



Determinants of Sustainable Behavior in Higher Education: Insights from a Systematic Literature Review

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ABSTRACT

This study identifies, classifies, and synthesizes the determinants of sustainable behavior among university students and develops an integrative explanation of how these determinants interact. In this review, sustainable behavior is used as an umbrella analytical term encompassing closely related pro-environmental and green behavioral outcomes reported in the reviewed literature, while recognizing conceptual differences in breadth and emphasis. A Systematic Literature Review was reported using the PRISMA framework. Seven overlapping Scopus searches covering publications from 2016 to 2026 yielded 219 records. After duplicate removal and screening, 105 reports were selected for full-text retrieval; 40 reports without DOIs could not be retrieved via the available access routes for the review team, and 65 studies were included in the final synthesis. Thematic synthesis was researcher-led, while the Watase Uake System was used only to support reference organization, extracted data management, and preliminary theme mapping. The synthesis identifies four interrelated domains shaping students' sustainable behavior: psychological, social, educational, and institutional factors. Environmental knowledge, environmental attitudes, subjective norms, personal values, self-efficacy, and institutional support emerge as recurrent determinants. Beyond summarizing these determinants, this review proposes an integrative multilevel framework in which institutional context and educational processes shape social and psychological mechanisms, while institutional support and green campus infrastructure function as enabling conditions that facilitate or constrain the translation of sustainable intentions into actual behavior. The framework provides a systemic behavioral ecosystem perspective for understanding environmentally oriented sustainable behavior in higher education.

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1. INTRODUCTION

Sustainable behavior in higher education has become a crucial issue on the global development agenda. Students are agents of change and have the potential to influence the environmental, social, and economic future. Universities serve not only as centers for scientific development but also as spaces for forming values, attitudes, and behaviors that support sustainability. Over the past decade, growing environmental issues like climate change, the energy crisis, and pollution have heightened awareness of the importance of sustainable behavior in higher education. Numerous studies have shown that students play a strategic role in supporting sustainable practices. These include green consumption behavior, waste reduction, energy efficiency, and participation in pro-environmental activities (Naz et al., 2020; Shafiei & Maleksaeidi, 2020; Vicente-Molina et al., 2018). Therefore, universities play a crucial role in supporting sustainable development by fostering more environmentally and socially conscious student behavior.

Several previous studies have identified various determinants influencing students' sustainable behavior in higher education. Early studies emphasized the influence of environmental knowledge, attitudes, and social norms on students' pro-environmental behavior (Shafiei & Maleksaeidi, 2020; Vicente-Molina et al., 2018). Later research integrated various theoretical approaches. For example, Education for Sustainable Development (ESD) highlights the importance of sustainability education in shaping student behavior (Abdullahi et al., 2024; Al-Naqbi & Alshannag, 2018; K. Wang & Zhang, 2021). The Theory of Planned Behavior (TPB) is widely used to explain how attitudes, subjective norms, and behavioral control influence sustainable behavior (Huang & Yu, 2022; Wendlandt Amézaga et al., 2022). The Value-Belief-Norm Theory (VBN) explains the relationships among values, beliefs, and students' pro-environmental behavior (Janmaimool & Khajohnmanee, 2019). Recent research has even integrated theories, such as the TPB and Social Cognitive Theory (SCT), to better understand sustainable behavior (Maleki et al., 2025; Senthil Kumar et al., 2026). Several systematic literature reviews (SLRs), meta-analyses, and scoping reviews examine research trends, educational effectiveness, and identify dominant factors shaping students' sustainable behavior (Abdullahi et al., 2024; K. Wang & Zhang, 2021).

Existing review studies have helped to map research trends, examine sustainability education, and summarize factors influencing sustainability-related behavior. However, few studies have clarified the conceptual boundaries among sustainable, pro-environmental, and green behavior. Even fewer have integrated psychological, social, educational, and institutional determinants into a single multilevel explanation, distinguished between psychological mechanisms and contextual conditions, or explained how institutions shape the link between intentions and behavior. This review addresses these gaps by proposing an integrative framework with testable ideas for higher education.

The literature on student behavior related to sustainability employs several overlapping but not fully identical terms, including sustainable behavior, pro-environmental behavior, green behavior, and sustainability behavior. In this review, sustainable behavior is adopted as an umbrella analytical term for environmentally oriented actions through which students seek to reduce environmental harm, conserve resources, engage in responsible consumption, and participate in sustainability-oriented practices. Pro-environmental behavior refers specifically to actions aimed at protecting the environment or minimizing negative environmental impacts, whereas green behavior denotes context-specific, environmentally responsible practices such as green consumption, waste reduction, energy conservation, sustainable mobility, and participation in green campus activities. The term sustainability behavior is retained only when it reflects the terminology used in the original studies. These constructs are therefore treated as conceptually related but not fully interchangeable. Because the reviewed literature

predominantly operationalizes sustainability through environmental actions, the present review focuses primarily on the environmentally oriented dimension of sustainable behavior rather than claiming comprehensive coverage of the social and economic dimensions of sustainability (Hansmann et al., 2020; Huang & Yu, 2022; Kirby & Zwickle, 2021).

Despite the rapid growth of research on students' sustainable behavior, previous findings still show several limitations. Most studies were conducted in specific country contexts, particularly in Europe and East Asia, thus limiting representation of the social, cultural, and economic contexts of developing countries (Abdullahi et al., 2024; Naz et al., 2020; K. Wang & Zhang, 2021). Furthermore, inconsistent findings exist regarding the determinants of students' sustainable behavior, ranging from environmental knowledge, attitudes, and social norms to personal intentions and values (Janmaimool & Khajohnmanee, 2019; Shafiei & Maleksaeidi, 2020; Vicente-Molina et al., 2018). Several previous studies are also partial and theoretically fragmented (Maleki et al., 2025; Senthil Kumar et al., 2026). As a result, the complexity of the relationship between psychological, educational, social, and institutional factors in shaping students' sustainable behavior has not been fully described. The literature nevertheless contains emerging examples of studies that combine psychological, motivational, social, educational, and institutional variables (Maleki et al., 2025; Naz et al., 2020; Senthil Kumar et al., 2026). These studies indicate the potential value of more integrative explanations, but their presence does not by itself establish a systematic theoretical transition across the field. The literature, therefore, remains theoretically fragmented, creating a need for a synthesis that clarifies how different levels of determinants may be conceptually connected.

Given these limitations, this SLR moves beyond identifying and classifying determinants of students' sustainable behavior. It aims to synthesize fragmented evidence into an integrative, multilevel framework that explains how psychological, social, educational, and institutional factors interact to shape sustainable behavior. The review also maps theoretical development, methodological approaches, and emerging research trends. Its theoretical contribution lies in distinguishing proximal psychological mechanisms from contextual and institutional enabling conditions and in explaining how university environments may facilitate or constrain the translation of sustainable intentions into actual behavior. By doing so, the study advances a systemic behavioral ecosystem perspective and provides a theoretical foundation for future multilevel, cross-cultural, and longitudinal research in higher education.

2. METHOD

This study followed PRISMA guidelines to ensure transparent and consistent reporting of systematic reviews (Page et al., 2021). We chose PRISMA for its wide use and flexibility across disciplines (Siddaway et al., 2019; Ter Huurne et al., 2017). We conducted the literature search using Scopus for its rigorous journal selection, broad coverage, and credibility (Rocha et al., 2019).

2.1 Review Design and Information Source

This study employed a Systematic Literature Review (SLR) to identify, evaluate, and synthesize evidence on the determinants of environmentally oriented sustainable behavior among university students. The review was reported using PRISMA 2020 terminology and flow reporting to improve transparency in identification, screening, retrieval, eligibility assessment, and inclusion (Page et al., 2021). The review scope, information sources, search terms, eligibility criteria, extraction categories, quality procedures, and synthesis stages were specified prior to the final synthesis.

Scopus was selected as the sole bibliographic database because the topic spans education, psychology, environmental studies, social sciences, and sustainability research, and therefore requires multidisciplinary coverage with standardized bibliographic metadata. Scopus also supported consistent export, merging, duplicate detection, and descriptive mapping of the retrieved records. Using a single database was intended to maintain consistency in indexing and metadata handling; however, it may omit relevant studies that are indexed elsewhere. This limitation is acknowledged in the Discussion, and the review does not claim exhaustive coverage of all global literature.

2.2 Search Strategy

The search strategy included several related behavioral labels, as the literature uses varied terms for environmentally oriented sustainability behavior. Seven phrase-based Scopus searches were run separately, then merged: (1) “sustainable behavior university student”; (2) “green behavior university student”; (3) “pro-environmental behavior university”; (4) “sustainability behavior university”; (5) “sustainability behavior university student”; (6) “pro-environmental behavior college”; and (7) “green behavior university”. Publications were limited to 2016-2026. The searches intentionally overlapped to maximize retrieval sensitivity, so the merged results contained duplicate records. Duplicates were identified by DOI matching when available, or by title comparison if not.

