmental values, environmental beliefs, and personal norms. This integrated framework provides a more precise explanation of the mechanism through which institutional environments are translated into students' energy saving intentions. It therefore contributes to the literature by showing that pro environmental behavioral intention in higher education is not only a result of individual environmental concern, but also an outcome of the interaction between institutional support and internalized moral responsibility.

1.2.2 Practical Significance

The practical significance of this study lies in its ability to provide targeted guidance for improving campus energy conservation in higher education, particularly in Shanxi Province, where coal dominated electricity production and carbon reduction pressure make demand side conservation highly relevant. By focusing on students' electricity saving intention rather than general environmental attitudes, this study offers practical evidence for designing behavioral interventions that are directly connected with campus energy use, dormitory electricity consumption, digital learning practices, and daily student routines.

For policymakers, the study provides evidence that student energy conservation can serve as a behavioral component of regional low carbon governance. In Shanxi, renewable energy development and industrial restructuring remain essential, but these supply side measures need to be complemented by demand side behavioral change. The findings can help policymakers incorporate student energy saving behavior into green campus evaluation systems, youth low carbon education programs, and university energy management policies. This provides a practical basis for connecting the Double Carbon goals with higher education governance and for encouraging universities to become active participants in regional carbon reduction.

For university administrators, the study offers practical guidance for strengthening institutional energy management. The findings suggest that leadership should not be limited to formal policy statements, but should include continuous communication, visible participation, departmental responsibility, and regular feedback on campus electricity use. University administrators can use these insights to design clearer energy saving rules, establish department level responsibility mechanisms, disclose electricity consumption information, and create campus activities that encourage students to connect personal electricity use with institutional sustainability goals. These measures can help transform energy conservation from a general slogan into a visible and routine part of campus governance.

For educators and curriculum designers, the study provides practical implications for improving sustainability oriented education. The findings indicate that education should not only deliver environmental knowledge, but also strengthen students' environmental values, beliefs, and personal norms. Courses and learning activities can be designed around campus electricity data, dormitory energy saving scenarios, regional carbon intensity, and practical energy management tasks. Such educational design can help students understand the environmental consequences of daily electricity use and develop a stronger sense of responsibility for energy conservation.

For students, the study clarifies how institutional support and psychological motivation jointly shape energy saving intention. The findings can help students recognize that electricity conservation is not only an institutional requirement, but also a form of personal environmental responsibility. This is especially meaningful in Shanxi, where electricity consumption is closely connected with coal based energy production and regional carbon emissions. By strengthening students' awareness of this connection, the study supports the development of more stable and self regulated energy saving behavior in daily campus life.

1.3 Statement of Research Questions

RQ1: How do university leadership and sustainability-oriented education influence HEIs students' pro-environmental behavioral intention in Shanxi Province?

RQ2: How do environmental values, environmental beliefs and personal norms influence HEIs students' pro-environmental behavioral intention in Shanxi Province?

RQ3: How do environmental values, environmental beliefs and personal norms function as mediating mechanisms shaping HEIs students' pro-environmental behavioral intention?

1.4 Statement of Research Objectives

RO1: To investigate the relationships between university leadership, sustainability-oriented education and HEIs students' pro-environmental behavioral intention in Shanxi Province.

RO2: To verify the relationships between environmental values, environmental beliefs, personal norms and pro-environmental behavioral intention among HEIs students in Shanxi Province.

RO3: To test the mediating roles of environmental values, environmental beliefs and personal norms in shaping HEIs students' pro-environmental behavioral intention.

1.5 Methodology

This study adopts a quantitative study approach to examine the factors influencing pro-environmental behavioral intention among higher education students in Shanxi Province. Quantitative study is appropriate for this study because it allows the studyer to test theoretical relationships among variables and evaluate the proposed conceptual framework using statistical analysis. By employing a structured survey and statistical modeling techniques, the study investigates how university leadership, sustainability-oriented education, environmental values, environmental beliefs, and personal norms influence students’ pro-environmental behavioral intention.

The study design is based on a cross-sectional survey method. Data were collected from students enrolled in higher education institutions located in different regions of Shanxi Province. A structured questionnaire was developed based on established measurement scales from previous studies related to sustainability education and pro-environmental behavior. The questionnaire includes several sections measuring university leadership, sustainability-oriented education, environmental values, environmental beliefs, personal norms, and pro-environmental behavioral intention. All measurement items were assessed using a Likert-type scale to capture respondents’ perceptions and attitudes toward environmental issues and sustainability practices.

To ensure the reliability and validity of the measurement instrument, a pilot study was conducted before the formal survey. The pilot test helped refine questionnaire items and ensure that the measurement scales were appropriate for the study context. After the pilot testing phase, the formal questionnaire was distributed to students in selected higher education institutions. A total of 864 valid responses were obtained and used for subsequent data analysis.

The collected data were analyzed using statistical software to examine the measurement and structural relationships among the variables. Reliability and validity tests were first conducted to evaluate the quality of the measurement scales. Confirmatory factor analysis was then applied to assess the measurement model, followed by structural equation modeling to test the hypothesized relationships among variables. In addition, bootstrap analysis was employed to examine the mediating roles of environmental values, environmental beliefs, and personal norms within the proposed model. Through these analytical procedures, the study provides empirical evidence for understanding the institutional and psychological mechanisms that influence students' pro-environmental behavioral intention in higher education contexts.

1.6 Definitions of Terms

1.6.1 University Leadership

University leadership refers to the role of institutional leaders, including university administrators and senior management, in guiding the strategic direction and governance of higher education institutions with regard to sustainability and environmental responsibility (Kasalak et al., 2022). Leadership commitment to sustainability may be reflected through institutional vision, policies, environmental initiatives, and the allocation of resources to support sustainable development activities within the university (Flori et al., 2025).

In this study, university leadership refers to students' perceptions of how university leaders promote environmental sustainability through policy guidance, institutional initiatives, and strategic priorities (Aggarwal & Agarwala, 2025). Leadership actions can influence the institutional culture of sustainability and shape students' environmental awareness, values, and beliefs, thereby indirectly contributing to the development of pro-environmental behavioral intention.

1.6.2 Sustainability-Oriented Education

Sustainability-oriented education refers to educational activities and learning experiences designed to enhance students' knowledge, awareness, and understanding of environmental protection and sustainable development (Akinsemolu & Onyeaka, 2025). Within higher education institutions, this type of education often includes sustainability-related courses, environmental training, interdisciplinary learning opportunities, and campus sustainability programs that expose students to environmental challenges and solutions (Montes de Oca et al., 2026).

In this study, sustainability-oriented education reflects students' perceptions of how sustainability concepts are integrated into university teaching and learning activities (Pauw et al., 2015). Through classroom learning, campus initiatives, and experiential activities, sustainability-oriented education helps students develop environmental awareness, strengthen their understanding of environmental responsibility, and cultivate positive attitudes toward environmentally responsible behavior.

1.6.3 Environmental Values

Environmental values refer to individuals' fundamental beliefs regarding the importance of environmental protection and ecological sustainability. These values represent the degree to which individuals prioritize environmental conservation, sustainable resource use, and the protection of natural ecosystems as important guiding principles in their decision-making and attitudes (Gao et al., 2024).

In the context of this study, environmental values refer to students' value orientations toward environmental protection and sustainability (Yang et al., 2024). Students who hold strong environmental values are more likely to recognize the importance of protecting the environment and supporting sustainable practices, which can influence their environmental attitudes and contribute to the development of pro-environmental behavioral intentions.

1.6.4 Environmental Beliefs

Environmental beliefs refer to individuals' cognitive perceptions and understandings regarding environmental issues, including the causes of environmental problems and the consequences of human activities on ecological systems (Meng & Si, 2022). These beliefs reflect how individuals evaluate environmental risks and the responsibility of individuals and society in addressing environmental challenges.

In this study, environmental beliefs represent students' perceptions regarding the seriousness of environmental problems and their belief that human actions can contribute to environmental protection (Yang et al., 2024). When students develop stronger environmental beliefs, they are more likely to recognize the need for environmental responsibility and become more willing to support behaviors that contribute to environmental sustainability.

1.6.5 Personal Norms

Personal norms refer to individuals' internalized moral obligations to engage in certain behaviors based on their personal values and ethical beliefs. In the context of environmental behavior, personal norms represent the degree to which individuals feel morally responsible for protecting the environment and reducing environmental harm (Niu et al., 2023).

In this study, personal norms refer to students' internal sense of responsibility toward environmental protection (Yang et al., 2024). When students perceive that engaging in environmentally responsible actions is a moral obligation, they are more likely to develop stronger motivations to participate in sustainability-related behaviors and adopt environmentally friendly practices in their daily lives.

1.6.6 Pro-Environmental Behavioral Intention

Pro-environmental behavioral intention refers to an individual's willingness or readiness to engage in actions that contribute to environmental protection and sustainable resource use. It reflects the motivational factors that influence individuals' decisions to perform environmentally responsible behaviors in the future (Song et al., 2024).

In this study, pro-environmental behavioral intention refers to higher education students' intentions to participate in behaviors that support environmental sustainability, such as conserving energy, reducing waste, and supporting environmental initiatives (Lee & Tanusia, 2016). Examining behavioral intention helps provide insight into students' potential environmental actions and their commitment to environmental responsibility.

1.7 Delimitation of the Thesis

This study focuses on examining the factors influencing pro-environmental behavioral intention among students in higher education institutions in Shanxi Province. The scope of the study is limited to undergraduate and postgraduate students enrolled in

universities located within this region. By concentrating on Shanxi Province, the study aims to provide a contextualized understanding of how institutional factors and psychological mechanisms influence students' environmental behavioral intentions within a specific higher education environment.

In addition, the study framework is delimited to a selected set of institutional and psychological variables, including university leadership, sustainability-oriented education, environmental values, environmental beliefs, personal norms, and pro-environmental behavioral intention. These variables were chosen based on the theoretical foundations of the value–belief–norm theory and social support theory. While other factors such as peer influence, environmental knowledge, or external policy conditions may also affect environmental behavior, they are not included in the analytical model of this study.

Furthermore, the study focuses specifically on pro-environmental behavioral intention rather than actual environmental behavior. Behavioral intention is used as a key indicator because it reflects individuals' willingness and motivation to engage in environmentally responsible actions. The data for this study were collected using a cross-sectional survey method, which captures students' perceptions and attitudes at a single point in time. As a result, the findings are intended to explain relationships among the selected variables within the defined study scope rather than to provide a comprehensive explanation of all possible determinants of pro-environmental behavior.

1.8 Outline of Thesis

This thesis is organized into five chapters, each addressing a specific component of the study process, from the introduction of the study problem to the discussion of findings and conclusions.

Chapter One introduces the overall background of the study and explains the significance of examining pro-environmental behavioral intention among higher education students. This chapter presents the study problem, study objectives, and study questions that guide the study. It also introduces the study methodology, definitions of key terms, delimitations of the study, and the overall structure of the thesis.

Chapter Two reviews the relevant literature and theoretical foundations related to the study topic. It examines previous studies on sustainability education, university leadership, environmental values, environmental beliefs, personal norms, and pro-

environmental behavioral intention. This chapter also introduces the theoretical frameworks underpinning the study, particularly the value–belief–norm theory and social support theory, and develops the study hypotheses and conceptual framework based on the literature review.

Chapter Three presents the study methodology used to conduct the study. It describes the study design, population and sampling procedures, data collection methods, measurement instruments, and data analysis techniques. This chapter also explains how reliability and validity were ensured in the study process.

Chapter Four reports the empirical results of the study. It includes descriptive analysis of the sample, reliability and validity testing, confirmatory factor analysis, and structural equation modeling results. The chapter also presents the analysis of direct effects, indirect effects, and total effects in order to test the proposed hypotheses and evaluate the study model.

Chapter Five discusses the study findings in relation to the study objectives and theoretical framework. It provides theoretical implications and practical implications for various stakeholders, including university leadership, sustainability educators, higher education institutions, and policymakers. The chapter also outlines the limitations of the study, suggests directions for future study, and concludes the thesis by summarizing the key findings and contributions of the study.

1.9 Conclusion

This chapter has established the foundational context for examining higher education students' pro-environmental behavioral intention in Shanxi Province by linking rising energy demand, campus electricity pressures, and sustainability imperatives to the strategic role of universities in advancing low-carbon transitions. The discussion clarified that higher education institutions operate as electricity-intensive environments where students' everyday practices, particularly in dormitory life and digitally mediated learning, represent a critical leverage point for reducing energy consumption and supporting broader decarbonization objectives. Within China's "Double Carbon" agenda, and more specifically within Shanxi's coal-dependent and carbon-intensive regional context, student electricity-saving intention becomes both an institutional management concern and a

meaningful indicator of how young adults respond to sustainability signals in a high-carbon setting.

The chapter further identified clear theoretical and empirical gaps that motivate the present study, particularly the limited integration of institutional support perspectives with the value–belief–norm psychological chain in explaining electricity-related pro-environmental intention in higher education. By positioning university leadership and sustainability-oriented education as institutional antecedents and environmental values, environmental beliefs, and personal norms as internal motivational mechanisms, the study frames student intention as the product of interacting external support structures and internalized moral cognition. Based on this rationale, the study questions and objectives were articulated to guide systematic testing of the proposed relationships and mediating pathways.

Finally, the chapter outlined the methodological approach and defined key terms to ensure conceptual clarity and empirical consistency across subsequent analyses, while delimitations were specified to clarify the scope and boundaries of inference. The overall organization of the thesis was also presented to indicate how the study proceeds from theory development and methodological design to empirical testing and interpretation. Building on these foundations, the next chapter reviews the literature and theoretical perspectives that inform the conceptual model and hypotheses developed for the study.

CHAPTER 2
LITERATURE REVIEW

This chapter provides the conceptual and theoretical foundation for the study by outlining the contextual background of energy conservation in higher education, reviewing the key theories that inform the study, and defining the central variables examined. It first describes the global and national relevance of energy-saving behavior among university students, then introduces the value–belief–norm theory and social support theory, followed by detailed constructs and the proposed theoretical model that guides the study's hypotheses.

2.1 Contexts of the Study

2.1.1 Global Emphasis on Energy Conservation

Energy conservation has emerged as a central concern in global sustainability agendas as rising energy demand continues to intensify environmental degradation and heighten climate related risks (Elkhatat & Al-Muhtaseb, 2024). Rapid urbanization, digital expansion, and the growing reliance on electricity in daily life have pushed global energy use to record levels, placing significant pressure on energy systems and contributing to increased carbon emissions (Farghali et al., 2023; Ngoc Xuan, 2024). International assessments underline that electricity consumption in buildings, residential environments, and institutional facilities accounts for a substantial proportion of global demand, highlighting the critical role that consumption behavior plays in shaping long term environmental outcomes (Firoozi et al., 2025; Ruggeri et al., 2020). As a result, major global frameworks such as the United Nations Sustainable Development Goals identify responsible energy use and efficiency improvement as essential pathways for mitigating climate change and promoting sustainable development (Gan et al., 2023; South & Alpay, 2025).

Within this global discourse, behavioral approaches to energy conservation have attracted increasing attention. Although technological innovations such as renewable

energy systems and efficient appliances have advanced significantly, these improvements alone cannot deliver the reductions required to meet global climate commitments (Gan et al., 2023; Hasan et al., 2023). Scholars note that individuals' choices, habits, and value orientations directly influence energy consumption, making behavioral interventions an indispensable component of global energy strategies (Dincă et al., 2022; Sascha Heib et al., 2023). Young populations, in particular, are seen as influential actors in the global energy transition because their developing values and consumption patterns have long term implications for societal energy trajectories (Pillan et al., 2023).

Higher education settings occupy a central position in this discussion because universities function as micro environments where energy intensive academic, residential, and social activities converge. International evidence shows that universities are among the most energy consuming public institutions, driven by high density populations, extensive building operations, and widespread dependence on digital technologies (Almasri et al., 2024). Consequently, higher education institutions are increasingly recognized in international sustainability agendas as important platforms for fostering energy awareness and promoting sustainable consumption practices (Al-Nuaimi & Al-Ghamdi, 2022; Suklun & Bengü, 2024).

In this global context, investigating the drivers of students' intention to conserve energy responds directly to international calls for integrating behavioral perspectives into energy policy. As universities cultivate future professionals, decision makers, and socially responsible citizens, understanding how institutional environments and individual psychological processes influence energy saving behavior offers valuable insights for aligning educational practices with broader global sustainability goals.

2.1.2 Energy Use and Conservation in Higher Education Institutions and Management of Energy Conservation in HEIs

Higher education institutions represent one of the most energy intensive sectors within public administration due to their complex operational structures, dense populations, and continuous reliance on electricity for academic, residential, and administrative activities. Campus buildings such as classrooms, laboratories, libraries, dormitories, and technology centers require significant energy inputs for lighting, ventilation, heating, cooling, and the operation of electronic and study equipment. International studies indicate that building operations alone account for the majority of

energy use in universities, often exceeding the consumption of comparable public facilities (Chaer et al., 2025; Jasim et al., 2025). This high demand is further amplified by the expansion of digital learning environments, the widespread use of personal electronic devices, and the shift toward technologically enriched pedagogy, all of which increase the baseline electricity load on campuses. In many universities, energy consumption is not evenly distributed across functional spaces. Laboratories, information technology centers, libraries with extended opening hours, and student dormitories often constitute the most energy intensive units because they operate for long periods and depend on multiple electricity consuming devices simultaneously (Nasir et al., 2022). Seasonal variation further intensifies this pattern, as electricity demand rises sharply during periods of extreme heat or cold when heating, cooling, and ventilation systems are used continuously (Aryal & Hassan, 2026). As a result, campus energy use reflects not only infrastructural demand but also temporal fluctuations related to academic schedules, weather conditions, and patterns of building occupancy.

Given these characteristics, energy conservation has become a strategic priority within higher education governance. Many universities have integrated sustainability principles into campus planning, infrastructure management, and administrative decision making (Zhu & Dewancker, 2021). Initiatives such as energy efficient retrofits, smart monitoring systems, green building standards, and low carbon campus plans reflect institutions' efforts to reduce their ecological footprint (Li et al., 2024). However, study consistently shows that technological and managerial solutions achieve only partial results when they are not accompanied by sustained behavioral engagement from students (Lin & Jia, 2023; Xing et al., 2022). Since students occupy campus spaces daily and make frequent energy related decisions in dormitories, classrooms, and communal facilities, their behavioral patterns directly influence the effectiveness of conservation measures (Du & Pan, 2021). In practice, energy management in higher education institutions usually involves a combination of administrative regulation, facility maintenance, consumption monitoring, and behavioral intervention (Abo-Khalil, 2024). Universities often formulate electricity use guidelines, restrict unnecessary lighting and air conditioning, assign staff to supervise building energy performance, and install digital metering systems to identify abnormal consumption (Jasim et al., 2025). Nevertheless, the effectiveness of these measures varies substantially across institutions because implementation capacity,

financial resources, and the degree of coordination between academic departments, facility managers, and student affairs units are often uneven. This variation indicates that campus energy conservation is not solely a technical issue, but also an organizational and managerial issue shaped by governance capacity and institutional commitment (Sugiarto et al., 2022).

In addition to these structural efforts, leadership within higher education institutions plays a critical role in motivating students to adopt energy saving behaviors. Department heads and other academic leaders directly influence students' daily academic experiences, communicate sustainability expectations, and demonstrate responsible energy use through their own practices (Bui et al., 2024). By setting clear behavioral norms, providing guidance, and endorsing conservation initiatives, institutional leaders can shape students' perceptions of the importance of energy saving and strengthen their willingness to act accordingly (Heib et al., 2023). Their visibility and authority position them as key drivers in translating institutional commitments into student engagement, making leadership an indispensable component of effective campus energy governance (Olugboyega et al., 2024). This leadership function is particularly important in university settings because students are embedded in structured academic environments where expectations are often interpreted through interactions with teachers, department heads, and administrative authorities. When leaders consistently communicate that energy conservation is part of campus responsibility, support student participation in sustainability campaigns, and align institutional discourse with everyday practice, they help transform energy saving from a peripheral environmental message into a legitimate academic and moral expectation (Filho et al., 2025). By contrast, where leadership support is weak or inconsistent, institutional sustainability goals may remain symbolic and fail to generate meaningful behavioral change among students.

Despite ongoing institutional efforts, studies from various regions reveal persistent gaps between students' stated concern for environmental issues and their actual energy use practices (Chen et al., 2025). Overuse of heating and cooling systems, prolonged use of lighting, and widespread dependence on electronic devices remain common challenges in university settings. These patterns suggest that institutional policies alone cannot fully reduce energy consumption without complementary efforts aimed at shaping students' values, beliefs, and personal responsibility toward energy saving (Li et al., 2024). This

discrepancy is especially evident in dormitory life, where students exercise relatively high autonomy over electricity use and where convenience frequently overrides conservation awareness. Charging multiple devices overnight, leaving lights on when rooms are unoccupied, using air conditioning at excessive levels, and maintaining prolonged screen time are common examples of routine practices that cumulatively increase campus electricity demand (Vrain et al., 2026). Similar patterns can also be observed in classrooms and shared study areas, where users may assume that energy responsibility belongs to the institution rather than to individual occupants. These everyday practices indicate that the challenge of campus energy conservation lies not only in reducing technical inefficiency but also in addressing habitual behavior, weak personal accountability, and the limited internalization of conservation norms (Akponzele et al., 2025).

As universities worldwide are increasingly expected to model sustainable practices, understanding the behavioral dimension of energy conservation has become essential. Higher education institutions function not only as energy consumers but also as environments where sustainability knowledge is taught, practiced, and internalized (Al-Nuaimi & Al-Ghamdi, 2022). Therefore, examining how institutional environments influence students' energy saving intentions provides insight into both operational energy management and the educational mission of universities. This issue is especially salient in the Chinese higher education context, where large student populations, rapid campus expansion, and increasing digitalization have created growing pressure on institutional energy systems (Bing, 2023). Under national carbon reduction goals and broader sustainability agendas, universities are expected to improve not only infrastructural efficiency but also the environmental literacy and responsible conduct of students (Leal Filho et al., 2023). In this sense, campus energy conservation has dual significance. It is an operational matter related to cost control, electricity efficiency, and low carbon campus development, and it is also an educational matter related to the cultivation of long term pro-environmental values and behaviors among future social actors. This recognition lays the groundwork for examining pro environmental energy saving behavior among students in China, which is the focus of the next section.

2.1.3 Energy and Carbon Context of Shanxi province in China

China's national energy landscape provides a critical contextual foundation for examining electricity-saving behavior because the country remains the world's largest electricity producer and consumer (Li et al., 2023). As urban development accelerates and digital infrastructure expands, electricity demand continues to rise, reinforcing the need for demand-side conservation as part of the national ecological civilization strategy (Xu & Ding, 2026). The Double Carbon goals, which emphasize peaking carbon emissions before 2030 and achieving carbon neutrality by 2060, increasingly highlight the role of behavioral change in complementing technological and structural decarbonization (Fu et al., 2025). Within this national framework, higher education institutions are expected to reduce campus energy intensity and cultivate environmentally responsible behaviors among students due to their large-scale operations and influence on youth values (Wang et al., 2025).

Shanxi Province represents a particularly significant regional context within this national landscape due to its long-standing dependence on coal-based energy production and its status as one of China's most carbon-intensive provincial economies (Zhang et al., 2022). As a historical energy base, Shanxi's electricity generation has relied predominantly on coal, shaping both economic structures and environmental pressures (Chen et al., 2023). Although efforts to promote green transformation have expanded in recent years, the province continues to face substantial challenges in reducing carbon emissions and improving energy efficiency. Provincial development plans emphasize the need for behavioral adjustment alongside technological modernization, identifying the public sector—including universities—as an essential domain for promoting electricity-saving norms (Yin, 2023).

Universities in Shanxi province operate under conditions that magnify the importance of understanding electricity-saving behavior. Dense residential living, extensive reliance on digital devices, and climate-related dependence on heating and cooling systems contribute to electricity consumption patterns that exceed those of institutions in many other regions (Jiasheng Li et al., 2024). These structural features interact with provincial energy pressures, making student electricity-use decisions more consequential in terms of both campus operations and broader carbon outcomes. As a result, the behavioral dimension of energy conservation becomes particularly salient in

Shanxi province, where regional sustainability priorities depend not only on infrastructural improvements but also on cultivating low-carbon behavioral orientations among young populations.

Given these conditions, Shanxi province offers an analytically rich and policy-relevant setting for examining the determinants of electricity-saving intention among university students. The province's combination of high carbon intensity, policy-driven energy-transition imperatives, and behavior-sensitive electricity demand provides a meaningful context in which the interaction between institutional support and psychological mechanisms can be explored (Ning et al., 2025). Situating the study in Shanxi province, therefore, aligns with both national decarbonization priorities and regional sustainability needs, while also offering insights that may be transferable to other high-carbon regions undergoing similar transitions.

2.1.4 Pro-environmental Energy Saving among HEIs Students in China

In China, the promotion of energy-saving behavior among university students has become increasingly important in the context of national efforts to advance ecological civilization, reduce energy intensity and strengthen demand-side management in the education sector (Li et al., 2024). As electricity consumption continues to rise due to expanding urban development, the growth of digital services and the intensification of everyday reliance on electronic devices, higher education institutions face mounting pressure to align campus operations with national sustainability priorities (Zeng, 2024). Chinese universities typically operate large-scale campuses with dense residential populations, extensive academic building networks and technology-intensive learning environments, all of which contribute to elevated electricity demand (Jia et al., 2021; Zhou et al., 2021). Within these environments, students' everyday decisions shape a substantial portion of campus electricity usage, making their behavioral patterns a critical factor in determining institutional energy performance.

Empirical studies in China reveal several concrete electricity-related behaviors that significantly affect campus energy consumption. One major category involves temperature regulation practices, including the frequency and duration of air-conditioning and electric-heating use, preferred temperature settings and the common habit of operating these systems while windows remain open (Tian et al., 2022). The second category concerns lighting behavior, including reluctance to switch off unused lights in classrooms, corridors

and dormitories due to convenience, comfort expectations or collective action dilemmas (Yingzi Zhang et al., 2024). The third category relates to electronic-device management, particularly the widespread reliance on laptops, smartphones and entertainment electronics that remain plugged in or charging for extended periods (Qiang et al., 2021). Dormitory-based use of high-power appliances such as electric kettles, hair dryers and induction cookers further amplifies electricity load in many settings (Zhou et al., 2022). The fourth behavioral domain includes engagement with shared facilities, such as computer rooms, study halls and public areas where improper energy use practices, including leaving devices running or failing to shut down equipment, remain prevalent (Du & Pan, 2021). These concrete behavioral forms collectively shape the daily electricity profile of Chinese campuses.

Although university students frequently express concern for environmental issues, their participation in these energy-saving behaviors remains inconsistent (Hou & Law, 2024; Wang et al., 2025). Surveys across multiple provinces indicate that frequent use of air-conditioning and electric heating, prolonged device charging and low engagement with institutional conservation initiatives such as energy-awareness campaigns or voluntary reduction programs remain common challenges (Bahinipati et al., 2022; Du & Pan, 2021; Hou & Law, 2024). This persistent gap between environmental attitudes and electricity-use practices underscores the need to examine the psychological and institutional mechanisms that influence students' willingness to adjust their behavior.

In response to these challenges, higher education institutions in China have introduced an array of initiatives intended to encourage more responsible electricity-use habits. These include educational campaigns that explain the environmental impacts of campus energy consumption, energy-conservation competitions linked to dormitory electricity data, smart-metering technologies that provide real-time consumption feedback and curriculum integration of sustainability concepts to strengthen students' understanding of energy systems (Hou et al., 2025). The effectiveness of these initiatives, however, depends on students' internal motivations, their perceived responsibility for environmental outcomes and their belief in the significance of small-scale behavioral adjustments. study in environmental psychology highlights the roles of environmental values, beliefs and personal norms in shaping behavioral intention, suggesting that students are more likely to engage in consistent electricity-saving practices when these psychological drivers are

strongly internalized (Song et al., 2024). At the same time, university leadership, campus culture and sustainability-oriented education influence the development of these internal factors by providing visible cues, structured guidance and learning opportunities that reinforce the importance of responsible energy use.

Given the national emphasis on ecological transformation and the increasingly prominent role of higher education in cultivating environmentally responsible citizens, examining electricity-specific energy-saving behaviors among university students in China offers valuable insight into the interaction between institutional environments and individual psychological mechanisms (Wang et al., 2023). By focusing on concrete electricity-use behaviors—including temperature regulation, lighting practices, device management and engagement with shared facilities—the study aligns with China's policy priorities and contributes to understanding how energy conservation can function as a collective social practice within the higher education sector.

2.2 Parent Disciplines

Despite its strong explanatory power, the value belief norm framework presents limitations when applied to understanding energy saving behavior in higher education settings. The theory explains how environmental values, environmental beliefs, and personal norms operate as internal moral and cognitive mechanisms that guide pro environmental behavioral intention, but it gives less attention to the external conditions through which these psychological mechanisms are formed and strengthened. This limitation is particularly relevant among university students, many of whom are still developing stable environmental identities and may not yet perceive daily electricity use as a morally significant behavior. In this regard, social support theory complements the value belief norm framework by explaining how external support from institutional actors can provide the informational, emotional, instrumental, and appraisal resources needed to cultivate students' environmental values, reinforce environmental beliefs, and activate personal norms. The two theories are therefore complementary because the value belief norm framework explains the internal moral pathway from cognition to intention, whereas social support theory explains the institutional and relational conditions that enable this pathway to emerge within higher education settings. Integrating these two perspectives allows the study to move beyond a purely individual centered explanation and to examine

how university leadership and sustainability oriented education shape students' energy saving intention through internalized psychological mechanisms.

2.2.1 Value-Belief-Norm (VBN) Theory

The value belief norm theory developed by Stern et al. (1999) and colleagues provides a structured explanation for why individuals engage in pro environmental behavior through a sequence of internal processes that begin with values, move through beliefs, and culminate in personal moral norms that motivate action. The theory identifies three value orientations, namely egoistic, altruistic, and biospheric values, which influence individuals' environmental beliefs concerning ecological worldview, awareness of environmental consequences, and perceived responsibility. These beliefs then shape personal norms, which represent an internalized moral obligation to act in ways that support environmental protection and sustainability.

Although the theory is widely used in study on pro environmental behavior, scholars emphasize that values, beliefs, and norms do not develop instantly and often require a long period of personal experience and social learning to become influential. As highlighted by the expert comment, these psychological components may not always be salient or fully formed among university students, many of whom are still developing stable moral orientations and may not yet perceive environmental issues as closely connected to their daily energy use (Grønhøj & Hubert, 2022). This raises important questions about the degree to which the elements of the theory resonate with students' lived experiences and the extent to which they guide their energy saving decisions. The relevance of these constructs therefore cannot be assumed but must be empirically examined within educational settings.

Despite these considerations, the value-belief-norm theory provides a strong conceptual foundation for this study because it directly supports the three psychological variables under investigation: environmental values, environmental beliefs, and personal norms (Stern et al., 1999). Environmental values reflect the moral orientations that shape students' concern for ecological protection. Environmental beliefs capture students' cognitive understanding of environmental consequences and their sense of responsibility. Personal norms represent the internalized moral pressure to engage in energy saving behavior. These three constructs reflect the core sequence of the theory and form the internal mechanisms that guide voluntary sustainability actions.

Importantly, these three constructs also function as the mediating variables in this study, linking institutional conditions such as university leadership and sustainability-oriented education to students' pro-environmental behavioral intention. Within the logic of the VBN framework, institutional influences alone cannot directly generate sustained behavioral motivation; they must first shape individuals' values, beliefs, and moral norms, which then mediate the translation of external support into internalized commitment (Batool et al., 2024). This mediating role is therefore not an additional feature but a natural extension of the VBN sequence, clarifying how internal psychological mechanisms bridge institutional structures and energy-saving intentions among higher education students.

Figure 2.1 illustrates the original structure of the value-belief-norm model proposed by Stern and colleagues. The figure shows how the three value orientations influence the development of key beliefs, including ecological worldview, awareness of consequences, and ascription of responsibility. These beliefs then shape personal norms, which ultimately serve as the immediate psychological antecedent of pro environmental behavior. This visual representation clarifies the logical progression of the theory and illustrates how the variables used in this study correspond to established components within the model.

By grounding the study in this theoretical framework, the study examines how environmental values, environmental beliefs, and personal norms operate among students in higher education settings and how these internal psychological processes contribute to their intention to conserve energy. The framework also provides a basis for investigating how educational environments may strengthen or weaken the development of these psychological components, which is particularly important given the possibility that these constructs may not yet hold strong relevance in students' everyday lives. Through this approach, the value-belief-norm theory offers a systematic foundation for understanding the internal motivations that support energy saving behavioral intention in the context of higher education institutions.

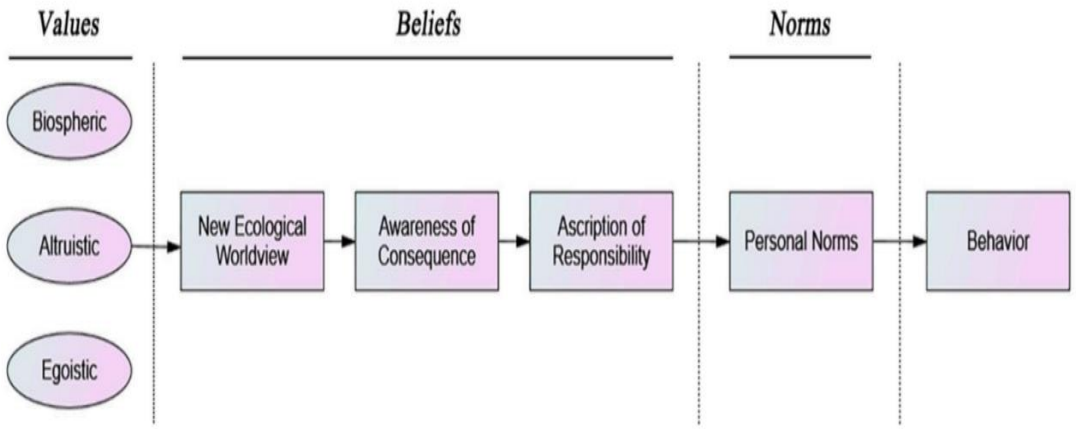

Figure 2.1 VBN model

Sources: Stern et al. (1999); Wang et al. (2023)

2.2.2 Social Support Theory

Within this study, the four support dimensions identified in social support theory are reflected through the institutional structures of university leadership and sustainability-oriented education. These two constructs do not function as abstract organizational influences; rather, they operationalize distinct forms of support that shape students' cognitive evaluations and behavioral motivations toward energy conservation.

University leadership primarily embodies emotional support, informational support and appraisal support. Emotional support is reflected in leaders' expressions of encouragement, recognition of students' participation in conservation initiatives and reinforcement of collective environmental responsibility. Informational support emerges through leaders' communication of sustainability priorities, dissemination of energy-saving guidelines and clarification of expected behavioral standards within academic units. Appraisal support is conveyed when leaders provide feedback, set normative expectations for responsible electricity use and help students interpret the significance of their actions in relation to institutional and societal sustainability goals (Aggarwal & Agarwala, 2025). Through these combined forms of support, leadership signals contribute to the interpretation of environmental issues as morally and academically important, thereby strengthening the development of environmental beliefs and personal norms.

Sustainability-oriented education functions primarily as a source of informational support and instrumental support. Informational support is reflected in the provision of knowledge about energy systems, environmental impacts, carbon reduction pathways and

strategies for responsible electricity use (Pauw et al., 2015). Instrumental support is embedded in the resources, learning opportunities and structured activities offered through courses, workshops and experiential programs that equip students with the skills needed to perform energy-saving behaviors effectively (Akinsemolu & Onyeaka, 2025). These forms of support help students understand the practical relevance of their energy-use decisions and facilitate the translation of abstract sustainability principles into concrete behavioral competencies. By enhancing knowledge and providing practical means for action, sustainability-oriented education contributes directly to the formation of environmental values and the strengthening of environmentally relevant personal norms.

By aligning specific forms of social support with university leadership and sustainability-oriented education, the study conceptualizes institutional support as a multidimensional mechanism that shapes students' internal psychological processes. This mapping clarifies how external structures activate the value–belief–norm sequence by fostering moral meaning, cognitive understanding and practical capability. Through this theoretical integration, social support theory provides a detailed explanation of how institutional environments in higher education generate the conditions that enable stronger electricity-saving intentions among students.

2.3 Immediate Disciplines

2.3.1 University Leadership

University leadership refers to the capacity of higher education administrators, particularly department heads, to shape sustainability-oriented behavior by offering structured forms of support within institutional settings (Aggarwal & Agarwala, 2025; Flori et al., 2025). In the organizational hierarchy of Chinese universities, department heads occupy a uniquely influential position because they oversee both academic affairs and daily management, maintain frequent contact with students and faculty and serve as the primary intermediaries between institutional policies and individual behavior (Ruan et al., 2023). Their proximity to students learning environments enables them to transmit sustainability expectations, promote responsible electricity-use practices and reinforce pro-environmental norms through routine communication and visible role modeling (Ngare, 2024; Portus et al., 2024). Within the context of this study, such administrators

represent the most immediate leadership figures whose actions directly shape students' interpretation of institutional sustainability priorities.

