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From Environmental Knowledge to Action tn Universities: Explaining The Sustainability Knowledge-Action Gap

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Abstract

This study aimed to examine how scientific reasoning has been repositioned in educational research in the post-COVID era through a bibliometric review. Bibliographic data were retrieved from the Scopus database, covering journal articles published between 2021 and 2025. A total of 161 articles were analyzed using Biblioshiny and VOSviewer to identify publication trends, country contributions, collaboration patterns, and thematic structures. The results showed a growing scholarly emphasis on scientific reasoning after COVID-19, particularly in relation to student-centered pedagogies, assessment practices, higher-order thinking skills, and technology-enhanced learning environments. Keyword network analysis revealed scientific reasoning as a central research theme interconnected with inquiry-based learning, problem-based learning, critical thinking, and digital learning contexts. Overlay visualization further indicated emerging research directions involving artificial intelligence and hybrid learning environments. Overall, the findings demonstrated a clear repositioning of scientific reasoning as a foundational competency in post-COVID educational research and provided insights to inform future studies and instructional innovations.

Keywords: *scientific reasoning; post-COVID education; bibliometric analysis; VoSviewer; Biblioshiny*

INTRODUCTION

Education for Sustainable Development (ESD) has emerged as a significant approach for encouraging sustainability awareness and active participation within higher education settings. Its purpose is to provide students with the competencies, perspectives, ethical principles, and capacity needed to respond to complex global issues and support the achievement of the Sustainable Development Goals (Tilbury, 2011; Ashida, 2023; Zaccaï, 2007). Within higher education, ESD is commonly implemented through sustainability-related course content, co-curricular initiatives, campus practices, and institution-wide sustainability strategies (Lozano et al., 2015; Zamora-Polo & Sánchez-Martín, 2019). Universities are therefore increasingly recognised as key actors in promoting sustainability awareness and knowledge among students (Curnier, 2022; Diemer et al., 2015).

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However, a substantial body of research shows that increased environmental knowledge and awareness do not necessarily translate into pro-environmental behaviour among students. This phenomenon is commonly described as the environmental knowledge-action gap or attitude-action gap (Kollmuss & Agyeman, 2002; Hulme, 2014). In this context, pro-environmental behaviour refers to deliberate actions aimed at reducing environmental harm, including energy conservation, waste reduction, sustainable mobility, and engagement in environmental advocacy.

Over the past two decades, environmental sustainability has moved from a specialised concern to a central theme in global policy agendas and higher education systems. Scientific knowledge about climate change and sustainable development has expanded significantly, and levels of environmental awareness among students are generally high (Edsand & Broich, 2020; Yusuf & Fajri, 2022). Nevertheless, empirical studies across different regions show that this increased awareness is not consistently reflected in everyday behaviour or collective environmental engagement (Akrofi, 2019; Venghaus et al., 2022; Qin & Jiang, 2025).

Previous research suggests that the knowledge-action gap cannot be explained by knowledge deficits alone. Psychological factors such as attitudes, perceived self-efficacy, and social norms play an important role in shaping environmental behaviour (Wamsler, 2020; Zhang & Cao, 2025; Knapp et al., 2021). At the same time, educational approaches to sustainability may remain predominantly cognitive and fragmented, providing limited opportunities for students to develop practical action competence (Lim et al., 2022; Shiwani & Kumar, 2025).

Universities therefore occupy a strategic position in addressing the environmental knowledge-action gap. As institutions responsible for education, research, and societal engagement, they influence how sustainability knowledge is produced, taught, and mobilised within society (Ashida, 2023; Lozano et al., 2015). However, sustainability initiatives within higher education institutions often remain unevenly integrated across curricula, campus operations, and governance structures (Lad & Akerlof, 2022; Zhou, 2025; Smolennikov et al., 2024).

Based on these considerations, this article presents a narrative literature review examining the environmental knowledge-action gap within higher education. The study aims to synthesise interdisciplinary research in order to identify the psychological, educational, and institutional mechanisms that influence how environmental knowledge is translated into action in universities.

METHODS

This study adopts a narrative literature review approach in order to synthesise interdisciplinary research on the environmental knowledge-action gap in higher education (Grant & Booth, 2009). The narrative review design was selected because the topic spans several academic fields, including environmental psychology, education for sustainable development, higher education studies, and sustainability governance. This approach allows the integration of empirical and conceptual studies and facilitates the development of an analytical framework that connects different strands of research (Grant & Booth, 2009).