The use of multiple search labels did not imply conceptual equivalence. During extraction, terminology from each source was preserved. For synthesis, outcomes deemed conceptually related were grouped under the umbrella of environmentally oriented sustainable behavior, while outcomes labeled as pro-environmental or green behavior remained separate if those terms represented distinct constructs in the original studies.

2.3 Eligibility Criteria and Quality Procedures

Eligibility criteria were applied consistently during screening and full-text assessment. Studies were eligible if they met all of the following: (a) examined university, college, undergraduate, or other higher education students; (b) investigated environmentally oriented sustainable behavior, pro-environmental behavior, green behavior, related behavioral intention, or an intervention with a student behavioral outcome; (c) examined determinants, antecedents, correlates, mechanisms, or behavioral effects; (d) reported empirical quantitative, qualitative, mixed-method, or experimental evidence; (e) were peer-reviewed journal articles published between 2016 and 2026; and (f) met the publication-source quality criterion used for the review corpus. The publication-source criterion required that articles appear in journals ranked Q1–Q3 in the SJR quartile classification at the time of data collection. Studies were excluded if they focused on non-higher-education populations and did not separately report student results. Studies were also excluded if they addressed institutional sustainability without a student behavioral outcome, were non-empirical, were published outside the period, or did not meet the publication-source criterion.

Publication-source quality screening and study-level methodological appraisal were treated as distinct procedures. At the identification stage, 20 records were removed. These records did not meet the publication-source quality criterion for defining the review corpus. This source-level filter was not a substitute for methodological appraisal. For included full texts, methodological credibility was assessed using a structured matrix. This matrix covered five domains: clarity of the study objective, adequacy of population and context description, transparency of data collection or measurement, appropriateness of the analytical approach, and traceability of conclusions to the results. Judgments were recorded as Yes, Partly, or No. These

ratings informed the interpretation of evidence rather than generating a single aggregate quality score. Among the 65 eligible full texts, none was excluded solely because of the appraisal.

Table 1. Eligibility Criteria for Study Selection

Criterion	Inclusion criteria	Exclusion or classification criteria
Population	University, college, undergraduate, or other higher education students	School students, general populations, employees only, or mixed samples without separately reported student results
Behavioral focus	Environmentally oriented sustainable behavior, pro-environmental behavior, green behavior, related intention, or interventions with student behavioral outcomes	Sustainability topics without a student behavioral outcome
Analytical focus	Determinants, antecedents, correlates, mechanisms, behavioral effects, or interventions	Purely descriptive institutional sustainability performance without behavioral relevance
Study type	Empirical quantitative, qualitative, mixed-method, or experimental journal articles	Reviews, editorials, commentaries, conference abstracts, book chapters, or non-empirical papers
Publication period	2016-2026	Published outside the review period
Publication source	Peer-reviewed journal articles published in Q1–Q3 journals according to the SJR quartile classification available at the time of data collection	Articles published in journals outside the Q1–Q3 criterion
Full-text status	Full text available for eligibility assessment	Full text unavailable; classified as report not retrieved, not as a substantive exclusion

2.4 Study Selection, Full-text Retrieval, and Data Extraction

The seven search outputs produced 219 records. After merging, 55 duplicate records were removed, 9 records outside the 2016-2026 publication period were removed, and 20 records that did not meet the pre-specified publication-source quality criterion were removed. This process resulted in 135 records for title and abstract screening; 30 were excluded because they were outside the scope of the review. Consequently, 105 reports were sought for full-text retrieval.

A total of 40 out of the 105 requested reports could not be retrieved. All 40 lacked DOI identifiers, and full-text versions could not be located through available retrieval routes. Importantly, the inability to retrieve these reports may have led to the potential omission of relevant studies, thereby introducing a risk of selection bias. These reports were not excluded on substantive grounds, and no full-text eligibility judgment was made based solely on title and abstract information; they were classified as not retrieved. The remaining 65 reports were assessed in full text; all met the eligibility criteria and were included in the final qualitative and thematic synthesis. This retrieval loss is explicitly noted as a limitation of the review.

Next, a structured extraction matrix was used to record author(s), publication year, country or geographical context, higher education setting, sample characteristics, theoretical framework, study design, analytical method, behavioral construct, determinant variables, principal findings, and reported implications. Source-specific behavioral terminology was preserved during extraction to support the conceptual distinctions discussed in the review.

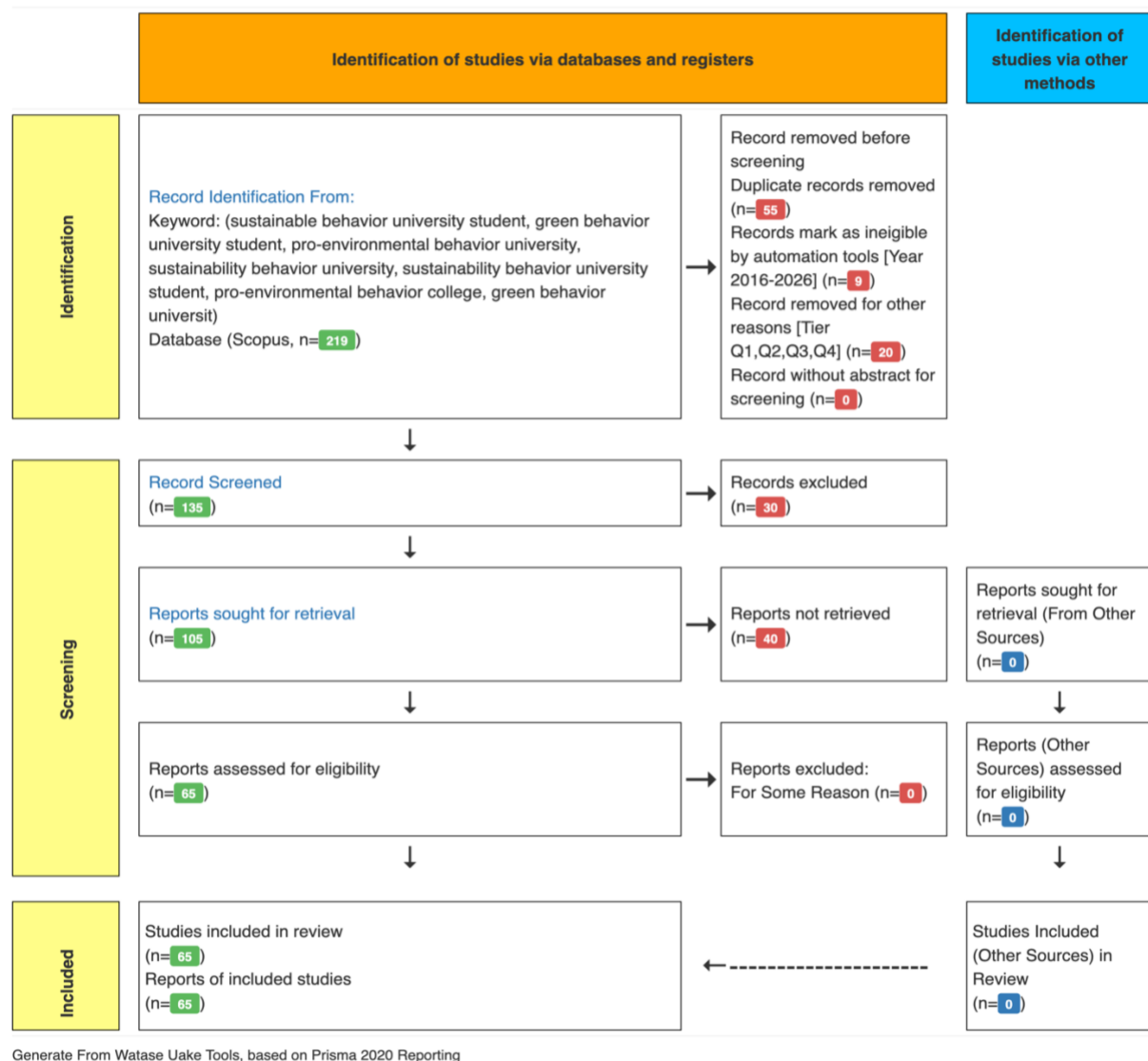


Figure 1. PRISMA Diagram

2.5 Data Synthesis and the Role of the Watase UAKE System

Data analysis combined descriptive mapping with researcher-led thematic synthesis. Descriptive mapping summarized publication years and geographical distribution. It also identified theoretical frameworks, methodological approaches, journal characteristics, and recurring keywords. Thematic synthesis then identified substantive determinants and examined their conceptual relationships across studies.