Guided by social support theory, university leadership is conceptualized as a multidimensional form of institutional support comprising informational, emotional and instrumental support (Chen et al., 2023; Flori et al., 2025). These dimensions map directly onto the typical responsibilities of higher education administrators and reflect the mechanisms through which leadership exerts influence in academic settings.

The first dimension is informational support, which reflects leaders' role in communicating sustainability objectives, clarifying behavioral expectations and providing guidance on responsible electricity use (Hariyani et al., 2025). In Chinese higher education governance, department heads deliver institutional policies, initiate departmental briefings, and coordinate internal communication channels that help students understand the practical and moral significance of energy conservation (Wang et al., 2022). Their policy interpretation and contextualization transform abstract institutional goals into actionable knowledge for students.

The second dimension is emotional support, which captures the degree to which leaders attend to the motivational, relational and well-being needs of students. Department heads in Chinese universities routinely engage with students through class meetings, academic advising and informal interactions, creating a relational climate that can foster trust, encouragement and emotional affirmation (Guo et al., 2025). When leaders express genuine concern, recognize students' conservation efforts and cultivate an inclusive departmental culture, they reinforce students' sense of belonging and strengthen their willingness to engage in energy-saving practices.

The third dimension is instrumental support, which encompasses leaders' capacity to provide practical assistance and facilitate access to sustainability-related resources (Heim et al., 2026). Within departmental governance, this includes endorsing conservation initiatives, allocating support for awareness-building activities, coordinating the use of shared facilities to reduce waste and modeling energy-conscious behavior. By translating sustainability commitments into tangible actions, leaders demonstrate that energy-saving is both feasible and institutionally valued (Eelager et al., 2025).

Through these interconnected forms of support, university leadership shapes a departmental environment that encourages students to internalize pro-environmental

beliefs and norms and to view energy conservation as a meaningful and achievable responsibility (Aggarwal & Agarwala, 2025). Communication practices, emotional engagement and resource-based actions work collectively to influence students' cognitive understanding of sustainability and to reinforce the behavioral relevance of electricity-saving within their daily routines (Ásványi & Gedeon, 2025). This conceptualization aligns directly with the operationalization of leadership in the measurement model and ensures coherence between the theoretical grounding in social support theory and the empirical evaluation employed in this study.

2.3.2 Sustainability-Oriented Education

Sustainability-oriented education refers to the systematic integration of sustainability principles, ecological literacy and energy-related awareness into higher education teaching and institutional practices (Wardat & Alali, 2025). It reflects the extent to which universities embed responsibility for electricity use and environmental protection into their academic culture by providing structured learning opportunities that help students understand the long-term implications of energy systems and the societal relevance of energy conservation (Hassan & Ahmad, 2025). Within social support theory, sustainability-oriented education operates as a form of informational, emotional and instrumental support by offering conceptual explanations of energy challenges, fostering critical engagement with sustainability issues and creating practical conditions that encourage responsible electricity-use decisions (Silva-Jean & Kneipp, 2024). Through curriculum content, classroom interaction and home–school reinforcement, sustainability-oriented education strengthens students' comprehension of energy problems, encourages critical reflection and nurtures a sense of shared responsibility for sustainable campus operations.

In this study, sustainability-oriented education is conceptualized through two interrelated dimensions aligned with the revised measurement items (Pauw et al., 2015). The first dimension, holistic energy learning, reflects the degree to which universities guide students to connect past, present and future energy issues, to understand links among local, national and global energy challenges and to recognize how economic, social and environmental systems intersect through energy consumption (Martínez-Borreguero et al., 2024). This dimension highlights the educational environment that supports students in

developing a coherent understanding of energy-related issues and their broader societal implications.

The second dimension, pluralistic and participatory energy learning, captures the extent to which universities encourage students to engage in discussions on energy use, critically examine energy-related information, express independent views on electricity-saving decisions and internalize energy-use norms through both classroom interaction and family reinforcement (Nik Abdul Majid et al., 2025). This dimension reflects an educational context that values multiple perspectives, supports active student involvement and strengthens students' personal engagement in sustainable behavior. Together, these dimensions illustrate how sustainability-oriented education provides cognitive grounding, practical reinforcement and participatory support that shape environmental values, strengthen environmental beliefs and reinforce personal norms related to energy-saving behavior in higher education settings.

2.3.3 Environmental Values

Environmental values represent the fundamental moral orientations and evaluative principles that shape how individuals understand human relationships with the natural environment and determine what they consider ethically important in ecological contexts (Yang et al., 2024). Within the value belief norm theoretical tradition, environmental values function as the most distal psychological drivers that predispose individuals to develop environmental beliefs, recognize moral obligations, and ultimately engage in sustainability-oriented behavior (Drageset, 2021; Jolly et al., 2021). These values serve as the ethical foundation upon which students in higher education interpret environmental issues, assign importance to ecological protection, and form long term commitments to responsible resource use.

In this study, environmental values are operationalized through two core dimensions that reflect established value structures within the VBN framework (Yang et al., 2024). The first dimension is altruistic values, which encompass moral concern for the well-being of others, social justice, fairness, and the broader collective good. Students who endorse altruistic values tend to extend their prosocial orientation toward environmental stewardship, viewing environmental protection as a shared responsibility necessary for the welfare of society and future generations. These values motivate individuals to consider

the consequences of their behaviors on the community, promoting a moral awareness that supports energy conservation and sustainable practices.

The second dimension is traditional values, which capture respect for moral order, self-discipline, social responsibility, and the cultural emphasis on harmony between humans and nature. Individuals with strong traditional values typically demonstrate adherence to behavioral norms, appreciation for moderation, and a conscientious attitude toward resource use (Kim & Hall, 2021). Such values reinforce restrained consumption and responsible decision-making, supporting alignment with sustainability principles within higher education environments. In the context of this study, traditional values also reflect moral continuity and relational responsibility that are particularly relevant to students' interpretation of environmental duties (Yang et al., 2024).

Together, these two dimensions conceptualize environmental values as a culturally grounded ethical framework that informs students' cognitive assessments of environmental issues and guides their judgments regarding appropriate environmental behavior. By shaping how individuals perceive ecological responsibility and moral obligation, environmental values provide the motivational basis for the development of environmental beliefs and personal norms, ultimately influencing students' intention to conserve energy and engage in pro-environmental actions.

2.3.4 Environmental Beliefs

Environmental beliefs refer to individuals' cognitive evaluations and moral understandings of how human behaviors influence environmental conditions and ecological outcomes (Yang et al., 2024). Within the Value Belief Norm theoretical framework, these beliefs operate as the cognitive link through which environmental values are translated into moral assessments and behavioral motivation (Batool et al., 2024). They shape how individuals interpret the interdependence between humans and the natural environment, evaluate the consequences of environmental degradation, and judge the extent to which personal and collective action is required to address sustainability challenges.

In this study, environmental beliefs are conceptualized through three closely related dimensions that capture the cognitive structure underlying sustainability-oriented thought (Yang et al., 2024). The first dimension is the ecological worldview, which reflects individuals' understanding of the interconnectedness between human activity and

ecological systems. Students with a strong ecological worldview recognize that human well-being and environmental health are mutually dependent and that responsible energy use is integral to maintaining this balance. The second dimension is awareness of consequences, referring to the recognition that excessive consumption, irresponsible energy use, and environmental neglect can generate harm for ecosystems and society. This awareness encourages individuals to view their daily behaviors, including energy consumption, as actions with real environmental implications. The third dimension is the ascription of responsibility, which captures the belief that both individuals and institutional actors such as governments, corporations, and universities share moral and practical obligations to prevent environmental degradation and promote sustainability.

Together, these dimensions describe how students cognitively interpret environmental issues within higher education settings. Environmental beliefs form the evaluative foundation upon which students judge the severity of environmental problems, perceive their own role in addressing them, and develop readiness to act (Anglim & Marty, 2025). When strengthened through supportive institutional environments such as sustainability-oriented leadership and education, these beliefs foster heightened awareness, greater personal responsibility, and stronger alignment with sustainability goals, thereby shaping the psychological pathways that lead to pro-environmental behavioral intention (Alemu, 2025).

2.3.5 Personal Norms

Personal norms refer to individuals' internalized moral expectations regarding how they should behave in ways that support environmental protection and social well-being (Yang et al., 2024). Within the Value Belief Norm theoretical framework, personal norms represent the point at which cognitive evaluations and moral beliefs crystallize into a sense of ethical duty (Anglim & Marty, 2025). They emerge when individuals recognize the potential negative consequences of environmentally harmful behavior and accept that they hold personal responsibility for contributing to positive environmental outcomes. In this sense, personal norms function as the internal motivational force that transforms environmental awareness into a stable intention to act sustainably.

In this study, personal norms are conceptualized through two interrelated dimensions that reflect the moral structure guiding pro-environmental behavior (Yang et al., 2024). The first dimension, moral obligation, captures individuals' self-expectation to

safeguard the environment and support collective welfare based on ethical conviction rather than external pressure. This moral obligation reflects a belief that acting sustainably is inherently the right course of action, independent of whether others comply or institutional enforcement mechanisms are present. The second dimension, moral accountability, reflects individuals' perceived responsibility to uphold sustainability principles through their own choices and daily practices. It represents the belief that one has a personal role in preventing environmental degradation and that responsible energy use is a demonstration of integrity and ethical commitment.

Within higher education settings, personal norms are strengthened through sustained exposure to sustainability-oriented education, leadership communication, and participatory initiatives that encourage students to reflect on the ethical dimensions of their behavior (Al Husban, 2025). As these experiences accumulate, environmental cognition becomes internalized as a moral commitment, guiding students to view sustainable energy use as both a personal duty and a reflection of their values (Orellano & del Rey López, 2025). Through this process, personal norms form the crucial psychological bridge between environmental beliefs and pro-environmental behavioral intention, ensuring that environmentally responsible action becomes both self-endorsed and enduring (Kaçani et al., 2025).

2.3.6 Pro-Environmental Behavioral Intention

Pro-environmental behavioral intention refers to individuals' conscious willingness and planned commitment to undertake actions that support environmental protection and sustainable development (Lee & Tanusia, 2016). Within the value belief norm theoretical framework, behavioral intention represents the final psychological outcome in the progression from values to beliefs and subsequently to personal norms (Drageset, 2021; Jolly et al., 2021). It reflects a readiness to act in ways that prevent environmental degradation, demonstrating both cognitive understanding and motivational determination to behave sustainably in everyday life. In the context of higher education, these intentions are particularly relevant because students' daily energy-use choices, consumption patterns, and participation in sustainability initiatives directly influence campus energy demand and the broader environmental footprint of universities (Hu & Yang, 2024).

In this study, pro-environmental behavioral intention is conceptualized through two interrelated dimensions that capture the depth of students' readiness to engage in

sustainability-oriented behavior (Lee & Tanusia, 2016). The first dimension, behavioral willingness, represents individuals' intention to adopt environmentally responsible actions, such as conserving electricity, reducing waste, choosing low-impact alternatives, and avoiding unnecessary resource consumption. This dimension reflects a deliberate inclination to behave in ways that align with sustainable principles (Syed et al., 2024). The second dimension, behavioral commitment, represents individuals' readiness to translate their awareness and moral responsibility into sustained environmental practices over time. It includes a sense of future-oriented resolve to maintain environmentally responsible behavior and to actively support initiatives that enhance environmental quality (Tian & Jiang, 2025).

Together, these dimensions illustrate how students transform environmental understanding and personal moral norms into specific, goal-directed behavioral plans. Pro-environmental behavioral intention therefore functions as a critical indicator of whether institutional support-such as leadership guidance and sustainability-oriented education-successfully nurtures internal motivation. It also represents the psychological foundation on which actual sustainability behavior is built, making it an essential construct for analyzing energy-saving engagement among higher education students.

2.4 Conceptual Model and Hypothesis Statement

2.4.1 Conceptual Model

Figure 2.2 presents the integrated conceptual framework developed for this study. The model aligns with the three study objectives and combines social support theory with the psychological logic of the value belief norm theory. It explains how external institutional factors and internal psychological mechanisms jointly shape pro-environmental behavioral intention among higher education students in Shanxi Province. In this framework, university leadership and sustainability-oriented education represent institutional antecedents, while environmental values, environmental beliefs, and personal norms function as key psychological variables linked to students' pro-environmental behavioral intention.

In relation to RO1, the model proposes that university leadership and sustainability-oriented education serve as two major institutional conditions within the higher education environment. Both variables are expected to exert direct effects on

students' pro-environmental behavioral intention, as represented by H1a and H2d. In addition, the model assumes that these institutional factors also influence students' environmental values, environmental beliefs, and personal norms through H1b, H1c, H1d, H2a, H2b, and H2c. In this sense, the framework suggests that institutional support does not operate only at the behavioral level, but also shapes the cognitive and normative conditions that may encourage environmentally responsible intention.

For RO2, the framework specifies the relationships among environmental values, environmental beliefs, personal norms, and pro-environmental behavioral intention. The model proposes that environmental values, environmental beliefs, and personal norms each have direct effects on pro-environmental behavioral intention, as indicated by H3, H4, and H5. At the same time, the model incorporates sequential psychological linkages in which environmental values are expected to positively influence environmental beliefs through H6, and environmental beliefs are expected to positively influence personal norms through H7. Accordingly, RO2 is addressed not only through the direct predictive roles of these psychological variables, but also through their internal structural relationships within the value belief norm process.

For RO3, the framework includes a set of indirect paths that capture the mediating roles of environmental values, environmental beliefs, and personal norms in shaping pro-environmental behavioral intention. The mediation structure is represented by H8a to H8d, H9a to H9e, and H10a to H10c. These paths indicate that university leadership and sustainability-oriented education may influence pro-environmental behavioral intention indirectly through environmental values, environmental beliefs, and personal norms, while additional mediation processes are also specified among the psychological variables themselves. Therefore, the model reflects both the direct influence of institutional and psychological factors and the indirect mechanisms through which these variables jointly contribute to students' pro-environmental behavioral intention.

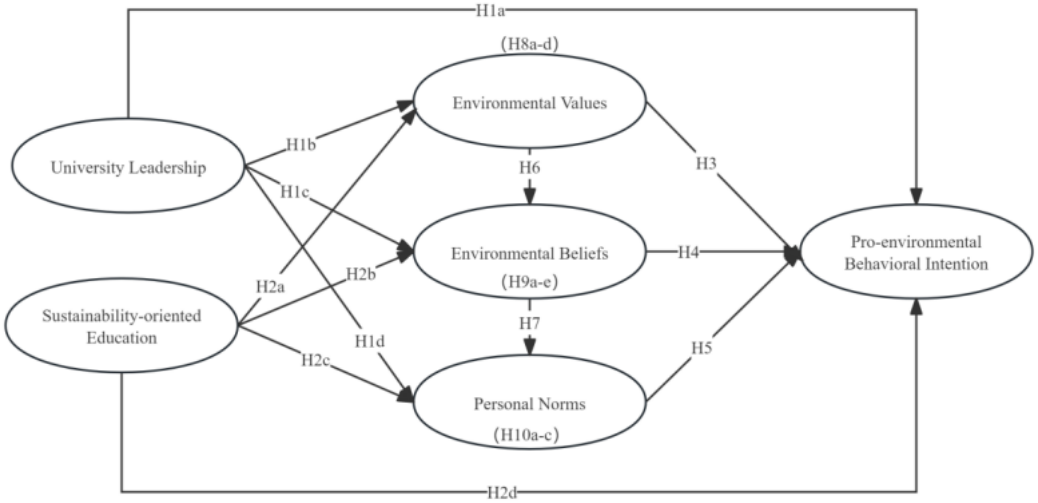

Figure 2.2 Conceptual Model

2.4.2 Hypothesis Development

University leadership refers to the formal and strategic actions through which higher education administrators provide direction, resources, and guidance for sustainability-oriented transformation (Aung & Hallinger, 2023). Drawing from Social Support Theory, university leadership functions as a structured form of formal social support that conveys informational, emotional, and instrumental assistance to members within the academic community (Jolly et al., 2021). Effective leaders not only communicate the institutional vision for sustainability but also establish the organizational conditions necessary for its realization-such as policy implementation, funding allocation, and participatory governance (Miao & Nduneseokwu, 2025; Mohammadi et al., 2023). Within this supportive framework, leadership provides informational support through sustainability education and awareness programs, emotional support through recognition and encouragement of pro-environmental behavior, and instrumental support through access to eco-friendly facilities and resources (Hu et al., 2025). These mechanisms collectively shape students' perceptions of institutional care and responsibility, strengthening their sense of belonging to a sustainable academic environment.

Leadership influence operates through multiple psychological pathways that align closely with the VBN framework. First, supportive university leadership fosters environmental values by articulating moral and ecological priorities within institutional discourse, helping students internalize sustainability as part of their personal value system

(Miao & Nduneseokwu, 2025; Price et al., 2021). Second, by providing consistent informational cues and transparent communication about environmental challenges and solutions, leaders enhance students' environmental beliefs, particularly their ecological worldview, awareness of environmental consequences, and sense of responsibility (Arya & Kumar, 2023; Wang et al., 2023). Third, through moral reinforcement and participatory encouragement, leadership activates students' personal norms-the sense of moral obligation to engage in sustainable behaviors (Alwali & Alwali, 2025). Finally, the cumulative effect of these psychological mechanisms manifests in stronger pro-environmental behavioral intentions, as students feel morally compelled and institutionally supported to translate their values and beliefs into concrete behavioral commitments (Maulana et al., 2025; Rohmah et al., 2024).

Leadership commitment to sustainability exerts significant influence on the attitudes and behaviors of organizational members (Boeske, 2023). For instance, Al-Dmour (2023) found that supportive leadership directly predicts students' participation in green campus programs, while Mohammadi et al. (2023) showed that transparent governance and visionary leadership strengthen sustainability awareness and moral responsibility among university communities. These findings suggest that leadership serves as a critical antecedent for cultivating environmental values, shaping cognitive beliefs, and nurturing moral engagement.

Accordingly, the following hypotheses are proposed:

H1a: University leadership positively influence the pro-environmental behavioral intention.

H1b: University leadership positively influence the environmental values.

H1c: University leadership positively influence the environmental beliefs.

H1d: University leadership positively influence the personal norms.

Sustainability-oriented education refers to the systematic integration of sustainability principles, environmental literacy, and ecological ethics into the teaching, learning, and experiential processes of higher education institutions (Versteijlen & Wals, 2023). It encompasses both formal curriculum design, such as sustainability-related courses, environmental science modules, and interdisciplinary learning programs, and informal educational practices including experiential projects, environmental clubs, and community engagement activities (Lucas Mangas et al., 2021; Mendes et al., 2025).

Educational processes thus serve as a formal channel of support through which universities provide consistent information, guidance, and reinforcement to foster students' pro-environmental cognition and moral engagement (Akhtar et al., 2022).

By transmitting ecological concepts, ethical reasoning, and systems thinking, education strengthens students' environmental values, particularly biospheric and altruistic orientations, which form the moral foundation for sustainability behavior (Rohmah et al., 2024). Learning activities that integrate environmental topics into real-world contexts help students internalize sustainability as a personal and social value, cultivating empathy toward nature and a sense of shared responsibility (Suarlin, 2023). Moreover, sustainability-oriented education enhances students' environmental beliefs by raising their awareness of environmental consequences and their perceived responsibility for ecological protection (Arya & Kumar, 2023; Wang et al., 2023). Through structured exposure to environmental problems and participatory solutions, students develop stronger ecological worldviews and a belief in the efficacy of their individual actions.

Education also contributes to the formation of personal norms, as repeated engagement in sustainability activities fosters moral reflection and strengthens individuals' sense of ethical obligation to act pro-environmentally (Yadav et al., 2023). In this moral transformation process, classroom learning and extracurricular sustainability programs jointly reinforce internalized norms through both cognitive understanding and emotional identification (Zhang & Cao, 2025). Ultimately, these values, beliefs, and norms collectively enhance pro-environmental behavioral intention, motivating students to engage in actions such as energy conservation, waste reduction, green consumption, and environmental volunteering (Chen et al., 2024; Mendes et al., 2025).

Balakrishnan et al. (2020) emphasized that education is a decisive predictor of pro-environmental behavior, while Rohmah et al. (2024) found that sustainability-related courses significantly strengthen students' moral norms and environmental intentions. Similarly, Mendes et al. (2025) demonstrated that experiential learning and interdisciplinary curricula improve both environmental beliefs and behavioral readiness among university students. These findings confirm that sustainability-oriented education serves as a vital pathway through which higher education institutions transmit sustainability values, reinforce environmental beliefs, and cultivate moral responsibility.

Therefore, the following hypotheses are proposed:

H2a:Sustainability-oriented education positively influence the environmental values.

H2b:Sustainability-oriented education positively influence the environmental beliefs.

H2c:Sustainability-oriented education positively influence the personal norms.

H2d:Sustainability-oriented education positively influence the pro-environmental behavioral intention.

Environmental values constitute the foundational moral and ethical orientations that guide individuals' judgments and behaviors toward environmental protection (Begum et al., 2022). Environmental values-particularly biospheric and altruistic values-serve as the most distal yet powerful drivers of pro-environmental intentions and actions (Pasquariello et al., 2025). Individuals who prioritize ecological well-being and collective welfare are more likely to view environmental protection as an intrinsic moral responsibility rather than a utilitarian choice (Deplazes-Zemp, 2024; Naeeni, 2023). When these values are strongly internalized, individuals perceive environmentally responsible behavior as consistent with their self-concept and moral identity, resulting in greater behavioral consistency. Students and consumers with strong biospheric values display higher willingness to engage in sustainable practices such as recycling, green purchasing, and low-carbon consumption (Kang et al., 2024; Rohmah et al., 2024). Therefore, environmental values provide the motivational foundation for behavioral intention formation.

H3: Environmental values positively influence the pro-environmental behavioral intention.

Environmental beliefs reflect individuals' cognitive understanding and evaluative judgments about the relationship between human behavior and environmental outcomes (Li et al., 2021). Encompassing ecological worldview, awareness of environmental consequences, and ascription of personal responsibility-translate moral concern into behavioral readiness (Liao, 2025). When individuals recognize that environmental degradation has tangible social and moral implications, they are more likely to perceive sustainable actions as both necessary and personally meaningful (Boermans et al., 2024). Environmental beliefs also shape behavioral efficacy-the perception that individual actions can produce meaningful environmental outcomes-thereby strengthening behavioral

intention (Perry et al., 2021; Yanting Zhang et al., 2024). Heightened environmental beliefs significantly predict participation in energy-saving, waste-reduction, and green-consumption practices among university students (Lee et al., 2023; Mendes et al., 2025). Therefore, the following hypotheses are proposed:

H4: Environmental beliefs positively influence the pro-environmental behavioral intention.

Personal norms represent internalized moral obligations and self-expectations to act in ways that protect the environment (Yang et al., 2024). When individuals perceive environmental protection as an ethical duty, their behavior becomes guided by intrinsic moral reasoning rather than external enforcement (MacLeod et al., 2022). This moral internalization transforms sustainable behavior into a self-endorsed goal, reducing the "intention–action gap" often observed in sustainability contexts (Yadav et al., 2023). Personal moral norms significantly predict students' willingness to participate in environmental volunteering, adopt low-carbon lifestyles, and support environmental policies (Lee et al., 2023; Tian & Liu, 2022). Therefore, the following hypotheses are proposed:

H5: Personal norms positively influence the pro-environmental behavioral intention.

Environmental values serve as the moral and cognitive foundation from which environmental beliefs emerge (Al Mamun et al., 2025). Values determine what individuals deem important and worthy of protection, while beliefs represent their understanding of how human actions affect those valued objects (Stern et al., 1999). Individuals who strongly endorse biospheric and altruistic values are more likely to develop robust environmental beliefs characterized by ecological awareness, perceived consequences of environmental degradation, and a sense of personal responsibility (Arya & Kumar, 2023; Wang et al., 2023). This relationship has been supported across multiple cultural contexts, with empirical evidence showing that biospheric values predict environmental worldviews and responsibility attribution (Syropoulos & Markowitz, 2024; Yechen Zhang et al., 2024). Therefore, the following hypotheses are proposed:

H6: Environmental values positively influence the environmental beliefs.

Environmental beliefs form the cognitive basis for the activation of personal norms (Yang et al., 2024). When individuals believe that environmental degradation has serious

consequences and that they bear responsibility for mitigation, they develop a sense of moral duty to act sustainably (Wongsaichia et al., 2025). This belief-driven moral awareness strengthens personal norms-internalized self-expectations that compel individuals to behave consistently with their ethical understanding (Yadav et al., 2023). Awareness of environmental consequences and ascription of responsibility are strong predictors of moral norm activation and subsequent behavioral engagement (Lee et al., 2023; Niu et al., 2023). Therefore, the following hypotheses are proposed:

H7: Environmental beliefs positively influence the personal norms.

Environmental values play a crucial role in how individuals interpret and respond to sustainability-related stimuli within their institutional environment (Yang et al., 2024). They reflect core beliefs about the importance of the biosphere and collective well-being, forming the ethical foundation for environmental cognition and behavior (Li & Song, 2024). Within the context of higher education, Institutional structures, such as leadership and sustainability-oriented education, act as sources of support that nurture and reinforce these environmental values through exposure, encouragement, and recognition (Iqbal & Piwowar-Sulej, 2022).

University leadership and sustainability-oriented education are key institutional mechanisms through which environmental values are transmitted and internalized (Gohr et al., 2023). University leadership plays a pivotal role in setting priorities and allocating resources that reinforce ecological responsibility, aligning institutional goals with students' values (Flori et al., 2025). Sustainability-oriented education serves as the main platform for imparting knowledge and ethical reasoning, enhancing students' understanding of ecological issues and encouraging values such as biospheric and altruistic responsibility (Sarid & Goldman, 2021). These institutional supports collectively contribute to the development of environmental values, which in turn shape students' beliefs, personal norms, and behavioral intentions toward sustainability.

Environmental values significantly influence pro-environmental behaviors (Tamar et al., 2021; Yang et al., 2024). Strong environmental values can mediate the relationship between educational interventions and students' engagement in sustainability actions (Collado et al., 2022; Penker & Kirbiš, 2025). Specifically, the internalization of environmental values strengthens the pathway from awareness to action, fostering greater behavioral intention (Peng et al., 2021; Song et al., 2022). Thus, environmental values are

a key psychological mechanism that connects institutional influences to sustainability-related beliefs and behaviors.

Based on this understanding, the following hypotheses are proposed:

H8a: Environmental values mediates the relationship between university leadership and the pro-environmental behavioral intention.

H8b: Environmental values mediates the relationship between sustainability-oriented education and the pro-environmental behavioral intention.

H8c: Environmental values mediates the relationship between university leadership and the environmental beliefs.

H8d: Environmental values mediates the relationship between sustainability-oriented education and the environmental beliefs.

Environmental beliefs represent individuals' cognitive frameworks and evaluative judgments concerning the relationship between human behavior and environmental systems (Albarracín & Dai, 2024). They reflect individuals' awareness of environmental consequences, perceived responsibility for ecological degradation, and confidence in the efficacy of pro-environmental actions (Constantino et al., 2021). When environmental beliefs are strong, individuals not only acknowledge the moral relevance of environmental protection but also translate this awareness into actionable behavioral intentions (Han et al., 2025). From the perspective of Social Support Theory, institutional environments-such as university leadership and sustainability-oriented education-provide informational and emotional reinforcement that shapes students' environmental cognition and value internalization (Rashed et al., 2025).

In higher education contexts, institutional mechanisms significantly influence students' environmental beliefs. University leadership reinforces belief systems by communicating sustainability visions, implementing environmental governance, and modeling responsible behavior (Boeske, 2023). Sustainability-oriented education strengthens these beliefs through structured knowledge acquisition, experiential learning, and interdisciplinary engagement that help students perceive the interconnectedness between human action and ecological outcomes (Sommier et al., 2025). These institutional supports nurture the cognitive aspect of sustainability awareness, establishing environmental beliefs as a central conduit through which institutional influences affect behavioral and moral responses.

Students' awareness of environmental consequences significantly mediates the relationship between sustainability education and pro-environmental intentions (Simiyu et al., 2022; Zhang & Cao, 2025). Similarly, studies have identified environmental beliefs as a key predictor of moral norm activation and pro-environmental intention formation (Savari et al., 2023; Setiawan et al., 2020). Additionally, it has been demonstrated that value activation strengthens sustainable behavior primarily through enhanced environmental beliefs, confirming their mediating function in the Value-Belief-Norm (VBN) theory chain (Lima et al., 2024; Martey, 2025).

Therefore, the following hypotheses are proposed:

H9a: Environmental beliefs mediates the relationship between university leadership and the pro-environmental behavioral intention.

H9b: Environmental beliefs mediates the relationship between sustainability-oriented education and the pro-environmental behavioral intention.

H9c: Environmental beliefs mediates the relationship between university leadership and the personal norms.

H9d: Environmental beliefs mediates the relationship between sustainability-oriented education and the personal norms.

H9e: Environmental beliefs mediates the relationship between environmental values and the personal norms.

Personal norms represent individuals' internalized moral standards and perceived obligations to act in ways that protect the environment (Čapienė et al., 2022; Krettenauer & Lefebvre, 2021). These norms emerge when individuals recognize the negative consequences of environmental degradation, accept personal responsibility, and experience moral pressure to act sustainably. In this sense, personal norms represent the culmination of moral cognition, converting environmental values and beliefs into a deeply rooted sense of ethical duty (Krettenauer & Lefebvre, 2021; Sampene et al., 2024). Institutional mechanisms such as leadership and education reinforce these norms by providing emotional validation and social recognition for sustainability-oriented actions (Iqbal & Piwowar-Sulej, 2022). When individuals perceive consistent moral encouragement from their academic environment, their intrinsic commitment to sustainability is strengthened, leading to more stable and enduring behavioral intentions (Meng et al., 2024).

In higher education settings, university leadership and sustainability-oriented education jointly create the moral and motivational conditions under which personal norms develop (Versteijlen & Wals, 2023). Supportive leadership communicates moral expectations and acknowledges sustainability participation, signaling institutional approval for ethical behavior (Boeske, 2023; Nie et al., 2023). Sustainability-oriented education provides knowledge and reflection-based learning that encourages students to internalize environmental protection as an ethical responsibility (Uzorka et al., 2024). These institutional supports nurture the cognitive and moral pathways that strengthen personal norms, thereby shaping students' pro-environmental intentions.

Personal norms play a crucial mediating role in the relationship between environmental beliefs and pro-environmental behavioral intentions. Personal moral norms significantly mediate this relationship among university students (Isa & Abdullah, 2021; Wu et al., 2022). Personal norms translate sustainability awareness into consistent eco-friendly behaviors, and moral obligation acts as a key psychological driver linking cognitive understanding to environmental action (Sampene et al., 2024). Collectively, these findings affirm that personal norms bridge institutional reinforcement and individual intention by internalizing external support into self-endorsed moral motivation (Ding & Rafiq, 2025).

Therefore, the following hypotheses are proposed:

H10a: Personal norms mediates the relationship between university leadership and the pro-environmental behavioral intention.

H10b: Personal norms mediates the relationship between sustainability-oriented education and the pro-environmental behavioral intention.

H10c: Personal norms mediates the relationship between environmental beliefs and the pro-environmental behavioral intention.

2.5 Conclusion

This chapter establishes the conceptual and theoretical foundation for examining higher education students' pro-environmental behavioral intention toward energy conservation. The contextual analysis demonstrates that global energy demand, the expansion of digitalized lifestyles, and the intensive electricity use in higher education institutions have made behavioral approaches to energy saving an essential component of

sustainability governance. In China, despite growing environmental awareness, university students continue to exhibit inconsistent energy-saving practices, which underscores the need to understand the psychological and institutional factors shaping their willingness to conserve energy.

To address this, the chapter draws on two complementary theoretical frameworks: the Value–Belief–Norm (VBN) theory, which explains how environmental values, environmental beliefs, and personal norms evolve into moral motivation for sustainable behavior, and Social Support Theory, which clarifies how institutional factors-university leadership and sustainability-oriented education-function as structured forms of emotional, informational, and instrumental support that nurture these internal psychological processes. The chapter further conceptualizes the seven core constructs of the study and articulates their relevance within higher education settings.

Finally, the integrated theoretical model synthesizes institutional support mechanisms with the VBN psychological sequence, proposing that the interaction between external institutional environments and internal moral–cognitive drivers jointly determines students' energy-saving intentions. This framework provides a clear foundation for the empirical testing that follows and offers a coherent pathway for understanding how universities can cultivate meaningful and sustained energy-conservation behavior among students.

CHAPTER 3
METHODOLOGY

This chapter will first discuss the study paradigm applicable to this study. Secondly, this chapter will detail the study methodology used in this study, which includes the study design, data collection methods, data analysis methods, target population, and sample size. Finally, the ethical considerations used in this study will be presented.

3.1 Overview and Justification of Study Paradigm

The study adopts a positivist study paradigm to ensure a coherent alignment between the study questions, theoretical foundations and methodological choices. The central objective of the study is to determine how institutional support structures, represented by university leadership and sustainability-oriented education, shape internal psychological mechanisms including environmental values, environmental beliefs and personal norms, and how these mechanisms ultimately influence students' electricity-saving behavioral intention. This objective requires a paradigm capable of examining measurable relationships between constructs, testing theoretically derived pathways and identifying the magnitude of both direct and indirect effects. The positivist paradigm therefore provides an appropriate philosophical foundation because it assumes that social phenomena, including institutional practices and psychological tendencies, follow observable patterns that can be empirically assessed (Park et al., 2019).

Ontologically, the study adopts a realist position that treats the variables of interest as stable and measurable features of higher education environments (Pretorius, 2024). Environmental values, beliefs and norms are conceptualized as latent psychological constructs that influence behavior in systematic ways, while institutional dimensions such as leadership and education are viewed as genuine organizational characteristics rather than subjective interpretations. This realist stance is necessary for the study's study goal, which seeks to quantify the strength of institutional and psychological influences on electricity-saving intention among students.

Epistemologically, positivism provides the logic through which knowledge is generated in this study (Montenegro et al., 2023). Because the study questions focus on identifying and evaluating structured relationships among institutional support, psychological mechanisms and behavioral intention, knowledge must be obtained through objective measurement, validated scales and replicable analytical procedures. The study relies on numerical indicators, standardized survey instruments and statistical modeling to establish empirical regularities, test hypothesized causal pathways and evaluate their explanatory power. Such an epistemic approach directly supports the study objective of assessing how institutional and psychological factors interact within a clearly defined theoretical framework.

Axiologically, the study emphasizes neutrality and analytic rigor by minimizing studyer influence throughout the study process. Although the topic of electricity conservation carries intrinsic social relevance, the study refrains from normative assumptions and instead aims to generate objective explanations grounded in empirical evidence. Measurement tools, statistical procedures and interpretation criteria follow established conventions to ensure impartiality. This value stance strengthens the credibility of the findings and aligns the study with the evaluative expectations of positivist scholarship (William, 2024).

Methodologically, the study adopts a deductive and quantitative approach. Based on the theoretical propositions of the value–belief–norm framework and social support theory, hypotheses regarding the effects of leadership, education and psychological mechanisms are derived in advance. These hypotheses are tested using cross-sectional survey data, Likert-type scales and structural equation modeling to examine direct effects, mediating pathways and the integrated influence of institutional and psychological factors. This methodological approach is essential for addressing the study goal, which requires disentangling multiple interrelated constructs and estimating the magnitude of their relationships in a statistically robust manner. By employing techniques that emphasize measurement precision, model fit and generalizability, the study ensures a rigorous examination of the determinants of electricity-saving intention in higher education.

Through this paradigm, the study provides a systematic, evidence-based explanation of how institutional support and internal psychological processes jointly influence students' energy-saving behavioral intentions. The positivist foundation

therefore not only guides the methodological choices but also ensures coherence between the study aims, theoretical assumptions and empirical analysis.

3.2 Study Tools

3.2.1 Operational Definitions of Variables

Table 3.1 provides brief operational definitions of the six variables used in this study.

Table 3.1 Operational Definitions of Variables

Variable	Definition	Source
University leadership	Department heads' sustainability-oriented communication, guidance, and resource support that shape students' perceptions of institutional priorities and encourage active participation in campus energy-saving practices.	Aggarwal and Agarwala (2025)
Sustainability-oriented Education	The extent to which schools and families jointly provide structured, accessible and participatory learning opportunities that offer informational, emotional and practical support enabling students to understand energy-related issues, critically reflect on electricity use, and engage in responsible energy-saving behavior.	Pauw et al. (2015)
Environmental Values	Students' moral orientations emphasizing responsibility, fairness, and harmony with nature, which guide their attitudes toward environmental protection and responsible campus energy use.	Yang et al. (2024)
Environmental Beliefs	Students' cognitive evaluations of human–environment relations, including awareness of consequences and responsibility, shaping how they interpret the impact of campus energy use.	Yang et al. (2024)

Table 3.1 (continued)

Variable	Definition	Source
Personal Norms	Internalized moral obligations and feelings of responsibility that motivate students to reduce energy waste and support a more sustainable campus environment.	Yang et al. (2024)
Pro-environmental Behavioral Intentions	Students' willingness and planned efforts to conserve energy on campus, including responsible use of electricity, reduced air-conditioning, and participation in energy-saving activities.	Lee and Tanusia (2016)

3.2.2 Variable Measurements

(1) University leadership

The variable University Leadership reflects the extent to which department heads, as key institutional leaders, demonstrate sustainability-oriented communication, support, and responsibility within higher education institutions. Department heads are considered central leadership figures because their attitudes, decisions, and actions directly shape departmental policies, resource allocation, and the behavioral expectations communicated to students (Boeske, 2023). In particular, their guidance on sustainability issues-such as promoting energy conservation activities, encouraging student participation, upholding environmental principles, and providing resources for energy-saving programs-plays a critical role in fostering a supportive institutional environment for pro-environmental behavior (Mohammadi et al., 2023). In this study, university leadership is measured using six items (UL1–UL6) adapted from Aggarwal and Agarwala (2025), which assess leadership commitment, encouragement of student engagement, principled decision-making, value endorsement, and resource support related to sustainability and energy conservation. These items collectively capture how department heads provide informational, emotional, and instrumental support that shapes students' perceptions of institutional priorities and strengthens their intention to engage in energy-saving behavior.

