International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

Adoption Level of High School Students Towards Environmental Sustainability Development Practices: A Review (2016–2025)

Kritika[1], Rajni Pandey[2]

[1]PhD Scholar, Patna University, Patna, Bihar, India
[2]Senior Assistant Professor, Post Graduate Department of Home Science.Patna University, Patna, Bihar, India

Abstract
During the past decade, environmental sustainability has moved from a peripheral curricular concern to a central educational priority across secondary schooling systems worldwide. Despite the expansion of environmental education frameworks, the degree to which high school students adopt sustainable development practices in their daily behaviour remains uneven. This review synthesises empirical research published between 2016 and 2025 to examine behavioural adoption across key domains: waste management, water conservation, energy use, sustainable lifestyle choices, and structured eco-club participation. Evidence indicates that although environmental knowledge and attitudinal orientation have improved significantly, consistent behavioural internalisation is strongly mediated by institutional design, participatory pedagogy, peer norms, and socio-economic context. Meta-analytic findings confirm the positive effects of environmental education on behavioural intention; however, durable adoption requires structural reinforcement rather than exposure to awareness alone (van de Wetering et al., 2022). The review argues that sustainability education must transition from informational transmission to behavioural institutionalisation embedded within school culture.

Keywords: Environmental Sustainability, High School Students, Behavioural Adoption, Secondary Education, Sustainable Development Practices

1. Introduction

Environmental sustainability has increasingly become embedded within national and international education policies. Secondary schools are now viewed as critical sites for cultivating environmentally responsible citizenship. However, the presence of sustainability content within curricula does not automatically ensure behavioural transformation. The question is no longer whether students are aware of environmental challenges, but whether such awareness translates into consistent, sustainable practices.

Recent meta-analytic evidence demonstrates that environmental education positively influences knowledge, attitudes, and intentions, yet the strength of impact on actual behaviour is comparatively modest (van de Wetering et al., 2022). Similarly, modelling studies suggest that while environmental knowledge contributes to literacy, values and personal norms more strongly predict reported behaviour

(Maurer & Bogner, 2020). These findings indicate the necessity of examining adoption as a distinct construct beyond awareness.

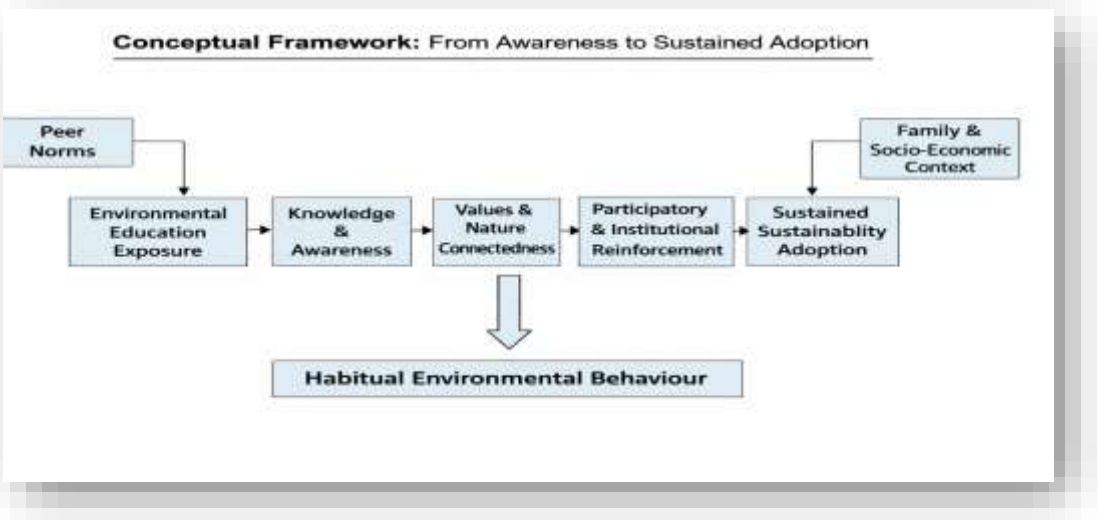
Adolescence represents a formative stage during which behavioural routines and identity orientations are consolidated. Research emphasises that environmental engagement during this period can influence long-term ecological responsibility (Otto & Pensini, 2017). Therefore, understanding the adoption level among high school students is not merely descriptive; it has intergenerational implications. Despite the growing volume of studies on environmental awareness and literacy, comparatively fewer reviews synthesise empirical evidence specifically addressing sustained behavioural adoption among high school students. Much of the existing literature focuses on cognitive outcomes rather than observable practice. Consequently, a consolidated analysis of determinants influencing actual sustainability adoption remains necessary. The present review addresses this gap by integrating empirical findings from 2016 to 2025 to examine behavioural continuity rather than awareness alone.