The Watase Uake System was used only as a supporting research-management tool for organizing bibliographic records, structuring extracted study information, and assisting preliminary mapping of recurring terms and candidate themes (Wahyudi, 2024). It was not treated as an autonomous thematic analysis method, and the final categories were not generated solely by the software. The substantive coding, category development, interpretation, and construction of the integrative framework remained researcher-led. Accordingly, the validity of the synthesis does not depend on assuming that the software itself is a validated or universally accepted thematic-analysis framework.

The thematic synthesis proceeded through five streamlined stages: (1) extracting findings on determinants, mechanisms, theories, and behavioral outcomes from each study; (2)

assigning descriptive codes; (3) consolidating similar codes into analytical categories; (4) grouping categories into four higher-order domains: psychological, social, educational, and institutional; and (5) interpreting the relationships among these domains to propose an integrative multilevel framework. Credibility was strengthened through team review, discussion to resolve interpretive differences, and the maintenance of an audit trail. Analytical rigor stemmed from transparent extraction, traceable coding, iterative comparison, team review, and auditable synthesis procedures. Watase Uake served an operational support role.

3. RESULTS AND DISCUSSION

3.1 Publication Trends

The annual publication trend shows that research on students' sustainable behavior fluctuated from 2016 to 2026 (Figure 2). The number of publications has generally increased in recent years. However, the growth pattern has not been consistent. In 2021, there were 11 articles, the highest number recorded. This rise shows that students' sustainable behavior is an important theme in higher education research. It is discussed particularly in the context of growing global concerns about climate change, the implementation of the Sustainable Development Goals (SDGs), and the strengthening of sustainability education in higher education institutions.

Yearly Article

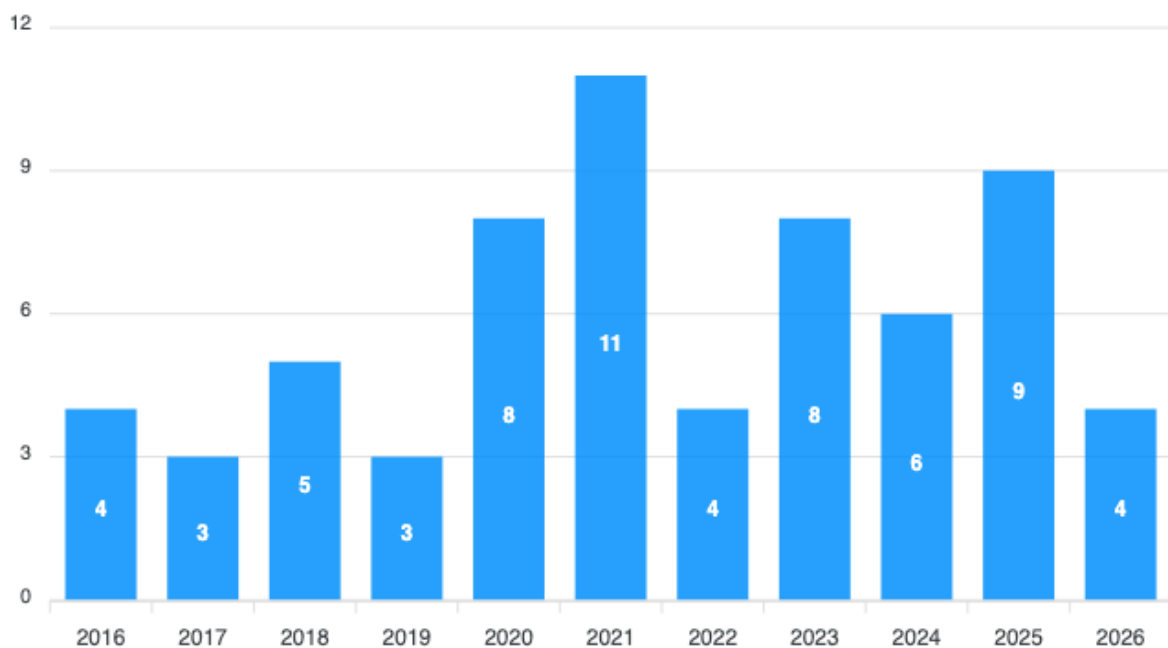


Figure 2. Annual Publication Trend

In addition to more publications, research on students' sustainable behavior now spans a wider range of geographical contexts (Figure 3). China led with 16 articles, followed by Thailand (5) and the United States (4). South Africa, Colombia, Iran, and Pakistan each contributed 3 articles. Malaysia, South Korea, Spain, India, Italy, and Portugal made moderate contributions. These findings show that research is no longer dominated by Western countries. It is growing in Asia and other developing regions. This trend reflects higher education's rising focus in these regions on integrating sustainability and encouraging behavioral change among younger generations.

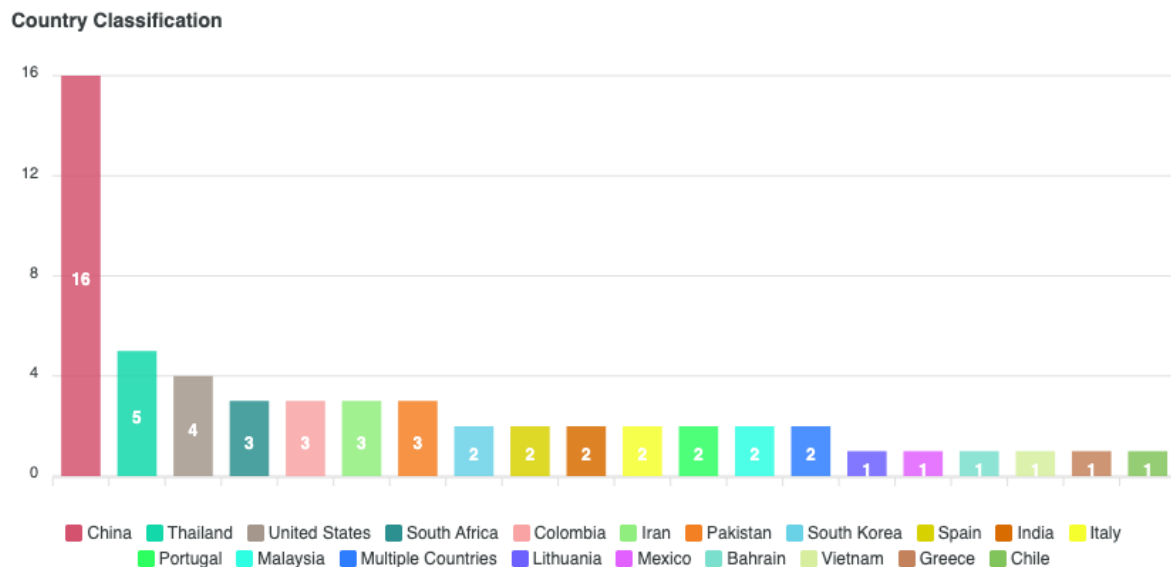


Figure 3. Geographical Distributions

3.2 Theoretical Development

The classification of theories reveals that research on students' sustainable behavior is still largely categorized as "not available" (NA), comprising 23 studies (Figure 4). This result indicates that many studies prioritize empirical analysis and testing relationships among variables without explicitly articulating their theoretical frameworks. These circumstances suggest that theoretical development in students' sustainable behavior remains nascent and has yet to achieve robust theoretical consolidation.

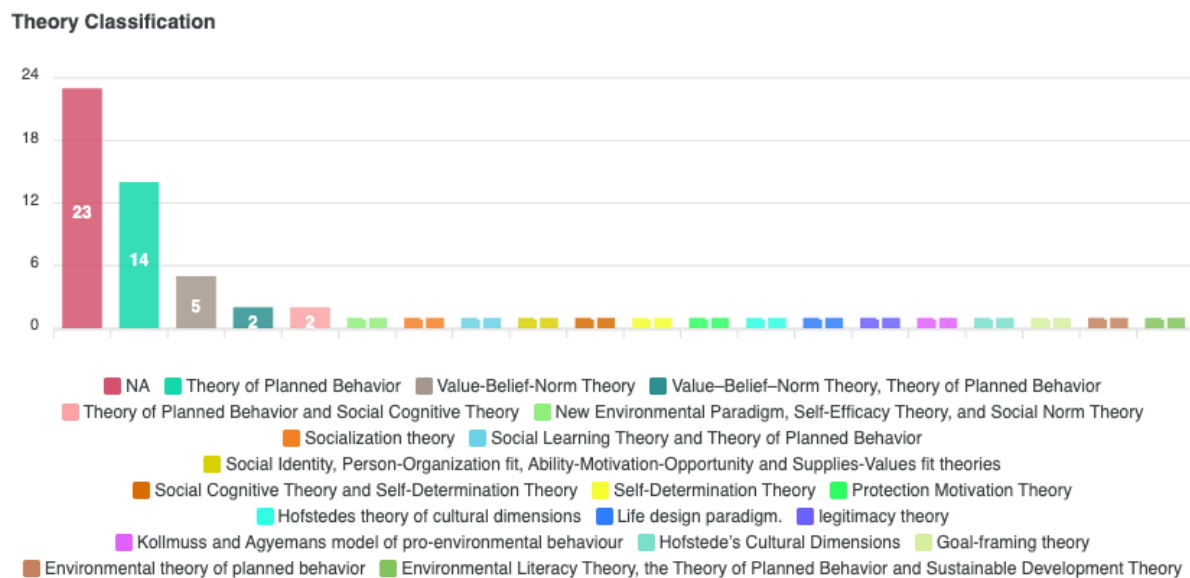


Figure 4. Grand Theory Approaches

Among the explicitly applied theories, the TPB emerged as the dominant framework, used in 14 studies. TPB was applied to explain how students' sustainable behavior is influenced by attitudes, subjective norms, and perceived behavioral control (Ajzen, 1991). Several studies have demonstrated TPB's strong relevance for explaining students' sustainable intentions and behaviors (Huang & Yu, 2022; Janmaimool & Khajohnmanee, 2019). Meanwhile, the Value-