Table 3.2 Detailed Statements used to Measure University Leadership

Variables	Original Items	Revised Items	Source
University Leadership	1.My university leadership is committed to protecting greenery and the environment.	UL1.My department heads are committed to promoting energy conservation and environmental protection on campus.	Aggarwal and Agarwala (2025)
	2.Senior leadership of my university encourages environment-related extracurricular activities.	UL2.Department heads in my university encourage students to participate in energy-saving and other environmental activities.	
	3.Students are encouraged by the teachers in my department to volunteer for environmental activities.	UL3.Students in my department are encouraged by the department heads and teachers to volunteer for energy conservation initiatives.	
	4.I believe that the leadership of my university will never compromise on environmental principles.	UL4.I believe that the department heads of my university will not compromise on sustainability and energy-saving principles.	
	5.I believe that my university leadership holds high environmental (green) standards and values.	UL5.I believe that my department heads uphold high standards and values regarding sustainability and energy conservation.	

Table 3.2 (continued)

Variables	Original Items	Revised Items	Source
	6.My university devotes high resources and funding for environmental initiatives.	UL6.My department heads allocate sufficient resources and support for energy-saving programs and environmental initiatives.	

(2) Sustaibability-oriented education

Sustainability-oriented Education refers to the extent to which universities integrate sustainability principles, ecological literacy and energy-related awareness into teaching and institutional practices. In this study, the construct is measured using seven revised items (SE1–SE7) adapted from Pauw et al. (2015) and evaluated on a seven-point Likert scale. Grounded in social support theory, sustainability-oriented education is conceptualized as a structured form of informational, emotional and instrumental support that enables students to develop informed and responsible attitudes toward electricity use and energy conservation. Consistent with the revised measurement items, the construct comprises two interrelated dimensions. The first dimension, holistic energy learning (SE1–SE3), reflects the extent to which university curricula help students understand connections among historical, local and global energy issues and the broader links between economic development, social well-being and environmental impacts. The second dimension, pluralistic and participatory energy learning (SE4–SE7), captures the degree to which classroom discussions, critical reading practices, personal expression and family–school reinforcement encourage students to engage actively with energy-related topics and to internalize responsible energy-use norms. Together, these dimensions represent the broader educational environment through which universities cultivate cognitive, behavioral and moral foundations for energy-conscious action.

Table 3.3 Detailed Statements used to Measure Sustaibability-Oriented Education

Variables	Original Items	Revised Items	Source
Sustaibability-oriented Education	1.In school, we look at the connections between the past, the present, and the future as regards various issues	SE1. In school, we learn to connect past, present and future energy issues to understand the long-term consequences of electricity use.	Pauw et al. (2015)
	2.In school, we look at both local and global problems and the connection between them	SE2. In school, we examine both local and national energy challenges and how they are linked to global sustainability concerns.	
	3.In school, we look at how economics, social issues, and environmental problems are connected	SE3. In school, we learn about the relationships between economic development, social well-being and environmental impacts created by energy consumption.	
	4.When we have class discussions, it is possible for many different views to emerge	SE4. In class discussions, different perspectives on energy use, electricity saving and environmental responsibility are encouraged to emerge.	

Table 3.3 (continued)

Variables	Original Items	Revised Items	Source
	5.When we read texts in school, we usually take a critical look at the content	SE5. When reading course materials, we are encouraged to critically examine information on energy systems, environmental impacts and sustainability solutions.	
	6.In school, we are encouraged to take a stand and have our own opinions on the issues at hand	SE6. In school, we are encouraged to express our own views on energy-saving behavior and evaluate the choices we make in daily electricity use.	
	7.We decide what we study ourselves, with support of the teacher	SE7. At home, my family encourages responsible electricity use, and the school reinforces these values through classroom activities and guidance.	

(3) Environmental values

The variable environmental values captures individuals' fundamental moral orientations and evaluative principles that guide environmentally responsible cognition and behavior. Measured through fourteen items (EV1–EV14) adapted from Yang et al. (2024) using a seven-point Likert scale (1 = strongly disagree, 7 = strongly agree), this construct comprises two key dimensions aligned with the Value–Belief–Norm (VBN) Theory: Altruistic Values (EV1–EV7), representing moral concern for social justice, equality, and collective environmental welfare; and Traditional Values (EV8–EV14), reflecting respect for harmony with nature, self-discipline, and responsibility toward the community. Together, these dimensions capture how individuals internalize moral

responsibility toward both people and the environment, forming the ethical foundation for sustainability-oriented behavior.

Table 3.4 Detailed Statements used to Measure Environmental Values

Variables	Dimension	Original Items	Revised Items	Source
Environmental Values	Altruistic value	1.Social justice, correcting injustice, care for the weak.	EV1. Social justice, correcting injustice, and caring for the weak through fair and responsible use of school energy resources.	Yang et al. (2024)
		2.Preventing pollution, conserving natural resources.	EV2. Preventing pollution and conserving natural resources by reducing unnecessary energy use on campus.	
		3.Equality, equal opportunity for all.	EV3. Equality and equal opportunity for all in accessing shared campus energy resources fairly.	
		4.Unity with nature, fitting into nature.	EV4. Unity with nature by avoiding energy waste and maintaining a balanced relationship with natural resources.	
		5.A world of peace, free of war and conflict.	EV5. A peaceful world supported by responsible use of limited energy resources.	

Table 3.4 (continued)

Variables	Dimension	Original Items	Revised Items	Source
		6.Respecting the earth, harmony with other species.	EV6. Respecting the earth and protecting other species by lowering energy-related environmental pressure.	
		7.Protecting the environment, preserving nature.	EV7. Protecting the environment and preserving nature by practicing daily energy conservation.	
	Traditional value	8.True friendship, close supportive friends, supportive community.	EV8. True friendship and a supportive campus community that encourages one another to save energy.	
		9.Loyal, faithful to my friends and community.	EV9. Loyalty to friends and the campus community by acting responsibly in shared energy use.	
		10.Obedient, dutiful, meeting obligations.	EV10. Obedient and dutiful in meeting personal obligations to follow school energy-saving rules.	

Table 3.4 (continued)

Variables	Dimension	Original Items	Revised Items	Source
		11.Self-discipline, self-restraint, resistance to temptations.	EV11. Self-discipline and restraint in avoiding unnecessary energy consumption.	
		12.Honoring parents and elders, showing support and respect.	EV12. Honoring parents and elders by practicing a simple lifestyle and avoiding energy waste.	
		13.Honest, genuine, sincere.	EV13. Honest and sincere in contributing to campus energy-saving efforts.	
		14.Forgiving, willing to pardon others	EV14. Forgiving and tolerant toward others while encouraging better energy-saving habits.	

(4) Environmental belief

The variable environmental belief represents individuals' cognitive evaluations and moral convictions concerning the relationship between human behavior and environmental outcomes. Measured through six items (EB1–EB6) adapted from Yang et al. (2024) using a seven-point Likert scale (1 = strongly disagree, 7 = strongly agree), this construct embodies three theoretical dimensions consistent with the Value–Belief–Norm (VBN) Theory: Ecological worldview, reflecting the understanding of human–nature interdependence; Awareness of consequences, indicating recognition of the environmental and social impacts of human actions; and Ascription of responsibility, capturing individuals' belief in personal, corporate, and governmental obligations to address sustainability challenges. Collectively, these dimensions measure the cognitive foundation

through which environmental values are transformed into moral awareness and sustainability-oriented behavioral intention.

Table 3.5 Detailed Statements used to Measure Environmental Belief

Variables	Original Items	Revised Items	Source
Environmental belief	1.I feel a personal obligation to do whatever I can to prevent social injustice.	EB1. I believe that reducing energy waste can help prevent environmental problems on campus.	Yang et al. (2024)
	2.I feel a sense of personal obligation to take action to support vulnerable communities	EB2. I believe that reducing unnecessary energy use can support a cleaner and healthier campus environment.	
	3.Business and industry should focus more on corporate social responsibility to protect vulnerable communities.	EB3. I believe that businesses and industries should take more responsibility in reducing energy waste and supporting environmental protection.	
	4.The government should take stronger action to minimize the inequality in the distribution on income.	EB4. I believe that the government should take stronger action to reduce energy waste and ensure fair access to clean and efficient energy resources.	
	5.The government should take stronger action to promote community engagement and empowerment.	EB5. I believe that public participation in energy conservation and environmental protection is important.	

Table 3.5 (continued)

Variables	Original Items	Revised Items	Source
	6.The government should take stronger action to provide equal opportunity to all.	EB6. I believe that everyone should have equal opportunities to participate in energy saving and sustainability programs.	

(5) Personal norms

The variable Personal Norms reflects individuals' internalized moral duties and perceived ethical responsibility to act in environmentally and socially sustainable ways. Measured through five items (PN1–PN5) adapted from Yang et al. (2024) using a seven-point Likert scale (1 = strongly disagree, 7 = strongly agree), this construct encompasses two dimensions consistent with the Value–Belief–Norm (VBN) Theory: Moral obligation, representing individuals' self-expectation to contribute to environmental protection and social welfare; and Moral accountability, indicating their perceived personal responsibility to uphold sustainability principles regardless of external enforcement. Together, these dimensions capture the transformation of environmental cognition into moral motivation, reflecting individuals' intrinsic drive to align behavior with ethical and ecological values.

Table 3.6 Detailed Statements used to Measure Personal Norms

Variables	Original Items	Revised Items	Source
Personal norms	1.I feel morally accountable to reduce the social disparity.	PN1. I feel morally accountable for reducing energy waste on campus.	Yang et al. (2024)
	2.People like me should use the work to curtail the social inequality.	PN2. People like me should make personal efforts to reduce unnecessary energy use and support a more sustainable campus environment.	

Table 3.6 (continued)

Variables	Original Items	Revised Items	Source
	3.I feel morally obliged to make efforts to promote the social wellbeing of community.	PN3. I feel morally obliged to contribute to the environmental wellbeing of the campus community.	
	4.I morally think that working for community wellbeing is important, regardless of what others do.	PN4. I believe it is morally important to contribute to campus energy saving, regardless of what others do.	
	5.I feel personally obliged to work for the promotion of community wellbeing.	PN5. I feel personally obliged to support energy saving efforts that help improve the campus environment.	

(6) Pro-environmental behavioral intention

The variable Pro-environmental Behavioral Intention captures students' conscious willingness and planned effort to engage in energy-saving actions within the university setting. Measured through seven items (PI1–PI7) adapted from Lee and Tanusia (2016) using a seven-point Likert scale, this construct reflects the degree to which students intend to practice responsible energy use in their daily academic and residential routines. The construct encompasses two closely related dimensions: action-oriented intention, referring to students' readiness to adopt specific energy-saving behaviors such as switching off unused lights, reducing air-conditioning use, and managing electronic devices responsibly; and participatory intention, describing their willingness to engage in campus energy-saving activities and encourage peers to conserve energy. As the final component of the Value–Belief–Norm framework, pro-environmental behavioral intention represents the point at which internalized environmental values, beliefs, and personal norms are translated into a clear motivational commitment to conserve energy in the higher education environment.

Table 3.7 Detailed Statements used to Measure Pro-Environmental Behavioral Intention

Variables	Original Items	Revised Items	Source
Pro-environmental behavioral intention	1.I will try to conserve electricity consumption when I am in the campus.	PI1. I will try to reduce electricity use whenever I am on campus.	Lee and Tanusia (2016)
	2.I intend to switch off lights and air-conditioning when not in use.	PI2. I intend to switch off lights and air-conditioning when they are not in use.	
	3.I plan to open windows rather than turning on air-conditioning when it's hot.	PI3. I plan to open windows for ventilation before turning on the air-conditioning.	
	4.I will make sure to switch off the electrical-electronic equipment after each class session.	PI4. I will make sure to switch off electronic and electrical equipment after each class.	
	5.I intend to join energy awareness campaigns in campus.	PI5. I intend to participate in energy-saving or awareness activities on campus.	
	6.It is my responsibility to reduce energy resources I use in campus to save cost.	PI6. I feel responsible for reducing the amount of energy I use on campus.	
	7.I will encourage my classmates to conserve energy all the time.	PI7. I will encourage my classmates to save energy whenever possible.	

3.3 Data Collection Administration

3.3.1 Target Population

The target population of this study consists of students enrolled in higher education institutions in Shanxi Province. Shanxi was selected as the study setting for three reasons. First, the province plays a central role in China's national energy transition due to its long-standing coal-dominated industrial structure (Qin et al., 2021). As a major coal-producing region, Shanxi faces pronounced challenges related to high energy intensity, heavy reliance on conventional electricity generation, and significant pressure to reduce carbon emissions. These conditions make energy conservation especially important for public institutions. Universities, in particular, are expected to demonstrate leadership by modeling low-carbon behavior, reducing electricity demand, and cultivating energy-saving habits among young people. In a coal-dominated context, where energy consumption patterns are often taken for granted, understanding how to motivate students to change everyday energy-use behavior becomes even more critical.

Second, Shanxi's higher education system is sizable and regionally balanced, providing a suitable and representative context for examining student energy-saving behavior (Yan et al., 2025). According to official statistics from the Shanxi Provincial Department of Education, the province hosts 81 higher education institutions distributed across 11 prefecture-level cities, as illustrated in Figure 3.1. These institutions include a wide variety of higher education providers with different academic orientations and campus environments, offering a diverse landscape for observing how institutional practices and student experiences shape energy-use behavior.

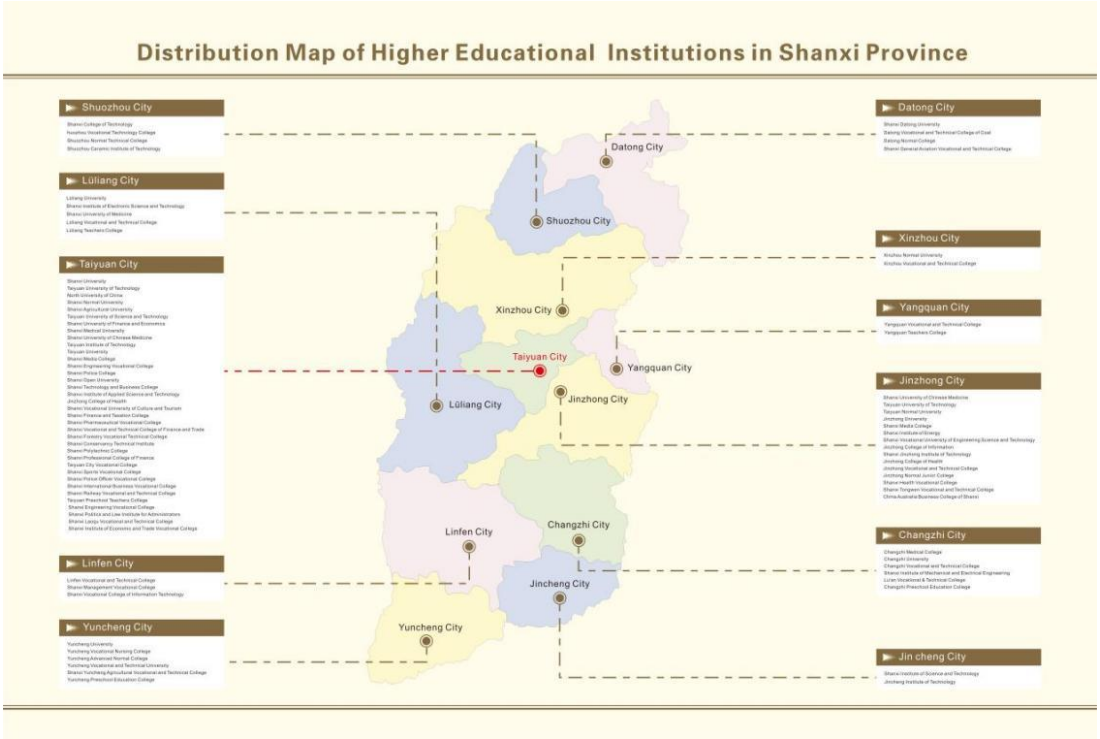

Figure 3.1 Higher Education Institutions in Shanxi Province

Sources: https://jyt.shanxi.gov.cn

Third, the scale of the student population ensures sufficient variability for empirical analysis. The higher education system in Shanxi enrolls approximately 553,500 students, covering a wide range of academic disciplines, living arrangements, and daily energy-use behaviors (He et al., 2020). The geographic dispersion of HEIs across cities such as Taiyuan, Datong, Changzhi, Jinzhong, and Yuncheng further allows the study to capture behavioral patterns across diverse institutional settings rather than a single localized context. These five cities were selected because they constitute the principal higher education clusters in Shanxi and provide broad regional coverage of the province. They capture variation in institutional type, campus context, and student composition, thereby enhancing the representativeness of the empirical setting. These differences strengthen the generalizability of the findings and provide a robust foundation for examining how institutional support and psychological factors jointly shape students' intention to conserve energy.

3.3.2 Sample Size

The sample size of this study is determined following the recommendation of Memon et al. (2020), who suggested that the minimum sample size for structural equation modeling (SEM) should be at least ten times the number of measurement items. In this study, a total of 43 items were used across all constructs; therefore, the minimum required sample size is 645 respondents (43× 15 = 645). This threshold ensures adequate statistical power, reliability, and model stability for the planned SEM analysis. To further enhance representativeness and account for potential non-responses or incomplete questionnaires, a slightly larger number of surveys were distributed to achieve valid and robust results. After data screening, a total of 864 valid questionnaires were ultimately collected and used for the final analysis.

3.3.3 Sampling Method

To ensure representativeness and maintain the principles of probability sampling, the study adopted a proportionate stratified sampling strategy based on key structural characteristics of higher education institutions. Stratification was implemented in three sequential stages, namely institution type, academic major, and year level, in order to capture variation in students' learning environments and energy-related behavioral contexts. The overall stratification framework is presented in Table 3.8.

This sampling strategy was considered more suitable than convenience sampling because the target population was not homogeneous. Students from different institution types, academic majors, and year levels may differ in their exposure to sustainability education, access to campus facilities, dormitory routines, laboratory use, and awareness of energy conservation. A convenience sampling approach would risk overrepresenting students who were easier to reach, more willing to respond, or concentrated in particular classes or majors, thereby weakening the representativeness of the sample and limiting the generalizability of the findings. In contrast, proportionate stratified sampling allowed the study to preserve the actual structural composition of the student population and to ensure that key subgroups relevant to energy saving behavior were adequately represented.

Table 3.8 Stratification Structure of the Sampling Design

Stratification Stage	Category	Subcategories
Stage 1	Institution type	Public universities, Private universities
Stage 2	Academic major	Science and Engineering, Social Sciences, Arts and Humanities, Business and Economics, Others
Stage 3	Year level	Freshman, Sophomore, Junior, Senior

At the first stage, universities were classified into public and private institutions. This distinction reflects differences in governance structures, funding mechanisms, and campus management practices, which may shape institutional support for energy conservation and students' exposure to sustainability-related initiatives. At the second stage, students within each institutional category were grouped by academic major, including Science and Engineering, Social Sciences, Arts and Humanities, Business and Economics, and Others. These disciplinary domains differ in laboratory dependence, facility usage, and daily activity patterns, thereby influencing the ways in which students interact with campus energy consumption. At the third stage, students were further stratified by year level, namely freshman, sophomore, junior, and senior, to reflect differences in campus engagement, study routines, and environmental awareness across stages of academic progression.

After the strata were established, proportionate allocation was used to determine the number of participants selected from each subgroup. The sample size assigned to each stratum was based on its relative share in the total student population, so that larger strata received a correspondingly larger number of respondents. Within each stratum, simple random sampling was then conducted using official student lists or class rosters obtained from university administrative offices. Random numbers were generated through statistical software to ensure that all students within the same stratum had an equal probability of selection. The proportionate allocation results are shown in Table 3.9.

Table 3.9 Proportionate Sample Allocation Across Strata

Institution Type	Academic Major	Year Level	Population Size	Population Share %	Allocated Sample Size	Valid Responses
Public	Science and Engineering	Freshman	1,200	5	43	43
Public	Science and Engineering	Sophomore	1,100	4.6	40	40
Public	Science and Engineering	Junior	1,150	4.8	42	42
Public	Science and Engineering	Senior	1,050	4.4	38	38
Public	Social Sciences	Freshman	900	3.8	33	33
Public	Social Sciences	Sophomore	850	3.5	31	31
Public	Social Sciences	Junior	870	3.6	31	31
Public	Social Sciences	Senior	820	3.4	30	30
Public	Arts and Humanities	Freshman	700	2.9	25	25
Public	Arts and Humanities	Sophomore	680	2.8	24	24
Public	Arts and Humanities	Junior	660	2.8	24	24
Public	Arts and Humanities	Senior	640	2.7	23	23
Public	Business and Economics	Freshman	800	3.3	29	29
Public	Business and Economics	Sophomore	780	3.3	29	29

Table 3.9 (continued)

Institution Type	Academic Major	Year Level	Population Size	Population Share %	Allocated Sample Size	Valid Responses
Public	Business and Economics	Junior	760	3.2	28	28
Public	Business and Economics	Senior	740	3.1	27	27
Public	Others	All years	600	2.5	22	22
Private	Science and Engineering	All years	900	3.8	33	33
Private	Social Sciences	All years	700	2.9	25	25
Private	Arts and Humanities	All years	650	2.7	23	23
Private	Business and Economics	All years	750	3.1	27	27
Private	Others	All years	600	2.5	22	22
Total			24,000	100	864	864

As shown in Table 3.9, the allocation process followed the logic of proportionate stratified sampling by distributing the sample according to the relative size of each subgroup in the target population. This procedure helped preserve the structural composition of the student population while avoiding overrepresentation or underrepresentation of particular institutional, disciplinary, or academic categories. The use of random selection within each stratum further strengthened the methodological rigor of the sampling process.

The final distribution of valid responses by academic major and year level is presented in Table 3.10. This distribution indicates that the sample covered a broad range of disciplinary and academic backgrounds, thereby providing sufficient variation for subsequent empirical analysis.

Table 3.10 Final Sample Distribution by Major and Year Level

Academic Major	Freshman	Sophomore	Junior	Senior	Total
Science and Engineering	76	70	72	68	286
Social Sciences	58	56	57	55	226
Arts and Humanities	48	46	47	45	186
Business and Economics	56	54	53	52	215
Others	25	24	23	23	95
Total	263	250	252	243	864

As indicated in Table 3.10, Science and Engineering students constituted the largest group in the final sample, followed by Social Sciences and Business and Economics. The distribution across year levels was relatively balanced, with freshman, sophomore, junior, and senior students all adequately represented. This pattern suggests that the final sample retained diversity across both disciplinary domains and stages of academic progression, which is important for examining variations in students' energy saving intention under different institutional and educational conditions.

3.3.4 Data Collection Method

The data for this study were collected through onsite questionnaire surveys conducted across 81 higher education institutions in Shanxi Province. Following the sampling framework established in the previous section, the distribution of questionnaires was carried out according to the student name lists or class rosters obtained from the participating universities. Based on these lists, respondents were randomly selected by the study team prior to field implementation, and the onsite survey process was then used to approach the selected students and administer the questionnaires in person.

Rather than relying on an online approach, the onsite method allowed the study team to verify that the selected respondents matched the sampling lists and satisfied the eligibility criteria of the study. Questionnaires were administered in campus settings such as classrooms, libraries, cafeterias, and student activity areas, depending on where the selected students could be reached most effectively. This procedure helped ensure that the collected data came from the intended respondents within each stratum and that the randomization procedure designed in the sampling stage was properly implemented during fieldwork.

The onsite administration also enabled immediate clarification of questionnaire items when necessary, reduced the likelihood of incomplete, duplicate, or careless responses, and improved overall data quality. By combining randomized selection based on official student lists with face to face questionnaire administration, the study achieved a more rigorous and controlled data collection process that was consistent with the principles of probability sampling.

3.4 Data Analysis

3.4.1 Pilot Study

A pilot study served as a preliminary step to evaluate the clarity, reliability, and validity of the study instrument before conducting the main survey (Van Teijlingen & Hundley, 2002). In this study, a pilot survey consisting of 35 questionnaires was distributed to students from several higher education institutions in Shanxi Province (Bujang et al., 2024). The participants represented diverse backgrounds in terms of academic major, gender, and year of study, thereby reflecting the heterogeneity of the target population.

The pilot data were analyzed to assess the reliability of each construct using Cronbach's alpha and composite reliability, and to test the validity of the items through item total correlation and factor loading examination. Based on the results and participant feedback, minor modifications were made to improve wording precision and content clarity, ensuring that the final questionnaire was contextually appropriate and methodologically robust for the main data collection phase.

Table 3.11 presents the results of the item level diagnostics, which were used to assess the extent to which each item adequately represented its corresponding construct. The corrected item total correlation, a standard indicator of item contribution within classical measurement theory, reflects the degree to which an item aligns with the overall construct score. Higher corrected item total correlation values indicate that an item moves consistently with the underlying dimension, whereas substantially lower values suggest that respondents may interpret the item differently or that it captures a concept that diverges from the scale. In this pretest analysis, most items demonstrated satisfactory alignment with their constructs and exhibited reasonable variability, indicating that respondents were able to understand and distinguish among the statements. However, SE5

and SE7 displayed notably weaker associations with their construct compared with the other items, as reflected by their relatively low corrected item total correlation values. This interpretation is further supported by the reliability diagnostics, where the Cronbach's alpha coefficients of the corresponding construct increased when either SE5 or SE7 was hypothetically removed. Such a pattern suggests that these items weakened the internal consistency of the scale. Therefore, SE5 and SE7 were identified as candidates for deletion, while the remaining items, including EV14, demonstrated stable relationships with their constructs and were retained for use in the final questionnaire.

Table 3.11 Item Analysis for Pilot Test

Construct	Item	Mean	SD	CITC	Cronbach's α if item deleted
University leadership	UL1	4.62	0.78	0.68	0.901
	UL2	4.55	0.81	0.7	0.899
	UL3	4.47	0.83	0.66	0.903
	UL4	4.51	0.79	0.64	0.905
	UL5	4.58	0.74	0.72	0.897
	UL6	4.49	0.82	0.69	0.9
Sustainability-oriented education	SE1	4.78	0.71	0.63	0.912
	SE2	4.69	0.75	0.66	0.91
	SE3	4.55	0.77	0.64	0.911
	SE4	4.41	0.84	0.59	0.916
	SE5	4.32	0.88	0.28	0.941
	SE6	4.68	0.73	0.62	0.914
	SE7	4.52	0.8	0.27	0.939
Environmental values	EV1	4.36	0.82	0.57	0.922
	EV2	4.58	0.75	0.63	0.918
	EV3	4.41	0.81	0.6	0.92
	EV4	4.49	0.78	0.62	0.919
	EV5	4.37	0.85	0.58	0.922
	EV6	4.44	0.8	0.64	0.918
	EV7	4.63	0.72	0.66	0.916

Table 3.11 (continued)

Construct	Item	Mean	SD	CITC	Cronbach's α if item deleted
	EV8	4.29	0.87	0.55	0.924
	EV9	4.33	0.84	0.57	0.923
	EV10	4.48	0.79	0.61	0.92
	EV11	4.52	0.78	0.63	0.918
	EV12	4.27	0.89	0.53	0.925
	EV13	4.3	0.86	0.55	0.924
	EV14	4.15	0.91	0.56	0.923
Environmental beliefs	EB1	4.72	0.73	0.68	0.908
	EB2	4.66	0.77	0.66	0.91
	EB3	4.59	0.79	0.6	0.915
	EB4	4.64	0.76	0.62	0.913
	EB5	4.71	0.74	0.63	0.912
	EB6	4.55	0.81	0.59	0.916
Personal norms	PN1	4.8	0.71	0.71	0.894
	PN2	4.75	0.73	0.69	0.896
	PN3	4.67	0.77	0.66	0.898
	PN4	4.62	0.79	0.6	0.904
	PN5	4.7	0.75	0.64	0.901
Pro-environmental behavioral intention	PI1	4.89	0.68	0.72	0.892
	PI2	4.93	0.67	0.74	0.89
	PI3	4.85	0.7	0.69	0.895
	PI4	4.78	0.73	0.66	0.898
	PI5	4.67	0.78	0.61	0.904
	PI6	4.82	0.72	0.68	0.896
	PI7	4.7	0.77	0.63	0.902

The overall internal consistency of each construct is reported in Table 3.12. All constructs surpassed the accepted reliability standard, with Cronbach's alpha coefficients ranging from 0.894 to 0.928. These results indicate that the retained items within each construct formed cohesive and dependable scales. Environmental values showed the strongest internal consistency among the variables, while the remaining constructs demonstrated similarly robust reliability, confirming that the questionnaire possessed an adequate level of measurement stability for subsequent analyses.

Table 3.12 Pretest Reliability Statistics

Study variables	Number of questions	Cronbach's α
University leadership	6	0.903
Sustainability-oriented education	7	0.915
Environmental values	14	0.928
Environmental beliefs	6	0.912
Personal norms	5	0.901
Pro-environmental behavioral intention	7	0.894

To determine whether the dataset was suitable for factor analysis, the Kaiser–Meyer–Olkin statistic and Bartlett's Test of Sphericity were examined, as shown in Table 3.13. The KMO value of 0.901 suggests excellent sampling adequacy, indicating that the data were appropriate for identifying underlying factor structures. Bartlett's test was significant at a high level, confirming that the correlations among items were sufficiently patterned rather than random. Together, these results demonstrate that the measurement instrument had the structural properties necessary for exploratory and confirmatory factor analysis.

Table 3.13 Pre-investigation KMO and Bartlett's test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	0.901	
Bartlett's Test of Sphericity	Approx. Chi-Square	5843.216
	df	903
	Sig.	0

3.4.2 Descriptive Statistical Analysis

Descriptive statistical analysis is conducted to summarize and explain the essential characteristics of the collected data, offering an overview of respondents' demographic distribution and general response patterns across all measured constructs (Ghanad, 2023). The analysis includes calculations of frequencies, percentages, means and standard deviations to describe central tendencies and variability, while also screening the dataset for missing values, abnormal patterns or extreme scores that may influence subsequent model estimation. By outlining the structure of the sample, descriptive analysis establishes the empirical foundation for interpreting later inferential findings.

In this study, descriptive analysis was performed using SPSS to examine all demographic indicators included in Part 1 of the questionnaire, covering university region, gender, academic year, major discipline, place of growth, and age. Descriptive statistics were also generated for each set of latent variables measured in Parts 2 to 7, including university leadership, sustainability-oriented education, environmental values, environmental beliefs, personal norms, and pro-environmental behavioral intention. Item-level means and standard deviations were used to assess students' perceptions of departmental leadership, their exposure to energy-related education, the strength of their energy-related values and beliefs, their sense of moral obligation toward energy conservation, and their intention to engage in electricity-saving practices. These descriptive findings contextualized the structural paths examined later in the analysis and helped determine whether the sample drawn from 81 higher education institutions in Shanxi Province adequately reflected the demographic diversity and attitudinal variation of the target student population.

3.4.3 Reliability Analysis

Reliability analysis is conducted to assess the internal consistency and stability of the measurement scales used in the study. It ensures that the items within each construct consistently reflect the same underlying concept and produce dependable results across repeated measurements. The most common indicator, Cronbach's alpha (α), is employed to evaluate internal consistency, with a threshold value of 0.70 or higher generally considered acceptable for social science study (Hair Jr et al., 2020). Additionally, Composite Reliability (CR) is calculated to confirm construct reliability, with acceptable

values exceeding 0.70, ensuring that the constructs demonstrate adequate internal coherence and measurement precision.

In this study, reliability analysis was performed for all seven latent constructs, namely university leadership, university culture, sustainability-oriented education, environmental values, environmental beliefs, personal norms, and pro-environmental behavioral intentions. The analysis was carried out using SPSS to compute Cronbach's alpha and composite reliability for each variable. Items that exhibited low reliability or weak inter-item correlations were reviewed and, where necessary, refined or removed to enhance the robustness of the measurement model. Establishing strong reliability at this stage ensured that subsequent analyses, such as validity testing and structural equation modeling, were based on stable and credible measures.

3.4.4 Validity Analysis

Validity analysis is performed to ensure that the measurement items accurately represent the theoretical constructs they are intended to measure. It examines the degree to which the instrument captures both the conceptual and empirical meaning of each variable. In this study, two main types of validity will be assessed: convergent validity and discriminant validity. Convergent validity evaluates whether items that are theoretically related load strongly on the same construct, typically tested through factor loadings, Average Variance Extracted (AVE), and Composite Reliability (CR). An AVE value above 0.50 and factor loadings above 0.70 indicate adequate convergent validity (Fornell & Larcker, 1981). Discriminant validity, on the other hand, assesses the distinctiveness of constructs-ensuring that each variable captures a unique dimension of the model-commonly tested using the Fornell–Larcker criterion and the Heterotrait–Monotrait (HTMT) ratio, with acceptable HTMT values below 0.85.

In this study, validity analysis was conducted using SmartPLS 4.0 to assess the quality of the measurement model for all constructs, including university leadership, university culture, sustainability-oriented education, environmental values, environmental beliefs, personal norms, and pro-environmental behavioral intentions. Convergent validity was verified by examining factor loadings and average variance extracted for each item, while discriminant validity was established through inter-construct correlation comparisons. Items that failed to meet validity thresholds were reviewed and refined to ensure conceptual clarity. Establishing strong validity ensured that the model accurately

reflected the theoretical structure of the value belief norm framework and the institutional support dimensions adopted in this study.

3.4.5 Structural Equation Model Analysis

The Structural Equation Modeling (SEM) approach is adopted in this study to rigorously test the hypothesized relationships among institutional and psychological factors influencing students' pro-environmental behavioral intentions. SEM enables the simultaneous estimation of multiple interrelated dependence relationships, combining the measurement model (which validates the relationships between observed indicators and latent constructs) and the structural model (which examines the causal relationships among latent variables) (Fan et al., 2016). This approach is particularly appropriate for the extended Value–Belief–Norm (VBN) framework proposed in this study, as it accommodates both institutional antecedents (university leadership, university culture, and sustainability-oriented education) and psychological mediators (environmental values, environmental beliefs, and personal norms), ultimately predicting pro-environmental behavioral intention.

The SEM analysis was conducted using AMOS 24.0 and SmartPLS 4.0, following a two step modeling strategy. First, confirmatory factor analysis was performed to assess the reliability, convergent validity, and discriminant validity of all constructs. Second, the structural model was estimated to test the hypothesized causal paths and mediating mechanisms. The overall goodness of fit of the model was evaluated through standard indices, including the Chi square statistic, CFI and TLI, RMSEA, and SRMR (Hair Jr et al., 2020)..

Both direct and indirect effects were examined to capture the full scope of the causal mechanisms. Direct effects were used to assess the immediate relationships between institutional variables, including university leadership, culture, and education, and students' pro-environmental behavioral intention. Indirect effects were analyzed through the mediating pathways involving environmental values, environmental beliefs, and personal norms, as specified in hypotheses H9 to H11. The bootstrapping method with 5,000 resamples and a 95 percent confidence interval was employed to test the significance of the mediation effects and determine whether the indirect influence of institutional support on behavioral intention through psychological constructs was statistically significant. This dual examination of direct and indirect pathways provided a

comprehensive understanding of how institutional environments shaped students' sustainability-oriented cognition and behavior, while ensuring the robustness and theoretical coherence of the proposed model.

Table 3.14 Structural Equation Modeling Indicators

Index	Ideal Value	Source
χ^2 (Chi-square)	p>0.05	Hair Jr et al. (2021)
CFI (Comparative Fit Index)	CFI>0.95	
TLI (Tucker-Lewis Index)	TLI>0.95	
RMSEA (Root Mean Square Error of Approximation)	RMSEA<0.06	
SRMR (Standardized Root Mean Square Residual)	SRMR<0.08	

3.5 Ethical Considerations

This study adheres to strict ethical study standards to ensure the protection, respect, and informed participation of all respondents. Prior to data collection, the study proposal and survey instrument were reviewed and approved by the Ethics Committee of Chongqing Technology and Business University to guarantee compliance with academic and ethical guidelines. Participation in the survey was voluntary, and all respondents were clearly informed about the purpose of the study, the anonymous nature of the data collection, and their right to withdraw at any time without penalty. An informed consent statement was included at the beginning of the questionnaire, ensuring that participants provided explicit consent before proceeding.

The survey did not collect any personally identifiable information, such as names, student numbers, or contact details, to protect participants' privacy and confidentiality. All responses were stored securely on the WenJuanXing platform and were accessible only to the study team for academic analysis purposes. The collected data were used exclusively for study and statistical reporting, with no individual results disclosed. Moreover, the study fully complies with the principles of academic integrity, transparency, and non-maleficence, ensuring that participants were not exposed to any physical, psychological, or social harm during the study process. By upholding these ethical standards, the study

ensures both the credibility of its findings and the trustworthiness of its data collection process.