2. Conceptual Framing: From Awareness to Adoption

Environmental adoption involves movement from cognitive understanding to habitual practice. Studies examining sustainability consciousness demonstrate that implementation of Education for Sustainable Development (ESD) frameworks correlates with increased behavioural orientation among pupils (Olsson et al., 2016). However, knowledge without contextual reinforcement often results in symbolic endorsement rather than behavioural consistency. The literature increasingly distinguishes between: Environmental knowledge, Attitudinal support, Behavioural intention, and Observable repeated practice. Systematic reviews of pedagogical strategies confirm that praxis-oriented approaches, rather than lecture-based methods, produce stronger environmental literacy outcomes (Xiong et al., 2025). Furthermore, children's pro-environmental behaviour appears strongly mediated by contextual opportunity and modelling (Liu & Green, 2024).

Thus, adoption should be interpreted as sustained, context-supported behaviour rather than event-based participation.

Figure 1: From Awareness to Sustained Adoption



The framework proposes that environmental education exposure initiates cognitive awareness; however, sustained adoption is mediated by value formation, participatory reinforcement, and contextual support. Peer norms and socio-economic conditions act as moderating influences. Behaviour becomes habitual only when structural and social reinforcement mechanisms are aligned.

3. Methodology

This review synthesises empirical research published between 2016 and 2025 examining sustainability adoption among high school students. A structured literature search was conducted using academic databases including Scopus, Web of Science, and Google Scholar. Keywords used in the search process included "environmental sustainability adoption," "high school students," "pro-environmental behaviour," "eco-school programmes," and "environmental literacy." Studies were included if they (1) focused on secondary-level learners, (2) measured observable sustainability practices or behavioural outcomes, and (3) were published in peer-reviewed journals. Conceptual-only papers without empirical evidence were excluded. A total of 34 studies were initially screened, of which 18 met the inclusion criteria and were synthesised in this review. Both quantitative and qualitative studies were examined to ensure conceptual breadth and cross-contextual comparison. The study selection process involved screening titles, abstracts, and full texts to ensure relevance to behavioural adoption outcomes.

Table 1: Summary of Empirical Studies on Sustainability Adoption Among High School Students (2016–2025)

Author(s)	Year	Country	Sample	Research Design	Sustainability Domain	Key Findings Related to Adoption
Olsson et al.	2016	Sweden	Secondary pupils	Implementation evaluation	Sustainability consciousness	ESD implementation strengthened behavioural orientation.
Hoang & Kato	2016	Vietnam	247 students	Pre–post intervention	Waste & conservation	Education improved engagement with sustainability practices.
Otto & Pensini	2017	Germany	School students	Correlational	Nature connectedness	Emotional attachment predicted ecological behaviour.
Nurwidodo et al.	2020	Indonesia	275 high school students	Comparative survey	Eco-school	Eco-school participation is linked to higher environmental behaviour.