The literature corpus was constructed through iterative searches conducted between January 2005 and December 2025. Academic databases including Google Scholar and Scopus were used to identify relevant publications. The search strategy combined keywords related to the knowledge-action gap and sustainability education, including "environmental knowledge-action gap", "attitude-behaviour gap", "education for sustainable development", "sustainability in higher education", "youth climate activism", and "knowledge mobilisation". Backward and

forward citation tracking was also used to identify additional relevant studies referenced in key articles (Mooney et al., 2022).

The initial search process yielded 58 publications from Scopus and 572 results from Google Scholar. Given the interdisciplinary and narrative nature of the review, the study did not adopt a fully systematic PRISMA review procedure. Instead, a structured screening approach based on predefined inclusion and exclusion criteria was applied in order to improve transparency and relevance in study selection.

The selection of studies was conducted through a two-stage screening process. First, titles and abstracts were examined to identify publications addressing environmental knowledge, environmental attitudes, sustainability education, or behavioural outcomes related to sustainability practices in higher education contexts. Second, full texts were reviewed when relevance was uncertain or when studies appeared potentially significant for understanding the environmental knowledge-action gap.

Studies were included when they met the following criteria: (1) they were peer-reviewed empirical or conceptual studies; (2) they addressed environmental knowledge, sustainability learning, environmental attitudes, or pro-environmental behaviour; and (3) they analysed behavioural outcomes, educational practices, institutional strategies, governance mechanisms, or forms of environmental engagement related to sustainability in higher education or youth contexts. Studies were excluded when they focused exclusively on technical environmental processes without educational, behavioural, or institutional dimensions related to the knowledge-action gap. Publications lacking relevance to higher education or sustainability-related action and engagement were also excluded.

Following the screening and interpretive selection process, the final corpus consisted of sixty peer-reviewed empirical and conceptual studies published between 2005 and 2025. The selected literature covers research conducted in diverse geographical contexts, including Europe, Africa, Asia, the Americas, and Oceania. To provide an overview of the corpus, the studies were descriptively mapped according to publication trends, thematic focus, and geographical distribution.

The selected studies were analysed using an interpretive thematic coding process. Each article was examined to identify its primary analytical contribution to understanding the environmental knowledge-action gap (Saakwor Batsa et al., 2025). In addition to empirical studies, the review also incorporated foundational theoretical frameworks explaining pro-environmental behaviour, including the Theory of Planned Behaviour (Ajzen, 1991) and the Value-Belief-Norm model (Stern, 2000), which were used to interpret behavioural mechanisms underlying the knowledge-action gap.

Based on this analysis, the literature was organised into a four-layer analytical framework consisting of: (1) empirical evidence demonstrating the knowledge-action gap, (2) psychological mechanisms influencing behavioural outcomes, (3) educational mechanisms related to sustainability learning and Education for Sustainable Development initiatives, and (4) institutional and governance mechanisms shaping the mobilisation of sustainability knowledge within higher education institutions (Saakwor Batsa et al., 2025). Table 1 summarises the main sources associated with each analytical layer.

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Table 1 : Sources Organised by Analytical Layer

Layer	*Purpose in this Review*	*Key Sources*
1	*Demonstrate the persistence of mismatches between environmental knowledge, attitudes, or concern and actual behaviour across contexts and sectors, including waste management, circular economy, and campus sustainability practices.*	*Edsand & Broich (2020); Venghaus et al. (2022); Zahir et al. (2019); Yusuf & Fajri (2022); Qin & Jiang (2025); Kouzer et al. (2021); Fahim et al. (2021); Kinas (2025); Pardal et al. (2025); Zamora-Polo & Sánchez-Martín (2019); Smolennikov et al. (2024); Teather & Etterson (2023); Wang et al. (2025); Alharbi et al. (2025).*
2	*Explain why knowledge and concern do not automatically translate into action, focusing on psychological and behavioural mediators such as attitudes, self-efficacy, emotions, social norms, and action competence.*	*Kollmuss & Agyeman (2002); Knapp et al. (2021); Colombo et al. (2023); Wamsler (2020); Zhang & Cao (2025); Sass et al. (2020); Shiwani & Kumar (2025).*
3	*Analyse how educational designs, pedagogies, and curricula shape, enable, or limit the translation of knowledge into action across schools and higher education institutions.*	*Tilbury (2011); Lim et al. (2022); Douglas et al. (2024); Kumar et al. (2023); Husin et al. (2025); Khaerudin et al. (2025); Rudnicka-Reichel et al. (2025); Maleval (2025); Sultan & Susanto (2025); Akinsemolu & Onyeaka (2025).*
4	*Examine how university governance, rankings, SDG implementation, knowledge mobilisation, activism, and power relations shape sustainability strategies and opportunities for student and youth participation.*	*Lozano et al. (2015); Lad & Akerlof (2022); Wardat & AlAli (2025); Zhou (2025); Drissi et al. (2025); Ashida (2023); Zaccaï (2007); Onyancha et al. (2025); Okello et al. (2024); Yang et al. (2025); Coman et al. (2025); Inguaggiato et al. (2025); Sperduti et al. (2025); Khajuria et al. (2022).*