Belief-Norm Theory (VBN) was also frequently used to explain how personal values, environmental beliefs, and moral norms shape students' sustainable behavior (Liu et al., 2018).

However, while TPB remains the dominant theory, its primary focus is on individual psychological factors, leaving institutional, cultural, and contextual factors less fully integrated. For this reason, recent studies have begun combining TPB with other theories, such as SCT, Social Learning Theory (SLT), and Self-Determination Theory (SDT), to generate a more holistic understanding of students' sustainable behavior.

3.3 Methodological Trends

The methodological classification reveals that research on students' sustainable behavior primarily utilizes quantitative methods, with surveys being the most prevalent strategy (Figure 5). Fifty-eight studies used surveys, highlighting a strong focus on measuring sustainable behavior using structured tools and statistical analysis. In contrast, mixed methods were adopted in only 2 studies, and experimental methods in 3, while other approaches, such as cluster sampling and pedagogical strategies, were rarely employed. These results demonstrate that research on students' sustainable behavior primarily relies on survey-based empirical analysis, with limited methodological diversity.

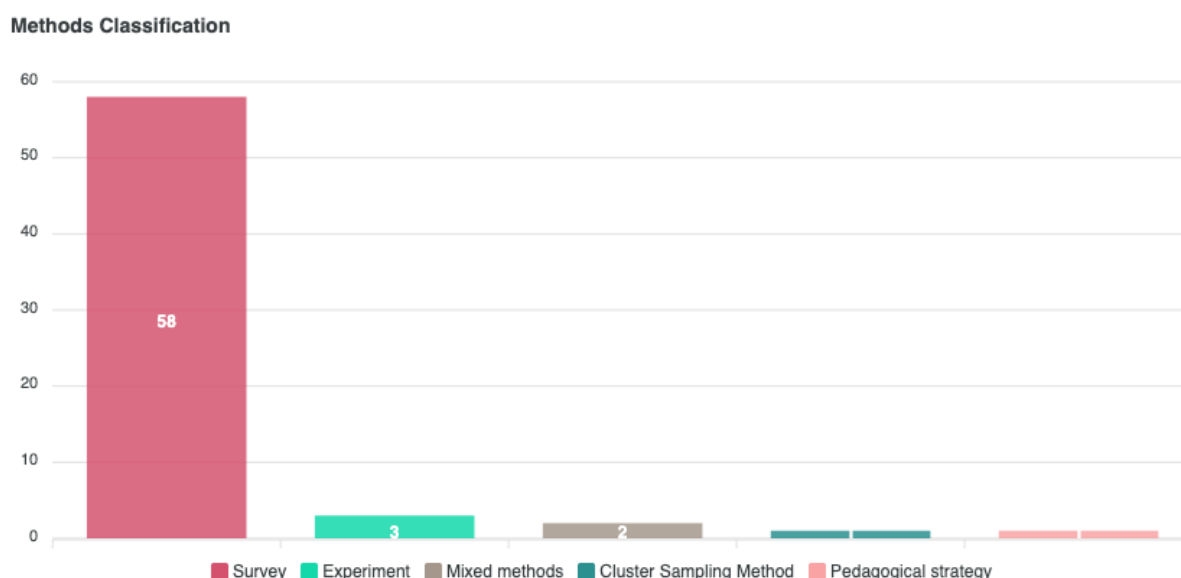


Figure 5. Methodological Classification

The prevalence of survey research is matched by the frequent use of Structural Equation Modeling (SEM) to analyze data in studies of students' sustainable behavior (Han et al., 2025; Moon et al., 2021; Z. Wang et al., 2023). Furthermore, the Theory of Planned Behavior (TPB) has emerged as the principal theoretical framework for clarifying associations among variables related to sustainable behavior (Kirby & Zwickle, 2021). The pronounced reliance on surveys, SEM, and TPB suggests that scholarship in this area continues to prioritize the examination of relationships among psychological and behavioral variables.

3.4 Tier Journal Classification

The journal tier classification demonstrates that research on student sustainable behavior is concentrated in highly reputable journals, particularly Q1 journals (Figure 6). Among the 65 articles analyzed, 50 were published in Q1 journals, 12 in Q2 journals, and 3 in Q3 journals. Sustainability is the leading journal, publishing 28 articles, underscoring its prominence in this

research area. The dominance of Q1 publications indicates that student sustainable behavior is regarded as highly relevant by academics and is attracting increasing scholarly attention (Al-Naqbi & Alshannag, 2018; Vicente-Molina et al., 2018). This trend also reflects a move towards more rigorous, high-quality publications in the field.

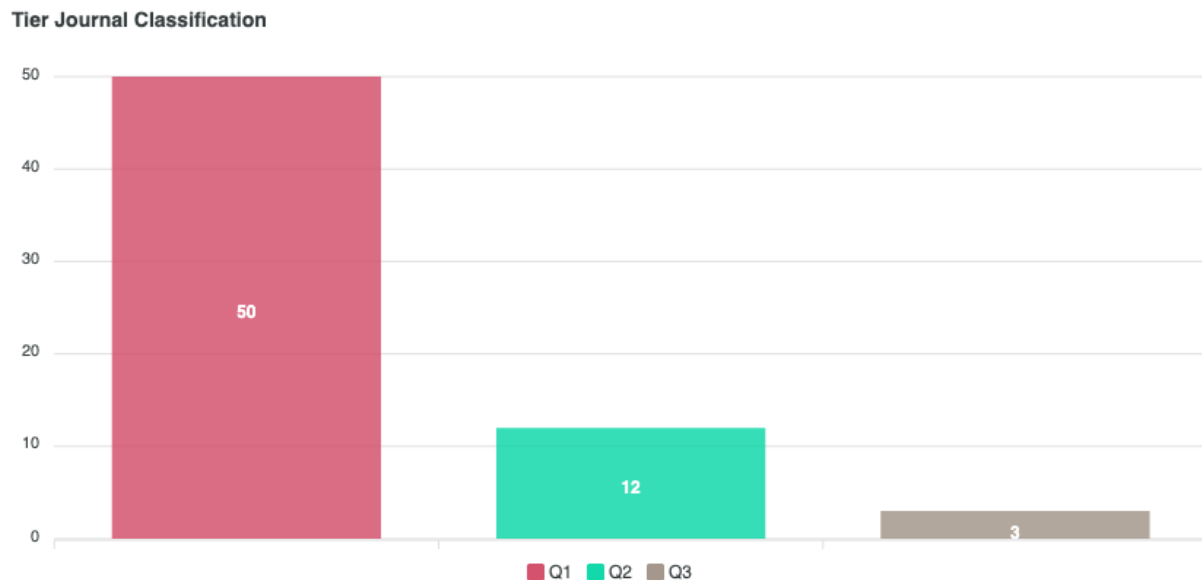


Figure 6. Journal Tier Classification

Although Q1 journals are prevalent, expanding research across diverse journals and contexts could foster more comprehensive support for students' sustainable behavior going forward.

3.5 Wordcloud Analysis

The word cloud analysis of article keywords shows that research on students' sustainable behavior is dominated by university students, pro-environmental behavior, sustainability, and sustainable development (Figure 7). Other frequent keywords are environmental education, environmental knowledge, environmental attitudes, green behavior, and TPB. These keywords indicate that the field focuses on the links among environmental education, psychological factors, and eco-friendly behavior in higher education.