3.6 Conclusion

This chapter outlined the study methodology adopted to examine the institutional and psychological determinants of higher education students' pro-environmental behavioral intentions in Shanxi Province. It detailed the study design, target population, sampling method, data collection procedures, and data analysis techniques, including reliability, validity, and structural equation modeling analyses. Ethical considerations were also addressed to ensure data integrity and participant protection. Overall, this methodological framework provides a rigorous and systematic foundation for testing the proposed hypotheses and supports the empirical validation of the conceptual model presented in the subsequent chapter.

CHAPTER 4
RESULTS

This chapter presents the empirical analysis of the study by examining the survey data and testing the proposed study model. It begins with a descriptive analysis that outlines the sample characteristics and provides descriptive statistics of the observed variables, offering an overview of respondents' demographic distribution and the basic distributional properties of the measurement items. Building on these preliminary tests, confirmatory factor analysis is conducted to validate the measurement model, including the assessment of measurement model fit metrics as well as tests of convergent validity and discriminant validity to ensure that the indicators adequately represent their respective constructs. After confirming the adequacy of the measurement model, the structural model path analysis is performed to test the hypothesized relationships among the constructs. This stage includes the evaluation of model fit metrics for the structural model, followed by the examination of direct effects, indirect effects, and total effects in order to identify the influence mechanisms among university leadership, sustainability-oriented education, environmental values, environmental beliefs, personal norms, and pro-environmental behavioral intention. Finally, the chapter concludes with a summary of the main empirical findings.

4.1 Descriptive Analysis

4.1.1 Sample Characteristics

Table 4.1 summarizes the demographic and background characteristics of the respondents and provides an overall profile of the sample in terms of regional distribution, gender, age, grade level, academic major, and place of growth. Overall, the sample exhibits substantial heterogeneity across key demographic categories, which supports the representativeness of the dataset for examining pro-environmental behavioral intention in the higher education context.

Regarding the region of university, the respondents were drawn from five selected cities in Shanxi Province, which were grouped into four broader sub-regions according to their geographic location. Specifically, Northern Shanxi included Datong, Central Shanxi included Taiyuan and Jinzhong, Southern Shanxi included Yuncheng, and Southeastern Shanxi included Changzhi. As shown in Table 4.1, Central Shanxi represented the largest proportion of the sample at 31.7 percent, followed by Northern Shanxi at 23.3 percent, Southern Shanxi at 22.9 percent, and Southeastern Shanxi at 22.1 percent. This distribution indicates that the sample covered the principal higher education areas included in the study and was not concentrated in a single locality. The relatively higher proportion of Central Shanxi is reasonable because this sub-region included both Taiyuan and Jinzhong, which are important higher education centers in the province, whereas the inclusion of Datong, Yuncheng, and Changzhi ensured broader regional coverage and strengthened the geographic diversity of the dataset.

In terms of gender, female respondents constituted 55.0 percent of the sample, whereas male respondents accounted for 45.0 percent. The distribution suggests a moderately female-skewed sample, which is consistent with the demographic patterns observed in many university-based surveys and may also reflect enrollment structures in certain academic programs. Importantly, both gender groups are sufficiently represented to support reliable statistical estimation and to mitigate concerns regarding gender imbalance in subsequent analyses.

The age structure of the sample aligns closely with expectations for a university student population. Most respondents fall within the 18–20 and 21–23 age groups, accounting for 41.2 percent and 41.9 percent respectively, which together comprise more than four-fifths of the total sample. Students aged 24 or above make up 12.2 percent, representing older undergraduates or students with non-linear educational trajectories. The under-18 group accounts for 4.7 percent, a proportion that may correspond to early entrants or students who began tertiary education at a younger age. Taken together, the distribution confirms that the sample is primarily composed of traditional college-age respondents while still capturing a meaningful share of older students, thereby enhancing the demographic breadth of the dataset.

With respect to grade level, the sample is broadly balanced across the four academic years. Freshmen represent 27.0 percent, sophomores 22.5 percent, juniors 25.5

percent, and seniors 25.1 percent. This pattern indicates that respondents were not disproportionately concentrated in a single year of study, which is important because exposure to campus policies, sustainability-oriented education, and institutional environmental initiatives may differ by academic stage. The relatively even representation across grade levels strengthens the study's ability to capture variation in experiences and perceptions associated with time spent in the university environment.

The distribution of academic majors also demonstrates considerable disciplinary diversity. Science and engineering students form the largest group at 33.7 percent, followed by social sciences at 24.1 percent. Business and economics account for 19.2 percent, arts and humanities constitute 17.0 percent, and the remaining 6.0 percent are classified as other majors. This disciplinary spread is beneficial because attitudes toward environmental issues and engagement with sustainability-related content can vary across academic fields. The presence of sizeable subgroups across major categories helps ensure that the empirical findings are not solely reflective of a single disciplinary perspective and supports a more comprehensive interpretation of the results.

Finally, the place of growth variable shows that 54.6 percent of respondents reported an urban background, while 45.4 percent reported a rural background. This relatively balanced urban–rural composition is noteworthy in the Shanxi context and is analytically relevant because prior environmental socialization, access to environmental education, and daily energy-use practices may differ between urban and rural environments. The inclusion of both groups in substantial proportions provides a strong basis for capturing heterogeneity in environmental values, beliefs, and norms that may be rooted in early-life contexts.

Table 4.1 Sample Information

Category	Item	N	%
Region of University	Northern Shanxi	201	23.3
	Central Shanxi	274	31.7
	Southern Shanxi	198	22.9
	Southeastern Shanxi	191	22.1
Gender	Male	389	45
	Female	475	55

Table 4.1 (continued)

Category	Item	N	%
Age	Under 18	41	4.7
	18–20	356	41.2
	21–23	362	41.9
	24 or above	105	12.2
Grade Level	Freshman	233	27
	Sophomore	194	22.5
	Junior	220	25.5
	Senior	217	25.1
Academic Major	Science and Engineering	291	33.7
	Social Sciences	208	24.1
	Arts and Humanities	147	17
	Business and Economics	166	19.2
	Others	52	6
Place of Growth	Urban	472	54.6
	Rural	392	45.4

4.1.2 Descriptive Statistics

Table 4.2 reports the descriptive statistics of all observed variables included in the study, including the mean value, standard deviation, skewness, and kurtosis for each measurement item. Descriptive statistics provide an overview of the central tendency and dispersion of the data, allowing an initial assessment of the distributional characteristics of the variables prior to conducting further statistical analyses such as reliability testing and structural equation modeling (Yellapu, 2018). In this study, the mean values reflect the average level of agreement of respondents with each item measured on a five-point Likert scale, while the standard deviation indicates the extent of variation in respondents' answers. In addition, skewness and kurtosis are used to evaluate the normality of the data distribution. Skewness measures the symmetry of a distribution around its mean, where values close to zero indicate a relatively symmetric distribution, negative values indicate a slight left skew, and positive values indicate a right skew. Kurtosis reflects the degree of peakedness or flatness of the distribution compared with a normal distribution. In

empirical study using structural equation modeling, skewness values within the range of ±2 and kurtosis values within the range of ±7 are generally considered acceptable, suggesting that the data do not deviate substantially from normality and are suitable for further multivariate analysis.

With respect to the construct of university leadership, the mean scores of the six measurement items range from approximately 4.09 to 4.25, indicating that respondents generally show a relatively strong perception of the environmental leadership demonstrated by universities. Among these items, UL3 records the highest mean value, suggesting that students tend to recognize the role of university leadership in supporting sustainability initiatives. The standard deviation values remain around 0.97 to 1.05, indicating a reasonable degree of response variation among participants. The skewness values are all negative, suggesting that responses tend to cluster slightly toward higher agreement levels. The kurtosis values indicate a relatively flat distribution without extreme concentration around the mean.

For sustainability-oriented education, the mean scores range from approximately 4.21 to 4.33, which suggests that respondents generally perceive sustainability-related education and learning activities to be clearly present and well developed in their university environment. The relatively higher mean values indicate that students have substantial exposure to sustainability-oriented educational content. The standard deviation values remain around 0.93 to 1.00, reflecting moderate variability in responses. The skewness values are negative, indicating that many respondents selected agreement options on the scale. The kurtosis values remain close to zero, suggesting that the distributions approximate normality.

Environmental values demonstrate mean scores between approximately 4.06 and 4.33 across fourteen items, reflecting a relatively high level of environmental value orientation among respondents. Items such as EV11 and EV13 show relatively higher mean values, suggesting stronger agreement with statements emphasizing environmental responsibility. The standard deviations indicate that while respondents generally share similar attitudes toward environmental values, some variation remains in individual perceptions. The skewness values indicate a tendency toward higher agreement responses, and the kurtosis values remain within acceptable limits for normality.

In terms of environmental beliefs, the mean values range from approximately 4.15 to 4.38, indicating that students generally hold strong beliefs regarding environmental issues and human responsibility for environmental protection. EB3 exhibits the highest mean value, indicating that students strongly acknowledge the importance of environmental protection. Standard deviation values indicate a moderate dispersion of responses. The skewness values demonstrate a slight left skew consistent with respondents' generally positive environmental beliefs. The kurtosis values remain within acceptable ranges, indicating no substantial deviation from normal distribution.

For personal norms, the mean values range from approximately 4.16 to 4.27, suggesting that respondents generally express a relatively strong sense of personal moral obligation toward environmental protection. The standard deviations indicate moderate variability in students' sense of responsibility regarding pro-environmental actions. The skewness values suggest that responses tend to lean toward agreement with statements reflecting personal environmental responsibility. The kurtosis values remain close to zero and indicate a relatively stable distribution pattern.

Finally, the construct of pro-environmental behavioral intention displays comparatively higher mean values than the other constructs, ranging from approximately 4.24 to 4.41, indicating that respondents demonstrate a strong willingness to engage in environmentally friendly behaviors. The item PEBI6 records the highest mean score, reflecting a particularly strong inclination toward pro-environmental action. The standard deviation values suggest that while most respondents report positive behavioral intentions, a certain degree of variation exists across individuals. The skewness values indicate that responses are slightly skewed toward higher agreement levels, and the kurtosis values remain well within acceptable limits, suggesting that the data do not display extreme peakedness or flatness.

Table 4.2 Descriptive Statistics Results

Study variables	Items	Mean	Std.	Skewness	Kurtosis
University Leadership	UL1	4.18	1.02	-0.62	-0.38
	UL2	4.12	1.05	-0.59	-0.41
	UL3	4.25	0.98	-0.66	-0.32
	UL4	4.09	1.03	-0.52	-0.45
	UL5	4.22	0.97	-0.69	-0.27
	UL6	4.14	1.01	-0.57	-0.4
Sustainability-oriented Education	SE1	4.31	0.95	-0.74	0.1
	SE2	4.33	0.93	-0.72	0.08
	SE3	4.26	0.94	-0.7	0.22
	SE4	4.28	0.96	-0.73	0.19
	SE5	4.21	1	-0.66	-0.04
Environmental Values	EV1	4.12	0.92	-0.55	-0.28
	EV2	4.15	0.9	-0.58	-0.09
	EV3	4.09	0.96	-0.47	-0.4
	EV4	4.06	0.94	-0.43	-0.46
	EV5	4.1	0.98	-0.49	-0.52
	EV6	4.13	0.96	-0.54	-0.38
	EV7	4.28	0.93	-0.72	-0.05
	EV8	4.18	0.91	-0.61	-0.18
	EV9	4.16	0.95	-0.56	-0.27
	EV10	4.11	0.89	-0.58	-0.31
	EV11	4.3	0.92	-0.74	0.16
	EV12	4.22	0.99	-0.66	-0.25
	EV13	4.33	1.01	-0.83	-0.1
	EV14	4.25	0.98	-0.78	-0.07

Table 4.2 (continued)

Study variables	Items	Mean	Std.	Skewness	Kurtosis
Environmental Beliefs	EB1	4.22	1.02	-0.64	-0.42
	EB2	4.25	1.04	-0.63	-0.48
	EB3	4.38	0.99	-0.71	-0.35
	EB4	4.15	1.01	-0.41	-0.65
	EB5	4.23	1	-0.66	-0.4
	EB6	4.2	1.03	-0.55	-0.56
Personal Norms	PN1	4.2	0.92	-0.56	0.15
	PN2	4.23	0.9	-0.48	-0.05
	PN3	4.27	0.95	-0.46	-0.42
	PN4	4.18	0.93	-0.32	-0.5
	PN5	4.16	0.96	-0.45	-0.39
Pro-environmental Behavioral	PEBI1	4.32	0.88	-0.6	-0.24
Intention	PEBI2	4.29	0.86	-0.61	-0.12
	PEBI3	4.24	0.9	-0.58	-0.2
	PEBI4	4.27	0.94	-0.64	-0.26
	PEBI5	4.28	0.96	-0.69	-0.1
	PEBI6	4.41	0.83	-1.02	0.98
	PEBI7	4.33	0.85	-0.7	0.2

4.2 Confirmatory Factor Analysis

4.2.1 Measurement Model and Fit Metrics

Figure 4.1 displays the confirmatory factor analytic measurement model used to validate the latent constructs and their observed indicators prior to hypothesis testing. The diagram follows the standard CFA representation in which ellipses denote latent variables and rectangles denote observed items, while the small circles attached to each item represent measurement error terms. Six latent constructs are specified in the model, including university leadership, sustainability-oriented education, environmental values, environmental beliefs, personal norms, and pro-environmental behavioral intention, each operationalized by multiple observed indicators consistent with the questionnaire design. The single-headed arrows from each latent construct to its indicators represent

standardized factor loadings, which quantify the strength of the relationship between the latent variable and each observed item. The curved double-headed links among latent constructs represent estimated covariances, reflecting the extent to which constructs co-vary at the measurement level.

The factor loading pattern shown in Figure 4.1 indicates that all retained indicators load strongly on their intended constructs, supporting the adequacy of the measurement specification. University leadership is measured by six items with standardized loadings ranging from 0.699 to 0.828, suggesting that the indicators capture a coherent perception of leadership commitment and support for sustainability-related initiatives. Sustainability-oriented education is measured by five items with loadings between 0.733 and 0.805, indicating that the education-related indicators consistently reflect sustainability-oriented learning exposure and pedagogical emphasis. Environmental values are measured by fourteen items with loadings ranging from 0.693 to 0.848, demonstrating robust measurement of value-based orientations toward environmental responsibility, conservation, and ethical energy use across a broad set of statements. Environmental beliefs are measured by six items with loadings between 0.752 and 0.837, reflecting stable and substantial associations between the belief indicators and the underlying belief construct. Personal norms are measured by five items with loadings from 0.723 to 0.831, supporting the interpretation that these indicators reliably capture moral obligation and internalized responsibility toward pro-environmental action. Pro-environmental behavioral intention is measured by seven items with loadings between 0.756 and 0.865, indicating that the intention items provide strong representation of planned and self-reported willingness to engage in energy-saving and environmentally responsible behavior.

The overall measurement model fit is evaluated using multiple goodness-of-fit indices to determine whether the covariance structure implied by the model reproduces the observed covariance matrix with sufficient accuracy. The fit metrics reported for the measurement model indicate a satisfactory and well-accepted model fit. The chi-square to degrees of freedom ratio is below the commonly recommended threshold, and the RMSEA value is well within the conventional acceptable range, indicating minimal approximation error. In addition, the absolute and incremental fit indices, including GFI and AGFI as well as NFI, TLI, and CFI, all exceed recommended cutoffs, providing convergent evidence

that the measurement model fits the data adequately. Taken together, the standardized loading pattern illustrated in Figure 4.1 and the favorable fit indices provide empirical support for the adequacy of the measurement model, indicating that the observed indicators are valid representations of their respective latent constructs and that the model is suitable for subsequent reliability and validity assessment as well as structural model estimation.

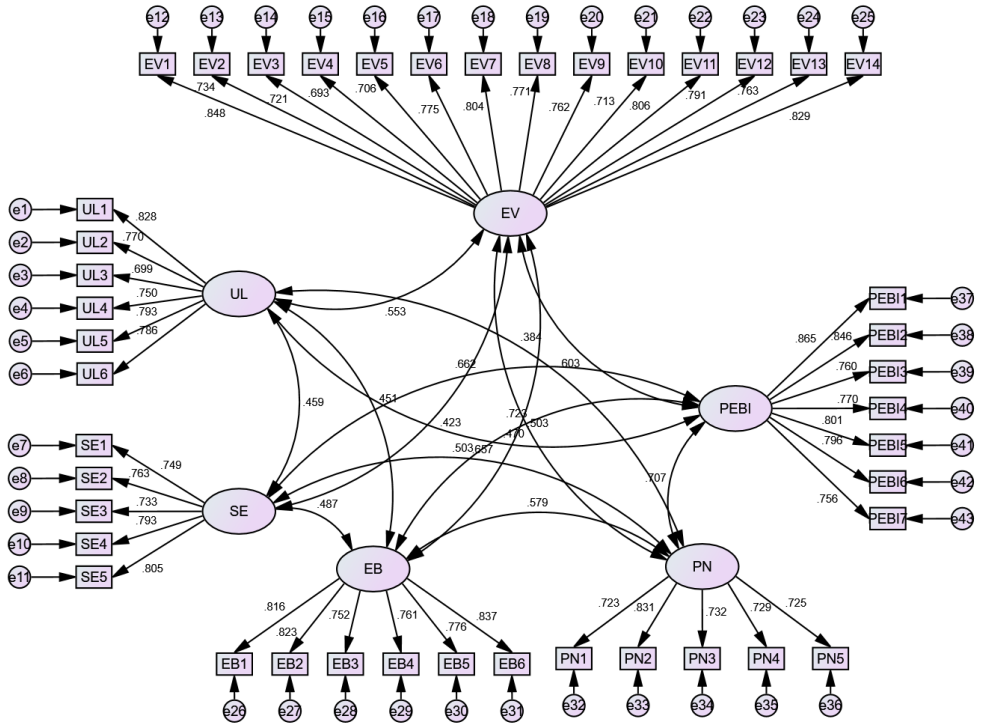

Figure 4.1 Measurement model

Following the specification of the measurement model illustrated in Figure 4.1, the overall goodness-of-fit of the model was evaluated using a series of commonly recommended structural equation modeling fit indices. Table 4.3 reports the measurement model fit metrics, including the chi-square to degrees of freedom ratio, the root mean square error of approximation, and several absolute and incremental fit indices. These indicators collectively assess how well the proposed measurement model reproduces the observed covariance matrix. In confirmatory factor analysis, relying on multiple fit indices rather than a single statistic provides a more comprehensive evaluation of model adequacy.

The chi-square to degrees of freedom ratio (χ^2/df) is a commonly used indicator that evaluates the discrepancy between the observed data and the model-implied covariance matrix while accounting for model complexity. Lower values indicate a better

fit between the model and the data. In general, values below 3 are considered indicative of an acceptable model fit, while values below 2 suggest an excellent fit. As shown in Table 4.3, the χ^2/df value of the measurement model is 1.953, which falls well below the recommended threshold of 3. This result indicates that the discrepancy between the sample covariance matrix and the model-implied covariance matrix is relatively small, suggesting that the measurement model adequately represents the observed data structure.

The root mean square error of approximation (RMSEA) evaluates the degree of approximation error in the model per degree of freedom. It reflects how well the model would fit the population covariance matrix if it were available. RMSEA values below 0.08 indicate an acceptable fit, while values below 0.05 are generally interpreted as indicating a very good fit. The RMSEA value reported in Table 4.3 is 0.033, which is substantially lower than the recommended threshold of 0.08. This value indicates that the measurement model exhibits very low approximation error and demonstrates strong model adequacy.

In addition to these indices, several absolute and incremental fit indices are used to further evaluate model performance. The goodness-of-fit index (GFI) assesses the proportion of variance and covariance in the sample data that is accounted for by the model. Values greater than 0.90 indicate that the model explains a large proportion of the observed covariance structure. In this study, the GFI value is 0.926, which exceeds the recommended standard and indicates a satisfactory level of model fit. The adjusted goodness-of-fit index (AGFI) further adjusts the GFI value by incorporating model complexity, thereby penalizing overly complex models. The AGFI value reported in Table 4.3 is 0.917, which also surpasses the recommended threshold of 0.90, suggesting that the model maintains good explanatory power even after accounting for model parsimony.

The normed fit index (NFI), Tucker–Lewis index (TLI), and comparative fit index (CFI) are incremental fit indices that compare the proposed measurement model with a null model in which no relationships among variables are assumed. These indices evaluate the extent to which the proposed model improves model fit relative to the baseline model. Values greater than 0.90 are generally considered indicative of acceptable fit, while values above 0.95 suggest a very good fit. As shown in Table 4.3, the NFI value is 0.936, the TLI value is 0.965, and the CFI value is 0.968. All of these values exceed the recommended thresholds and indicate that the proposed measurement model significantly improves upon the null model and provides an excellent representation of the data.

Table 4.3 Measure Model Fit Metrics

Fit index	χ^2/df	RMSEA	GFI	AGFI	NFI	TLI	CFI
Reference standards	<3	<0.08	>0.9	>0.9	>0.9	>0.9	>0.9
Result	1.953	0.033	0.926	0.917	0.936	0.965	0.968

4.2.2 Convergent Validity

Convergent validity refers to the extent to which multiple indicators designed to measure the same latent construct are strongly correlated with one another and jointly represent the underlying theoretical concept (Clark & Watson, 2019). In confirmatory factor analysis, convergent validity is typically evaluated using three main indicators, namely standardized factor loadings, composite reliability (CR), and the average variance extracted (AVE). Standardized factor loadings assess the strength of the relationship between observed indicators and their corresponding latent constructs. Composite reliability measures the internal consistency of the construct based on the factor loadings and error variances. The average variance extracted reflects the proportion of variance in the indicators that is explained by the latent construct. According to commonly accepted criteria, standardized factor loadings should generally exceed 0.50 and preferably 0.70, CR values should be greater than 0.70, and AVE values should be above 0.50 to indicate satisfactory convergent validity.

Table 4.4 presents the results of the convergent validity analysis for all constructs included in the measurement model. For the construct of university leadership, six observed indicators were used to measure perceptions of institutional leadership support for sustainability initiatives. The standardized factor loadings range from 0.699 to 0.828, indicating strong relationships between the latent construct and its measurement items. The composite reliability value for university leadership is 0.898, which is substantially higher than the recommended threshold of 0.70, demonstrating high internal consistency among the items. In addition, the AVE value is 0.596, exceeding the recommended minimum value of 0.50, which indicates that more than half of the variance in the observed indicators is explained by the underlying latent construct.

The construct of sustainability-oriented education is measured using five items that capture students' perceptions of sustainability-related learning experiences within the university environment. The standardized factor loadings for these items range from 0.733

to 0.805, all exceeding the acceptable threshold and demonstrating strong indicator reliability. The composite reliability value is 0.878, indicating a high level of internal consistency among the indicators. The AVE value is 0.591, which confirms that the construct explains a substantial proportion of the variance in its measurement items. These results suggest that the indicators effectively capture the concept of sustainability-oriented education within the measurement model.

Environmental values represent individuals' value-based orientation toward environmental protection and sustainability. This construct is measured using fourteen indicators, reflecting different aspects of value commitment to environmental responsibility. The standardized factor loadings range from 0.693 to 0.848, indicating that all items exhibit strong associations with the latent construct. The composite reliability value for environmental values is 0.952, which indicates very high internal consistency among the measurement items. The AVE value is 0.588, exceeding the recommended threshold of 0.50, which suggests that the latent construct explains a substantial portion of the variance in the observed indicators despite the relatively large number of items used to capture the construct.

Environmental beliefs are measured by six items that represent individuals' beliefs regarding environmental problems and the consequences of human actions on ecological systems. The standardized factor loadings range from 0.752 to 0.837, demonstrating strong indicator reliability across all items. The composite reliability value is 0.911, which indicates excellent internal consistency. The AVE value is 0.632, which is well above the recommended minimum of 0.50 and suggests that the construct captures a high proportion of the variance in its indicators. These results confirm that the measurement items provide a reliable representation of the environmental beliefs construct.

The construct of personal norms reflects an individual's perceived moral obligation to engage in environmentally responsible behavior. Five items were used to measure this construct, with standardized factor loadings ranging from 0.723 to 0.831. These values exceed the recommended threshold and demonstrate that each item contributes meaningfully to the measurement of the latent construct. The composite reliability value for personal norms is 0.864, indicating strong internal consistency among the indicators. The AVE value is 0.561, which surpasses the minimum recommended level and confirms that the construct explains more than half of the variance in the measurement items.

Finally, pro-environmental behavioral intention represents individuals' willingness or intention to engage in environmentally responsible behaviors. This construct is measured using seven indicators with standardized factor loadings ranging from 0.756 to 0.865. These relatively high loadings indicate strong relationships between the latent construct and its observed indicators. The composite reliability value is 0.926, indicating excellent internal consistency among the items. The AVE value is 0.640, which is well above the recommended threshold and indicates that a substantial portion of the variance in the indicators is captured by the latent construct.

Table 4.4 Convergence Validity

Variable	Item	Factor Loading	CR	AVE
University Leadership	UL1	0.828	0.898	0.596
	UL2	0.77		
	UL3	0.699		
	UL4	0.75		
	UL5	0.793		
	UL6	0.786		
Sustainability-oriented Education	SE1	0.749	0.878	0.591
	SE2	0.763		
	SE3	0.733		
	SE4	0.793		
	SE5	0.805		
Environmental Values	EV1	0.848	0.952	0.588
	EV2	0.734		
	EV3	0.721		
	EV4	0.693		
	EV5	0.706		
	EV6	0.775		
	EV7	0.804		
	EV8	0.771		
	EV9	0.762		

Table 4.4 (continued)

Variable	Item	Factor Loading	CR	AVE
	EV10	0.713		
	EV11	0.806		
	EV12	0.791		
	EV13	0.763		
	EV14	0.829		
Environmental Beliefs	EB1	0.816	0.911	0.632
	EB2	0.823		
	EB3	0.752		
	EB4	0.761		
	EB5	0.776		
	EB6	0.837		
Personal Norms	PN1	0.723	0.864	0.561
	PN2	0.831		
	PN3	0.732		
	PN4	0.729		
	PN5	0.725		
Pro-environmental Behavioral Intention	PEBI1	0.865	0.926	0.64
	PEBI2	0.846		
	PEBI3	0.76		
	PEBI4	0.77		
	PEBI5	0.801		
	PEBI6	0.796		
	PEBI7	0.756		

4.2.3 Discriminant Validity

Discriminant validity refers to the extent to which a construct is empirically distinct from other constructs in the model (Rönkkö & Cho, 2022). In other words, it assesses whether theoretically different constructs capture unique phenomena rather than measuring the same underlying concept. Establishing discriminant validity is an essential

step in confirmatory factor analysis because it ensures that each latent variable represents a specific conceptual domain and that the relationships among constructs are not artificially inflated due to measurement overlap. One of the most widely adopted approaches for evaluating discriminant validity in structural equation modeling is the Fornell–Larcker criterion. According to this method, discriminant validity is supported when the square root of the average variance extracted for each construct is greater than the correlations between that construct and all other constructs in the model.

Table 4.5 presents the results of the discriminant validity test based on the Fornell–Larcker criterion. In this table, the diagonal elements represent the square roots of the average variance extracted for each latent construct, while the off-diagonal elements represent the correlations between constructs. The abbreviations used in the table correspond to the study variables. UL represents university leadership, SE denotes sustainability-oriented education, EV refers to environmental values, EB indicates environmental beliefs, PN represents personal norms, and PEBI refers to pro-environmental behavioral intention. The double asterisks associated with the correlation coefficients indicate statistical significance at the 0.01 level.

As shown in Table 4.5, the square root of the average variance extracted for university leadership is 0.772. This value is greater than its correlations with all other constructs in the model, including sustainability-oriented education (0.405), environmental values (0.509), environmental beliefs (0.408), personal norms (0.342), and pro-environmental behavioral intention (0.459). This result indicates that the university leadership construct shares more variance with its own indicators than with other constructs, thereby supporting discriminant validity.

Similarly, the square root of the average variance extracted for sustainability-oriented education is 0.769. This value exceeds its correlations with university leadership (0.405), environmental values (0.381), environmental beliefs (0.434), personal norms (0.571), and pro-environmental behavioral intention (0.598). Although sustainability-oriented education shows moderate correlations with several constructs, particularly personal norms and pro-environmental behavioral intention, these correlations remain lower than the square root of its AVE. This indicates that sustainability-oriented education remains empirically distinguishable from the other constructs.

For the construct of environmental values, the square root of the AVE is 0.767. This value is higher than its correlations with university leadership (0.509), sustainability-oriented education (0.381), environmental beliefs (0.473), personal norms (0.427), and pro-environmental behavioral intention (0.569). These results demonstrate that the environmental values construct possesses sufficient distinctiveness relative to the other constructs included in the study model.

Environmental beliefs exhibit a square root of AVE equal to 0.795. This value exceeds the correlations between environmental beliefs and university leadership (0.408), sustainability-oriented education (0.434), environmental values (0.473), personal norms (0.516), and pro-environmental behavioral intention (0.664). Although environmental beliefs show a relatively strong correlation with pro-environmental behavioral intention, the square root of AVE remains higher, indicating that the construct maintains adequate discriminant validity.

The construct of personal norms has a square root of AVE value of 0.749. This value is greater than its correlations with university leadership (0.342), sustainability-oriented education (0.571), environmental values (0.427), environmental beliefs (0.516), and pro-environmental behavioral intention (0.637). These results confirm that personal norms represent a conceptually and empirically distinct construct within the measurement model.

Finally, the square root of the AVE for pro-environmental behavioral intention is 0.800, which is higher than its correlations with university leadership (0.459), sustainability-oriented education (0.598), environmental values (0.569), environmental beliefs (0.664), and personal norms (0.637). This indicates that the construct of pro-environmental behavioral intention captures a unique dimension of behavioral intention that is not redundant with the other latent variables.

Table 4.5 Discriminant Validity Test

Latent variables	**UL**	**SE**	**EV**	**EB**	**PN**	**PEBI**
UL	0.772					
SE	.405**	0.769				
EV	.509**	.381**	0.767			
EB	.408**	.434**	.473**	0.795		

Table 4.5 (continued)

Latent variables	UL	SE	EV	EB	PN	PEBI
PN	.342**	.571**	.427**	.516**	0.749	
PEBI	.459**	.598**	.569**	.664**	.637**	0.800

Note: The abbreviations used in this table represent the following constructs. UL refers to university leadership. SE denotes sustainability-oriented education. EV represents environmental values. EB indicates environmental beliefs. PN refers to personal norms. PEBI represents pro-environmental behavioral intention. Diagonal elements are the square roots of the average variance extracted. Off-diagonal elements represent the correlations between constructs. ** indicates significance at the 0.01 level.

4.3 Structural Model Path Analysis

4.3.1 Model Fit Metrics for the Structural Model

After confirming the reliability and validity of the measurement model, the structural model was estimated to examine the hypothesized causal relationships among the latent constructs. Structural equation modeling was employed to test the theoretical framework derived from the value–belief–norm perspective combined with institutional support factors. Prior to interpreting the structural paths, it is necessary to evaluate the overall fit of the structural model to ensure that the proposed theoretical structure adequately represents the observed data. Model fit assessment examines whether the covariance matrix implied by the structural model closely approximates the empirical covariance matrix obtained from the sample data. Multiple goodness-of-fit indices are typically considered simultaneously to provide a comprehensive evaluation of model adequacy.

Table 4.6 presents the fit metrics for the structural model. These metrics include the chi-square to degrees of freedom ratio (χ^2/df), the root mean square error of approximation (RMSEA), the goodness-of-fit index (GFI), the adjusted goodness-of-fit index (AGFI), and several incremental fit indices including the normed fit index (NFI), Tucker–Lewis index (TLI), and comparative fit index (CFI). Each of these indices evaluates model performance from a different statistical perspective, allowing a more reliable judgment of overall model fit.

The chi-square to degrees of freedom ratio is a commonly used index for assessing the discrepancy between the observed covariance matrix and the model-implied

covariance matrix while adjusting for model complexity. Smaller values indicate better model fit. In structural equation modeling study, values lower than 3 are generally considered acceptable, and values below 2 suggest a very good fit. As reported in Table 4.6, the χ^2/df value of the structural model is 1.969, which falls comfortably below the recommended threshold of 3. This result indicates that the difference between the observed data and the model-implied covariance structure is relatively small, suggesting that the structural model provides a satisfactory representation of the empirical data.

The root mean square error of approximation evaluates the degree of approximation error per degree of freedom in the model and reflects how well the model would fit the population covariance matrix. RMSEA values lower than 0.08 indicate acceptable model fit, while values below 0.05 suggest excellent model fit. The RMSEA value reported in Table 4.6 is 0.034, which is substantially lower than the recommended threshold. This result indicates that the structural model exhibits a very low level of approximation error and provides strong evidence of good model adequacy.

The goodness-of-fit index measures the proportion of variance and covariance in the data that is explained by the model. Values greater than 0.90 are typically interpreted as indicating satisfactory model fit. In this study, the GFI value is 0.925, which exceeds the recommended standard and indicates that the structural model explains a large proportion of the covariance structure among the observed variables. The adjusted goodness-of-fit index further adjusts the GFI value by accounting for model complexity. The AGFI value obtained in the analysis is 0.916, which also surpasses the recommended threshold of 0.90, demonstrating that the structural model maintains strong explanatory power even after adjusting for model parsimony.

Incremental fit indices are also used to compare the proposed model with a baseline model in which all variables are assumed to be independent. The normed fit index evaluates the relative improvement of the proposed model compared with the null model. The NFI value in this study is 0.935, which exceeds the commonly recommended value of 0.90, indicating that the proposed structural model significantly improves model fit relative to the baseline model. The Tucker–Lewis index further evaluates model fit while penalizing model complexity. The TLI value is 0.965, which is well above the recommended threshold and indicates excellent model performance. Similarly, the comparative fit index assesses the improvement of the proposed model relative to the

independence model while correcting for sample size effects. The CFI value of 0.967 also exceeds the recommended standard of 0.90 and approaches the level typically associated with excellent model fit.

Table 4.6 Model Fit Metrics

Fit index	χ^2/df	RMSEA	GFI	AGFI	NFI	TLI	CFI
Reference standards	<3	<0.08	>0.9	>0.9	>0.9	>0.9	>0.9
Result	1.969	0.034	0.925	0.916	0.935	0.965	0.967

4.3.2 Path Analysis for Direct Effects

After confirming that the structural model demonstrates satisfactory overall fit, the next step involves examining the direct structural relationships among the latent constructs in order to test the proposed hypotheses. Table 4.7 reports the standardized path coefficients, standard errors, critical ratios, and significance levels for each hypothesized relationship. The standardized effect value (β) represents the strength and direction of the relationship between constructs. The standard error reflects the estimation precision of the coefficient, while the critical ratio represents the ratio between the parameter estimate and its standard error, functioning similarly to a t statistic. In structural equation modeling, a critical ratio greater than approximately 1.96 generally indicates statistical significance at the 0.05 level, whereas higher values indicate stronger statistical evidence. The significance level is further reported using p values, with *** indicating significance at the level of $p < 0.001$.

The first group of hypotheses examines the influence of university leadership on the key constructs within the model. Hypothesis H1a proposed that university leadership positively influences pro-environmental behavioral intention. The standardized path coefficient for the relationship between university leadership and pro-environmental behavioral intention is 0.037, with a critical ratio of 1.254 and a p value of 0.21. Because the significance level does not reach the commonly accepted threshold, this relationship is not statistically supported. This result indicates that university leadership does not exert a significant direct effect on students' pro-environmental behavioral intention within the model.

Hypothesis H1b proposed that university leadership positively influences environmental values. The results indicate a strong and statistically significant relationship between these constructs, with a standardized coefficient of 0.45 and a critical ratio of 11.834, which is highly significant at $p < 0.001$. This finding suggests that stronger perceptions of institutional leadership support for sustainability initiatives are associated with higher levels of environmental value orientation among students. Therefore, H1b is supported.

Hypothesis H1c examined the relationship between university leadership and environmental beliefs. The results indicate a positive and statistically significant effect, with a standardized coefficient of 0.154 and a critical ratio of 3.76. The significance level confirms that university leadership contributes positively to the development of environmental beliefs, although the magnitude of the effect is relatively moderate compared with the effect on environmental values. Consequently, H1c is supported.

Hypothesis H1d proposed that university leadership positively influences personal norms related to environmental responsibility. However, the results show a standardized coefficient of 0.011 with a critical ratio of 0.308 and a p value of 0.758. This relationship is statistically insignificant, indicating that university leadership does not directly influence students' internalized moral obligations toward pro-environmental behavior. Therefore, H1d is not supported.

The second group of hypotheses examines the influence of sustainability-oriented education on the psychological constructs within the model. Hypothesis H2a proposed that sustainability-oriented education positively influences environmental values. The results reveal a statistically significant relationship with a standardized coefficient of 0.225 and a critical ratio of 6.134. This finding indicates that exposure to sustainability-related educational experiences contributes positively to the formation of environmental value orientations among students. Thus, H2a is supported.