RESULTS AND DISCUSSION

Empirical Evidence of the Environmental Knowledge-Action Gap

The literature reviewed in this study consistently demonstrates the persistence of the environmental knowledge-action gap across diverse higher education contexts. Empirical studies indicate that university students frequently report high levels of environmental awareness and positive attitudes toward sustainability while their everyday behaviours remain only partially aligned with environmental goals (Kollmuss & Agyeman, 2002; Arshad et al., 2020; Venghaus et al., 2022; Kouzer et al., 2021). Research conducted in Europe, Africa, Asia, and Latin America shows that sustainability knowledge often translates into limited behavioural engagement, typically restricted to low-cost actions such as recycling or energy-saving practices (Edsand & Broich, 2020; Yusuf & Fajri, 2022; Pardal et al., 2025; Kinas, 2025). Studies focusing on university students highlight that awareness of climate change or sustainability issues does not automatically lead to significant behavioural transformation, suggesting that cognitive knowledge alone is insufficient to produce sustained environmental action (Zahir et al., 2019; Wang et al., 2025; Alharbi et al., 2025; Qin & Jiang, 2025). These findings confirm that the knowledge-action gap is a widespread phenomenon within higher education institutions (Teather & Etterson, 2023; Guslyakova et al., 2025).

Psychological Mechanisms Explaining the Gap

The reviewed literature further highlights that the relationship between environmental knowledge and behaviour is influenced by several interconnected psychological factors. The Theory of Planned Behaviour and the Value-Belief-Norm model both suggest that individual

attitudes, perceived behavioural control, social norms, and moral obligations influence whether individuals translate environmental knowledge into action (Ajzen, 1991; Stern, 2000). Even when students demonstrate strong environmental concern, habitual routines, emotional barriers, and perceived social expectations can inhibit behavioural change (Kollmuss & Agyeman, 2002; Colombo et al., 2023). Research also emphasises the role of self-efficacy and agency in shaping pro-environmental behaviour. Students who feel capable of influencing environmental outcomes and who perceive supportive social environments are more likely to engage in sustainability-related practices (Knapp et al., 2021; Zhang & Cao, 2025; Yang et al., 2025). These findings illustrate that the environmental knowledge-action gap cannot be understood solely as a deficit of information but must be interpreted through psychological and behavioural dynamics (Wamsler, 2020; Hulme, 2014).

Educational Mechanisms and Sustainability Learning

From an educational perspective, the literature indicates that many Education for Sustainable Development initiatives remain predominantly knowledge-oriented (Tilbury, 2011; Lim et al., 2022). Sustainability education within universities often focuses on raising awareness or transmitting conceptual knowledge about environmental issues while offering limited opportunities for experiential learning or collective action (Lim et al., 2022; Akinsemolu & Onyeaka, 2025). Studies examining pedagogical practices suggest that experiential learning approaches, project-based learning, and participatory sustainability initiatives can significantly strengthen students' action competence and engagement (Kılınç, 2010; Douglas et al., 2024; Rudnicka-Reichel et al., 2025; Khaerudin et al., 2025). Educational programmes that encourage collaboration, critical reflection, and real-world problem solving are more likely to support the translation of sustainability knowledge into meaningful behavioural practices (Sass et al., 2020; Maleval, 2025; Husin et al., 2025). Additional studies emphasise the role of sustainability-oriented curricula and pedagogical innovation in strengthening environmental competencies and student engagement (Kumar et al., 2023; Sultan et al., 2025; Shiwani & Kumar, 2025). These findings indicate that the design of learning environments plays a crucial role in addressing the knowledge-action gap (Tilbury, 2011).