Schröder et al.	2020	Spain	Secondary students	Programme analysis	Eco-school participation	Participation quality influenced behavioural outcomes.
Maurer & Bogner	2020	Greece	223 adolescents	CFA modelling	Environmental literacy	Values are more predictive of behaviour than knowledge.
Torres-Pereda et al.	2020	Mexico	754 students	Intervention study	Waste management	Structured monitoring improved adoption.
Sprague et al.	2021	USA	Youth participants	Photovoice	Engagement	Participatory learning enhanced environmental pathways.
van de Wetering et al.	2022	Multi-country	Meta-analysis	Behavioural outcomes	EE impact	Education improved behavioural intention and reported practice.
Boonchieng et al.	2023	Thailand	74 students	School-based program	Waste management	Peer leadership improved behavioural continuity.
Kiss et al.	2024	Hungary	38 participants	Qualitative interviews	Ecoclubs	Experiential participation shifted lifestyle practices.
Liu & Green	2024	Global	Systematic review	Pro-environmental behaviour	Contextual influence	Social modelling and opportunity-mediated behaviour.
Xiong et al.	2025	Global	Systematic review	Pedagogical strategies	Literacy & ERB	Praxis-oriented teaching strengthened behavioural outcomes.

Table 2: Thematic Determinants of Sustainability Adoption

Determinant	Supporting Studies	Mechanism of Influence
Institutional Reinforcement	Torres-Pereda et al., 2020	Monitoring increases accountability

Participatory Pedagogy	Xiong et al., 2025	Praxis promotes behavioural internalisation
Environmental Values	Maurer & Bogner, 2020	Values drive behavioural consistency
Nature Connectedness	Otto & Pensini, 2017	Emotional attachment encourages care
Peer Leadership	Boonchieng et al., 2023	Social norms reinforce practice
Contextual Opportunity	Liu & Green, 2024	The environment shapes behavioural feasibility

4. Discussion

As indicated in Table 1, sustainability adoption among high school students demonstrates several recurring patterns across contexts. First, institutional embedding of sustainability practices appears more effective than awareness campaigns alone. Intervention-based studies show that structured systems, including monitoring protocols and student leadership roles, produce measurable behavioural gains (Torres-Pereda et al., 2020; Boonchieng et al., 2023).

Second, participation depth matters. Programmes labelled as eco-schools do not automatically guarantee behavioural transformation. Instead, active student involvement and participatory governance structures are decisive (Schröder et al., 2020; Kiss et al., 2024).

Third, values and affective orientation consistently predict behaviour more strongly than knowledge acquisition alone (Maurer & Bogner, 2020; Otto & Pensini, 2017). Emotional connection to environmental issues strengthens commitment.

Finally, meta-analytic evidence confirms that environmental education improves behavioural intention; however, effect sizes remain moderate, indicating that structural reinforcement is necessary for durable adoption (van de Wetering et al., 2022).

The synthesis presented in Table 2 reveals that sustainability adoption is multidimensional rather than linear. Institutional reinforcement functions as a structural anchor. Without infrastructure such as waste segregation systems or energy-monitoring routines, intentions remain symbolic.

Participatory pedagogy shifts sustainability from abstract knowledge to lived experience. When students engage in problem-solving, peer leadership, or environmental audits, behavioural internalisation strengthens.

Value orientation represents the psychological substrate of adoption. Knowledge may inform, but values motivate sustained behaviour. Likewise, nature connectedness deepens ecological responsibility beyond compliance.

Peer leadership amplifies behavioural norms. Adolescents are particularly sensitive to group expectations; therefore, visible peer commitment can normalise sustainability practices.

Finally, contextual opportunity determines feasibility. Socio-economic realities shape behavioural capacity. Adoption must therefore be analysed within structural conditions rather than solely individual willingness. Collectively, these findings indicate that sustainability adoption is contingent upon systemic alignment rather than isolated instructional exposure.