The keyword patterns show that TPB and SEM remain prominent theoretical and methodological markers in the reviewed literature. The occurrence of terms such as higher education, green campus, sustainable consumption, and self-efficacy indicates that the literature encompasses constructs drawn from psychological, educational, social, and institutional domains. However, keyword frequency and co-occurrence alone cannot demonstrate a systematic transition toward multidimensional research. These patterns should therefore be interpreted as evidence of thematic diversification and the coexistence of multiple levels of analysis rather than as proof of a field-wide theoretical shift. The appearance of sustainable, pro-environmental, and green behavior in the keyword landscape also reflects terminological heterogeneity rather than conceptual equivalence; their conceptual boundaries are clarified in Section 3.8.1.

Taken together, the descriptive mappings in Sections 3.1–3.5 contextualize the field's development; the following synthesis shifts attention to the substantive determinants of students' sustainable behavior and the mechanisms that underpin them.

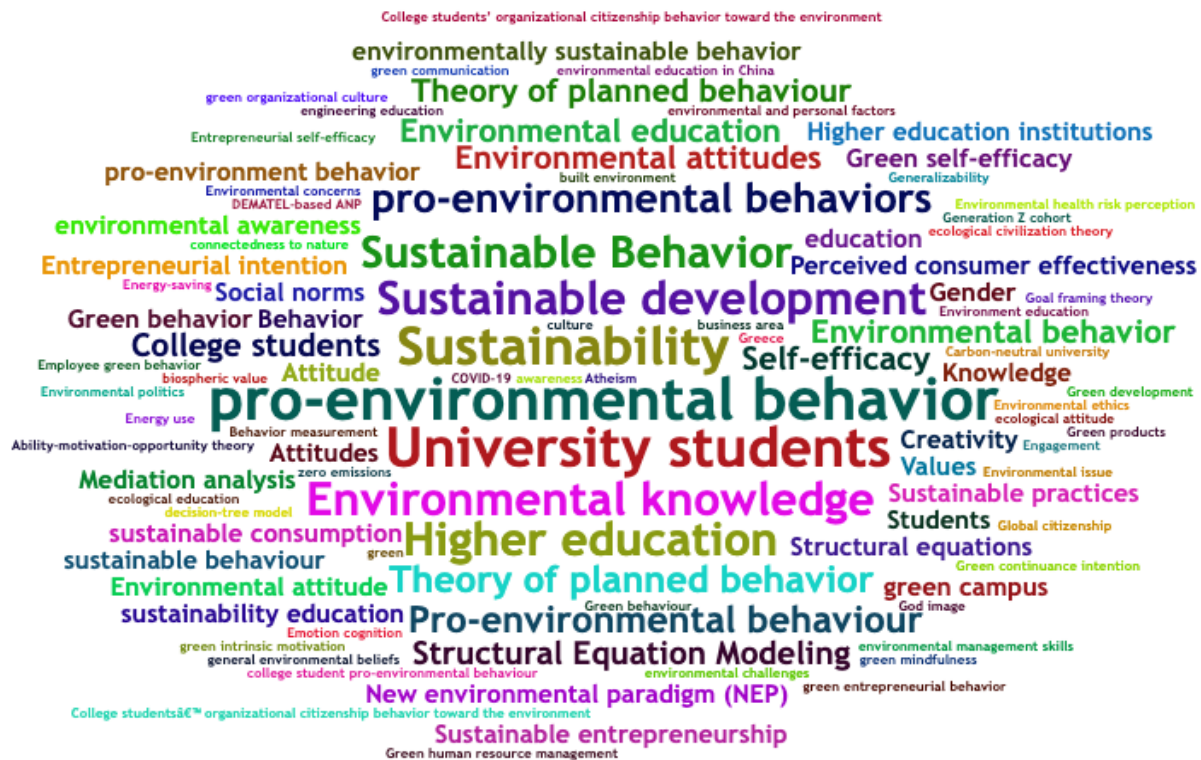


Figure 7. Wordcloud Analysis

3.6 Substantive Determinants of Students' Sustainable Behavior

The synthesis of the reviewed studies identifies four interrelated domains of determinants shaping students' sustainable behavior: psychological, social, educational, and institutional. Rather than functioning independently, these domains interact; for instance, while psychological determinants are most proximal to intention and action, educational, social, and institutional domains provide context and shape the environment in which those mechanisms develop. Sustainable behavior, as clarified above, is used here as the umbrella analytical term, with the synthesized evidence interpreted primarily as environmentally oriented.

Psychological determinants constitute the most frequently examined domain. Environmental knowledge, environmental attitudes, personal values, beliefs, self-efficacy, perceived behavioral control, motivation, and behavioral intention repeatedly emerge across the reviewed studies. Environmental knowledge provides cognitive awareness of environmental problems and possible responses, whereas attitudes and personal values influence how students evaluate the importance and desirability of sustainable action. Self-efficacy and perceived behavioral control contribute to students' confidence in their ability to engage in sustainable practices. The synthesis therefore indicates that knowledge alone is insufficient; sustainable behavior is more likely when students also value it, evaluate it positively, and believe they are capable of performing it (Janmaimool & Khajohnmanee, 2019; Kirby & Zwickle, 2021; Z. Wang et al., 2023).

The second domain comprises social determinants, including subjective norms, peer influence, social expectations, and campus culture. The synthesis indicates that students' sustainable behavior is socially embedded. Sustainable practices are more likely to be adopted and maintained when they are visible, socially approved, and routinely performed by peers and other members of the university community. Social determinants, therefore, function not merely as external pressures but as mechanisms through which sustainability expectations become normalized and internalized (Khan & Terason, 2022; Moon et al., 2021).

Educational determinants form the third domain. Not only do sustainability education, environmental education, Education for Sustainable Development (ESD), sustainability literacy, and experiential learning consistently contribute to students' knowledge, awareness, competencies, and opportunities for behavioral engagement, but the synthesis also suggests that educational exposure is more behaviorally relevant when learning extends beyond classroom-based information and provides direct experience. Through project-based learning, campus sustainability activities, and community-based environmental initiatives, students can strengthen self-efficacy and perceived behavioral control by practicing sustainable action in real settings (Abdullahi et al., 2024; Al-Naqbi & Alshannag, 2018; K. Wang & Zhang, 2021).

The fourth domain comprises institutional determinants, such as university sustainability policies, institutional support, sustainability leadership, green campus infrastructure, and organizational culture. Importantly, these determinants influence the translation of sustainable intentions into actual behavior. Even with adequate knowledge, positive attitudes, and strong behavioral intentions, students may find it difficult to take sustainable action when infrastructure is unavailable, institutional policies are inconsistent, or sustainable practices are unsupported by the campus environment. In contrast, supportive policies, visible leadership commitment, accessible infrastructure, and a strong sustainability culture can reduce practical barriers and reinforce individual motivation (Han et al., 2025; Hansmann et al., 2020).

Together, these findings reveal a layered pattern of influence. For example, psychological factors shape motivation and intention, which are then reinforced by social factors through expectations and norms. Educational factors equip individuals with the knowledge and skills needed to recognize and seize opportunities, while institutional factors can enable or constrain behavior based on available structures. The principal substantive finding of this review is not just that multiple determinants affect sustainable behavior, but that sustainable behavior specifically arises when personal agency, social reinforcement, educational experience, and institutional conditions interact. Table 2 summarizes the key determinants and the role of each domain.

Table 2. Synthesis of Determinants of Environmentally Oriented Sustainable Behavior among University Students

Domain	Key Determinants	Explanatory Role
Psychological	Environmental knowledge; attitudes; personal values and beliefs; self-efficacy; perceived behavioral control; motivation; intention	Proximal mechanisms shaping cognitive evaluation, moral significance, perceived capability, motivation, and intention.
Social	Subjective norms; peer influence; social expectations; campus culture	Reinforce expectations, normalize sustainable practices, and provide social approval or pressure.
Educational	ESD; environmental education; sustainability literacy; experiential learning	Develop knowledge, competencies, behavioral experience, and opportunities for engagement.
Institutional	Sustainability policy; leadership; institutional support; green campus infrastructure; organizational culture	Create enabling or constraining conditions for translating sustainable intention into actual behavior.

3.7 Research Gaps and Future Directions

Table 3 is presented to highlight the empirical gaps identified in previous studies and to serve as the foundation for future research on students' sustainable behavior.