Institutional and Governance Conditions in Higher Education

Beyond individual and educational factors, the institutional context of universities strongly shapes the conditions under which sustainability knowledge can be translated into action (Lozano et al., 2015; Ashida, 2023). Higher education institutions increasingly adopt sustainability strategies aligned with the Sustainable Development Goals and global sustainability frameworks (Ashida, 2023; Khajuria et al., 2022). However, research indicates that these initiatives are often implemented unevenly across institutional structures (Lozano et al., 2015; Lad & Akerlof, 2022). Sustainability commitments may remain symbolic when they are not integrated across teaching, research, and campus operations (Zhou, 2025). Governance arrangements, accountability mechanisms, and sustainability rankings also influence how universities prioritise sustainability initiatives (Smolennikov et al., 2024; Zhou, 2025). Studies examining institutional practices in different regions, including Moroccan universities, show that structural constraints such as limited resources, fragmented governance, and weak coordination between academic programmes and campus initiatives can limit the effectiveness of sustainability efforts (Fahim et al., 2021; Drissi et al., 2025; Okello et al., 2024; Wardat & AlAli, 2025). Research on knowledge mobilisation and science-policy interfaces further

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highlights how institutional arrangements influence the circulation of sustainability knowledge between universities, policymakers, and society (Onyancha et al., 2025; Cuéllar-Ramírez, 2021). In addition, studies on youth participation and environmental activism show that opportunities for meaningful engagement are often shaped by institutional and policy frameworks within higher education systems (Murphy, 2021; Inguaggiato et al., 2025; Sperduti et al., 2025; Coman et al., 2025).

Integrating the Four Analytical Layers

Taken together, the findings suggest that the environmental knowledge-action gap emerges from the interaction between multiple dimensions operating at different levels. Empirical evidence demonstrates the persistence of the gap, while psychological mechanisms explain how individual attitudes and perceptions influence behaviour. Educational approaches shape the opportunities available for students to develop action competence, and institutional governance structures determine how sustainability initiatives are implemented within universities. The four-layer analytical framework developed in this study therefore provides a comprehensive perspective for understanding how environmental knowledge is produced, learned, and mobilised within higher education institutions. By integrating these dimensions, the framework highlights the need for coordinated psychological, educational, and institutional strategies to strengthen the translation of sustainability knowledge into meaningful environmental action.

While many studies confirm the persistence of the environmental knowledge-action gap, some research suggests that under specific institutional and pedagogical conditions, sustainability knowledge can contribute to meaningful behavioural transformation. Studies emphasising experiential learning, participatory governance, and action-oriented sustainability programmes indicate that behavioural engagement increases when students are provided with opportunities for collective action and real-world problem solving. These findings suggest that the knowledge-action gap is not inevitable but strongly dependent on educational and institutional conditions.

To synthesise the reviewed literature, the studies were classified according to their dominant analytical contribution to understanding the environmental knowledge-action gap. The resulting classification organises the literature into four analytical layers: empirical evidence of the gap, psychological mechanisms, educational mechanisms related to sustainability learning, and institutional and governance mechanisms shaping the mobilisation of environmental knowledge. Table 2 presents the classification of key studies according to these four analytical layers.

Table 2 : Article Classification by Analytical Role in the Environmental Knowledge-Action Gap Literature