Hypothesis H2b examined the effect of sustainability-oriented education on environmental beliefs. The standardized coefficient for this path is 0.287 with a critical ratio of 7.343, which is statistically significant at the 0.001 level. This result suggests that sustainability-oriented educational activities strengthen students' beliefs regarding environmental responsibility and ecological consequences. Accordingly, H2b is supported.

Hypothesis H2c proposed that sustainability-oriented education positively influences personal norms. The analysis reveals a relatively strong positive effect, with a standardized coefficient of 0.49 and a critical ratio of 11.382. This result indicates that sustainability-oriented education plays a particularly important role in shaping students' internalized moral responsibility toward environmental protection. Consequently, H2c is supported.

Hypothesis H2d examined whether sustainability-oriented education directly influences pro-environmental behavioral intention. The results show a positive and statistically significant relationship with a standardized coefficient of 0.231 and a critical ratio of 6.444. This finding indicates that sustainability-oriented education not only shapes psychological antecedents but also directly encourages behavioral intentions toward environmentally responsible actions. Therefore, H2d is supported.

The next set of hypotheses focuses on the internal relationships among the psychological constructs derived from the value–belief–norm theoretical framework. Hypothesis H3 proposed that environmental values positively influence pro-environmental behavioral intention. The results support this relationship, with a standardized coefficient of 0.193 and a critical ratio of 6.522. This finding suggests that stronger pro-environmental values are associated with higher intentions to engage in environmentally responsible behavior.

Hypothesis H4 proposed that environmental beliefs positively influence pro-environmental behavioral intention. The standardized coefficient for this path is 0.357 with a critical ratio of 10.698, indicating a strong and statistically significant relationship. Among the psychological predictors, environmental beliefs demonstrate one of the strongest direct effects on behavioral intention.

Hypothesis H5 examined the influence of personal norms on pro-environmental behavioral intention. The results show a positive and significant relationship with a standardized coefficient of 0.244 and a critical ratio of 6.475. This finding suggests that individuals who experience stronger moral obligations toward environmental protection are more likely to express intentions to engage in pro-environmental behavior.

Hypothesis H6 proposed that environmental values positively influence environmental beliefs. The analysis confirms this relationship with a standardized coefficient of 0.299 and a critical ratio of 7.534. This result indicates that value orientations

toward environmental protection contribute to the development of beliefs about environmental consequences and responsibility.

Finally, hypothesis H7 examined whether environmental beliefs positively influence personal norms. The results indicate a significant positive effect with a standardized coefficient of 0.339 and a critical ratio of 8.809. This finding suggests that individuals who strongly believe in environmental responsibility are more likely to internalize moral obligations toward environmentally responsible behavior.

Table 4.7 Direct Path Effects

Hypothesis	Structural path	Effect value (β)	SE	C.R.	P	Results
H1a	UL → PEBI	0.037	0.024	1.254	0.21	Not supported
H1b	UL → EV	0.45	0.031	11.834	***	Supported
H1c	UL → EB	0.154	0.04	3.76	***	Supported
H1d	UL → PN	0.011	0.024	0.308	0.758	Not supported
H2a	SE → EV	0.225	0.036	6.134	***	Supported
H2b	SE → EB	0.287	0.046	7.343	***	Supported
H2c	SE → PN	0.49	0.035	11.382	***	Supported
H2d	SE → PEBI	0.231	0.035	6.444	***	Supported
H3	EV → PEBI	0.193	0.03	6.522	***	Supported
H4	EB → PEBI	0.357	0.028	10.698	***	Supported
H5	PN → PEBI	0.244	0.045	6.475	***	Supported
H6	EV → EB	0.299	0.048	7.534	***	Supported
H7	EB → PN	0.339	0.027	8.809	***	Supported

Note: UL refers to university leadership. SE denotes sustainability-oriented education. EV represents environmental values. EB indicates environmental beliefs. PN refers to personal norms. PEBI represents pro-environmental behavioral intention. *** indicates significance at $p < 0.001$.

Figure 4.2 illustrates the structural model estimated using structural equation modeling to test the hypothesized relationships among the key constructs in the study. Similar to the measurement model diagram, ellipses represent latent constructs, rectangles represent observed indicators, and small circles represent measurement error terms

associated with each indicator. The arrows connecting latent constructs represent the causal relationships specified in the theoretical framework, while the numerical values displayed along these arrows represent the standardized path coefficients. These coefficients quantify the strength and direction of the relationships among the constructs and provide the empirical evidence for hypothesis testing.

The measurement component of the structural model remains consistent with the previously validated measurement model. Each latent construct is measured by multiple observed indicators with substantial factor loadings, indicating strong associations between the latent variables and their respective measurement items. University leadership is represented by six observed items, with standardized factor loadings ranging from approximately 0.699 to 0.828, indicating that the indicators reliably capture students' perceptions of institutional leadership support for sustainability initiatives. Sustainability-oriented education is measured by five items with loadings ranging from approximately 0.733 to 0.805, demonstrating that the indicators effectively represent students' exposure to sustainability-related educational experiences. Environmental values are measured by fourteen indicators with loadings between approximately 0.693 and 0.848, reflecting a broad and stable representation of value orientations toward environmental protection. Environmental beliefs are represented by six indicators with loadings between approximately 0.752 and 0.837, while personal norms are measured by five indicators with loadings ranging from approximately 0.722 to 0.832. Finally, pro-environmental behavioral intention is measured by seven indicators with factor loadings between approximately 0.755 and 0.864, indicating strong reliability of the behavioral intention construct.

The structural component of the model depicts the hypothesized causal relationships among the constructs derived from the extended value–belief–norm theoretical framework. As illustrated in the diagram, university leadership and sustainability-oriented education function as the primary institutional antecedents influencing students' environmental cognition and behavioral intentions. The path from university leadership to environmental values shows a relatively strong standardized coefficient of 0.450, indicating that institutional leadership plays a significant role in shaping students' environmental value orientations. University leadership also exerts a smaller but significant influence on environmental beliefs, with a standardized coefficient

of 0.154. However, the direct paths from university leadership to personal norms and pro-environmental behavioral intention are very weak, with coefficients of 0.011 and 0.037 respectively, indicating that leadership does not directly influence these outcomes but instead operates through indirect psychological mechanisms.

Sustainability-oriented education demonstrates substantial effects on several downstream constructs. The path from sustainability-oriented education to environmental values has a standardized coefficient of 0.225, suggesting that sustainability-focused educational experiences contribute positively to students' environmental value formation. The influence of sustainability-oriented education on environmental beliefs is also significant, with a coefficient of 0.287. Furthermore, sustainability-oriented education shows a strong influence on personal norms, with a standardized coefficient of 0.490, indicating that sustainability-oriented curricula and educational activities play an important role in shaping students' internalized moral obligations toward environmental responsibility. In addition, sustainability-oriented education has a direct positive effect on pro-environmental behavioral intention, with a standardized coefficient of 0.231.

The internal relationships among the psychological constructs follow the logical sequence proposed in the value–belief–norm framework. Environmental values significantly influence environmental beliefs, with a standardized coefficient of 0.299, indicating that stronger environmental value orientations contribute to stronger ecological beliefs. Environmental beliefs, in turn, positively influence personal norms with a coefficient of 0.339, demonstrating that individuals who recognize environmental consequences and responsibilities are more likely to internalize moral obligations toward environmental protection.

Finally, pro-environmental behavioral intention is influenced by three key psychological constructs. Environmental values exert a positive influence on behavioral intention with a coefficient of 0.193, indicating that individuals who hold stronger pro-environmental values are more likely to intend to engage in environmentally responsible actions. Environmental beliefs show a stronger effect on behavioral intention, with a coefficient of 0.357, suggesting that beliefs about environmental consequences and responsibility play an important role in motivating behavioral intentions. Personal norms also significantly influence behavioral intention, with a standardized coefficient of 0.244,

reflecting the role of moral obligation in shaping individuals' willingness to engage in pro-environmental behavior.

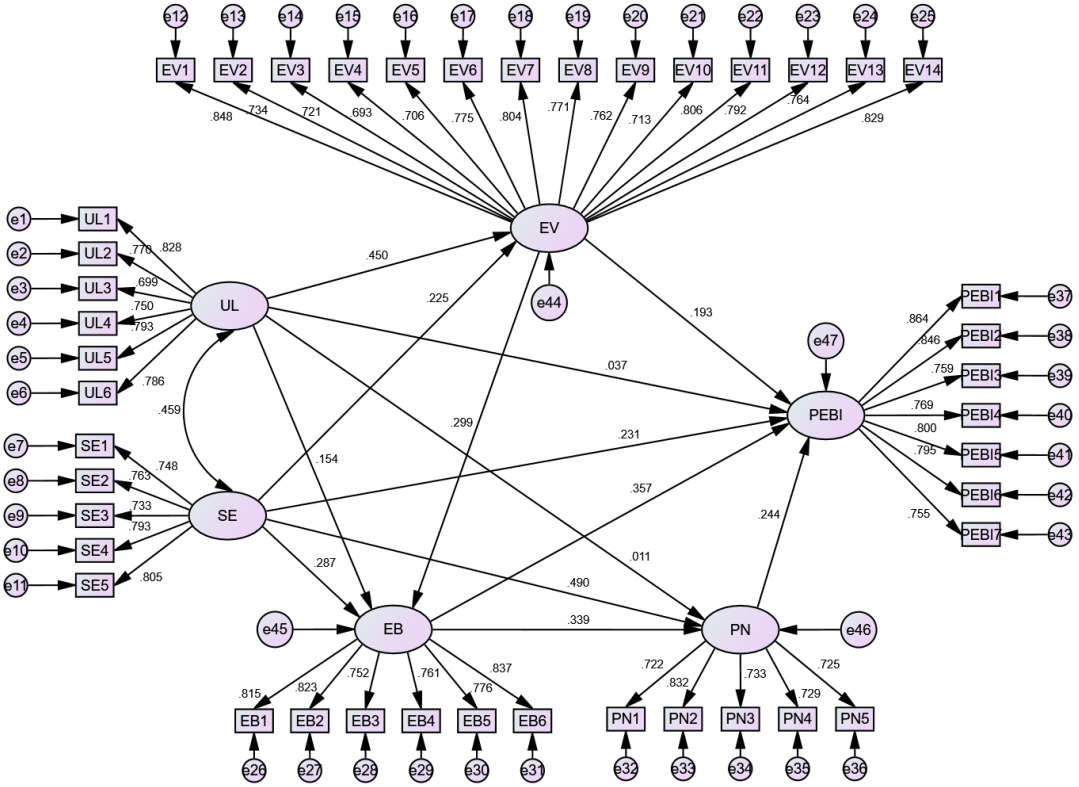

Figure 4.2 Structural model

4.3.3 Path Analysis for Indirect Effects

In addition to examining the direct relationships among constructs, the study further investigates the mediating mechanisms within the proposed theoretical framework. Mediation analysis helps determine whether the influence of one construct on another occurs indirectly through an intervening variable. In structural equation modeling, the bootstrap method is widely used to test indirect effects because it does not assume normal distribution of the sampling distribution of indirect effects and provides more robust statistical inference. The bootstrap procedure repeatedly resamples the dataset to estimate the indirect effect and its confidence interval. If the 95 percent confidence interval does not include zero, the mediation effect is considered statistically significant.

Table 4.8 presents the results of the bootstrap analysis for indirect effects, including the estimated effect values, standard errors, and the lower and upper bounds of the 95 percent confidence intervals for each mediation pathway. The results provide empirical

evidence regarding the mediating roles of environmental values, environmental beliefs, and personal norms in the relationships between institutional factors and pro-environmental behavioral intention.

The first group of mediation hypotheses examines the mediating role of environmental values. Hypothesis H8a proposes that environmental values mediate the relationship between university leadership and pro-environmental behavioral intention. The bootstrap analysis shows an indirect effect value of 0.087 with a standard error of 0.02. The 95 percent confidence interval ranges from 0.052 to 0.13, and since this interval does not include zero, the mediation effect is statistically significant. This result indicates that university leadership influences pro-environmental behavioral intention indirectly through its positive impact on environmental values. Therefore, H8a is supported.

Hypothesis H8b examines whether environmental values mediate the relationship between sustainability-oriented education and pro-environmental behavioral intention. The results indicate an indirect effect value of 0.043 with a standard error of 0.012, and the 95 percent confidence interval ranges from 0.023 to 0.07. Because the confidence interval excludes zero, the mediation effect is statistically significant. This finding suggests that sustainability-oriented education contributes to pro-environmental behavioral intention partly by strengthening students' environmental values. Thus, H8b is supported.

Hypothesis H8c tests whether environmental values mediate the relationship between university leadership and environmental beliefs. The bootstrap analysis shows an indirect effect value of 0.134 with a standard error of 0.025, and the confidence interval ranges from 0.09 to 0.189. Since zero is not included in this interval, the mediation effect is significant. This result indicates that university leadership contributes to the formation of environmental beliefs indirectly through its influence on environmental values. Therefore, H8c is supported.

Hypothesis H8d examines whether environmental values mediate the relationship between sustainability-oriented education and environmental beliefs. The estimated indirect effect is 0.067 with a standard error of 0.018, and the 95 percent confidence interval ranges from 0.037 to 0.106. Because the interval does not include zero, the mediation effect is statistically significant. This result indicates that sustainability-oriented

education strengthens environmental beliefs partially through its positive influence on environmental values. Accordingly, H8d is supported.

The second group of mediation hypotheses focuses on the mediating role of environmental beliefs. Hypothesis H9a proposes that environmental beliefs mediate the relationship between university leadership and pro-environmental behavioral intention. The results indicate an indirect effect value of 0.055 with a standard error of 0.017, and the 95 percent confidence interval ranges from 0.025 to 0.09. Since the confidence interval does not include zero, the mediation effect is significant, supporting H9a.

Hypothesis H9b examines whether environmental beliefs mediate the relationship between sustainability-oriented education and pro-environmental behavioral intention. The results show an indirect effect value of 0.102 with a standard error of 0.016, and the confidence interval ranges from 0.074 to 0.136. This interval excludes zero, indicating a statistically significant mediation effect. This finding suggests that sustainability-oriented education indirectly enhances pro-environmental behavioral intention through strengthening environmental beliefs. Therefore, H9b is supported.

Hypothesis H9c tests whether environmental beliefs mediate the relationship between university leadership and personal norms. The estimated indirect effect is 0.052 with a standard error of 0.016, and the confidence interval ranges from 0.025 to 0.09. Since the interval does not include zero, the mediation effect is statistically significant. This result indicates that university leadership indirectly influences personal norms through the formation of environmental beliefs. Thus, H9c is supported.

Hypothesis H9d examines whether environmental beliefs mediate the relationship between sustainability-oriented education and personal norms. The bootstrap results indicate an indirect effect value of 0.097 with a standard error of 0.017, and the confidence interval ranges from 0.069 to 0.138. Because the interval excludes zero, the mediation effect is significant. This finding suggests that sustainability-oriented education contributes to stronger personal norms partly through its effect on environmental beliefs. Therefore, H9d is supported.

Hypothesis H9e tests the mediating role of environmental beliefs in the relationship between environmental values and personal norms. The estimated indirect effect is 0.101 with a standard error of 0.023, and the confidence interval ranges from 0.06 to 0.153. Since the interval does not include zero, the mediation effect is statistically significant. This

result indicates that environmental values influence personal norms indirectly through environmental beliefs, supporting H9e.

The final group of mediation hypotheses focuses on the mediating role of personal norms. Hypothesis H10a proposes that personal norms mediate the relationship between university leadership and pro-environmental behavioral intention. The bootstrap analysis shows an indirect effect value of 0.003 with a standard error of 0.011, and the 95 percent confidence interval ranges from -0.019 to 0.024. Because this interval includes zero, the mediation effect is not statistically significant. This result indicates that personal norms do not mediate the relationship between university leadership and pro-environmental behavioral intention. Therefore, H10a is not supported.

Hypothesis H10b examines whether personal norms mediate the relationship between sustainability-oriented education and pro-environmental behavioral intention. The results indicate an indirect effect value of 0.12 with a standard error of 0.027, and the confidence interval ranges from 0.07 to 0.174. Since the interval does not include zero, the mediation effect is statistically significant. This finding suggests that sustainability-oriented education influences pro-environmental behavioral intention partly through strengthening students' personal norms. Thus, H10b is supported.

Finally, hypothesis H10c tests whether personal norms mediate the relationship between environmental beliefs and pro-environmental behavioral intention. The bootstrap results show an indirect effect value of 0.083 with a standard error of 0.019, and the confidence interval ranges from 0.049 to 0.124. Because the confidence interval excludes zero, the mediation effect is statistically significant. This indicates that environmental beliefs indirectly influence pro-environmental behavioral intention through personal norms. Therefore, H10c is supported.

Table 4.8 Indirect Effect Bootstrap Analysis

Hypothesis	Mediation path	Effect value	SE	Lower 95% CI	Upper 95% CI	Results
H8a	UL → EV → PEBI	0.087	0.02	0.052	0.13	Supported
H8b	SE → EV → PEBI	0.043	0.012	0.023	0.07	Supported
H8c	UL → EV → EB	0.134	0.025	0.09	0.189	Supported

Table 4.8 (continued)

Hypothesis	Mediation path	Effect value	SE	Lower 95% CI	Upper 95% CI	Results
H8d	SE → EV → EB	0.067	0.018	0.037	0.106	Supported
H9a	UL → EB → PEBI	0.055	0.017	0.025	0.09	Supported
H9b	SE → EB → PEBI	0.102	0.016	0.074	0.136	Supported
H9c	UL → EB → PN	0.052	0.016	0.025	0.09	Supported
H9d	SE → EB → PN	0.097	0.017	0.069	0.138	Supported
H9e	EV → EB → PN	0.101	0.023	0.06	0.153	Supported
H10a	UL → PN → PEBI	0.003	0.011	-0.019	0.024	Not supported
H10b	SE → PN → PEBI	0.12	0.027	0.07	0.174	Supported
H10c	EB → PN → PEBI	0.083	0.019	0.049	0.124	Supported

Note: UL refers to university leadership. SE denotes sustainability-oriented education. EV represents environmental values. EB indicates environmental beliefs. PN refers to personal norms. PEBI represents pro-environmental behavioral intention.

4.3.4 Total Effects

In addition to examining the direct and indirect relationships among constructs, the total effects analysis provides a comprehensive assessment of the overall influence that each independent variable exerts on other constructs within the structural model. The total effect represents the sum of direct and indirect effects between two variables, thereby capturing the complete magnitude of influence transmitted through all possible pathways in the model. Evaluating total effects is particularly important in complex structural models where certain variables may exert relatively small direct effects but substantial indirect effects through mediating mechanisms. Table 4.9 presents the estimated total effects for the key structural relationships, along with the corresponding standard errors and the lower and upper bounds of the 95 percent confidence intervals obtained through bootstrap estimation.

The first set of total effects concerns the influence of institutional antecedents on environmental values. The results indicate that university leadership has a significant positive total effect on environmental values with an effect size of 0.45. The corresponding

95 percent confidence interval ranges from 0.389 to 0.51, indicating that the effect is statistically significant and robust. This finding suggests that institutional leadership plays an important role in shaping students' environmental value orientations. Similarly, sustainability-oriented education also exerts a significant positive influence on environmental values, with a total effect of 0.225 and a confidence interval ranging from 0.154 to 0.296. Although this effect is smaller than that of university leadership, it still indicates that sustainability-related educational experiences contribute meaningfully to the development of environmental values among students.

The second set of relationships concerns the determinants of environmental beliefs. University leadership demonstrates a total effect of 0.288 on environmental beliefs, with the confidence interval ranging from 0.208 to 0.368. This result indicates that leadership influences students' environmental beliefs both directly and indirectly through environmental values. Sustainability-oriented education shows an even stronger total effect on environmental beliefs, with an effect size of 0.354 and a confidence interval ranging from 0.27 to 0.438. These findings highlight the important role of sustainability-oriented education in strengthening environmental beliefs. In addition, environmental values exert a direct and significant influence on environmental beliefs with a total effect of 0.299, further supporting the sequential relationship proposed in the value–belief–norm theoretical framework.

The analysis also examines the factors influencing personal norms. University leadership demonstrates a relatively small but statistically significant total effect on personal norms, with an effect size of 0.063 and a confidence interval ranging from 0.012 to 0.114. This result indicates that the influence of leadership on personal norms occurs primarily through indirect pathways rather than through a strong direct relationship. In contrast, sustainability-oriented education shows a much stronger total effect on personal norms, with an effect size of 0.587 and a confidence interval ranging from 0.513 to 0.661. This finding suggests that sustainability-focused educational experiences play a crucial role in fostering students' internalized moral responsibility toward environmental protection. Environmental beliefs also exert a substantial influence on personal norms, with a total effect of 0.44 and a confidence interval ranging from 0.374 to 0.506. This result confirms the theoretical proposition that beliefs about environmental responsibility contribute significantly to the formation of moral obligations.

Finally, the total effects on pro-environmental behavioral intention are examined. University leadership exhibits a total effect of 0.182 on pro-environmental behavioral intention, with a confidence interval ranging from 0.119 to 0.245. Although the direct effect of leadership on behavioral intention was not statistically significant, the total effect indicates that leadership still influences behavioral intention indirectly through the mediating constructs of environmental values, environmental beliefs, and personal norms. Sustainability-oriented education shows a particularly strong total effect on pro-environmental behavioral intention, with an effect size of 0.496 and a confidence interval ranging from 0.416 to 0.576. This finding highlights the central role of sustainability-oriented education in shaping students' willingness to engage in environmentally responsible behavior.

Among the psychological constructs, environmental values demonstrate a total effect of 0.294 on pro-environmental behavioral intention, while environmental beliefs exhibit an even stronger effect of 0.44. These results indicate that belief-based cognitive evaluations of environmental responsibility play a particularly important role in motivating pro-environmental behavioral intentions. Personal norms also significantly influence behavioral intention, with a total effect of 0.244 and a confidence interval ranging from 0.156 to 0.332. This result confirms the importance of internalized moral obligation as a key determinant of environmentally responsible behavioral intention.

Table 4.9 Total Effects

Effect path	Effect size	SE	Lower 95% CI	Upper 95% CI
UL → EV	0.45	0.031	0.389	0.51
SE → EV	0.225	0.036	0.154	0.296
UL → EB	0.288	0.041	0.208	0.368
SE → EB	0.354	0.043	0.27	0.438
EV → EB	0.299	0.048	0.205	0.393
UL → PN	0.063	0.026	0.012	0.114
SE → PN	0.587	0.038	0.513	0.661
EB → PN	0.44	0.034	0.374	0.506
UL → PEBI	0.182	0.032	0.119	0.245
SE → PEBI	0.496	0.041	0.416	0.576

Table 4.9 (continued)

Effect path	Effect size	SE	Lower 95% CI	Upper 95% CI
EV → PEBI	0.294	0.037	0.222	0.366
EB → PEBI	0.44	0.032	0.378	0.502
PN → PEBI	0.244	0.045	0.156	0.332

Note: UL refers to university leadership. SE denotes sustainability-oriented education. EV represents environmental values. EB indicates environmental beliefs. PN refers to personal norms. PEBI represents pro-environmental behavioral intention.

4.4 Conclusion

This chapter reported the empirical results of the study by describing the sample profile, assessing the psychometric properties of the measures, and testing the proposed structural relationships. The descriptive findings indicate that the respondents are broadly distributed across regions, gender, age groups, grade levels, academic majors, and urban–rural backgrounds, supporting the heterogeneity of the dataset. Item-level distributions show moderate to relatively positive evaluations across the constructs, and the skewness and kurtosis statistics remain within acceptable ranges, suggesting that the data are suitable for subsequent structural equation modeling.

Confirmatory factor analysis indicates satisfactory measurement model fit, with substantial factor loadings and acceptable global fit indices. Convergent validity is supported by composite reliability and average variance extracted values meeting conventional criteria, while discriminant validity is confirmed by the Fornell–Larcker test, indicating that each construct captures a distinct conceptual domain.

The structural results support the core logic of the extended value–belief–norm framework embedded in an institutional context. Sustainability-oriented education demonstrates significant effects on environmental values, environmental beliefs, personal norms, and pro-environmental behavioral intention, highlighting its central role in shaping both psychological antecedents and behavioral intention. University leadership significantly strengthens environmental values and environmental beliefs but does not exert a significant direct effect on personal norms or pro-environmental behavioral intention, implying that leadership primarily influences behavioral intention through indirect psychological pathways. The value–belief–norm sequence is empirically supported, as environmental values enhance environmental beliefs, environmental beliefs

strengthen personal norms, and environmental values, beliefs, and norms jointly predict pro-environmental behavioral intention, with environmental beliefs showing the strongest direct effect among the psychological predictors.

Mediation and total effect analyses further clarify the transmission mechanisms. Environmental values, environmental beliefs, and personal norms serve as key mediators linking institutional antecedents to pro-environmental behavioral intention. Sustainability-oriented education exhibits both direct and indirect influences on behavioral intention, whereas the contribution of university leadership is largely indirect. The total effects indicate that sustainability-oriented education exerts the strongest overall influence on pro-environmental behavioral intention, reinforcing the importance of sustainability-focused educational exposure in motivating energy-saving and environmentally responsible intentions in the higher education setting.

CHAPTER 5
DISCUSSION AND CONCLUSION

This chapter presents the discussion and conclusions of this study by interpreting the empirical findings and highlighting their theoretical and practical implications. The chapter first discusses the results in relation to the study objectives, examining how university leadership and sustainability-oriented education influence students' pro-environmental behavioral intention and how environmental values, environmental beliefs, and personal norms interact within the proposed framework. Through the discussion of the three study objectives, the relationships among institutional factors and psychological mechanisms are interpreted based on the empirical results of the structural model and mediation analysis. Building on this discussion, implication to theories elaborates on how the findings contribute to the development of the Value–Belief–Norm (VBN) theory and social support theory within the context of higher education sustainability study. The chapter then presents implication to practitioners, outlining practical recommendations for university leadership, sustainability educators, higher education institutions, and higher education policymakers in promoting pro-environmental behavioral intentions among students. Subsequently, Limitation of the study and implications of future study discusses the main limitations of the present study and proposes directions for future studies that could further expand the understanding of pro-environmental behavior in higher education contexts. Finally, the chapter concludes with Conclusion, which summarizes the key findings of the study and highlights the overall contributions of the study to sustainability education and environmental behavior literature.

RO1: To investigate the relationships between university leadership, sustainability-oriented education and HEIs students' pro-environmental behavioral intention in Shanxi Province.

The first study objective aimed to investigate the relationships between university leadership, sustainability-oriented education, and higher education students' pro-environmental behavioral intention in Shanxi Province. This objective focuses on

understanding how institutional factors within higher education institutions influence students' willingness to engage in environmentally responsible behavior. The empirical results provide detailed insights into how these institutional elements operate within the proposed theoretical framework and how they contribute to shaping students' environmental cognition and behavioral intentions.

The results indicate that sustainability-oriented education plays a significant and direct role in influencing students' pro-environmental behavioral intention. The structural model shows that sustainability-oriented education has a positive and statistically significant effect on pro-environmental behavioral intention , supporting H2d. This finding suggests that educational experiences related to sustainability—such as environmental courses, sustainability-themed activities, and institutional initiatives promoting energy conservation—can directly enhance students' willingness to engage in environmentally responsible behaviors. The significance of this relationship implies that when sustainability concepts are integrated into university curricula and campus practices, students are more likely to translate environmental knowledge into behavioral intentions. In addition to this direct effect, sustainability-oriented education also exerts strong influences on several psychological antecedents of pro-environmental behavior. Specifically, sustainability-oriented education significantly affects environmental values, supporting H2a, indicating that exposure to sustainability-focused learning environments helps students develop stronger value orientations toward environmental protection. Sustainability-oriented education also shows a significant positive effect on environmental beliefs, supporting H2b, which suggests that sustainability education strengthens students' beliefs regarding environmental responsibility and the consequences of human activities on ecological systems. Furthermore, the relationship between sustainability-oriented education and personal norms is particularly strong, supporting H2c. This relatively large coefficient indicates that sustainability-oriented education plays an important role in shaping students' sense of moral obligation toward environmental protection. Through exposure to sustainability knowledge and environmental practices within the university environment, students may internalize stronger normative commitments to environmentally responsible behavior.

In contrast to sustainability-oriented education, the results show that university leadership does not directly influence students' pro-environmental behavioral intention.

The path coefficient from university leadership to pro-environmental behavioral intention is relatively small and statistically insignificant, leading to the rejection of H1a. This finding indicates that the presence of institutional leadership support for sustainability initiatives does not automatically translate into stronger behavioral intentions among students. One possible explanation is that leadership actions may be perceived at the organizational or administrative level but may not directly affect students' daily behavioral decision-making. Students may not always experience leadership initiatives in ways that directly influence their personal environmental behavior unless these initiatives are translated into concrete educational programs or campus practices. Similarly, the relationship between university leadership and personal norms is also not statistically significant, resulting in the rejection of H1d. This result suggests that leadership efforts alone may not be sufficient to generate a strong sense of moral obligation toward environmental protection among students. Personal norms often develop through internalization processes that are influenced by knowledge acquisition, belief formation, and personal reflection rather than through top-down institutional signals alone.

Although university leadership does not show a significant direct effect on pro-environmental behavioral intention or personal norms, it does significantly influence the cognitive components of the model. The empirical results indicate that university leadership has a strong positive effect on environmental values, supporting H1b. This relatively high coefficient suggests that institutional leadership plays an important role in shaping students' value orientations toward environmental protection. When universities demonstrate commitment to sustainability through leadership initiatives, policies, or environmental governance, students may develop stronger environmental values that reflect the institutional culture and priorities of the organization. University leadership also shows a significant positive influence on environmental beliefs, supporting H1c. This relationship indicates that leadership initiatives may help increase students' awareness of environmental issues and strengthen their beliefs regarding the importance of environmental responsibility. However, the magnitude of this effect is smaller than the effect on environmental values, suggesting that leadership may influence general environmental orientations more strongly than specific belief structures.

The combined results highlight a clear distinction between the roles of university leadership and sustainability-oriented education in shaping students' pro-environmental

behavioral intention. Sustainability-oriented education appears to function as a more direct and influential mechanism through which universities can promote environmentally responsible intentions among students. By embedding sustainability into teaching practices, course content, and campus activities, universities can influence not only students' behavioral intentions but also their environmental values, beliefs, and moral norms. In contrast, university leadership appears to operate primarily at a more indirect level, influencing students' environmental cognition rather than directly affecting their behavioral intentions. This suggests that leadership commitment to sustainability needs to be translated into concrete educational initiatives and student-centered practices in order to effectively influence behavioral outcomes. The empirical findings therefore demonstrate that institutional factors influence pro-environmental behavioral intention through different pathways, with sustainability-oriented education exerting both direct and indirect effects while university leadership primarily influences upstream cognitive components such as environmental values and environmental beliefs.

RO2: To verify the relationships between environmental values, environmental beliefs, personal norms and pro-environmental behavioral intention among HEIs students in Shanxi Province.

The second study objective aimed to verify the relationships between environmental values, environmental beliefs, personal norms, and pro-environmental behavioral intention among higher education students in Shanxi Province. This objective focuses on examining the internal psychological mechanisms that influence students' pro-environmental behavioral intention, particularly those proposed in the value–belief–norm framework. The empirical results provide substantial evidence supporting the sequential relationships among environmental values, environmental beliefs, personal norms, and pro-environmental behavioral intention.

The results indicate that environmental values significantly influence pro-environmental behavioral intention. The structural model shows a positive and statistically significant relationship between environmental values and pro-environmental behavioral intention, supporting H3. This result suggests that students who hold stronger environmental value orientations are more likely to express intentions to engage in environmentally responsible behaviors. Environmental values reflect individuals' fundamental orientations toward environmental protection, ecological balance, and

responsible resource use. When students place greater importance on environmental protection as a guiding value, they are more likely to translate these value orientations into behavioral intentions related to energy conservation and environmentally responsible practices. The magnitude of this relationship indicates that environmental values serve as an important motivational foundation for pro-environmental behavioral intention.

Environmental beliefs also demonstrate a strong influence on pro-environmental behavioral intention. The empirical results show that environmental beliefs have a significant positive effect on pro-environmental behavioral intention, supporting H4. Among the psychological constructs included in the model, this relationship represents one of the strongest direct effects on behavioral intention. Environmental beliefs refer to individuals' cognitive perceptions regarding environmental problems, ecological consequences, and the responsibility of individuals and society to address these issues. When students strongly believe that environmental problems are serious and that individual actions can contribute to environmental protection, they are more likely to develop stronger intentions to engage in environmentally responsible behavior. The relatively large coefficient of this path indicates that belief-based cognitive evaluations play a particularly important role in motivating pro-environmental behavioral intention among university students.

Personal norms also show a significant positive relationship with pro-environmental behavioral intention. The path coefficient from personal norms to pro-environmental behavioral intention is positive and statistically significant, supporting H5. This finding suggests that students who experience a stronger sense of moral obligation toward environmental protection are more likely to intend to perform environmentally responsible actions. Personal norms represent the internalized moral responsibility individuals feel regarding environmental protection. When students perceive that they personally ought to engage in behaviors that reduce environmental harm or conserve energy, this moral obligation strengthens their behavioral intentions. The presence of a significant relationship between personal norms and behavioral intention confirms the importance of normative motivation within the value–belief–norm theoretical framework.

In addition to the direct influences on behavioral intention, the results also confirm the sequential relationships among the psychological constructs. Environmental values significantly influence environmental beliefs, as indicated by a positive and statistically

significant path coefficient, supporting H6. This relationship suggests that students who place greater importance on environmental protection are more likely to develop stronger beliefs regarding environmental consequences and responsibilities. Environmental values provide a value-based foundation that shapes how individuals interpret environmental issues and evaluate the importance of environmental protection. As a result, stronger environmental values tend to reinforce belief structures related to environmental responsibility.

Environmental beliefs also demonstrate a significant positive influence on personal norms. The results show that environmental beliefs positively affect personal norms, supporting H7. This finding suggests that when students believe that environmental problems are serious and that individual actions can contribute to environmental protection, they are more likely to internalize a sense of moral responsibility toward environmental behavior. The relationship between environmental beliefs and personal norms reflects the process through which cognitive awareness of environmental issues develops into moral obligation. As students become more convinced about the importance of environmental protection, these beliefs can transform into personal ethical commitments that guide behavioral intentions.

The empirical results therefore demonstrate a clear chain of relationships among environmental values, environmental beliefs, personal norms, and pro-environmental behavioral intention. Environmental values influence environmental beliefs, environmental beliefs influence personal norms, and these psychological constructs collectively contribute to pro-environmental behavioral intention. The strength and significance of these relationships indicate that students' pro-environmental behavioral intentions are shaped through a combination of value-based motivations, cognitive beliefs about environmental consequences, and internalized moral obligations toward environmental protection.

RO3: To test the mediating roles of environmental values, environmental beliefs and personal norms in shaping HEIs students' pro-environmental behavioral intention.

For RO3, the study examined whether environmental values, environmental beliefs, and personal norms served as mediating mechanisms through which institutional conditions shaped students' pro-environmental behavioral intention. The findings indicate that these three variables did not function as isolated predictors, but as interconnected

psychological channels that translated institutional influence into behavioral intention. This pattern is consistent with the logic of value belief norm theory, which proposes that pro-environmental action emerges through a progressive process in which external conditions first shape value orientations, then reinforce environmental beliefs, and eventually activate a sense of moral obligation. In this study, the mediation results suggest that institutional support became behaviorally meaningful only when it was internalized by students at the levels of values, beliefs, and norms.

The mediating role of environmental values suggests that institutional influence was most effective when it contributed to students' deeper evaluative orientation toward environmental protection. University leadership and sustainability-oriented education did not merely provide administrative signals or informational input. More importantly, they appeared to shape the extent to which students regarded environmental protection as important and worthy of personal commitment. This finding implies that values constituted an important starting point in the psychological process of behavioral formation. When sustainability was framed as a meaningful and legitimate concern within the institutional environment, students were more likely to adopt environmental priorities that could later support stronger beliefs and intentions. This interpretation is broadly consistent with prior studies showing that educational and institutional contexts can cultivate durable environmental value orientations rather than only short term awareness.

The mediating role of environmental beliefs further indicates that students' cognitive interpretation of environmental issues was a key mechanism linking institutional experience to behavioral intention. Environmental beliefs reflect the extent to which students recognize environmental consequences and accept human responsibility for addressing them. The results suggest that institutional settings became influential when they helped students move beyond general exposure to sustainability discourse and toward a more concrete understanding of environmental responsibility. This helps explain why sustainability-oriented education displayed a particularly meaningful indirect role through environmental beliefs. Educational experiences are likely to provide not only information, but also structured opportunities for reflection, interpretation, and connection between environmental knowledge and everyday practice. In this sense, the effect of education appears to have depended not simply on the delivery of sustainability content, but on its capacity to shape how students cognitively understood energy use, environmental

consequences, and personal responsibility. This interpretation is consistent with earlier research emphasizing that pro-environmental intention is strengthened when sustainability learning fosters both awareness and personal relevance.

The mediating role of personal norms highlights the importance of moral internalization in the formation of pro-environmental behavioral intention. Personal norms represent a sense of felt obligation, and their significance in this study suggests that behavioral intention was more likely to emerge when students came to view energy conservation not only as desirable, but as something they personally ought to do. This finding reinforces the argument that pro-environmental intention in higher education settings is partly a moral outcome rather than a purely informational or attitudinal one. At the same time, the pattern of results indicates that personal norms were more effectively activated through educational and belief-based pathways than through leadership alone. This suggests that moral obligation may not arise directly from top-down institutional authority. Instead, it appears to develop when students first understand environmental consequences, accept the importance of environmental protection, and then internalize these understandings as a personal responsibility. Such a sequence is theoretically plausible and aligns with previous studies showing that norms tend to emerge from internal cognitive and value-based processing rather than from external managerial influence alone.