Table 3. Summary of Studies on Students' Sustainable Behavior

Authors	Methods	Implication
Vicente-Molina et al. (2018)	Quantitative survey	Environmental education and environmental experiences influence students' sustainable behavior. However, the study mainly focused on the European context, indicating the need for further exploration in developing countries and different cultural contexts.
Janmaimool & Khajohnmanee (2019)	Quantitative survey based on VBN Theory	Values, environmental beliefs, and moral norms influence students' pro-environmental behavior. However, the integration of VBN Theory with social and institutional approaches is still required to explain sustainable behavior more comprehensively.
Liu et al. (2018)	VBN Theory approach	Environmental values and personal norms contribute to students' pro-environmental behavior. However, integrating VBN with SCT is necessary to explain sustainable behavior more comprehensively.
Al-Naqbi & Alshannag (2018)	Sustainability education study	Education for sustainable development increases students' environmental awareness. However, research still focuses more on awareness aspects rather than evaluating actual behavioral changes in students' daily lives.
Shafiei & Maleksaeidi (2020)	Quantitative survey using SEM	Environmental awareness, personal values, and social norms influence students' sustainable behavior. However, research is still dominated by individual psychological factors, indicating the need to integrate institutional and campus cultural factors for a more comprehensive understanding.
Hansmann et al. (2020)	Survey and campus behavior analysis	Student participation in green campus programs improves daily sustainable behavior. However, the role of campus organizational culture and university leadership in strengthening students' sustainable behavior still requires further exploration.
Moon et al. (2021)	SEM	Psychological factors have a strong relationship with students' sustainability behavioral intentions. However, the development of multidimensional models integrating psychological, social, and institutional factors simultaneously is still needed.
Huang & Yu (2022)	TPB-based SEM	Attitudes, subjective norms, and perceived behavioral control influence students' sustainable behavioral intentions. However, the TPB model is still limited to individual intention aspects and should be expanded by incorporating contextual factors such as green campus initiatives and sustainability policies.
Khan & Terason (2022)	Quantitative survey	Social factors and environmental education influence students' sustainable behavior in Asia. However, the dominance of cross-sectional designs indicates the need for longitudinal studies to understand behavioral changes over time.
K. Wang & Zhang (2021)	Quantitative study	Education for Sustainable Development (ESD) improves students' awareness and sustainable behavior. However, studies examining the long-term effectiveness of ESD implementation in promoting actual behavioral changes remain limited.
Kirby & Zwickle (2021)	TPB-based survey	Environmental attitudes and perceived behavioral control are major predictors of students' pro-environmental behavior. However, the influence of digital technology and social media on shaping students' sustainable behavior remains underexplored.
Z. Wang et al. (2023)	SEM	Environmental knowledge and environmental attitudes influence students' sustainable behavior. However, the mediating and moderating roles of variables such as self-efficacy, sustainability literacy, and green campus support still need further examination.

Authors	Methods	Implication
Abdullahi et al. (2024)	Quantitative study	Environmental education and sustainability learning experiences influence students' behavior. However, cross-cultural studies are still needed to understand the influence of social contexts on the effectiveness of sustainability education.
Han et al. (2025)	SEM based on sustainability education	Sustainability education and institutional support influence students' sustainable behavior. However, the long-term influence of university policies on students' behavioral change still requires further investigation.
Zhang & Cao (2025)	Conceptual and empirical study	Students' sustainable behavior is influenced by a combination of educational, social, and psychological factors. However, the development of integrative models based on sustainability transition and green behavior in digital higher education contexts is still needed.

Based on the literature synthesis, several research gaps regarding students' sustainable behavior were identified. First, most studies are still dominated by quantitative survey-based approaches and cross-sectional designs, which are unable to capture longitudinal changes in students' behavior. Second, research continues to focus primarily on individual psychological factors such as attitudes, intentions, and subjective norms, while institutional factors, campus culture, and university sustainability policies remain relatively underexplored. Third, theoretical approaches remain dominated by the TPB and VBN, underscoring the need for greater multidimensional integration to account for the complexity of students' sustainable behavior. Taken together, these gaps point to a conceptual fragmentation problem: psychological, social, educational, and institutional factors are often examined as parallel predictors rather than as interacting mechanisms across levels. Therefore, the present review develops an integrative framework that connects contextual conditions, educational and social processes, proximal psychological mechanisms, intention, and actual behavior.

3.2 Discussion

3.2.1 Conceptual Boundaries among Sustainable, Pro-environmental, and Green Behavior

The synthesis reveals substantial terminological overlap across studies of student sustainability-related behavior. Sustainable, pro-environmental, green, and sustainability behaviors are frequently used in adjacent research streams, but they should not be treated as completely interchangeable constructs. Their common conceptual core is an orientation toward behaviors that reduce environmental harm, conserve resources, or support environmentally responsible practices. However, they differ in breadth and emphasis.

Sustainable behavior is the main idea in this review and acts as the overall category. While sustainability encompasses environmental, social, and economic factors, the studies in this review mostly focus on student actions that benefit the environment. Examples include responsible purchasing, reducing waste, saving energy, using sustainable transport, recycling, and participating in green campus activities. The main evidence in this review concerns the environmental side of sustainable behavior.

Pro-environmental behavior is conceptually narrower. It emphasizes actions intended to protect the environment or reduce negative impacts. Green behavior substantially overlaps with pro-environmental behavior but is often used in more specific contexts. These include green consumption, energy use, waste practices, mobility, and organizational or campus environmental behavior. Sustainability behavior appears less consistently standardized across the reviewed literature. As a result, it is retained only when individual studies use this term.

Accordingly, the present review does not assume complete equivalence among these constructs. Instead, it adopts a nested conceptual approach, where sustainable behavior serves as the broad umbrella concept, and pro-environmental and green behaviors are nested as specific types of environmentally oriented behavior within it, as discussed in the literature reviewed. This distinction clarifies how the review synthesizes various terms while recognizing differences in conceptual breadth. Consequently, conclusions apply chiefly to environmentally oriented sustainable behavior among university students, rather than to the entire spectrum of environmental, social, and economic sustainability behaviors.

3.2.2 Why Psychological Determinants Consistently Emerge

Building on the four-domain synthesis presented in Section 3.6, this section explains why psychological determinants recur most consistently and how their effects are conditioned by social, educational, and institutional factors identified across the reviewed studies. Research on students' sustainable behavior remains dominated by individual psychological perspectives, especially the Theory of Planned Behavior (TPB) and Value-Belief-Norm (VBN) Theory. This reflects the field's focus on how internal evaluations give rise to behavioral intentions. Attitudes, subjective norms, perceived behavioral control, personal values, beliefs, and intentions are frequently examined as the predominant mechanisms through which students assess sustainability and decide to act. This aligns with studies showing the key role of individual psychological factors in pro-environmental behavior (Janmaimool & Khajohnmanee, 2019; Shafiei & Maleksaeidi, 2020).

The recurring prominence of environmental knowledge, attitudes, subjective norms, personal values, self-efficacy, and perceived behavioral control can be explained by their distinct but interconnected positions in the behavioral formation process. Environmental knowledge provides cognitive awareness of sustainability problems and possible responses. Values and beliefs determine whether these problems are perceived as personally and morally significant, while attitudes translate these evaluations into favorable or unfavorable orientations toward sustainable action. Self-efficacy and perceived behavioral control concern whether students believe they are capable of acting and whether sustainable action is feasible. Subjective norms connect individual decision-making with perceived social expectations. These determinants therefore consistently emerge because, together, they explain what students know, what they value, what they believe others expect of them, what they think they can do, and what they intend to do.

In addition to individual influences, the recurrence of social and institutional determinants also has a clear theoretical explanation. Students' decisions are embedded in peer groups, learning environments, and campus systems. Social norms and peer practices provide cues about which behaviors are expected and socially valued, while institutional policies, leadership, and infrastructure determine whether sustainable choices are practically available. Consequently, the influence of psychological determinants is not independent of context. Knowledge and positive attitudes may support intention formation, but weak campus norms, limited facilities, or inconsistent policies can prevent intention from becoming action. Conversely, visible peer practices, experiential learning opportunities, and accessible green infrastructure can strengthen psychological readiness and reduce practical barriers to sustainable behavior (Han et al., 2025; Z. Wang et al., 2023).

Taken together, this interpretation helps explain why psychological factors continue to dominate empirical models while institutional support is increasingly visible in recent research. Psychological determinants are proximal to intention, whereas educational, social, and institutional factors shape the conditions under which those proximal mechanisms are developed, reinforced, and translated into behavior. The consistent emergence of particular

determinants should therefore not be interpreted as evidence that sustainable behavior is exclusively an individual phenomenon. Rather, it indicates a layered process in which personal agency operates within social and institutional environments.

The synthesis also reveals variation in the relative importance of determinants across studies. To clarify key contrasts: environmental knowledge and attitudes are often linked to sustainable behavior, but their effects rarely guarantee action. By contrast, studies on self-efficacy and perceived behavioral control show students may hold positive attitudes yet not act if they feel limited in capability or opportunity. Subjective norms have a stronger influence where peer practices and campus culture make sustainable behavior visible, whereas institutional support becomes more important when behavior depends on access to infrastructure, facilities, or enabling policies. These variations indicate that inconsistent study findings do not signal theoretical contradiction; instead, they reflect differences in behavioral outcomes, cultural context, institutional conditions, measurement approaches, and whether studies examine intention or actual behavior. The SLR shows that determinant effects are context-dependent and should be seen as interacting mechanisms, not as universal predictors with the same effects everywhere.