Analytical layer	Key Study	Main Contribution
Layer 1: Empirical evidence of the knowledge-action gap	Venghaus et al. (2022)	High climate awareness coexists with high-emission lifestyles in Germany.
	Pardal et al. (2025)	Students report sustainability knowledge but behavioural engagement remains limited.
	Zahir et al. (2019)	Moroccan universities show strong attitudes but weak behavioural implementation.
	Cherai et al. (2017)	Environmental awareness initiatives exist but institutional support is weak.
	Yusuf & Fajri (2022)	Environmental knowledge does not automatically predict behaviour.
	Edsand & Broich (2020)	Environmental education improves awareness only moderately once socio-economic factors are considered.
	Qin & Jiang (2025)	"Knowledge illusion": perceived knowledge exceeds actual understanding.
	Guslyakova et al. (2025)	Youth sustainability expectations are high but institutional integration remains partial.
	Teather & Etterson (2023)	Clear value-action gap among university students.
	Wang et al. (2025)	Environmental awareness only partially predicts low-carbon behaviour.
	Alharbi et al. (2025)	Sustainability awareness does not automatically translate into sustainable behaviour.
Layer 2: Psychological and behavioural mechanisms	Ajzen (1991)	**Theory of Planned Behaviour:** Behaviour depends on attitudes, norms and perceived behavioural control.
	Stern (2000)	**Value-Belief-Norm Model**: Moral norms mediate the translation of beliefs into behaviour.
	Kollmuss & Agyeman (2002)	Knowledge alone is insufficient without emotional and social drivers.
	Colombo et al. (2023)	Cognitive routines and emotional barriers inhibit action.
	Zhang & Cao (2025)	Self-efficacy and supportive norms reduce the gap.
	Murphy (2021)	Youth exclusion from governance contributes to the gap.
Layer 3: Educational mechanisms (ESD)	Tilbury (2011)	ESD must build action competence rather than awareness alone.
	Lim et al. (2022)	Many university ESD initiatives remain fragmented and knowledge-oriented.
	Douglas et al. (2024)	Experiential learning improves sustainability behaviour.
	Sass et al. (2020)	Action competence requires structured opportunities for agency.
	Maleval (2025)	Experiential climate education increases engagement.
	Rudnicka-Reichel et al. (2025)	Design thinking approaches increase applied sustainability action.
	Akinsemolu & Onyeaka (2025)	Green education supports SDG-related competencies.
Layer 4:	Lozano et al. (2015)	Sustainability commitments in universities are often symbolic.

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Institutional and governance conditions		
	Lad & Akerlof (2022)	Sustainability literacy initiatives require organisational learning.
	Smolennikov et al. (2024)	University sustainability rankings correlate with national SDG performance.
	Drissi et al. (2025)	Moroccan universities align with SDGs but institutional integration remains weak.
	Fahim et al. (2021)	Governance constraints shape sustainability implementation.
	Zhou (2025)	Sustainability strategies are often driven by accountability frameworks.
	Khajuria et al. (2022)	Circular economy strategies support institutional sustainability transitions.

Limitations of the Study

This study has several limitations that should be acknowledged. First, the review adopts a narrative literature review approach rather than a fully systematic review methodology, which means that the selection and interpretation of studies may involve a degree of subjective judgement. Second, although the review includes studies from multiple geographical regions, a significant proportion of the literature originates from Global North contexts, which may limit the representation of sustainability challenges and institutional realities in developing countries. Third, the study does not conduct a quantitative meta-analysis and therefore does not evaluate effect sizes or statistically compare findings across studies. Finally, the rapidly evolving nature of sustainability education and environmental behaviour research means that newly emerging studies may provide additional perspectives on the environmental knowledge-action gap. Despite these limitations, the review provides an interdisciplinary analytical framework for understanding how environmental knowledge is translated into action within higher education contexts.

CONCLUSION

This narrative literature review examined the environmental knowledge-action gap within higher education by synthesising interdisciplinary research on the psychological, educational, and institutional mechanisms that influence the translation of sustainability knowledge into action. The findings confirm that high levels of environmental awareness among university students do not consistently translate into sustained pro-environmental behaviour (Kollmuss & Agyeman, 2002; Venghaus et al., 2022). This gap reflects the interaction of multiple factors operating at different levels, including behavioural and psychological processes, the design of sustainability education, and the institutional contexts in which learning occurs (Lim et al., 2022; Lozano et al., 2015).

The review highlights that environmental behaviour is shaped not only by knowledge but also by factors such as attitudes, perceived self-efficacy, social norms, and opportunities for meaningful participation (Ajzen, 1991; Stern, 2000; Zhang & Cao, 2025). Educational approaches that focus primarily on cognitive knowledge are therefore insufficient to foster sustained engagement. Experiential learning environments, participatory pedagogies, and opportunities for real-world problem solving appear more effective in developing students' action competence and agency (Tilbury, 2011; Douglas et al., 2024). At the institutional level, the findings also show that university governance structures, sustainability strategies, and

organisational practices influence how sustainability knowledge is mobilised within higher education systems (Lad & Akerlof, 2022; Zhou, 2025).

These findings suggest that addressing the environmental knowledge-action gap requires integrated approaches that combine psychological, educational, and institutional strategies. Universities should therefore move beyond information-based sustainability education and develop learning environments that encourage active engagement, collective action, and collaboration with wider societal actors. Future research could further investigate how different combinations of educational design, behavioural support mechanisms, and institutional governance arrangements influence the long-term translation of sustainability knowledge into environmental action within higher education contexts.

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