The non-significant mediation pathway involving university leadership and personal norms is also theoretically meaningful and should not be treated merely as an unsupported hypothesis. This result suggests that leadership influence within higher education institutions may be more symbolic and contextual than morally transformative in a direct sense. Leadership can signal priorities, create supportive conditions, and legitimize sustainability within the institutional environment, but these functions may be insufficient by themselves to generate a strong personal sense of moral obligation among students. In the absence of sustained educational engagement or deeper belief formation, leadership messages may remain at the level of institutional discourse rather than becoming internalized as personal duty. This interpretation may help explain why leadership exerted influence more effectively through upstream cognitive channels such as environmental values and environmental beliefs. It also suggests that institutional commitment to sustainability becomes more effective when leadership is translated into

concrete educational practice, repeated student engagement, and opportunities for personal reflection.

Taken together, the mediation results indicate that the formation of pro-environmental behavioral intention among higher education students was a layered psychological process shaped by both institutional and internal factors. Institutional support did not automatically produce behavioral intention. Its influence became substantial when it first shaped how students valued the environment, how they understood environmental responsibility, and how strongly they felt morally obliged to act. This finding strengthens the explanatory value of the integrated framework adopted in the study, as it shows that sustainability-oriented behavior in university settings is best understood not as a simple reaction to institutional arrangements, but as the outcome of a progressive internalization process through which institutional influence is converted into value commitment, cognitive belief, and moral obligation.

The discussion of the three study objectives shows that pro-environmental behavioral intention among higher education students in Shanxi Province is shaped by the joint operation of institutional conditions and internal psychological mechanisms. More importantly, the model suggests that institutional influence does not affect behavioral intention in a uniform manner. Instead, different institutional factors appear to operate at different levels of the behavioral formation process. This interpretation is important because it shifts attention away from viewing universities as simple external drivers of behavior and toward understanding how institutional environments are translated into values, beliefs, and norms before they become behaviorally meaningful (Ngo et al., 2025).

With regard to the institutional dimension, sustainability-oriented education appears to be the most behaviorally effective factor because it connects institutional commitment with students' everyday learning experience. This finding suggests that sustainability becomes influential when it is embedded in formal and informal educational processes rather than remaining at the level of administrative discourse. In higher education settings, educational exposure can shape how students interpret environmental issues, how relevant they perceive energy conservation to be, and whether they internalize sustainability as part of responsible conduct. This helps explain why sustainability-oriented education is linked not only to behavioral intention itself but also to the psychological conditions that support such intention. This interpretation is consistent with

studies arguing that sustainability education promotes pro-environmental action by increasing environmental awareness, strengthening personal relevance, and creating repeated opportunities for reflection and value internalization (Ásványi & Gedeon, 2025).

By contrast, the absence of a direct relationship between university leadership and pro-environmental behavioral intention suggests that leadership influence may be more symbolic and contextual than immediately behavioral. In practice, leadership can communicate priorities, allocate attention, and legitimize sustainability within the institutional environment, but such influence may not automatically translate into students' intended behavior unless it is further transformed through educational practice and cognitive engagement. This means that leadership may matter not because students directly imitate institutional authority, but because leadership creates the conditions under which sustainability is perceived as legitimate, serious, and worthy of consideration. Such an interpretation is in line with studies showing that leadership often operates indirectly by shaping organizational climate, expectations, and value orientation rather than by producing direct behavioral compliance among students (Dextras-Gauthier et al., 2023). At the same time, this finding may differ from studies that reported a more immediate leadership effect, which could reflect contextual differences in governance visibility, student exposure to leadership initiatives, or the degree to which leadership messages are integrated into academic life (Stoica et al., 2025).

The non-significant relationship between university leadership and personal norms is also theoretically meaningful. Personal norms refer to an internalized sense of moral obligation, and such obligation may not be easily produced by top-down institutional authority alone. Students may recognize that university leaders support sustainability without necessarily converting that recognition into a personal moral duty. This suggests that moral internalization requires more than institutional endorsement. It likely depends on whether students cognitively understand environmental consequences, emotionally identify with sustainability goals, and repeatedly encounter sustainability in meaningful educational settings. In this sense, leadership may provide legitimacy, but legitimacy alone may be insufficient to generate personal obligation. This interpretation is consistent with arguments in the literature that norms tend to emerge from internal cognitive and evaluative processes rather than from external authority by itself (Prokop & Barandiaran, 2026). The unsupported hypothesis should therefore not be treated merely as a failed

result, but as evidence that the pathway from institutional authority to moral obligation is more complex than originally assumed.

From the perspective of the internal psychological mechanism, the study supports the broader logic of value belief norm theory by showing that pro-environmental behavioral intention is formed through a process of progressive internalization. Environmental values appear to function as a foundational orientation that shapes how students judge the importance of environmental protection. Once such values are established, they make it more likely that students will develop stronger environmental beliefs concerning environmental consequences and human responsibility. These beliefs then create the basis for the emergence of personal norms, through which sustainability is no longer viewed simply as desirable but as something one ought to do. This sequence is theoretically plausible because it reflects the gradual movement from broad evaluative orientation to specific cognitive recognition and finally to felt moral obligation (Lind, 2023).

The influence of environmental beliefs deserves particular interpretive attention because beliefs appear to function as the bridge between general environmental orientation and concrete behavioral intention. This suggests that students are more likely to intend to conserve energy when they not only value the environment in abstract terms, but also understand the consequences of environmental degradation and recognize personal responsibility in addressing such problems. In university contexts, this is especially important because many energy-related actions are routine and low visibility. Students may not automatically connect ordinary practices such as electricity use in dormitories, classrooms, or common spaces with broader environmental consequences unless such connections are cognitively activated. This helps explain why belief formation is central to the transformation of institutional messages into personally meaningful action (Becerra et al., 2023).

The role of personal norms further indicates that pro-environmental behavioral intention is partly moral rather than purely informational or attitudinal. Students may be aware of sustainability issues and even agree with them in principle, yet intention becomes stronger when environmental action is experienced as a matter of personal obligation. In this respect, the findings reinforce the argument that sustainable behavior in higher education cannot be fully explained by knowledge transmission alone. It also depends on

whether students come to feel that conserving energy is part of their own responsibility as members of a university community and as participants in wider environmental governance. This interpretation is compatible with prior studies emphasizing that moral obligation is a proximal predictor of environmentally responsible behavior (Niu et al., 2023).

The mediation analysis deepens this interpretation by showing that institutional conditions become behaviorally effective when they are filtered through psychological mechanisms. This means that the institutional environment does not act on intention in a direct and uniform way. Rather, its influence depends on whether it is translated into environmental values, environmental beliefs, and personal norms. The indirect role of sustainability-oriented education is especially meaningful because it indicates that education is not merely a channel for transmitting knowledge, but a mechanism through which students interpret, internalize, and morally organize environmental meaning. This is consistent with research suggesting that education often influences environmental behavior indirectly through shifts in cognition and norm formation rather than through immediate behavioral instruction alone (Helferich et al., 2023).

The unsupported mediation pathway from university leadership through personal norms to pro-environmental behavioral intention deserves explicit discussion because it provides an important boundary condition for the model. This result implies that leadership did not directly activate the type of moral self-obligation required to transmit influence through personal norms alone. One plausible explanation is that leadership was experienced by students as distant, formal, or institutional, whereas personal norms require a deeper form of internal engagement. Another explanation is that leadership messages may have influenced students earlier in the psychological sequence, particularly at the level of value orientation and belief formation, but were not sufficiently close to students' daily decision-making context to produce norm-based mediation on their own. This interpretation helps explain why leadership remained relevant in indirect cognitive pathways even though the norm-based route was not supported (Liu et al., 2022).

The added insight of the proposed model lies not in simply showing that institutional support and psychological factors are positively associated with pro-environmental behavioral intention, but in revealing how different forms of institutional influence are converted into behavioral motivation through different psychological

pathways. The results show that sustainability-oriented education functions as a direct and internalizing mechanism, while university leadership operates more as a contextual and cognitive enabler. This distinction would not be visible without testing the integrated model. The model therefore helps clarify why some institutional sustainability efforts may produce stronger behavioral effects than others, and why leadership signals need to be translated into educational experience, belief formation, and moral internalization before they can become behaviorally meaningful.

Taken together, the discussion suggests that the proposed framework is useful because it distinguishes between institutional visibility and psychological internalization. Sustainability-oriented education appears to function as the institutional mechanism most capable of crossing that boundary, since it translates organizational sustainability commitments into repeated student learning experiences. University leadership, by contrast, appears to function more effectively as a contextual enabler that shapes the legitimacy and direction of sustainability, but not necessarily its direct moral uptake among students. The psychological variables then explain how these institutional influences become behaviorally meaningful, with values, beliefs, and norms representing successive stages of internalization. In this sense, the study contributes not only by confirming key assumptions of value belief norm theory in the higher education context, but also by clarifying that different institutional influences operate through different mechanisms and with different degrees of immediacy (Russo et al., 2022; Song et al., 2022).

5.1 Implication to Theories

5.1.1 Implication to VBN (Value-Belief-Norm) Theory

The findings of this study provide important theoretical implications for the Value–Belief–Norm (VBN) theory by offering empirical evidence that supports and extends the theoretical framework within the context of higher education students in Shanxi Province. VBN theory proposes that environmentally significant behavior is shaped through a sequential psychological process in which values influence beliefs, beliefs activate personal norms, and personal norms subsequently motivate behavioral intentions or actions (Stern et al., 1999). The results of this study largely confirm this theoretical logic by demonstrating that environmental values significantly influence environmental beliefs,

environmental beliefs significantly influence personal norms, and these psychological constructs together contribute to pro-environmental behavioral intention. This VBN theory provides empirical support for the fundamental assumption of VBN theory that environmental behavior is not determined solely by situational factors but is rooted in a chain of internalized cognitive and normative processes.

The relationship between environmental values and environmental beliefs observed in this study reinforces the foundational role of values in shaping environmental cognition. According to VBN theory, environmental values represent relatively stable orientations that guide how individuals interpret environmental issues and evaluate the importance of environmental protection (Stern et al., 1999). The results confirm that students who hold stronger environmental values tend to develop stronger environmental beliefs regarding environmental responsibility and ecological consequences. This finding is consistent with previous empirical study demonstrating that value orientations form the basis for the development of environmental beliefs and environmental concern (de Groot & Steg, 2008; Marshall et al., 2019). These studies emphasize that individuals who prioritize biospheric or altruistic values are more likely to recognize environmental problems and accept responsibility for addressing them. The current findings extend this understanding by confirming that similar value–belief relationships operate among university students in the context of sustainability education and environmental awareness within higher education institutions.

The results also support the core VBN assumption that environmental beliefs contribute to the formation of personal norms. Personal norms refer to individuals' internalized sense of moral obligation to engage in environmentally responsible behavior (Al Mamun et al., 2025). VBN theory suggests that when individuals believe that environmental problems have serious consequences and that they personally share responsibility for addressing these problems, they are more likely to experience a moral obligation to act (Stern et al., 1999). The findings of this study confirm this mechanism, showing that stronger environmental beliefs significantly strengthen students' personal norms related to environmental protection. This result is consistent with earlier empirical studies that have demonstrated the importance of belief-based awareness of consequences and responsibility attribution in activating personal norms that motivate pro-environmental behavior (Han & Cheng, 2020; Song et al., 2024). By confirming this belief–norm

relationship in the higher education context, the present study reinforces the theoretical relevance of the norm-activation process within VBN theory.

Furthermore, the results demonstrate that personal norms play a significant role in shaping pro-environmental behavioral intention. Within the VBN framework, personal norms are considered the most immediate predictor of environmentally responsible behavior because they represent an internalized moral obligation that directly motivates action (Stern et al., 1999). The empirical findings of this study confirm that students who experience stronger personal norms toward environmental protection show stronger intentions to engage in pro-environmental behavior. This result is consistent with numerous previous studies that have validated the importance of personal norms in predicting pro-environmental behavior across various contexts, including household energy conservation, transportation choices, and environmental activism (Helferich et al., 2023; Hristova et al., 2025). The present study extends these findings by demonstrating that personal norms also play a crucial role in explaining pro-environmental behavioral intention among university students within the context of sustainability-oriented education.

In addition to supporting the traditional VBN relationships, the findings also provide an important theoretical extension of the VBN framework by incorporating institutional contextual factors. While the original VBN theory primarily focuses on internal psychological determinants of environmental behavior, Stern et al. (1999) also acknowledged that social and contextual factors may influence behavior indirectly by shaping values and beliefs. The results of this study illustrate this mechanism by showing that institutional factors such as university leadership and sustainability-oriented education influence environmental values and environmental beliefs rather than directly influencing behavioral intention. This pattern suggests that institutional contexts operate primarily at the earlier stages of the VBN chain by shaping students' environmental cognition rather than directly determining behavioral outcomes. Similar findings have been reported in recent studies that integrate VBN theory with contextual variables such as environmental education, policy environments, and institutional support mechanisms (Godinho Filho et al., 2024; Lin et al., 2025). These studies argue that environmental education and institutional environments can strengthen the psychological foundations of pro-environmental behavior by influencing individuals' environmental values and beliefs.

The findings also highlight the particularly strong role of sustainability-oriented education in activating the VBN mechanism. Sustainability education appears to influence multiple components of the VBN chain, including environmental values, environmental beliefs, and personal norms. This observation aligns with previous study suggesting that educational experiences can function as an important pathway through which environmental knowledge and values are internalized and translated into behavioral motivation (Portus et al., 2024). By integrating sustainability principles into academic curricula and campus practices, universities can contribute to the development of students' environmental values and beliefs, which subsequently strengthen personal norms and behavioral intentions. In this sense, sustainability-oriented education can be interpreted as an institutional mechanism that facilitates the activation of the value–belief–norm chain within the university environment.

At the same time, the findings provide an interesting theoretical nuance regarding the role of institutional leadership. Although university leadership significantly influences environmental values and environmental beliefs, it does not directly influence personal norms or pro-environmental behavioral intention. This result partially differs from some earlier studies that reported stronger direct influences of institutional leadership or organizational support on environmental behavior. One possible explanation is that leadership signals may operate primarily at the symbolic or policy level, which influences students' perceptions and values but may not immediately translate into personal moral obligation or behavioral intention. This suggests that institutional leadership may require effective educational implementation and student engagement strategies in order to fully activate the normative mechanisms described in VBN theory.

5.1.2 Implication to Social Support Theory

The findings of this study also contribute to the development of social support theory by illustrating how institutional support structures within higher education environments shape students' pro-environmental behavioral intentions through cognitive and normative mechanisms. Social support theory emphasizes that individuals' attitudes, psychological states, and behaviors are influenced by the informational, emotional, and instrumental support provided by social systems and institutional environments (Lakey & Cohen, 2000). Within educational settings, universities function as important social systems that provide multiple forms of support that can influence students' beliefs, values,

and behavioral motivations. The results of this study indicate that university leadership and sustainability-oriented education operate as two key forms of institutional social support that shape students' environmental cognition and behavioral intentions.

First, the role of university leadership in influencing environmental values and environmental beliefs reflects the informational and symbolic support functions emphasized in social support theory. Informational support refers to guidance, communication, and knowledge dissemination that help individuals interpret situations and form attitudes (House, 1987). In the context of universities, leadership commitment to sustainability often manifests through strategic vision, institutional policies, environmental initiatives, and public communication about sustainability goals. These leadership signals provide students with information about the importance of environmental protection and the institutional priority given to sustainable development. The findings of this study suggest that such informational support significantly contributes to the development of students' environmental values and environmental beliefs. This observation aligns with previous studies indicating that leadership support can shape individuals' environmental awareness and pro-environmental attitudes by providing direction and normative guidance within organizations (Cao et al., 2026; Fauzi et al., 2025). By reinforcing environmental values and beliefs among students, university leadership indirectly contributes to the psychological processes that motivate pro-environmental behavioral intention.

Second, sustainability-oriented education reflects another important dimension of social support within the university context. Educational programs related to sustainability provide both informational and instrumental support that can facilitate pro-environmental learning and behavioral motivation. Informational support in this context is reflected in the transmission of environmental knowledge, awareness of sustainability challenges, and understanding of environmental consequences. Instrumental support refers to the provision of resources, institutional arrangements, and practical opportunities that enable individuals to adopt desired behaviors (House, 1987). Sustainability-oriented education often includes sustainability-focused curricula, environmental training programs, campus sustainability initiatives, and experiential learning opportunities that allow students to engage with environmental practices. The findings of this study demonstrate that sustainability-oriented education significantly influences environmental values,

environmental beliefs, personal norms, and pro-environmental behavioral intention. This suggests that educational support not only enhances students' environmental knowledge but also contributes to the internalization of environmental responsibility. Similar conclusions have been reported in previous studies indicating that environmental education and sustainability programs can strengthen environmental attitudes and promote pro-environmental behavior among university students (Qi et al., 2025).

Third, the results also highlight the role of emotional and normative support within the university environment. Social support theory suggests that emotional support, such as encouragement, recognition, and social reinforcement, plays a crucial role in strengthening individuals' commitment to desired behaviors (Lakey & Cohen, 2000). Within higher education institutions, emotional support may be reflected through campus culture, peer engagement, and institutional recognition of environmentally responsible behavior. Although the present study focuses primarily on institutional leadership and sustainability-oriented education, the findings indicate that these institutional factors help create a supportive environment that reinforces students' environmental responsibility. By strengthening environmental beliefs and personal norms, universities can cultivate a moral and emotional commitment to environmental protection among students. This observation is consistent with previous study suggesting that supportive organizational climates can strengthen employees' and students' environmental commitment and environmentally responsible behavior (Alherimi et al., 2024; Sharpe et al., 2022).

Moreover, the results suggest that institutional social support operates primarily through psychological mechanisms rather than through direct behavioral control. Social support theory emphasizes that supportive environments can enhance individuals' motivation and behavioral intention by strengthening internal psychological resources (Lakey & Cohen, 2000). The findings of this study indicate that university leadership does not directly influence pro-environmental behavioral intention but significantly shapes environmental values and environmental beliefs, which subsequently influence behavioral intention through the value–belief–norm chain. This pattern suggests that institutional support functions as an enabling condition that facilitates the development of pro-environmental cognition rather than directly dictating behavior. In this sense, the results reinforce the theoretical argument that social support contributes to behavioral change by

strengthening individuals' psychological readiness and moral commitment rather than by imposing external pressure.

In addition, the findings demonstrate that sustainability-oriented education represents a particularly effective form of institutional support within universities. Compared with leadership signals, educational engagement appears to exert broader influence across multiple psychological dimensions, including values, beliefs, personal norms, and behavioral intention. This result suggests that educational support provides a more direct channel through which students can internalize sustainability principles and develop pro-environmental motivation. Previous studies on sustainability education have similarly argued that educational interventions are among the most effective institutional strategies for promoting environmental responsibility among students because they combine knowledge transmission with experiential learning and value formation (Isenaj et al., 2025; Montes de Oca et al., 2026). By integrating sustainability concepts into academic curricula and campus activities, universities can strengthen the social support mechanisms that encourage environmentally responsible behavior.

5.2 Implication to Practitioners

5.2.1 Implications for University Leadership

The findings of this study provide several practical implications for university leadership in promoting pro-environmental behavioral intention among students in higher education institutions. The empirical results demonstrate that university leadership significantly influences students' environmental values and environmental beliefs, although its direct effect on pro-environmental behavioral intention and personal norms is not statistically significant. Leadership actions primarily operate through shaping students' environmental cognition rather than directly influencing behavioral intentions. This finding implies that university leaders play a critical role in establishing the institutional environment that facilitates the formation of environmental awareness and environmental responsibility among students.

From a strategic governance perspective, university leadership should place sustainability at the core of institutional development agendas. Leaders can promote environmental values by integrating sustainability principles into university vision statements, strategic planning documents, and institutional development policies. When

sustainability is clearly articulated as a central institutional priority, students are more likely to perceive environmental protection as an important social value supported by the university community. Such institutional commitment helps cultivate students' environmental values, which subsequently influence environmental beliefs and pro-environmental behavioral intentions through the value–belief–norm psychological mechanism identified in this study.

In addition to strategic commitment, university leadership should strengthen institutional support systems for sustainability initiatives across campus. Leaders can encourage environmental engagement by allocating resources to sustainability projects, establishing green campus programs, and supporting student-led environmental activities. These initiatives provide visible signals that environmental protection is valued within the university environment. Through consistent policy support and resource investment, leaders can create an institutional atmosphere that reinforces students' environmental awareness and encourages the development of environmentally responsible attitudes.

The results also indicate that leadership influence is largely indirect rather than immediate. Although the direct path from university leadership to pro-environmental behavioral intention is not statistically significant. This suggests that leadership interventions should focus on strengthening the intermediate psychological factors that shape behavior. University leaders should therefore prioritize initiatives that enhance environmental education, environmental awareness, and campus sustainability culture, as these factors contribute to the formation of environmental values, environmental beliefs, and personal norms that ultimately motivate pro-environmental behavior.

Another important implication for university leadership concerns the role of institutional culture in shaping environmental responsibility. Universities function not only as educational institutions but also as social environments in which students develop values, attitudes, and behavioral habits. Leadership can influence this cultural environment by promoting sustainability-oriented campus culture through environmental campaigns, sustainability-themed events, and visible sustainability practices across campus infrastructure. When sustainability principles are embedded in daily campus operations, students are more likely to internalize environmental responsibility as a personal and social norm.

University leaders should also encourage cross-departmental collaboration in sustainability initiatives. Environmental challenges are complex and interdisciplinary, requiring cooperation across academic departments, administrative units, and student organizations. By establishing sustainability committees, interdisciplinary study programs, and collaborative environmental projects, university leaders can strengthen institutional capacity for sustainability governance. Such collaborative structures help ensure that sustainability principles are consistently reflected across teaching, study, campus management, and student engagement activities.

Furthermore, leaders can enhance the effectiveness of sustainability initiatives by promoting student participation in environmental decision-making processes. When students are actively involved in campus sustainability planning, they develop a stronger sense of ownership and responsibility toward environmental issues. Participation mechanisms such as student sustainability councils, green campus committees, and environmental innovation competitions provide opportunities for students to contribute ideas and engage in environmental action. These participatory experiences can strengthen students' environmental beliefs and personal norms, thereby increasing their willingness to adopt pro-environmental behaviors.

Finally, university leaders should consider sustainability as an integral component of institutional reputation and social responsibility. Higher education institutions increasingly play an important role in addressing global environmental challenges and promoting sustainable development. By demonstrating leadership commitment to sustainability, universities can strengthen their public image as socially responsible institutions while simultaneously influencing students' environmental attitudes and behaviors. Through strategic vision, policy support, institutional culture, and student engagement, university leadership can create a supportive environment that nurtures environmental values and beliefs among students, ultimately encouraging stronger pro-environmental behavioral intentions within the higher education community.

5.2.2 Implications for Higher Education Teachers

The findings of this study also provide important implications for teachers, who play a direct and influential role in shaping students' learning experiences, environmental awareness, and behavioral intentions. In higher education settings, teachers are not merely transmitters of disciplinary knowledge, but also key facilitators of value formation, critical

reflection, and behavioral guidance. Because students encounter sustainability-related ideas most frequently through classroom interaction, academic mentoring, and everyday educational practice, teachers occupy a particularly important position in promoting pro-environmental values and energy-saving intentions.

One important implication is that teachers should integrate sustainability-related content more systematically into teaching practice. Environmental responsibility should not be treated as a peripheral topic addressed only occasionally, but should be embedded into course design, classroom discussion, case selection, and learning activities whenever relevant. When sustainability issues are incorporated into routine teaching, students are more likely to perceive environmental protection as an intellectually meaningful and socially important issue rather than as an abstract institutional slogan.

Another implication concerns the role of teachers in connecting environmental knowledge with students' everyday life. Students may understand sustainability in general terms, yet fail to relate it to concrete behavioral contexts such as electricity use in dormitories, classrooms, and shared campus spaces. Teachers can help bridge this gap by using practical examples, situational discussion, and problem-based learning to show how environmental issues are linked to ordinary decisions and daily routines. In this way, teaching can strengthen students' environmental beliefs by making the consequences of energy consumption more visible and personally relevant.

The findings also suggest that teachers are important in cultivating students' environmental values. Value formation does not arise only from formal instruction, but also from repeated exposure to educational messages that frame sustainability as worthwhile, legitimate, and socially responsible. Through the selection of learning materials, the framing of environmental issues, and the encouragement of reflective discussion, teachers can help students gradually internalize stronger environmental priorities. This function is especially important in higher education, where students are expected not only to acquire knowledge, but also to develop broader ethical and civic orientations.

Teachers also contribute to the development of personal norms by reinforcing the moral dimension of sustainability. Pro-environmental behavioral intention is more likely to emerge when students come to regard energy conservation not simply as beneficial, but as something they personally ought to do. Teachers can support this process by

encouraging responsibility, discussing the ethical implications of environmental degradation, and creating learning environments in which sustainability is associated with accountability and responsible citizenship. Such educational influence may be particularly effective because moral obligation is often strengthened through discussion, reflection, and repeated normative reinforcement rather than through administrative instruction alone.

Another practical implication is that teachers should adopt more participatory and student-centered approaches in sustainability education. Lecture-based delivery alone may be insufficient to foster lasting behavioral intention. By contrast, classroom dialogue, project-based tasks, collaborative activities, and experiential learning opportunities can encourage students to engage more actively with environmental issues. These approaches allow students to move beyond passive awareness and toward deeper cognitive and moral involvement, which is more conducive to the formation of stable pro-environmental intention.

In addition, teachers should recognize the importance of acting as behavioral role models. Students are more likely to take sustainability seriously when educational messages are accompanied by visible consistency in professional practice. When teachers demonstrate responsible attitudes toward resource use, support environmentally conscious activities, and show genuine commitment to sustainability principles, they reinforce the credibility of the values communicated in teaching. This modeling effect may strengthen students' perception that environmental responsibility is not only academically relevant but also practically expected.

Finally, teachers should be encouraged to engage in interdisciplinary and collaborative approaches to sustainability education. Environmental issues are inherently complex and cannot be fully understood through a single disciplinary lens. Teachers from different fields can contribute complementary perspectives that help students appreciate the social, economic, technological, and ethical dimensions of sustainability. Through such collaboration, teachers can foster more comprehensive environmental understanding and strengthen students' ability to connect knowledge, values, and action in response to sustainability challenges.

5.2.3 Implications for Higher Education Policymakers

The findings of this study also provide important implications for higher education policymakers who are responsible for shaping the broader institutional and regulatory environments in which universities operate. Policymakers play a crucial role in guiding the development of sustainability initiatives within higher education systems by establishing national strategies, educational standards, and policy frameworks that encourage universities to incorporate sustainability principles into their teaching, governance, and campus management. As universities increasingly contribute to addressing global environmental challenges, policy support becomes essential in facilitating the integration of sustainability within higher education institutions and in promoting environmentally responsible behaviors among students.

One important implication for policymakers is the need to incorporate sustainability more explicitly into higher education policy frameworks and educational development strategies. Sustainability education should be recognized as a key component of higher education reform and long-term educational planning. By integrating sustainability objectives into higher education policies, governments can encourage universities to strengthen environmental education, promote sustainable campus initiatives, and support study related to environmental protection and sustainable development. Such policy integration can help ensure that sustainability becomes an essential element of university development rather than an optional or peripheral activity.

Another important implication concerns the role of policy incentives in encouraging universities to adopt sustainability practices. Policymakers can design policy mechanisms that provide financial support, institutional recognition, or evaluation incentives for universities that actively promote sustainability education and environmental initiatives. For example, sustainability performance indicators can be incorporated into higher education evaluation systems, institutional accreditation frameworks, or university ranking criteria. When sustainability becomes an important evaluation dimension, universities are more likely to allocate resources and institutional attention to sustainability-related activities. These policy incentives can help accelerate the adoption of sustainability practices across higher education institutions.

Policymakers should also support the development of sustainability-oriented curricula and educational programs across universities. Curriculum guidelines, teaching

standards, and educational reforms can encourage universities to integrate sustainability topics into different academic disciplines. By promoting interdisciplinary sustainability education, policymakers can help ensure that students from diverse academic backgrounds develop environmental awareness and sustainability-related competencies. This broader educational approach is essential for preparing future professionals who are capable of addressing complex environmental and sustainability challenges in various sectors of society.

In addition, policymakers can facilitate collaboration between universities and other social actors in sustainability initiatives. Environmental challenges require coordinated action from multiple stakeholders, including governments, educational institutions, industries, and civil society organizations. Policymakers can support partnerships between universities and external organizations by providing funding for collaborative sustainability projects, promoting study cooperation, and encouraging community engagement programs. Such collaborative frameworks enable universities to extend sustainability education beyond the classroom and create opportunities for students to participate in real-world environmental initiatives.

Another important implication relates to the need for long-term policy commitment to sustainability education. The development of environmental values, beliefs, and responsible behaviors among students is a gradual process that requires consistent institutional and policy support. Policymakers should therefore adopt long-term strategies that promote sustainability education across different levels of the education system. By ensuring stable policy support and continuous investment in sustainability initiatives, governments can create favorable conditions for universities to develop effective environmental education programs and sustainability practices.

Furthermore, policymakers should recognize the role of universities as key drivers of societal transformation toward sustainable development. Higher education institutions not only educate students but also generate knowledge, influence public discourse, and contribute to policy development. By strengthening policy support for sustainability initiatives within universities, policymakers can help leverage the broader societal impact of higher education. Universities can serve as important platforms for innovation, study, and knowledge dissemination related to environmental protection and sustainable development, thereby supporting national and global sustainability goals.

5.3 Limitation of the Research and Implications of Future Research

5.3.1 Limitation of the Present Research

Although this study provides meaningful insights into the factors influencing pro-environmental behavioral intention among higher education students, several limitations should be acknowledged. Recognizing these limitations helps clarify the scope of the study and provides direction for future study.

First, the geographical scope of the study was relatively limited. The data were collected from students in higher education institutions located in Shanxi Province, and this regional specificity may restrict the broader generalizability of the findings. Shanxi has long been associated with a resource-based industrial structure, particularly coal-related development, yet it has also undergone broader economic and social transformation in recent years, including increasing emphasis on environmental improvement, cultural development, and tourism-oriented regional renewal. This distinctive transitional context may have shaped students' environmental awareness, sustainability perceptions, and attitudes toward energy conservation to some extent. Therefore, the findings of this study should be interpreted as reflecting the institutional and social conditions of higher education within Shanxi Province rather than as universally applicable to all regional or national contexts.

Second, the study focused on pro-environmental behavioral intention rather than actual environmental behavior. Behavioral intention is widely recognized as an important predictor of behavior, but intention does not always translate directly into action. Students may report strong environmental intentions, while their actual behavior remains constrained by situational conditions, habitual routines, or institutional factors. As a result, the current findings primarily reflect students' willingness to engage in pro-environmental behavior rather than their observable environmental practices.

Third, the study adopted a cross-sectional design, which captured relationships among variables at a single point in time. Although the structural relationships identified in the model provide useful insight into the mechanisms influencing pro-environmental behavioral intention, the design does not allow examination of how these relationships may change over time. Students' environmental awareness, beliefs, and behavioral intentions may evolve throughout their academic experiences, particularly as they are exposed to sustainability-oriented education and campus environmental initiatives.

5.3.2 Implications for Future Research

Building upon the limitations identified above, several directions for future study can be proposed.

First, future studies could expand the geographical scope of the study by including universities from different provinces or countries. Comparative studies across regions or educational systems would help determine whether the relationships identified in this study remain consistent in different cultural, institutional, and environmental contexts. Such comparative analyses could provide a broader understanding of how institutional environments influence students' pro-environmental behavioral intentions.

Second, future study could examine actual pro-environmental behaviors in addition to behavioral intentions. Incorporating behavioral indicators such as participation in environmental activities, energy-saving practices, or waste reduction behaviors could provide a more comprehensive assessment of students' environmental engagement. This approach would help reduce the potential gap between intention and behavior and offer deeper insights into how psychological and institutional factors influence real environmental practices.

Third, future studies could adopt longitudinal study designs to explore how environmental values, beliefs, and personal norms develop over time. Tracking students across different stages of their university experience would allow studyers to examine how sustainability education and campus environmental initiatives influence students' attitudes and behaviors in the long term. Such study could provide a more dynamic understanding of the processes through which higher education contributes to the development of environmentally responsible behavior.

Finally, future study could explore additional variables that may influence students' pro-environmental behavior within higher education contexts. Factors such as peer influence, campus sustainability culture, environmental knowledge, and digital sustainability initiatives may also play important roles in shaping students' environmental attitudes and behaviors. Integrating these variables into future study models could help provide a more comprehensive understanding of the mechanisms that encourage environmentally responsible behavior among university students.

5.4 Conclusion

This study examined the factors influencing pro-environmental behavioral intention among higher education students in Shanxi Province by integrating institutional factors and psychological mechanisms within the Value–Belief–Norm (VBN) framework. The findings reveal that sustainability-oriented education plays a particularly influential role in promoting students' pro-environmental behavioral intention. It not only directly enhances behavioral intention but also significantly strengthens environmental values, environmental beliefs, and personal norms, indicating that sustainability education functions as a key mechanism through which universities cultivate environmental awareness and responsible behavioral intentions among students.

In contrast, university leadership demonstrates a more indirect influence on pro-environmental behavioral intention. Although leadership significantly affects environmental values and environmental beliefs, it does not directly influence personal norms or behavioral intention. This suggests that leadership commitment to sustainability mainly operates by shaping students' environmental cognition and value orientation, while its behavioral impact depends largely on how institutional initiatives are translated into educational practices and campus activities.

The results also confirm the sequential psychological relationships proposed by VBN theory. Environmental values significantly influence environmental beliefs, environmental beliefs activate personal norms, and these psychological factors collectively contribute to pro-environmental behavioral intention. Among them, environmental beliefs show a particularly strong influence on behavioral intention, highlighting the importance of students' cognitive awareness of environmental responsibility in motivating environmentally responsible intentions.

Furthermore, mediation analysis indicates that environmental values, environmental beliefs, and personal norms function as important mechanisms linking institutional factors to behavioral intention. Sustainability-oriented education influences behavioral intention through multiple psychological pathways, whereas university leadership primarily affects behavioral intention indirectly through environmental values and environmental beliefs.

Overall, the study demonstrates that promoting pro-environmental behavioral intention among university students requires both institutional support and psychological

engagement. By integrating sustainability education, strengthening institutional commitment, and cultivating supportive campus environments, higher education institutions can play a significant role in fostering environmentally responsible attitudes and intentions, thereby contributing to broader sustainable development goals.

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APPENDIXES

APPENDIX A

Questionnaire (English Version)

Appendix A. Questionnaire (English Version)



Rattanakosin International College of Creative Entrepreneurship

Of Rajamangala University of Technology, Rattanakosin

The instruction of the questionnaire:

Instruction: Please check ✓ in the ☐ and fill form all data with your information truly.

Part 1 Demographic Information

1. The Region of Your University (in Shanxi Province):

☐ Northern Shanxi ☐ Central Shanxi

☐ Southern Shanxi ☐ Southeastern Shanxi

2. Your Gender:

☐ Male

☐ Female

3. Your Grade Level:

☐ Freshman ☐ Sophomore

☐ Junior ☐ Senior

4. Your Major:

☐ Science and Engineering

☐ Social Sciences

☐ Arts and Humanities

☐ Business and Economics

☐ Others

5. Your Place of Growth:

☐ Urban

☐ Rural

6. Your Age:

☐ Under 18 ☐ 18–20

☐ 21–23 ☐ 24 or above

Part 2 University leadership

(Please draw a ✓ 1-7 below the score that suits you to indicate 'strongly disagree strongly agree')

Items	1	2	3	4	5	6	7
UL1. My department heads are committed to promoting energy conservation and environmental protection on campus.							
UL2. Department heads in my university encourage students to participate in energy-saving and other environmental activities.							
UL3. Students in my department are encouraged by the department heads and teachers to volunteer for energy conservation initiatives.							
UL4. I believe that the department heads of my university will not compromise on sustainability and energy-saving principles.							
UL5. I believe that my department heads uphold high standards and values regarding sustainability and energy conservation.							
UL6. My department heads allocate sufficient resources and support for energy-saving programs and environmental initiatives.							

Part 3 Sustaibability-oriented education

(Please draw a ✓ 1-7 below the score that suits you to indicate 'strongly disagree strongly agree')

Items	1	2	3	4	5	6	7
SE1. In school, we learn to connect past, present and future energy issues to understand the long-term consequences of electricity use.							
SE2. In school, we examine both local and national energy challenges and how they are linked to global sustainability concerns.							
SE3. In school, we learn about the relationships between economic development, social well-being and environmental impacts created by energy consumption.							
SE4. In class discussions, different perspectives on energy use, electricity saving and environmental responsibility are encouraged to emerge.							
SE5. When reading course materials, we are encouraged to critically examine information on energy systems, environmental impacts and sustainability solutions.							
SE6. In school, we are encouraged to express our own views on energy-saving behavior and evaluate the choices we make in daily electricity use.							
SE7. At home, my family encourages responsible electricity use, and the school reinforces these values through classroom activities and guidance.							