3.2.3 Theoretical Complementarity and Tensions

The theoretical patterns identified in the reviewed studies indicate that no single perspective fully explains the four domains synthesized in Section 3.6; instead, TPB, VBN Theory, SCT, and ESD-oriented perspectives illuminate different mechanisms within the overall behavioral formation process.

The reviewed literature shows that the main theoretical perspectives offer partially complementary explanations for different stages of sustainable behavior. TPB primarily explains the deliberative process, in which attitudes, norms, and perceived behavioral control shape intention. VBN Theory adds by focusing on how moral and normative values drive pro-environmental action through personal values and norms. Social Cognitive Theory (SCT) builds on individual-centered explanations by stressing self-efficacy, personal agency, observational learning, and the reciprocal interaction between the individual, behavior, and environment. ESD-oriented perspectives add an educational dimension. They explain how learning can build knowledge, competencies, and opportunities for engagement (Abdullahi et al., 2024; Ajzen, 1991; Liu et al., 2018; Maleki et al., 2025).

These perspectives are complementary because they answer different questions. TPB explains whether students intend to act; VBN Theory explains why sustainability may be experienced as a moral obligation; SCT explains how self-efficacy, observation, and environmental interaction support or inhibit action; and ESD explains how educational experiences can develop the knowledge and competencies required for sustainable practice. Together, they connect cognitive evaluation, moral obligation, personal agency, social influence, and learning experience. This complementarity provides a stronger basis for understanding sustainable behavior than any single theory used in isolation, as illustrated by recent examples that combine planned behavior and social cognitive perspectives (Maleki et al., 2025; Senthil Kumar et al., 2026).

However, the synthesis also shows theoretical tensions. First, TPB follows a largely sequential, intention-centered logic. In contrast, SCT sees personal factors, environment, and behavior as continuously influencing one another. Second, TPB emphasizes reasoned evaluation and perceived behavioral control, whereas VBN Theory gives greater explanatory weight to values, beliefs, and moral obligation. By contrast, VBN Theory emphasizes values, beliefs, and moral obligation. Third, individual-centered theories often assume enough opportunities for action. Yet institutional perspectives indicate that behavior may be

constrained by infrastructure, inconsistent policies, limited resources, and campus culture. These differences show that theoretical integration should avoid simply adding constructs from many theories into a long list.

The integrative interpretation proposed in this review, therefore, positions theories according to their explanatory functions. Institutional context is treated as the structural environment that enables or constrains action; educational processes build knowledge and provide behavioral experience; social mechanisms reinforce expectations and shared norms; and psychological mechanisms operate as proximal drivers of intention. Sustainable intention is subsequently translated into actual behavior under enabling or constraining institutional conditions. This functional integration preserves the distinct contribution of each theoretical perspective while providing a coherent explanation of how their mechanisms interact.

It is important not to assume that having these perspectives means the field has fully moved from individual to integrated approaches. Most literature still favors psychological and intention-centered explanations. Explicitly integrative studies are still few. This review does not claim an established theoretical shift. Instead, it brings together the explanatory power of perspectives that remain fragmented in the literature.

3.2.4 Methodological Limitations

The dominance of quantitative survey methods and the extensive use of SEM suggest that research on students' sustainable behavior remains focused on examining relationships among variables. This approach makes important contributions in explaining the influence of psychological factors on students' behavior. However, it also limits understanding of behavioral dynamics in a contextual and longitudinal perspective. Most studies also employ cross-sectional designs. As a result, changes in students' behavior over time have not been comprehensively examined.

Creswell (2023) states that complex social phenomena need varied methods for a deeper, contextual understanding. The rare use of qualitative, experimental, and mixed methods means research has not fully explored students' experiences, how behaviors form, or campus culture's influence. Future research should adopt more reflective, longitudinal approaches to better track changes in students' behavior.

This review also has two methodological coverage limitations. First, reliance on Scopus as the sole database may omit relevant studies that are indexed exclusively in other databases, particularly regionally or discipline-specific literature. Second, 40 of the 105 reports sought for full-text retrieval could not be retrieved because they lacked DOI identifiers, and full-text versions were not available through the retrieval routes accessible to the review team. Because these reports could not undergo full-text eligibility assessment, the final synthesis may be affected by retrieval-related selection bias and may underrepresent less accessible publication outlets, regions, or research contexts. The 40 reports were therefore classified as reports not retrieved rather than excluded for substantive reasons, and the findings should be interpreted with this limitation in mind. Future reviews should use multiple databases and broader retrieval strategies to reduce both database coverage bias and retrieval bias.

3.2.5 Cultural and Institutional Context

Students' sustainable behavior cannot be separated from the social and cultural contexts in which they exist. Khan & Terason (2022) explain that collectivist and individualistic cultures influence how individuals perceive social and environmental responsibilities. Within higher education contexts, factors such as green campus policies, sustainability leadership, and experiential learning play important roles in the successful implementation of students'

sustainable behavior. However, research concerning institutional factors remains relatively limited compared to studies focusing on individual psychological factors. Consequently, the contribution of higher education systems in shaping students' sustainable behavior remains incompletely understood. This condition highlights the need for contextual and cross-cultural research to better understand students' sustainable behavior across various higher education systems.

3.2.6 Integrative Multilevel Framework and Theoretical Propositions

Drawing directly on the recurring cross-study relationships synthesized in Sections 3.6 and 3.8.2–3.8.5, the proposed framework integrates the four determinant domains into a multilevel explanatory structure. This review identifies the determinants of students' sustainable behavior and organizes fragmented findings into an integrative multilevel framework. The synthesis shows that sustainable behavior results from interactions among contextual conditions, educational and social processes, and proximal psychological mechanisms, not isolated individual predictors. This reorganization addresses prior fragmentation and shifts the explanation from the student alone to the interaction between personal agency and the higher education environment.

At the contextual level, university sustainability policies, institutional support, sustainability leadership, and green campus infrastructure set conditions for action. At the educational level, sustainability education and experiential learning provide knowledge, behavioral opportunities, and repeated exposure to sustainable practices. These influences interact with social mechanisms, such as subjective norms, peer influence, and campus culture. These factors reinforce or weaken the internalization of sustainability expectations. At the proximal psychological level, environmental knowledge, personal values, attitudes, self-efficacy, perceived behavioral control, and intrinsic motivation shape behavioral intention. They also affect the likelihood that intention becomes an actual, sustainable behavior.

This framework extends previous research in three ways. First, it transforms a list of determinants into a multilevel explanatory structure that distinguishes distal contextual conditions from proximal psychological mechanisms. Second, it reconceptualizes institutional factors not simply as additional independent predictors, but as an enabling architecture that can facilitate or constrain the translation of intentions into behavior. Third, it introduces a reciprocal perspective: engagement in sustainable practices may reinforce self-efficacy, personal norms, peer expectations, and campus sustainability culture, thereby creating a behavioral reinforcement cycle rather than a purely linear sequence.

The proposed framework is summarized in Figure 8. It should be interpreted as a theory-building synthesis derived from recurring patterns across the reviewed studies, rather than as a causal model already verified in a single empirical setting. The framework should also not be interpreted as evidence that the field has already converged on a multidimensional paradigm. Rather, it represents an integrative synthesis, constructed by the present review, of determinants and mechanisms that remain dispersed across different theoretical traditions and empirical studies. Accordingly, the framework offers testable propositions for future research and a structure for comparing sustainable behavior across institutional and cultural contexts.

Proposition 1: Educational and institutional conditions influence sustainable behavior, in part, by shaping proximal psychological mechanisms, including environmental knowledge, attitudes, personal values, self-efficacy, and perceived behavioral control (PBC). Proposition 2: Building on this, Proposition 2 states that social norms, peer influence, and campus sustainability culture reinforce the internalization of sustainability values and strengthen sustainable behavioral intentions. Proposition 3: Institutional support and green campus infrastructure function as enabling conditions that strengthen the translation of sustainable

intentions into actual behavior. Proposition 4: Participation in sustainable practices generates reciprocal reinforcement, strengthening self-efficacy, personal norms, peer expectations, and a collective sustainability culture within higher education institutions.

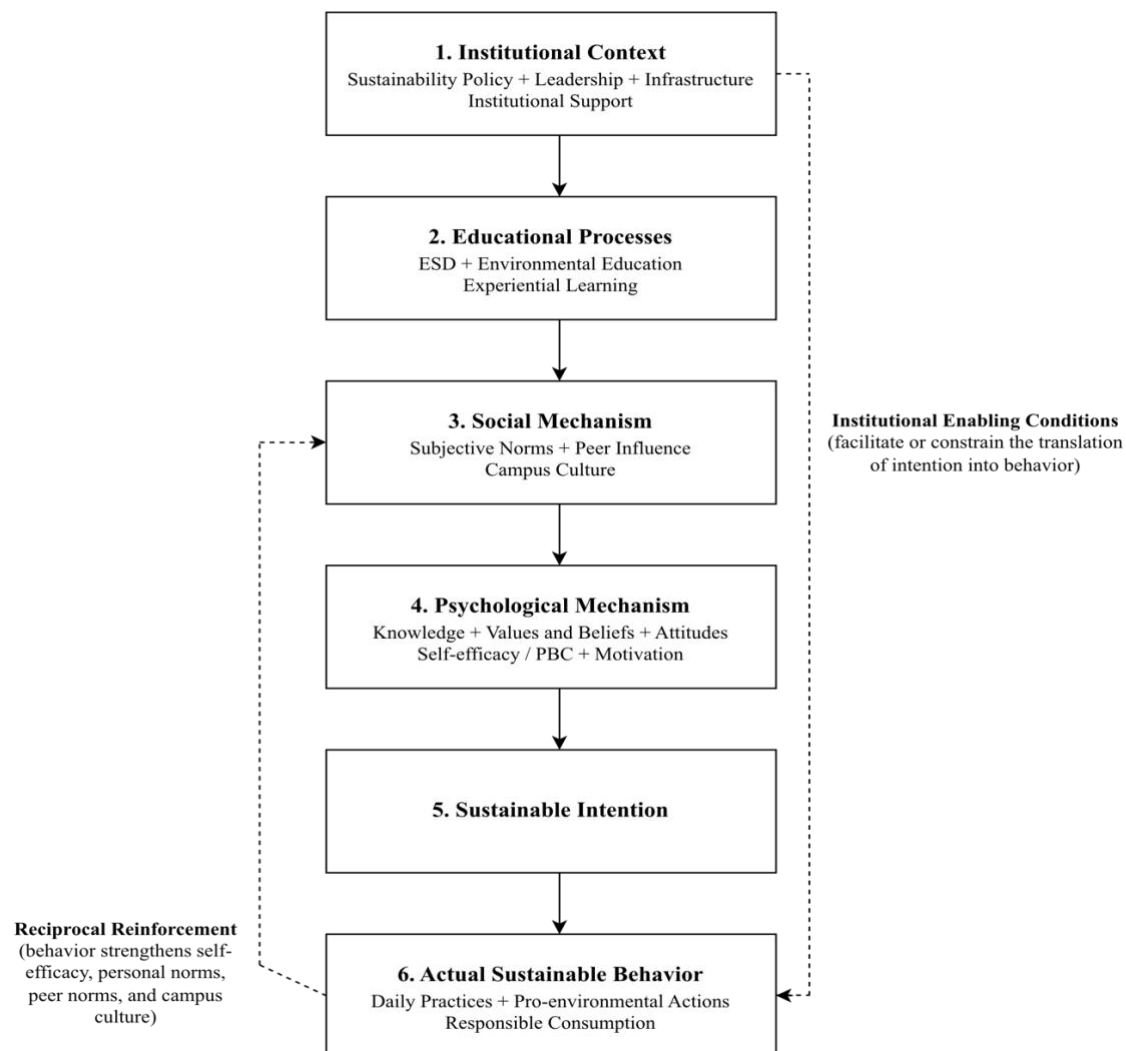


Figure 8. An Integrative Multilevel Framework of Environmentally Oriented Sustainable Behavior Formation in Higher Education

3.2.7 Implications for Higher Education Policy and Sustainability Practices

The integrative findings have direct implications for higher education policy. Universities should move beyond sustainability strategies that rely primarily on information campaigns and awareness-raising activities. Environmental knowledge and positive attitudes are important, but the synthesis indicates that they are insufficient when students lack confidence, social reinforcement, opportunities for participation, or institutional support for action. Sustainability policy should therefore align curriculum, experiential learning, campus culture, leadership commitment, and operational infrastructure rather than addressing these domains separately.

At the educational level, sustainability should be embedded across academic programs and connected with real campus and community challenges. Universities can integrate sustainability issues across disciplines and strengthen project-based, problem-based, and experiential learning. Activities such as campus energy audits, waste reduction projects,

sustainable mobility initiatives, responsible consumption campaigns, and community-based environmental projects can convert abstract knowledge into repeated behavioral experience. Such learning opportunities are particularly important because they can strengthen self-efficacy and perceived behavioral control by allowing students to experience that sustainable action is both feasible and consequential (Abdullahi et al., 2024; K. Wang & Zhang, 2021).

At the social level, universities should deliberately cultivate environments in which sustainable practices are visible, socially supported, and collectively performed. The recurring importance of subjective norms, peer influence, and campus culture suggests that students are more likely to maintain sustainable practices when these practices are normalized within their everyday environment. Student organizations, peer ambassadors, lecturers, and university leaders can therefore be involved in creating visible sustainability norms. Communication strategies should not only provide environmental information but also demonstrate that sustainable practices are expected, valued, and commonly performed within the university community.

At the institutional and operational levels, universities should ensure consistency between sustainability messages and the conditions available for action. Students should not be encouraged to behave sustainably while facing practical barriers that make such behavior difficult. Waste separation systems, energy-saving facilities, water conservation measures, sustainable transportation options, reduced single-use plastic policies, and responsible procurement practices can function as enabling conditions. In this respect, green campus infrastructure and institutional support are not peripheral additions to behavioral interventions; they are mechanisms for reducing the intention-behavior gap by making sustainable choices accessible and routine.

Finally, sustainability evaluation in higher education should assess not only students' knowledge, attitudes, and intentions but also actual participation, behavioral continuity, and institutional enabling conditions. Evaluation systems should examine whether educational interventions change everyday practices, whether these changes are maintained over time, and whether campus systems provide adequate opportunities for sustainable action. This implies the need for behavioral indicators alongside institutional indicators and supports greater use of longitudinal, experimental, mixed-methods, and multilevel designs. From a policy perspective, the central implication of this review is that sustainable student behavior is most likely to emerge when personal agency, social reinforcement, educational experience, and institutional support are designed as a coherent system rather than as separate initiatives.

4. CONCLUSION

This study demonstrates that research on environmentally oriented sustainable behavior among university students has expanded across diverse geographical contexts. The synthesis identifies recurrent psychological determinants, including environmental knowledge, attitudes, personal values, self-efficacy, subjective norms, and perceived behavioral control. It also identifies educational experiences, social processes, institutional support, campus culture, leadership, and green campus infrastructure as substantively relevant determinants. These conclusions primarily apply to environmentally oriented forms of sustainable behavior, which dominate the reviewed literature; the evidence does not establish a uniform temporal shift toward multidimensional approaches and should not be generalized automatically to the full social and economic dimensions of sustainability.

The main theoretical contribution of this review is the development of an integrative, multilevel explanation of students' sustainable behavior. The framework specifies five key elements: (1) contextual conditions; (2) educational and social processes; (3) proximal psychological mechanisms; (4) intention; and (5) behavioral outcomes. Rather than treating

psychological, social, educational, and institutional determinants as parallel predictors, it structures them hierarchically within these elements. The review reconceptualizes universities as behavioral ecosystems where policies, infrastructure, leadership, learning experiences, peer norms, and individual agency interact. This framework extends individual-centered models, such as the Theory of Planned Behavior (TPB) and Value-Belief-Norm Theory (VBN), while also incorporating insights from Social Cognitive Theory (SCT), Social Learning Theory (SLT), and Self-Determination Theory (SDT).

Methodologically, the field remains dominated by quantitative survey-based and cross-sectional designs. Structural Equation Modeling (SEM) is the primary analytical technique. Future research should test the proposed multilevel relationships through longitudinal, experimental, multilevel, and mixed-methods designs. Cross-cultural research is also needed. This work can examine whether institutional enabling conditions and social mechanisms operate differently across higher education systems and cultural settings.

In practice, the findings emphasize that universities should not rely solely on sustainability awareness or on the formation of attitudes. Sustainable intentions are more likely to become actual behavior when students are supported by experiential learning, visible peer norms, sustainability-oriented leadership, consistent policies, and accessible green infrastructure. Future studies should also examine mediating and moderating mechanisms, particularly self-efficacy, environmental concern, sustainability literacy, campus culture, and institutional support, to further refine the proposed framework and explain the intention–behavior gap in higher education.

Overall, this review shows that fostering sustainable behavior among university students requires shifting from isolated interventions to coordinated higher education ecosystems. Specifically, these ecosystems should integrate psychological agency, social reinforcement, experiential learning, supportive policies, and accessible green infrastructure. In terms of research, the proposed framework enables testing multilevel, longitudinal, and cross-cultural mechanisms. For practice, it provides universities and policymakers with a structured approach for designing integrated interventions that help turn student intentions into lasting behavioral change.

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