Part 4 Environmental values

(Please draw a ✓ 1-7 below the score that suits you to indicate 'strongly disagree strongly agree')

Items	1	2	3	4	5	6	7
EV1. Social justice, correcting injustice, and caring for the weak through fair and responsible use of school energy resources.							
EV2. Preventing pollution and conserving natural resources by reducing unnecessary energy use on campus.							
EV3. Equality and equal opportunity for all in accessing shared campus energy resources fairly.							
EV4. Unity with nature by avoiding energy waste and maintaining a balanced relationship with natural resources.							
EV5. A peaceful world supported by responsible use of limited energy resources.							
EV6. Respecting the earth and protecting other species by lowering energy-related environmental pressure.							
EV7. Protecting the environment and preserving nature by practicing daily energy conservation.							
EV8. True friendship and a supportive campus community that encourages one another to save energy.							
EV9. Loyalty to friends and the campus community by acting responsibly in shared energy use.							
EV10. Obedient and dutiful in meeting personal obligations to follow school energy-saving rules.							
EV11. Self-discipline and restraint in avoiding unnecessary energy consumption.							
EV12. Honoring parents and elders by practicing a simple lifestyle and avoiding energy waste.							
EV13. Honest and sincere in contributing to campus energy-saving efforts.							

Items	1	2	3	4	5	6	7
EV14. Forgiving and tolerant toward others while encouraging better energy-saving habits.							

Part 5 Environmental belief

(Please draw a ✓ 1-7 below the score that suits you to indicate 'strongly disagree strongly agree')

Items	1	2	3	4	5	6	7
EB1. I believe that reducing energy waste can help prevent environmental problems on campus.							
EB2. I believe that reducing unnecessary energy use can support a cleaner and healthier campus environment.							
EB3. I believe that businesses and industries should take more responsibility in reducing energy waste and supporting environmental protection.							
EB4. I believe that the government should take stronger action to reduce energy waste and ensure fair access to clean and efficient energy resources.							
EB5. I believe that public participation in energy conservation and environmental protection is important.							
EB6. I believe that everyone should have equal opportunities to participate in energy saving and sustainability programs.							

Part 6 Personal norms

(Please draw a ✓ 1-7 below the score that suits you to indicate 'strongly disagree strongly agree')

Items	1	2	3	4	5	6	7
PN1. I feel morally accountable for reducing energy waste on campus.							
PN2. People like me should make personal efforts to reduce unnecessary energy use and support a more sustainable campus environment.							
PN3. I feel morally obliged to contribute to the environmental wellbeing of the campus community.							
PN4. I believe it is morally important to contribute to campus energy saving, regardless of what others do.							
PN5. I feel personally obliged to support energy saving efforts that help improve the campus environment.							

Part 7 Pro-environmental behavioral intention

(Please draw a ✓ 1-7 below the score that suits you to indicate 'strongly disagree strongly agree')

Items	1	2	3	4	5	6	7
PI1. I will try to reduce electricity use whenever I am on campus.							
PI2. I intend to switch off lights and air-conditioning when they are not in use.							
PI3. I plan to open windows for ventilation before turning on the air-conditioning.							
PI4. I will make sure to switch off electronic and electrical equipment after each class.							
PI5. I intend to participate in energy-saving or awareness activities on campus.							

Items	1	2	3	4	5	6	7
PI6. I feel responsible for reducing the amount of energy I use on campus.							
PI7. I will encourage my classmates to save energy whenever possible.							

APPENDIX B

Questionnaire (Chinese Version)

Appendix B. Questionnaire (Chinese Version)

拉达那哥欣国际创意创业学院

拉加曼加拉理工大学拉达那科欣

问卷说明：请在相应的方框中打“√”，并如实填写所有个人信息。

第 1 部分 基本信息

1. 您所在大学所在地区（山西省）：

☐ 晋北 ☐ 晋中

☐ 晋南 ☐ 晋东南

2. 性别：

☐ 男

☐ 女

3. 您的年级：

☐ 大一 ☐ 大二 ☐ 大三

☐ 大四 ☐ 硕一 ☐ 硕二

☐ 硕三 ☐ 博一 ☐ 博二

☐ 博三 ☐ 博四

4. 您的专业:

☐ 理工类

☐ 社会科学类

☐ 人文艺术类

☐ 商业与经济类

☐ 医学 □农业

5. 您的成长环境:

☐ 城市

☐ 农村

6. 年龄:

☐ 18 岁及以下　　☐ 18 - 20

☐ 21 - 23　　☐ 24 岁及以上

Part 2 学校领导层

请在下方 1 至 7 分中选择并标注“ √ ”,以表示您的同意程度,从“非常不同意”到“非常同意”。）

项目	1	2	3	4	5	6	7
UL1.我所在学院的院长（系主任）致力于推动校园的节能与环境保护。							
UL2.我校的院长（系主任）鼓励学生参与节能及其他环保活动。							
UL3.我所在学院的院长（系主任）和老师会鼓励学生参加节能志愿活动。							
UL4.我相信本校院长（系主任）在可持续发展和节能原则方面不会妥协。							

项目	1	2	3	4	5	6	7
UL5.我认为我所在学院的院长（系主任）坚持高标准的可持续性与节能价值观。							
UL6.我所在学院的院长（系主任）会为节能项目和环保活动提供充足的资源与支持。							

Part 3 可持续发展教育

请在下方 1 至 7 分中选择并标注“ √”,以表示您的同意程度,从“非常不同意”到“非常同意”。）

项目	1	2	3	4	5	6	7
SE1.在学校，我们学习将过去、现在与未来的能源问题联系起来，从而理解用电行为的长期影响。							
SE2.在学校，我们探讨地方与国家层面的能源挑战，并了解它们与全球可持续性问题之间的联系。							
SE3.在学校，我们学习能源消耗与经济发展、社会福祉和环境影响之间的关系。							
SE4.在课堂讨论中，我们被鼓励提出关于能源使用、节电行为和环境责任的不同观点。							
SE5.在阅读课程材料时，我们被鼓励批判性地审视关于能源系统、环境影响和可持续解决方案的相关信息。							
SE6.在学校，我们被鼓励表达对节电行为的看法，并反思日常用电选择。							
SE7.在家庭中，我的家人鼓励我负责任地使用电力，而学校则通过课堂活动和教育进一步强化这些价值观。							

Part 4 环境价值观

请在下方 1 至 7 分中选择并标注“ √ ”,以表示您的同意程度,从“非常不同意”到“非常同意”。）

项目	1	2	3	4	5	6	7
EV1.通过公平、负责任地使用学校能源资源来维护社会公正、纠正不公并关心弱势群体。							
EV2.通过减少不必要的校园能源使用来防止污染、节约自然资源。							
EV3.在校园共享能源资源方面做到公平与平等机会。							
EV4.通过避免能源浪费来与自然保持和谐关系。							
EV5.通过负责任地使用有限能源促进和平、平衡的世界。							
EV6.通过降低能源相关的环境压力来尊重地球并保护其他物种。							
EV7.通过践行日常节能行为来保护环境、守护自然。							
EV8.通过互相鼓励节能来建立支持性校园友谊和社区。							
EV9.对朋友和校园社区保持忠诚,并在共享能源使用方面负责任地行动。							
EV10.自觉履行遵守学校节能规定的责任与义务。							
EV11.保持自律,自觉避免不必要的能源消耗。							
EV12.通过节俭生活方式与避免能源浪费来表达对父母与长辈的尊重。							
EV13.以诚实和真挚态度参与校园节能工作。							
EV14.在鼓励他人节能时保持宽容和理解。							

Part 5 环境信念

请在下方 1 至 7 分中选择并标注“√”,以表示您的同意程度,从“非常不同意”到“非常同意”。）

项目	1	2	3	4	5	6	7
EB1.我觉得有责任尽力减少能源浪费,避免校园环境问题。							
EB2.我觉得有责任采取行动减少不必要的能源使用,支持更清洁的校园环境。							
EB3.企业和行业应承担更多责任,减少能源浪费并支持环境保护。							
EB4.政府应采取更有力的措施减少能源浪费,确保公平获取清洁高效的能源资源。							
EB5.政府应促进公众参与节能与环境保护。							
EB6.政府应保障所有人平等参与节能与可持续发展项目的机会。							

Part 6 个人规范

请在下方 1 至 7 分中选择并标注“√”,以表示您的同意程度,从“非常不同意”到“非常同意”。）

项目	1	2	3	4	5	6	7
PN1.我对减少校园能源浪费和环境问题感到道德上的责任。							
PN2.像我这样的人应该努力减少不必要的能源使用,支持更可持续的校园环境。							
PN3.我在道德上有义务为提升校园环境福祉做出努力。							
PN4.无论他人是否这样做,我都认为节能和维护校园环境福祉在道德上很重要。							

项目	1	2	3	4	5	6	7
PN5.我个人觉得有义务支持校园节能工作以改善校园环境。							

第 7 部分 环保行为意向

请在下方 1 至 7 分中选择并标注“ √ ”,以表示您的同意程度,从“非常不同意”到“非常同意”。）

项目	1	2	3	4	5	6	7
PI1.我在校园内会尽量减少电力使用。							
PI2.我会在不用时关闭灯光和空调。							
PI3.在天气炎热时,我会优先选择开窗通风,而不是立即开启空调。							
PI4.我会在每次下课后关闭电子与电器设备。							
PI5.我打算参加校园内的节能或环保宣传活动。							
PI6.我认为自己有责任减少在校园使用的能源量。							
PI7.我会在可能的情况下鼓励同学节约能源。							

APPENDIX C

Publication of Journal during Ph.D. Study

APPENDIX C. Publication of Journal during Ph.D. Study

frontiers in Psychology

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Pro-environmental behavioral intention in university energy-saving contexts: extending the Value–Belief–Norm framework with institutional support

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Objective: With increasing energy demands across the globe and increased focus in sustainable development agenda, higher education institutions (HEIs) are relevant in developing energy-saving cognitions and attitudes of students.
Purpose: This paper will examine how university leadership, sustainability-oriented education, environmental values, environmental beliefs, and personal norms influence and affect the pro-environmental behavioral intention (PEBI) of HEIs students.
Methods: A group of 864 students of 81 HEIs located in the Shanxi Province took part in a survey and were recruited through a multi-stage stratified sampling design. The data analysis was done using structural equation modeling (SEM).
Results: First, sustainability-oriented education exhibits effective and multidimensional impacts which directly and indirectly impact the environmental values, environmental beliefs, personal norms, and behavioral intentions. Contrastingly, the university leadership (UL) has no direct impact on PEBI and does not trigger the personal norms in the students. Second, the Value–Belief–Norm (VBN) sequence was supported, and personal norms emerged as the strongest direct predictor of PEBI. However, environmental values and environmental beliefs also retained significant direct effects on PEBI. Third, sustainability-oriented education translates into PEBI through significant indirect pathways via environmental values and environmental beliefs, whereas the corresponding indirect effects of university leadership through these psychological mediators are weak or non-significant. Fourth, the integrated model demonstrates strong explanatory power, but this explanatory power is primarily driven by education and the VBN psychological chain rather than by university leadership.
Implications: The research reveals that effective HEIs interventions should combine direct, knowledge-based educational strategies with leadership actions designed to support and enable student-driven change, rather than attempting to directly command behavioral change through institutional authority.

KEYWORDS
pro-environment, social support, sustainability-oriented education, sustainable development, university leadership, Value-Belief-Norm

1 Introduction

The global process of urbanization, digitalization, and industrial transformation has resulted in the sudden high rate of energy demand, which imposes the greatest pressure on energy systems and the increase in sustainability issues in various regions (Zhang, 2025). The world is still increasing its demand on electricity at a rate of about 2.5 percent annually as more and more buildings are constructed, digital infrastructure is developed, and the growing energy requirements of homes are met (Castro et al., 2024). It is against this background that higher education has become a prime stage of promoting the world sustainable development agenda. The United Nations Sustainable Development Goals (SDGs) with SDG 7 (Affordable and Clean Energy) and SDG 12 (Responsible Consumption and Production) specifically invite universities not only to trim their operation footprint but also to raise environmentally friendly citizens able to contribute to a society-wide change toward energy efficiency (Küfeoglu, 2022; Olabi et al., 2023).

The Higher Education Institutions (HEIs) are organizations in the public sector which are energy-consuming. Their elaborate structures, such as laboratories, educational institutions, libraries, student hostels demand constant power supply to promote lighting, heating, air conditioning, and online forms of learning (Laporte and Cansino, 2024). Housing structures comprise close 80 percent of energy usage inside a university with the consumption behavior of students and their online lifestyles playing a significant role in total energy consumption (Gao et al., 2024). The use of electricity on the campus in China is an urgency that is facilitated by the sustainability objectives that the country is aiming at. By 2023, the electricity demand in the country had reached 8.7 trillion kWh, and the figure is steadily increasing with the growth of digitalization and the rise in living standards (He et al., 2025). In Chinese universities, electricity consumption is between 20 and 40 percent more intensive than in other institutions of higher education due to the high occupancy of dorms and the length of time that trainees use personal gadgets and the high use of air conditioning and heating (Zhou et al., 2022).

Although the importance of sustainability is generally recognized by students, there remains a large intention-action gap in their energy use consumer habits (Portus et al., 2024). The surveys conducted with a large sample of Chinese university students show that more than 60% of them do not unplug inactive electrical appliances, almost 70% use air conditioner or heating much more often, and less than 30% engage in energy-saving behaviors (Li et al., 2024). The above phenomena imply that information campaigns in and of themselves do not suffice to induce behavioral change, an in-depth investigation of the underlying psychological and institutional determinants affecting the energy-saving behavior in students is necessary. Hence, the research objectives are:

RO1: To investigate the direct relationship between university leadership and sustainability-oriented education as the external institutional support and the pro-environmental behavioral intention of students.

RO2: To confirm a direct relationship between environmental values and beliefs, and individual norms, as internal drivers in the psychological perception, and pro-environmental behavior intentions among students.

RO3: To identify the mediating effect of the environmental values, the environmental beliefs, and the personal norms in the connection between the institutional support and the behavioral intentions, and therefore to discover the internal transmission mechanisms.

2 Literature review

2.1 Theoretical framework

Value-Belief-Norm (VBN) theory is one of the most influential frameworks for explaining pro-environmental behavior (Stern et al., 1999). It conceptualizes pro-environmental action as a causal sequence in which environmental values shape environmental beliefs, beliefs activate personal norms, and personal norms motivate behavior. Traditional applications of VBN have been especially effective in explaining the internal moral-cognitive mechanisms underlying pro-environmental intention. However, in organized settings such as higher education institutions, these internal psychological processes do not emerge in a social vacuum and may be shaped by broader institutional conditions. The most recently published studies combined VBN with Theory of Planned Behavior (Syed et al., 2024; Zhang, 2025), and were able to predict complex behaviors, such as sustainable consumption and waste management. Gradually, growing numbers of researchers have expanded the application of VBN to a variety of populations and situations, such as the eco-friendly decision of tourists or involvement of students in campus sustainability (Pan and Zhou, 2024; Serio et al., 2026). The discussion of factors that are antecedent to the VBN chain is a major trend that is evident in the literature in recent times. Sun et al. (2023) also discovered that VBN + TPB offered a more detailed picture of student behaviors, whereas Kumar and Nayak (2022) have confirmed the cross-cultural applicability of the theory, indicating its cross-cultural generalizability. The present study uses VBN as the core psychological mechanism to explain how students' pro-environmental intentions are formed through the sequence of values, beliefs, and personal norms, while Social Support Theory is used to specify the institutional support conditions that precede and activate this psychological process. In this study, institutional factors are not introduced as substitutes for the VBN sequence, but as upstream contextual conditions that help explain how the Value-Belief-Norm process is activated and strengthened in the university energy-saving context. In other words, the present framework extends the traditional VBN model by incorporating institutional support as a distal layer of influence that shapes students' environmental meaning systems before these are internalized as beliefs, moral obligation, and behavioral intention. This integration allows the model to retain the explanatory strength of VBN at the psychological level while better accounting for the organizational conditions under which students' pro-environmental orientations are formed.

The social support theory is a classic example of how one can use the support of their social network (e.g., emotional, informational, instrumental) to come out of the stress period and reach the goal (House, 1987). This theory has in recent years been applied to the organizational and community context to offer a description of pro-social and pro-environmental actions. Qi et al. (2025) examined the role played by institutional support and sustainability-oriented education in influencing pro-environmental behavior by students and defined them as vital enabling factors. Based on the same observation, Nieminen et al. (2025) discovered that there is a mediating effect of social support between eco-anxiety and pro-environmental action, which implies that the supportive environment plays a key role in turning concern into behavior. This study extends this logic by defining university leadership and sustainability-oriented education as forms of institutional social support. University leadership provides directional, emotional, and instrumental support by setting a vision and providing resources, while sustainability-oriented education offers critical informational support (Aggarwal and Agarwala, 2025). These two institutional factors were selected because they represent two salient and complementary forms of support in higher education settings. University leadership reflects the strategic, symbolic, and resource-related dimension of institutional support, whereas sustainability-oriented education reflects the informational, interpretive, and practice-oriented dimension through which students repeatedly encounter and internalize sustainability-related knowledge and expectations. By integrating this theory, we position institutional factors not as external, disconnected variables, but as foundational supports that initiate and strengthen the VBN psychological process.

In the present study, social support theory is used as a contextual framework rather than as a full interpersonal support measurement model. In higher education settings, support is often institutionalized rather than purely interpersonal. Accordingly, this study captures institutional support through two context-relevant forms: university leadership and sustainability-oriented education. This conceptualization helps explain how institutional context enters the VBN framework not as an alternative causal chain, but as a distal support structure that shapes the emergence and strength of the internal Value-Belief-Norm process. These two institutional variables represent different support functions. University leadership primarily reflects institutional and instrumental support through policy direction, strategic commitment, and resource allocation, while sustainability-oriented education primarily reflects informational support by providing students with environmental knowledge, interpretive guidance, and practical energy-saving strategies (Flori et al., 2025). This distinction helps clarify why the two forms of institutional support may show different strengths across the psychological pathway. This conceptualization also strengthens the integration with Value–Belief–Norm (VBN) theory. Social Support Theory explains why institutional contexts matter by identifying the support conditions that shape students' value and belief formation (Zhang and Qian, 2024), whereas VBN theory explains how those external supports are internalized through environmental values, environmental beliefs, and personal norms to influence pro-environmental behavioral intention (Gao et al., 2024). In this way, institutional support is specified as a distal antecedent, while the VBN sequence represents the internal psychological transmission mechanism.

2.2 Hypothesis development

Social Support Theory is used to conceptualize university leadership and sustainability-oriented education as institutional support conditions (Iqbal and Piwowar-Sulej, 2022), whereas VBN theory is used to explain how these support conditions are translated into pro-environmental behavioral intention through environmental values, environmental beliefs, and personal norms (Batool et al., 2023). This structure extends the traditional VBN perspective by locating institutional support as an upstream contextual layer that shapes the development of the internal psychological pathway rather than treating pro-environmental intention as arising solely from individual dispositions. This structure allows the model to distinguish between upstream institutional influence and downstream psychological transmission, and it also provides a basis for testing why different forms of institutional support may produce different behavioral effects. University leadership is conceptualized as students' perceived sustainability-oriented university leadership, reflected in the extent to which university and departmental leaders communicate sustainability priorities, provide visible encouragement, and create a supportive campus climate for energy conservation (Sarwar et al., 2025c). This construct is intentionally defined at the student-perception level, because students are more likely to experience leadership through proximal and observable cues (e.g., reminders, communication, and support practices) than through direct access to high-level strategic decision making. Green University Initiatives (GUIs) have been demonstrated to positively influence students' environmental attitudes, which in turn strengthens their pro-environmental behaviors (Bimantoro and Ghazali, 2025). Furthermore, incorporating environmental and sustainability-oriented education into curricula and extracurricular activities, such as joining campus environmental groups, has been found to substantially increase students' engagement in environmental protection (Handayani and Widodo, 2024). University leadership is also critical for mediating the effects of green human resource management practices on students' PEB, indicating that institutional support can enhance the effectiveness of these practices (Al-Sabi et al., 2024). Moreover, institutional support, as a form of leadership, has been proven to mediate the relationship between sustainability competencies and environmental awareness, ultimately enhancing students' behavioral intentions toward sustainability (Arnejo et al., 2025). Hence, we posit:

H1a: University leadership has a positive effect on students' pro-environmental behavioral intention (PEBI).

H1b: University leadership has a positive effect on environmental values.

H1c: University leadership has a positive effect on environmental beliefs.

H1d: University leadership has a positive effect on personal norms.

Sustainability-oriented education is defined as the extent to which a university provides sustainability- and energy-saving-related informational support through curriculum, instruction, and campus programs, including knowledge, skills, and practice opportunities for students (Nousheen et al., 2020). The improvement of environmental citizenship of undergraduates due to sustainability-oriented curricula is a promising fact of direct correlation between educational measures and pro-environmental performance (Telešiene et al., 2021). Regarding this, the development of sustainability competencies, achieved by the use of generic teaching strategies, was directly linked to the student's perceptions of new paradigms of the environment and their pro-environmental attitudes (Hyytinen et al., 2023). In addition, school activities in the form of learning and extracurricular activities discussed the idea of sustainability in classrooms and attending campus environmental organizations, positively influencing the pro-environmental values and behavior among students (Papavasileiou et al., 2025). Increased intensity of green university initiatives is associated with stronger environmental attitudes among students, which in turn positively predict their pro-environmental behaviors (Bimantoro and Ghazali, 2025; Sarwar et al., 2025a). A study conducted at Cebu Institute of Technology has revealed the role of institutional support in balancing the relationship between the sustainability competencies and environmental awareness and finally improving the behavioral intentions of students toward sustainability (Arnejo et al., 2025). Also, the sustainability-oriented learning programs enhanced their environmental attitudes and intentions strongly to do so that the impact of their ecological footprints was minimized (Khazen et al., 2025). Hence, we posit:

H2a: There exists a positive influence of sustainability-oriented education on the environmental values.

H2b: There is a positive influence of Sustainability-Oriented Education on the beliefs about the environment.

H2c: Sustainability-oriented education impacts on personal norms positively.

H2d: Sustainability-oriented education positively influences student's pro-environmental behavioral intention (PEBI).

Environmental values refer to individuals long term biospheric and altruistic orientations of values that place environmental protection first and forms the distal motivational foundation in activating beliefs, personal norms, and pro environmental intentions (Aviste and Niemiec, 2023). The manifestation of environmental values largely depends on the new ecological paradigm and environmental responsibility as mediating variables, which suggests the complexity of interplay between variables that may increase PEBI with the help of educational interventions (Yang et al., 2024). In the same way, PEBI was positively linked to environmental values among the women in Rafsanjan, Iran, and education level further reinforced this association, indicating that educational interventions can be effectively used to foreigner environmental values and practices (Eslami et al., 2024). The PEBI of young people can be predicted through environmental values and mediated by risk perception and moral anger, which emphasizes the emotional and cognitive aspects, which can be used to encourage pro-environmental behaviors (Li et al., 2022). The influence of personal norms on the relationship between values and PEB is mediated by environmental values and problem awareness, as personal norms play a significant role in translating values into action (Sarwar et al., 2025b). Environmental values and attitudes mediate the influence of environmental consciousness of employees on voluntary PEBI at the work place, suggesting organizational solutions to increase environmental involvement (Aviste and Niemiec, 2023). The environmental values mediate the association between some recreational activity to PEBI that indicates that natural experience might foster values that lead to environmental behaviors (Zhang, 2025). PEBI is positively correlated with connection with nature and biosphere values, and the latter mediates this correlation, which supports the usefulness of intrinsic connection with nature in creating environmental action (Pereira and Forster, 2015). Hence, we assume:

H3: There is a positive influence of environmental values on the pro-environmental behavioral intention (PEBI).

The cognitive linkage between the abstract values and the concrete norms is captured in environmental beliefs which include the knowledge of consequences and assigning responsibility and are of vital importance in how behavioral intentions are formed (Yang et al., 2024). Ecological beliefs are indirectly affected by environmental factors and their influence on ecological behaviors has positive impacts which show that the mediation relationship between environmental factors and behaviors are affected by ecological beliefs (Li et al., 2021). The result is in line with studies that showed a significant positive correlation between environmental beliefs and green purchasing behavior and the mediating effects of these beliefs on the relationship between personal norms and behaviors (Ogiemwonyi et al., 2023). On the same note, Gawshinde et al. (2025) established that green purchasing intentions are directly affected by environmental beliefs with the moderating effect being environmental concerns. Beliefs about the environment directly and indirectly have a serious influence on eco-tourism attitudes via destination image (Yang et al., 2024). The environmental beliefs are also major predictors of personal norm, which influences recycling behaviors at a workplace (Mouro and Duarte, 2021). Hence, we propose:

H4: There is a positive impact of environmental beliefs on pro-environmental behavioral intention (PEBI).

Personal norms are described as the internalized sense of moral responsibility to do a particular thing and have been found to have the huge effect on pro-environmental actions by driving the behavioral intentions (Yang et al., 2024). Personal norms were identified to positively affect the energy-saving intentions in the most significant way, and the willingness of residents to participate in energy-saving behaviors had significant effects in the context of household energy-saving behaviors in China (Liu et al., 2025). Likewise, regarding civil servants in Taiwan, personal norms were found to be one of the most important predictors of pro-environmental behaviors and hence they will influence environmental behaviors (Fang et al., 2019). Moreover, a study of the energy-saving behavior of university students, green purchasing intentions showed that personal norms were a significant mediator of the problem of relationship between normative information and behavioral intentions, as well as indicated that they played a

crucial role in the development of pro-environmental intentions (Ling and Ling, 2025; Liu et al., 2025). Moreover, when examining the pro-environmental actions of Gen Z in the tourism setting, the study revealed that the individual norm has been identified as the key predictor of sustainable transportation decisions, showing that it affects the decision-making process of diverse groups of citizens (Marino et al., 2023). Hence, we propose:

H5: Personal norms have positive effect on pro-environmental behavioral intention (PEBI).

According to the Value-Belief- Norm (VBN) theory, the cause-effect process holds that the environmental values cause environmental beliefs, which then trigger personal norms, which provokes behavioral intentions (Soemantri et al., 2025). The positive influence of environmental values has been identified on PEBI, and mediating effects are observed with the help of the new ecological paradigm and environmental responsibility that combined in creating a chain mediation effect on PEBI (Yang et al., 2024). PEBI is also impacted by university leadership and green organizational culture, since it provides an environment where sustainability is appreciated and leadership has the capability to improve PEBI through encouraging a green work environment, environmental passion that are in harmony and partially mediate the relationship between leadership efforts and PEBI (Omarova and Jo, 2022). Moreover, genuine leadership has been directly associated with the intention to be sustainable in behavior with the condition of environmental values acting as a boundary variable to reinforce the relationship between employee engagement and sustainable behavior intentions (Ahsan et al., 2024). Environmental values mediated the effect of moral norms on the intention to reuse in the framework of the green university initiatives, emphasizing the ability to contribute to the development of sustainable behavior. In addition, the environmental knowledge and behaviors are mediated by environmental attitudes and the intellectual capacity, highlighting the significance of full-fledged environmental education programs, incorporating values (Pitaloka and Kardoyo, 2024). Hence, we posit:

H6: Environmental values have positive effect on environmental beliefs.

H7: Environmental beliefs have positive effect on personal norms.

Leadership of the university which encourages sustainability should first shape what is considered significant by the students via setting an agenda on green issues (Drissi et al., 2025), therefore, allowing the issue of environmental concerns to be more salient and students to subconsciously buy into the values articulated by authorities, as is the case in the principles of the social learning theory whereby individuals internalize the values as developed by the authority figures (Aggarwal and Agarwala, 2025). On the same note, Sustainability-Oriented Education directly conveys the knowledge on environmental issues and remedies, enhancing the environmental value systems of students as the basic sources of environmental pro-behavior (Nurkhin et al., 2025). These structural supportive processes operate on the basis of environmental values in order to manipulate the behavior intentions and down-running psychological variables like environmental beliefs. The mediating role of environmental values among different institutional and personal factors on pro-environmental behaviors has been demonstrated, which indicates that the institutions can effectively advance PEBI through connecting the environmental values to institutional culture and curricula, and thus improvement of the overall environmental welfare in the higher educational institutions (Pitaloka and Kardoyo, 2024). Hence, the following hypotheses:

H8a: Environmental values mediate the relationship between university leadership and pro-environmental behavioral intention (PEBI).

H8b: Environmental values mediate the relationship between sustainability-oriented education and pro-environmental behavioral intention (PEBI).

H8c: Environmental values mediate the relationship between university leadership and environmental beliefs.

H8d: Environmental values mediate the relationship between sustainability-oriented education and environmental beliefs.

The environmental beliefs are influenced by the support of the institutions, and personal values and are important cognitive interfaces converting the abstract values and institutional cues into specific behavioral intentions and moral duties (de Costa et al., 2025). The impact of sustainability-oriented education (ESD) on pro-environmental behaviors is mediated by environmental attitudes (a type of environmental beliefs), which receive the strongest portion of ESD effects, and this aspect is of critical importance to developing the pro-environmental behaviors in students (Bala et al., 2023). Equally, the environmental beliefs also have been defined as an important mediating factor in the correlation between personal norms and green purchasing behaviors, which makes them crucial in determining sustainable consumption practices (Ssenoga et al., 2025). Moreover, sustainability-oriented education programs were apprised to significantly improve environmental attitudes and intention to act, and these are directly associated with behavioral change also giving evidence to the mediating role of environmental beliefs (Khazen et al., 2025). Personal norms which are closely correlated with environmental beliefs also mediate the association between consciousness of the consequences and sustainable behaviors and it is further highlighted that environmental beliefs mediate between sustainability-oriented education (Yang et al., 2024). The mediation plays a crucial role in developing powerful educational programs resulting in the establishment of the long-term ecological responsibility and sustainable practice by the students. Hence, it is anticipated that the influence of institutional support and the even more distant psychological variables on behavioral intentions will be linked through the influence of environmental beliefs. Hence, this study assumes:

H9a: Environmental beliefs mediate the relationship between university leadership and pro-environmental behavioral intention (PEBI).

H9b: Environmental beliefs mediate the relationship between sustainability-oriented education and pro-environmental behavioral intention (PEBI).

H9c: Environmental beliefs mediate the relationship between university leadership and personal norms.

H9d: Environmental beliefs mediate the relationship between sustainability-oriented education and personal norms.

H9e: Environmental beliefs mediate the relationship between environmental values and personal norms.

A personal norms reflect an internal moral duty to behave in a pro-environmentally-oriented manner, are important in shifting leadership values to specific behaviors (Silvi and Padilla, 2021). Considering the context of the Ugandan universities, it was observed that environmental beliefs mediated the connection among the personal norms and green purchasing behaviors, which demonstrates the relevance of the change in behavior based on beliefs in sustainable consumption (Ssenoga et al., 2025). On that note, in Australia, the impact of personal environmental norms on environmentally conscious behaviors was identified to be stronger than the effect of climate change beliefs, and indicated that personal norms may serve to intensify the effect of environmental beliefs on behaviors (Perera et al., 2022). Personal norms are entirely mediating the connection between the alleged pro-environmental organization environment and the pro-environmental behaviors at the workplace, which is crucial to the establishment of the sustainable practice in the work environment (Mouro and Duarte, 2021). Besides, when considering the impact of environmental beliefs and issues on materialism concepts in consumer enactment, the role of personal norms is positive, meaning that they can help in addressing materialistic inclinations that interfere with green purchasing (Jhawar et al., 2023). The Value-Belief-Norm theory is also capable of supporting this mediating impact since personal norm has been observed to mediate the relationship that exists between environmental beliefs and sustainable behaviors like water use among pre-service teachers (Arslan and Durmuş, 2025). Besides, personal norms have full mediation of the impact of ecological worldviews in the context of child pro-environmental behaviors, also exemplifying the efforts to shape pro-environmental behaviors with the critical impact of personal norms (Wu, 2018). Hence, the research proposes:

H10a: Personal norms mediate the relationship between university leadership and pro-environmental behavioral intention (PEBI).

H10b: Personal norms mediate the relationship between sustainability-oriented education and pro-environmental behavioral intention (PEBI).

H10c: Personal norms mediate the relationship between environmental beliefs and pro-environmental behavioral intention (PEBI).

3 Method

3.1 Data collection and sample

This study targeted full-time undergraduate students enrolled in higher education institutions (HEIs) in Shanxi Province, China. To improve sample coverage and comparability across institutional and student subgroups, the study adopted a multi-stage stratified sampling design. The sampling strategy was structured to capture variation in institutional context while maintaining proportional representation of students across academic years. At the institutional level, this design followed a stratified sampling framework, whereas student recruitment within campuses was conducted through on-site invitation rather than pure simple random sampling.

At the institutional level, Shanxi Province was first divided into four geographic-economic strata (North, Central, South, and Southeast) for sampling purposes. Within each regional stratum, institutions were further organized to ensure coverage across key institutional characteristics, including university type (public vs. private) and broad academic orientation (medicine, natural sciences, and social sciences). Based on this stratified framework, the research team implemented institution-level sampling and field access across 81 HEIs, with the aim of ensuring broad coverage of the major regional and institutional categories in Shanxi rather than relying on a small number of campuses.

A total of 1,000 questionnaires were distributed, of which 864 valid responses were retained for analysis, yielding a valid response rate of 86.4%. Eligible participants were full-time undergraduate students who were approached by trained research assistants in public campus spaces across the sampled institutions and invited to participate voluntarily in the survey. After being informed of the academic purpose of the study and the voluntary nature of participation, students who agreed completed the questionnaire on site. Among the valid respondents ($n = 864$), 45.0% ($n = 389$) were male and 55.0% ($n = 475$) were female. The academic-year distribution was broadly balanced: freshmen (27.0%), sophomores (22.5%), juniors (25.5%), and seniors (25.1%). In terms of academic discipline, the sample included students from medicine (31.7%), natural sciences (34.7%), and social sciences (33.6%). These distributions indicate broad coverage across key demographic and academic subgroups and support subgroup-based comparisons in subsequent analyses.

It should be noted that, although the study used a stratified sampling framework at the institutional level and proportionate recruitment targets across major student subgroups, the on-site invitation of students in public campus spaces may still introduce self-selection bias (e.g., students who were more available or more willing to participate at the time of data collection). To mitigate this risk, the study used multi-campus coverage, multiple field locations within campuses, proportionate recruitment targets by academic year, and on-site completion procedures. Nevertheless, this potential source of bias is acknowledged as a limitation when interpreting the generalizability of the findings.

3.2 Measurement

All constructs were measured using a seven-point Likert scale ranging from 1 ("Strongly Disagree") to 7 ("Strongly Agree"). The main text provides a brief description of the operationalization of each construct, including item sources, number of items, and representative example items, while the full final wording of all measurement items is provided in Appendix 1. All items were adapted from established scales and contextually reworded where necessary to fit the Chinese university energy-saving setting, particularly by aligning the wording with campus-based energy use, sustainability education, and student daily practices.

The constructs were quantified as follows: University Leadership (UL) was measured using five items adapted from

Aggarwal and Agarwala (2025) to capture students' perceived sustainability-oriented university leadership in the university context. The items focus on leadership cues that are directly observable to students, such as leadership communication, reminders, and support for energy-saving practices (e.g., "My department head usually reminds us of the importance of energy saving"). In this study, such items are used to operationalize leadership at the student-experience level, where departmental leadership behaviors function as visible carriers of broader university leadership intent. Sustainability-oriented education was assessed using five items of Nousheen et al. (2020), and it considered the level of sustainability and energy-saving education that students obtained at their universities (e.g., "My university provides a course or a lecture connected with environmental protection or sustainable development"). The scale for measuring Environmental Values (EV) had four items constructed on the model by Yang et al. (2024), with biospheric and altruistic values (e.g., "I believe that preservation of natural environment and extinction of the species is extremely important"). Environmental Beliefs (EB) were assessed using five items that are synthesis of the New Ecological Paradigm (NEP) scale, and the research on the Awareness of Consequences (AC) and Ascription of Responsibility (AR) (e.g., "I believe my personal energy saving behavior helps reduce the energy crisis") (Yang et al., 2024). Personal Norms (PN) was also assessed using four items, which were based on Yang et al. (2024), and evaluated the personal moral obligation toward saving energy among students (e.g., "I would feel guilty if I have not turned off the lights when leaving a room"). The Pro-environmental Behavioral Intention (PEBI) was measured using five items as indicated by Lee and Tanusia (2016), which covers the willingness of the student to perform specific energy-saving activities in future (e.g., "I am willing to actively use the air conditioning less in the future").

3.3 Pre-test

A pilot test was conducted before the main survey using 50 full-time undergraduate students from one university in Shanxi Province to assess item clarity, contextual appropriateness, and preliminary reliability. All measurement items were translated into Chinese and then back-translated to improve semantic consistency with the original scales. In addition, minor wording adjustments were made to ensure that the items were appropriate for the Chinese university energy-saving context. The pilot results showed acceptable internal consistency across all constructs, with Cronbach's α values ranging from 0.79 to 0.88. Respondents also indicated that the questionnaire wording was clear and easy to understand. Based on the pilot feedback, only minor revisions were made to improve readability, and no substantive changes were made to the measurement structure before the main survey.

3.4 Data analysis

The data was analyzed on SPSS 26.0 and AMOS 24.0. The analysis was done in few steps. First, SPSS was used to collect the descriptive statistical analysis to analyze the demographic properties of the sampled and calculate the mean, standard deviation, skewness, and kurtosis of the primary variables to be in the position to appreciate the simple data distribution. Second, reliability and validity of the measurement model was determined. Cronbach alpha and Composite Reliability (CR) were used in assessing reliability. Confirmatory Factor Analysis (CFA) was used as the measure of validity. Convergent validity was determined by analyzing the factor loadings and the Average Variance Extracted (AVE), and discriminant validity was evaluated based on the Fornell-Larcker criterion which, taking the square root of AVE of each construct and comparing it with the correlation of the construct with other constructs was used to determine the validity. Lastly, Structural Equation Modeling (SEM) was taken to the test on the research hypotheses after a satisfactory measurement model was confirmed. Various fit indices (Chi^2/df, CFI, TLI, RMSEA, SRMR) were used to assess the overall fit of the structural model. The statistical importance of the path coefficients between the direct and indirect (mediation) effects were investigated by the bootstrapping technique with resamples of 5,000 to find out whether the hypotheses were accepted. Given the relatively low variance observed in some constructs (particularly EB and PN), bootstrapping with 5,000 resamples was also used to improve the robustness of significance testing and confidence-interval estimation for the structural paths.

Because the study used a single self-reported Likert-scale questionnaire, common method variance (CMV) was assessed. Harman's single-factor test was conducted using unrotated exploratory factor analysis. In the pilot sample ($n = 50$), the first factor accounted for 29.4% of the total variance, indicating no serious single-factor dominance. In the main sample ($n = 864$), the first factor explained 32.7% of the total variance, which was below the commonly used threshold, suggesting that CMV was unlikely to pose a serious threat to the main findings.

In addition, because the sample covered students from different academic disciplines and year levels, subgroup robustness was considered in the analysis plan. To strengthen the interpretability and generalizability of the findings across major subgroups, the study further examined whether the measurement structure and key relationships were reasonably stable across discipline- and year-based categories. This step was included to reduce the risk that the reported structural paths reflected subgroup-specific measurement patterns rather than the broader institutional–psychological mechanism proposed in the model. Furthermore, given the on-site field administration approach, the interpretation of results emphasizes structural relationships within the sampled population while acknowledging potential self-selection bias in external generalization.

4 Results

4.1 Descriptive statistics and demographic analysis

The demographics of the sample is contained in Table 1. The sample size was 864 students of the university, and the ratio of males

TABLE 1 Demographic characteristics of the sample ($N = 864$).

Demographic variable	Category	Frequency	Percentage
Gender	Male	389	45.0
	Female	475	55.0
Academic year	Freshman	233	27.0
	Sophomore	194	22.5
	Junior	220	25.5
	Senior	217	25.1
Academic discipline	Medicine	274	31.7
	Natural sciences	300	34.7
	Social sciences	290	33.6
University type	Public	601	69.6
	Private	263	30.4
Family income	Low	221	25.6
	Medium	438	50.7
	High	205	23.7

to females was relatively even (45.0:55.0). The sampling was fairly balanced across academic years, consisting of freshmen, sophist, juniors, and seniors in 27.0, 22.5, 25.5, and 25.1 percent of the sample, respectively. Academically, students of medicine, natural sciences, and social sciences constituted 31.7, 34.7, and 33.6 percent of the sample, respectively. Most of the students (69.6) studied in the public universities and only 30.4 in the private institutions. On the family income aspect, 25.6% claimed to be low income earners, 50.7% were medium income earners, and 23.7% were high income earners. These demographic spreads show that the sample represents the main population of the university students in the Shanxi Province well.

Table 2 demonstrates descriptive statistics data on the primary variables. The standard deviations were 0.33–1.15 with mean scores of all constructs between 1.34 and 2.73. All the skewness and kurtosis levels were within acceptable levels (skewness less than 1.0 and kurtosis less than 3.0) implying that the data was more or less normal, which was suitable in further structural equation modeling.

It should be noted that the mean scores for Environmental Beliefs (EB = 1.47) and Personal Norms (PN = 1.34) were relatively low, with limited dispersion, especially for PN (SD = 0.33). To verify that this pattern was not caused by data-processing errors, the coding direction of all items was rechecked prior to analysis, and no reverse-coding inconsistency was identified in the final dataset. Therefore, the low means are interpreted as reflecting a low baseline level of environmental moral obligation and belief activation in the sampled student population, rather than a scoring artifact. Although the absolute levels were low, the constructs still showed acceptable psychometric quality and meaningful covariance with other variables, supporting their continued inclusion in the SEM analysis. Nevertheless, the restricted variance in these constructs should be considered when interpreting the magnitude of the structural path coefficients.

4.2 Measurement model: reliability and validity assessment

Confirmatory factor analysis (CFA) was used to measure the validation of the model. Cronbachs alpha and Composite Reliability (CR) measures of reliability were used (Hair et al., 2022). As presented in Table 3, all the constructs had excellent internal consistency with Cronbach's alpha ranging between 0.88 and 0.93 (all above the 0.70 level), and CR values ranging between 0.91 and 0.95 (all above the 0.70 level).

Factor loading was tested, as well as AVE (Hair et al., 2019), to test convergent validity. Standardized factor loadings of all factors were between 0.78 and 0.89, which is higher than the stipulated 0.70. The AVE is 0.698 to 0.775, whereas it is above 0.50. Such findings validate the assumption that the measurement items can be used to measure its constructs.

Fornell-Larcker criterion was used to test discriminant validity; a comparison of square root of construct AVE and correlations with other constructs was undertaken (Fornell and Larcker, 1981). Table 4 indicates that all the diagonal values (square roots of AVE) were higher than the off-diagonal correlations provided in the rows and columns of the table, and that each of the constructs is independent enough of the others.

4.3 Structural model and hypothesis testing

The structural model demonstrated an acceptable overall fit to the data ($\chi^2/df = 2.38$, $p < 0.001$; CFI = 0.943; TLI = 0.932; RMSEA = 0.051; SRMR = 0.067), indicating that the hypothesized relationships adequately reproduced the observed covariance structure and providing a sound basis for interpreting the structural paths (Hu and Bentler, 1999; Schermelleh-Engel et al., 2003). As reported in Table 5, 11 out of 13 direct-effect hypotheses were supported, suggesting that the proposed framework is largely consistent with the data while also revealing clear heterogeneity in the effectiveness of different institutional levers.

Regarding institutional predictors, university leadership (UL) showed a differentiated pattern of effects. UL did not exert a statistically significant direct influence on pro-environmental behavioral intention (PEBI) (H1a: $\beta = 0.068$, $t = 1.287$, $p = 0.198$) and also failed to significantly predict personal norms (PN) (H1d: $\beta = 0.087$, $t = 1.542$, $p = 0.123$). In contrast, UL significantly and positively predicted environmental values (EV) (H1b: $\beta = 0.312$, $t = 5.876$, $p < 0.001$) and environmental beliefs (EB) (H1c: $\beta = 0.198$, $t = 3.654$, $p < 0.001$), indicating that leadership effects were more pronounced at the level of upstream cognitive orientations than at the level of the most proximal motivational determinant of intention. Sustainability-oriented education, by comparison, exhibited robust, and comprehensive effects across outcomes. SE significantly predicted EV (H2a: $\beta = 0.245$, $t = 4.892$, $p < 0.001$), EB (H2b: $\beta = 0.287$, $t = 5.543$, $p < 0.001$), PN (H2c: $\beta = 0.156$, $t = 2.876$, $p < 0.01$), and PEBI (H2d: $\beta = 0.218$, $t = 4.321$,

TABLE 2 Descriptive statistics for main variables ($N = 864$).

Variable	Mean	SD	Skewness	Kurtosis
University Leadership (UL)	2.73	1.15	0.18	−0.85
Sustainability-oriented education	2.71	1.11	0.22	−0.72
Environmental Values (EV)	2.11	0.85	0.31	−0.58
Environmental Beliefs (EB)	1.47	0.48	0.42	−0.41
Personal Norms (PN)	1.34	0.33	0.35	−0.29
Pro-environmental Behavioral Intention (PEBI)	2.09	0.83	0.39	−0.51

TABLE 3 Reliability and validity of the measurement model.

Construct	Items	Factor loadings	Cronbach's α	CR	AVE
UL	5	0.78–0.88	0.912	0.930	0.725
SE	5	0.80–0.86	0.898	0.921	0.698
EV	4	0.79–0.85	0.885	0.910	0.715
EB	5	0.78–0.89	0.925	0.940	0.758
PN	4	0.81–0.87	0.905	0.925	0.755
PEBI	5	0.83–0.88	0.931	0.945	0.775

$p < 0.001$), with the direct path to PEBI reaching a moderate magnitude, implying that educational interventions contribute to intention formation both directly and through downstream psychological processes.

The Value–Belief–Norm (VBN) chain was strongly supported. EV significantly predicted EB (H6: $\beta = 0.456$, $t = 9.876$, $p < 0.001$), and EB significantly predicted PN (H7: $\beta = 0.398$, $t = 8.234$, $p < 0.001$), providing empirical confirmation of the sequential structure from values to beliefs to moral obligation. Moreover, EV, EB, and PN each had significant positive direct effects on PEBI (H3: $\beta = 0.195$, $t = 4.567$, $p < 0.001$; H4: $\beta = 0.201$, $t = 4.892$, $p < 0.001$; H5: $\beta = 0.287$, $t = 6.543$, $p < 0.001$). Regarding the strength of the effects, PN proved to be the best direct predictor of PEBI, which is in line with the assumption that moral obligation is the most proximate cause of pro-environmental intention. Combined with Tables 4, 5 suggests a solid psychological chain with institutionalized differences in effects: sustainability-oriented education has important effects on all levels of the VBN pathway, as well as on any stage of intention formation, but the influence of university leadership is much stronger on the formation of values and beliefs at the upper levels, but not on the translation of this into personal norms and intention.

4.4 Mediation effects analysis

To test mediation (H8a–H10c), data was tested to see the indirect effects through bootstrapping with (5,000 resamples and 95% confidence interval) (Preacher and Hayes, 2008). Table 6 shows the results.

Table 7 summarizes the proposed framework, and overall, the empirical evidence is able to support the proposed framework with most of the hypothesized relationships established. Particularly, direct-effect hypotheses are highly supported, which shows that the integrated model contains both institutional factors and the basic VBN psychological pathway to elucidate the energy saving intentions held by students. The support rate of mediation hypothesis is also high, which implies that indirect transmission is one of the key mechanisms in which institutional factors do influence intention. It is noteworthy that the unsupported hypotheses are focused on UL-related associations with PEBI, both directly and indirectly with the key mediators, and SE-related mechanisms are always supported. This evidence on preferred vs. rejected hypotheses underlines the key conclusion of Section 4.4 namely that explanatory power is mainly provided by sustainability-oriented education and the VBN chain, whereas leadership influences appear to be relatively constrained and less predictable to convert institutional signals into behavioral intention.

The fact that the overall support rate of 76.0% in Table 7 indicates that there is a high level of validity in the proposed theoretical model, however, the existence of significant boundary conditions and limitations to the institutional effects should be investigated further. The tendency of non-supported hypotheses implies that the effect of institutional factors (leadership and education) is not unanimous on all psychological outcomes, and their impact on behavior is mostly indirect and implemented by activating beliefs and personal norms.

5 Discussion

5.1 Research findings

One of the most notable findings of this study is that university leadership did not show a significant direct effect on students' pro-environmental behavioral intention. This result challenges a common assumption in organizational and higher education

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TABLE 4 Discriminant validity (Fornell–Larcker criterion).

Construct	UL	SE	EV	EB	PN	PEBI
UL	**0.851**					
SE	0.512	**0.835**				
EV	0.445	0.489	**0.845**			
EB	0.298	0.325	0.412	**0.871**		
PN	0.215	0.241	0.285	0.398	**0.869**	
PEBI	0.298	0.356	0.521	0.512	0.621	**0.880**

Diagonal values in bold represent the square root of AVE for each construct.

TABLE 5 Structural model path coefficients and hypothesis testing results.

Hypothesis	Path	Standardized β	*t-value*	*p-value*	Result
H1a	UL → PEBI	0.068	1.287	0.198ns	Not Supported
H1b	UL → EV	0.312	5.876	***	Supported
H1c	UL → EB	0.198	3.654	***	Supported
H1d	UL → PN	0.087	1.542	0.123ns	Not Supported
H2a	SE → EV	0.245	4.892	***	Supported
H2b	SE → EB	0.287	5.543	***	Supported
H2c	SE → PN	0.156	2.876	**	Supported
H2d	SE → PEBI	0.218	4.321	***	Supported
H3	EV → PEBI	0.195	4.567	***	Supported
H4	EB → PEBI	0.201	4.892	***	Supported
H5	PN → PEBI	0.287	6.543	***	Supported
H6	EV → EB	0.456	9.876	***	Supported
H7	EB → PN	0.398	8.234	***	Supported

***$p < 0.001$, **$p < 0.01$, *$p < 0.05$, ns, not significant.
UL, University Leadership; SE, Sustainability-oriented Education; EV, Environmental Values; EB, Environmental Beliefs; PN, Personal Norms; PEBI, Pro-environmental Behavioral Intention.

literature that university leadership can directly translate into intended student outcomes. A more plausible explanation lies in the structural nature of leadership in higher education and the psychological distance between leadership actions and students' everyday energy-use behavior. At the macro-institutional level, university leadership is typically expressed through strategic plans, policy statements, and resource allocation decisions. These actions are often abstract and relatively distant from students' day-to-day experiences on campus. Even when sustainability is declared an institutional priority, students may not perceive such declarations as personally relevant to their own energy consumption behavior. This pattern is consistent with the implementation gap discussed in organizational studies, namely the gap between what leaders formally promote and what organizational members actually experience in practice. In the context of campus sustainability, students may recognize that their university promotes "green" initiatives, but this recognition may not automatically translate into an internalized sense of responsibility for energy conservation. This interpretation is consistent with Maqsoom et al. (2025), who found that leadership effects on pro-environmental behavior were primarily transmitted through intermediate psychological mechanisms rather than direct influence. Similarly, Ahsan et al. (2024) reported that authentic leadership tends to affect sustainable behavioral intention by activating values and cognition rather than by directly prompting behavior.

The non-significant direct leadership effect (H1a) may also reflect a perceived mismatch between symbolic sustainability messaging and students' everyday observations of institutional practice. Students in higher education settings are increasingly capable of evaluating institutional rhetoric critically, and leadership messages may lose persuasive power when they are not accompanied by visible and tangible changes in campus operations. One possible interpretation is that some students may perceive sustainability initiatives as largely symbolic or performative, which may reduce the persuasive power of leadership signals. However, this study did not directly measure students' perceptions of symbolic communication or institutional credibility, so this explanation should be treated as an interpretive possibility rather than a confirmed mechanism. This interpretation helps explain why leadership messaging alone may fail to generate behavioral intention. In this sense, the H1a result suggests that leadership influence on student energy-saving intention may require not only policy-level positioning, but also concrete institutional practices that students can directly observe and experience. It is also important to note that the UL construct in this study reflects students' perceived university leadership (i.e.,

TABLE 6 Mediation effects analysis.

Mediation hypothesis	Mediation path	Indirect effect	95% CI	Significance
H8a	UL → EV → PEBI	0.061	[−0.008, 0.142]	Not Significant
H8b	SE → EV → PEBI	0.048	[0.012, 0.098]	Significant
H8c	UL → EV → EB	0.142	[0.089, 0.201]	Significant
H8d	SE → EV → EB	0.112	[0.065, 0.167]	Significant
H9a	UL → EB → PEBI	0.040	[−0.005, 0.089]	Not Significant
H9b	SE → EB → PEBI	0.058	[0.021, 0.101]	Significant
H9c	UL → EB → PN	0.079	[0.034, 0.132]	Significant
H9d	SE → EB → PN	0.114	[0.067, 0.168]	Significant
H9e	EV → EB → PN	0.182	[0.128, 0.242]	Significant
H10a	UL → PN → PEBI	0.025	[−0.012, 0.068]	Not Significant
H10b	SE → PN → PEBI	0.045	[0.015, 0.082]	Significant
H10c	EB → PN → PEBI	0.114	[0.072, 0.161]	Significant

Significant mediation effects are indicated when the 95% confidence interval does not include zero.
UL, University Leadership; SE, Sustainability-oriented Education; EV, Environmental Values; EB, Environmental Beliefs; PN, Personal Norms; PEBI, Pro-environmental Behavioral Intention.

TABLE 7 Summary of hypothesis testing results.

Category	Total hypotheses	Supported	Not supported	Support rate
Direct effects (H1a–H7)	13	10	3	76.9%
Mediation effects (H8a–H10c)	12	9	3	75.0%
Total	25	19	6	76.0%

the leadership signals students can directly observe in campus life), rather than an objective measure of top-level university governance capacity. Therefore, the non-significant direct effect should be interpreted as a limitation in the behavioral influence of perceived leadership cues at the student level, rather than as evidence that university leadership is unimportant in a broader administrative sense.

A further explanation for the non-significant H1a result is the temporal and spatial distance between leadership decisions and student behavior. University leadership typically operates at a strategic level, often over long planning cycles and campus-wide agendas, whereas student energy-saving behavior occurs in immediate and localized settings such as dormitories, classrooms, and daily routines. This mismatch in temporal and spatial scale may weaken the direct influence of leadership on behavioral intention. In contrast, more proximal factors may play a more immediate role in shaping students' energy-saving intentions, such as whether energy-saving reminders are present in dormitory environments, whether peers model conservation behavior, or whether there are concrete incentives linked to daily practice. This interpretation is consistent with the proximity principle in environmental psychology, which suggests that people are more responsive to environmental cues and social influences that are physically and temporally close to the decision context (Shooshtarian et al., 2025).

The findings also suggest that university leadership is less effective in activating personal norms, which represent an internalized sense of moral obligation. Personal norms are typically formed through direct experience, moral reflection, and close interpersonal interaction rather than through remote institutional messaging. This helps explain why leadership may influence students' environmental beliefs (as reflected in the significance of H1c) but still fail to trigger a stronger sense of personal moral responsibility toward energy conservation (H1d). In other words, recognizing that environmental problems are serious and that one bears some responsibility for them is not necessarily equivalent to internalizing a personal duty to act. The latter generally requires a deeper process of psychological internalization. Moral psychology research similarly indicates that personal norms are shaped through value meaning, socialization processes in immediate social environments, and direct experience with the consequences of one's behavior (Yaban and Gaschler, 2025). From this perspective, leadership communication may support awareness, but it may be less effective in producing the internal moral commitment represented by personal norms.

Relatedly, students may interpret leadership-led sustainability efforts as externally driven rather than internally meaningful, which may further limit the formation of personal norms. If sustainability messages are perceived primarily as institutional requirements, image-oriented communication, or top-down expectations, students may be less likely to internalize them as part of their own moral framework. This interpretation is consistent with reactance-based explanations in prior research, which suggest that individuals may reduce acceptance of messages they perceive as externally controlling (Zhou et al., 2025). In this context, leadership communication may still raise awareness, but it may be less effective in fostering self-endorsed moral obligation.

The results further imply that personal norms may be shaped more effectively through peer-related and experience-based processes than through formal institutional authority. Emerging research on social influence in environmental behavior suggests that the perceived values and behaviors of one's close social group can have a strong effect on the development of moral responsibility (Gelfand et al., 2024). In university settings, roommates, classmates, and friendship groups are part of students' daily social environment and may therefore exert more immediate influence on whether energy conservation becomes morally salient. This pattern suggests that interventions relying solely on top-down leadership communication may be less effective than those that also create peer-supported social conditions in which energy-saving behavior is normalized.

The non-significant indirect effect H8a (University Leadership → Environmental Values → PEBI: IE = 0.061, 95% CI = −0.008 to 0.142, ns) highlights an important limitation in the leadership-to-behavior pathway. Although leadership significantly influenced environmental values (H1b), these values did not significantly transmit leadership influence to behavioral intention. This result suggests that value activation alone may be insufficient to convert institutional influence into specific energy-saving intention. Environmental values are broad guiding principles regarding what is important (e.g., protection of nature), whereas energy-saving intention refers to concrete and specific behavioral plans. The translation from general values to specific behavior often depends on additional cognitive and motivational processes. This interpretation is consistent with research on the value-action gap, which shows that people may endorse environmental values without consistently translating those values into everyday pro-environmental action (Trujillo and Luchs, 2025). In the present context, the values activated by leadership may operate at a general attitudinal level but may not be sufficiently internalized or behaviorally specific to support intention formation.

A related explanation is that leadership may activate environmental values at a broad normative level, while the behavioral outcome in this study is highly specific. Students may agree in principle that environmental protection is important, yet this broad endorsement may not readily translate into intention to perform specific energy-saving actions. This is also consistent with the specificity principle in attitude–behavior research, which suggests that prediction improves when the level of specificity between predictor and outcome is aligned (Burgos-Espinoza et al., 2025). The non-significance of H8a therefore suggests that leadership-led sustainability efforts may need to move beyond broad value messaging and provide stronger links to concrete energy-saving responsibilities and practices.

Although university leadership significantly influenced environmental beliefs (H1c), the indirect path from leadership through environmental beliefs to behavioral intention was not significant (H9a). This pattern suggests that increasing environmental beliefs alone may not be enough to generate behavioral intention unless students also perceive clear, feasible, and personally relevant action routes. Students may believe that energy conservation is important and that individuals bear responsibility for energy-related problems, but such beliefs may not translate into intention when students are uncertain about the practical impact of their own actions or lack concrete strategies for energy saving. This interpretation is consistent with environmental psychology research emphasizing the role of efficacy-related cognition in converting concern into intention (Song et al., 2024).

The contrast between leadership and sustainability-oriented education is also informative here. Environmental beliefs activated through leadership messaging may remain relatively general, whereas beliefs developed through educational processes are more likely to be linked to practical understanding and actionable knowledge. Educational interventions can more directly connect environmental problems with feasible daily energy-saving strategies, thereby strengthening the translation from belief to intention. From this perspective, the non-significance of H9a suggests that leadership-based influence through beliefs may remain limited unless it is reinforced by educational content that provides clear behavioral guidance.

Taken together, the results indicate that university leadership appears less effective in activating the personal norm pathway, and this has important implications for understanding institutional influence on student energy-saving intention. In the VBN framework, personal norms function as the most proximate moral driver of behavioral intention. However, leadership operates through institutional authority and hierarchical communication, which may be less conducive to the kind of internalization required for personal norm formation. In contrast, educational processes are more likely to support internalization because they provide knowledge, interpretation, and reflection opportunities that students can integrate into their own moral reasoning. This helps explain why sustainability-oriented education showed a stronger and more consistent role in activating personal norms than leadership did.

The same logic also helps explain why peer and experience-based processes remain important. Personal norms are often strengthened through socialization, role modeling, and direct experience. In university life, peers are socially and spatially closer to students than institutional administrators, which may make peer influence more salient in shaping moral obligation related to everyday energy use (Zhou and Zheng, 2024). This pattern suggests that institutional efforts to promote energy conservation may benefit from combining formal sustainability initiatives with peer-based engagement mechanisms and student-led sustainability activities. This interpretation is also consistent with the relatively low mean scores observed for environmental beliefs and personal norms in the descriptive results. These low baseline levels suggest that, in the sampled student population, environmental concern may not yet have been strongly internalized as personal responsibility or moral obligation in everyday campus energy-use contexts. This pattern further helps explain why educational intervention appeared more effective than leadership cues in activating downstream normative commitment.

In contrast to the limitations observed for university leadership, sustainability-oriented education showed strong and consistent effects across the model. Education significantly influenced environmental values, environmental beliefs, personal norms, and behavioral intention, both directly and through mediation pathways. This pattern underscores the central role of education in shaping pro-environmental intention among university

students and suggests that educational interventions may function as the most effective institutional channel for activating the VBN process.

The stronger effects of sustainability-oriented education can be understood through several complementary mechanisms. Educational interventions provide action-oriented knowledge that helps students connect environmental issues with specific behavioral responses. Compared with abstract leadership messaging, educational content can be made more personally relevant and easier to internalize. In addition, education is often delivered through repeated and context-rich formats—such as classroom teaching, workshops, and campus-based information sessions—which may strengthen reinforcement over time. Educational settings also allow instructors to function as credible knowledge sources and supportive guides, making students more receptive to sustainability-related meaning and practice. These features help explain why sustainability-oriented education appears more effective than leadership communication in activating multiple layers of the psychological pathway from values and beliefs to norms and behavioral intention.

Finally, the findings provide substantial support for the VBN causal chain in the context of university students' energy-saving intention. Personal norms emerged as the strongest direct predictor of pro-environmental behavioral intention, which is consistent with the core VBN proposition that moral obligation is the most proximal driver of intention. In addition, the significant mediation role of environmental beliefs within the VBN pathway (e.g., H9e) further highlights the importance of belief formation as an intermediate mechanism linking values to moral obligation and intention. However, the results also show that environmental values and environmental beliefs retained significant direct effects on pro-environmental behavioral intention. This means that the present findings are better interpreted as a partial-mediation pattern rather than a strict full-mediation version of VBN. In the HEI energy-saving context, upstream psychological factors appear to influence intention both through the normative pathway and through direct value- and belief-based routes. Overall, the results suggest that effective campus energy-saving interventions should not rely on information provision alone, but should also support the internalization of responsibility and the translation of environmental cognition into concrete daily behavioral commitment.

5.2 Theoretical contributions

The findings of the present study contribute to a more context-sensitive understanding of how institutional influence operates in university students' pro-environmental intention formation. The non-significant direct effect of university leadership, together with its significant effects on environmental values and environmental beliefs, suggests that institutional influence may be transmitted more effectively through intermediate psychological mechanisms than through a direct behavioral pathway (Maqsoom et al., 2025). The strong and stable effects of sustainability-oriented education observed in the present model further indicate that educational support may function as a more behaviorally proximal form of institutional influence in higher education settings (Qi et al., 2025). This interpretation is reinforced by evidence showing that environmental education can directly promote concrete pro-environmental behavior among college students, rather than merely serving as a general background condition (Luo et al., 2025). It has also been indicated that university-based contextual conditions can shape students' pro-environmental behavior by influencing the psychological and situational conditions surrounding action (Fu et al., 2025). Taken together, these comparisons suggest that institutional influence in higher education should be understood as a layered process in which different institutional conditions shape different stages of students' pro-environmental intention formation.

A further theoretical contribution lies in the extension of the Value–Belief–Norm framework in the higher education energy-saving context. Traditional applications of VBN have primarily emphasized the internal progression from values to beliefs, from beliefs to personal norms, and from personal norms to behavioral intention. The present findings indicate that this internal sequence can be more fully understood when institutional support is incorporated as an upstream contextual condition. This position is supported by research showing that educational conditions in universities can generate measurable effects on students' environmentally relevant behavior, thereby shaping the motivational foundation of pro-environmental action (Luo et al., 2025). It has also been shown that contextual influences within universities can contribute to the emergence of students' pro-environmental behavior, which supports the theoretical placement of institutional support ahead of the internal VBN process (Fu et al., 2025). On this basis, the present study further suggests that institutional support should not be treated as a single undifferentiated construct. Sustainability-oriented education was linked more strongly and more consistently to environmental values, environmental beliefs, personal norms, and pro-environmental behavioral intention. By contrast, university leadership was linked more clearly to upstream cognitive components, especially values and beliefs, but less strongly to personal norms and downstream behavioral intention. This differentiated pattern enriches the application of VBN in higher education by showing that distinct institutional mechanisms may activate different stages of the psychological pathway.

A third theoretical implication concerns the form of mediation within the VBN pathway. Although the sequential VBN structure was supported, significant direct effects were also retained by environmental values and environmental beliefs on pro-environmental behavioral intention. This pattern suggests that the present findings are better interpreted as reflecting partial mediation rather than a strict full-mediation version of VBN. This interpretation is consistent with research indicating that personal norms remain a particularly strong predictor of university students' energy-saving intention in campus-related settings (Ling and Ling, 2025). It is also consistent with evidence from student residential energy contexts, where energy-saving intention has been shaped by highly proximal and context-sensitive psychological processes (Hou and Law, 2024). These comparisons suggest that specific daily energy-saving intentions among university students may not be fully explained by a purely linear progression from distal cognition to action. In the higher education energy-saving context, upstream

psychological factors appear to influence intention both indirectly through personal norms and directly through value- and belief-based motivational routes. In this respect, the present study refines the application of VBN in higher education by showing that moral obligation remains the strongest proximal driver, while distal value and belief components may continue to retain independent explanatory power under institutional sustainability conditions.

5.3 Practical implications

The findings suggest that sustainability-oriented education should be treated as a central component of university energy-conservation strategies. Given its consistent effects across environmental values, environmental beliefs, personal norms, and pro-environmental behavioral intention, universities are advised to strengthen the integration of sustainability-related content into formal curricula, campus campaigns, and practice-based learning activities. Educational interventions appear especially valuable when they connect environmental issues with concrete, student-relevant actions.

The results also indicate that university leadership remains important, but its role may be more effective as an enabling and coordinating force than as a direct driver of student behavioral intention. In this study, leadership showed stronger influence on upstream psychological variables than on direct intention formation. Therefore, university leadership may be better positioned to provide policy support, allocate resources, and create institutional conditions that reinforce educational interventions, rather than relying mainly on top-down messaging to produce behavioral change.

A further implication is that universities should pay greater attention to the development of students' personal norms, because personal norms emerged as the strongest direct predictor of pro-environmental behavioral intention in the VBN chain. Since leadership signals alone appear less effective in activating personal moral obligation, universities may benefit from designing peer-based and student-centered sustainability initiatives. Examples include dormitory energy-saving campaigns led by student teams, student sustainability clubs, and peer-led participation mechanisms that make energy conservation more socially visible and morally meaningful in daily campus life.

The findings also suggest that sustainability interventions should not stop at raising general environmental awareness. While environmental values and beliefs are important, the results indicate that abstract environmental concern alone may be insufficient to generate strong behavioral intention. Universities should therefore complement awareness-building with practical guidance, such as clear energy-saving routines, actionable behavioral tips, and context-specific strategies that help students translate environmental concern into concrete energy-conservation intentions.

Finally, the results imply that universities should avoid relying primarily on symbolic or low-visibility sustainability communication. When sustainability efforts are communicated mainly at a rhetorical level, students may perceive them as distant from everyday campus life, which can weaken behavioral influence. Universities may therefore improve effectiveness by linking sustainability priorities to visible institutional actions and to educational content that helps students understand both the practical relevance of energy conservation and their own role in achieving it. This combination of visible institutional commitment and actionable educational support is likely to provide a stronger foundation for fostering pro-environmental intentions among students.

6 Conclusion

The present study contributes to the literature on pro-environmental behavior among university students by offering a more nuanced explanation of how institutional support shapes pro-environmental behavioral intention in higher education energy-saving contexts. The findings indicate that university leadership does not exert a significant direct effect on students' pro-environmental behavioral intention and does not significantly activate personal norms, which represent the most immediate and powerful motivational basis of intention. By contrast, sustainability-oriented education shows strong and significant effects across environmental values, environmental beliefs, personal norms, and pro-environmental behavioral intention, both directly and through multiple mediation pathways. These results suggest that educational support functions as a more immediate and effective institutional mechanism for promoting student energy-saving intention than leadership signals alone. Strong support was also found for the Value–Belief–Norm (VBN) framework, with personal norms emerging as the strongest direct predictor of pro-environmental behavioral intention. At the same time, the differentiated pattern of mediation indicates important boundary conditions: institutional support appears to be most effective in activating environmental beliefs, moderately effective in shaping environmental values, and comparatively less effective in fostering the deeper sense of moral obligation reflected in personal norms.

In practical terms, the findings suggest that universities seeking to strengthen students' energy-saving intention should adopt a multi-layered intervention strategy. Sustainability-oriented education should be treated as a core institutional mechanism, because it provides students with concrete knowledge, interpretive guidance, and action-oriented understanding of energy conservation. Universities are therefore encouraged to integrate sustainability-related content more systematically into curricula, co-curricular activities, and campus campaigns. At the same time, university leadership remains important, but its role appears to be more effective as an enabling and coordinating force than as a direct driver of student behavioral intention. Leadership efforts should therefore focus on providing policy support, allocating resources, and creating institutional conditions that strengthen student-centered and education-led sustainability action. The findings also indicate that peer-based engagement may be especially important for activating personal norms. Universities may therefore benefit from investing in student-led sustainability projects, dormitory-based energy-saving campaigns, and peer-supported participation mechanisms that make energy conservation more socially visible and morally meaningful in

everyday campus life. By combining direct educational strategies with leadership support for student-driven change, universities may more effectively foster sustained pro-environmental behavior among students.

Despite these contributions, several limitations should be acknowledged. First, the study relied on a single self-reported questionnaire, which may be subject to social desirability bias, perceptual bias, and the broader limitation that reported intention does not always translate into actual energy-saving behavior. Although common method variance was assessed and did not appear to pose a serious threat, the use of self-reported data still limits the extent to which the findings can be interpreted as reflecting actual behavioral practice. Second, the sample was drawn from full-time undergraduate students in Shanxi Province, China, and the findings should therefore be generalized with caution to other regional, cultural, or institutional settings. Differences in policy environments, campus governance structures, and sustainability cultures across universities or countries may lead to different patterns of institutional and psychological influence.

Future research could address these limitations in several ways. Behavioral or longitudinal data could be incorporated to examine whether reported intention is translated into sustained energy-saving practice over time. Broader sampling across multiple provinces, institutional types, or national contexts would also help determine whether the present institutional support–VBN relationships remain stable across different higher education environments. In addition, the integrated institutional support–VBN framework could be extended by incorporating perspectives such as self-determination theory to examine the role of perceived autonomy and intrinsic motivation in mediating institutional effects. Further work could also explore moderating mechanisms such as institutional credibility, peer influence strength, and students' environmental identity in order to clarify the conditions under which institutional and psychological factors most effectively promote sustained pro-environmental behavior.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving humans were approved by Institutional Review Board for Human Subject Research, Sirindhorn College of Public Health, Yala. The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

Author contributions

XZ: Conceptualization, Data curation, Investigation, Methodology, Software, Writing – original draft, Writing – review & editing. SJ: Data curation, Formal analysis, Investigation, Methodology, Project administration, Resources, Writing – original draft, Writing – review & editing. JD: Data curation, Resources, Supervision, Validation, Visualization, Writing – review & editing.

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Appendix

TABLE A1 Measurement items.

Construct	Code	Statement
University Leadership (UL)	UL1	My department heads are committed to promoting energy conservation and environmental protection on campus.
	UL2	Department heads in my university encourage students to participate in energy-saving and other environmental activities.
	UL3	Students in my department are encouraged by the department heads and teachers to volunteer for energy conservation initiatives.
	UL4	I believe that the department heads of my university will not compromise on sustainability and energy-saving principles.
	UL5	I believe that my department heads uphold high standards and values regarding sustainability and energy conservation.
Sustainability-Oriented Education (SE)	SE1	Sustainability-oriented education is provided at all levels within the university.
	SE2	Sustainability-related courses and activities are accessible to all students in the university.
	SE3	There are effective institutional policies ensuring access to sustainability-oriented education in the university.
	SE4	The participation rate in sustainability-oriented education programs is high in the university.
	SE5	The right to participate in sustainability-oriented education is guaranteed to all students in the university.
Environmental Values (EV)	EV1	Preventing pollution and conserving natural resources by reducing unnecessary energy use on campus is important to me.
	EV2	Respecting the earth and protecting other species by lowering energy-related environmental pressure is important to me.
	EV3	Protecting the environment and preserving nature through daily energy conservation is important to me.
	EV4	I value fair and responsible use of shared campus energy resources.
Environmental Beliefs (EB)	EB1	I believe that excessive energy use on campus contributes to environmental problems.
	EB2	I believe that reducing unnecessary energy use on campus can help protect the environment.
	EB3	I believe my personal energy-saving behavior can contribute to reducing energy waste on campus.
	EB4	I believe students share responsibility for improving energy conservation on campus.
	EB5	I believe universities should take stronger action to support energy conservation and environmental protection.
Personal Norms (PN)	PN1	I feel morally accountable to reduce energy waste and environmental problems on campus.
	PN2	People like me should make efforts to reduce unnecessary energy use and support a more sustainable campus environment.
	PN3	I feel personally obliged to support energy-saving efforts that help improve the campus environment.
	PN4	I believe it is morally important to contribute to campus energy saving and environmental well-being, regardless of what others do.
Pro-environmental Behavioral Intention (PEBI)	PEBI1	I will try to reduce electricity use whenever I am on campus.
	PEBI2	I intend to switch off lights and air-conditioning when they are not in use.
	PEBI3	I plan to open windows for ventilation before turning on the air-conditioning.
	PEBI4	I will make sure to switch off electronic and electrical equipment after each class.
	PEBI5	I intend to participate in energy-saving or awareness activities on campus.

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Essay 1

Zhang, X., Jiang, S. and Deeprasert, J. (2026). Pro-Environmental Behavioral Intention in University Energy-Saving Contexts: Extending the Value–Belief–Norm Framework with Institutional Support. *Frontiers in Psychology*, 17: 1827476, pp. 1-18. https://doi.org/10.3389/fpsyg.2026.1827476.

Essay 2

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Essay 3

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