5. Empirical Domains of Sustainability Adoption

5.1 Waste Management and Recycling Behaviour

Waste management remains the most empirically examined sustainability practice among students. Structured interventions demonstrate that behavioural adoption improves significantly when institutional systems support action. For instance, a large-scale institutional intervention in Mexico found measurable

waste reduction when monitoring mechanisms and educational components were integrated (Torres-Pereda et al., 2020). Similarly, a rural Thai school intervention using peer-led waste programs reported increased behavioural engagement following infrastructure support and leadership involvement (Boonchieng et al., 2023). However, comparative research in eco-school programmes indicates that participation quality influences outcomes; symbolic membership alone does not guarantee sustained practice (Schröder et al., 2020). These findings suggest that adoption is strongly influenced by structural reinforcement.

5.2 Water Conservation Practices

Water stewardship behaviours are often influenced by local environmental realities. In Vietnam, environmental education initiatives significantly improved students' engagement with sustainability topics, including waste and conservation awareness (Hoang & Kato, 2016).

Broader reviews of children's pro-environmental behaviour indicate that contextual exposure to environmental risk enhances conservation-oriented behaviour (Liu & Green, 2024). Nevertheless, behavioural consistency depends on alignment between school practices and household modelling.

5.3 Energy-Saving Behaviour

Energy conservation is frequently reported as the most accessible sustainability practice for adolescents. However, modelling research suggests that knowledge alone is insufficient to ensure behavioural continuity (Maurer & Bogner, 2020).

Meta-analytic findings confirm that while educational interventions increase environmental intentions, long-term behavioural retention requires reinforcement mechanisms (van de Wetering et al., 2022). Teacher modelling and visible institutional norms play a decisive role in sustaining energy-saving practices.

5.4 Nature Connectedness and Behaviour

Beyond structured interventions, emotional connection to nature significantly predicts ecological behaviour. Empirical evidence demonstrates that environmental knowledge combined with connectedness to nature produces stronger behavioural outcomes (Otto & Pensini, 2017).

Sustainability consciousness research further confirms that integrated ESD implementation correlates with enhanced behavioural orientation (Olsson et al., 2016). These findings underscore the importance of affective engagement alongside cognitive instruction.

5.5 Eco-School and Institutional Programmes

Comparative analysis of eco-school programmes indicates that institutional culture significantly shapes sustainability adoption. The Adiwiyata eco-school programme in Indonesia reported higher environmental literacy among participating students than among non-participants (Nurwidodo et al., 2020).

Similarly, qualitative research on ecoclubs reveals that autonomy, peer collaboration, and experiential engagement contribute to lifestyle shifts beyond school boundaries (Kiss et al., 2024). Participatory approaches such as photovoice also strengthen environmental awareness and engagement pathways (Sprague et al., 2021).

These findings collectively highlight that participatory, community-oriented models foster deeper adoption.

6. Determinants Influencing Adoption Level

A consistent finding across the reviewed empirical literature is that sustainability adoption among high

school students is not a spontaneous outcome of awareness. Rather, it is shaped by interacting structural, psychological, and contextual determinants. The process through which environmental knowledge transforms into sustained behavioural practice appears conditional upon reinforcement systems, value internalisation, participatory engagement, and opportunity structures. The determinants discussed below collectively explain why similar educational content may produce different behavioural outcomes across settings.

6.1 Institutional Reinforcement

Institutional reinforcement emerges as one of the most decisive factors influencing sustainability adoption. Schools that operationalise sustainability beyond curricular instruction by embedding it within administrative routines and physical infrastructure demonstrate more consistent behavioural continuity among students.

Empirical evidence suggests that monitoring systems and visible institutional norms play a regulatory role in shaping conduct (Torres-Pereda et al., 2020). When waste segregation bins are clearly labelled, when energy-saving reminders are displayed, and when environmental practices are systematically monitored, sustainable behaviour becomes normalised rather than exceptional. In such contexts, students are not merely encouraged to act responsibly; they operate within an environment structured to facilitate responsible action.

Institutional reinforcement also includes leadership commitment. Administrative endorsement signals the legitimacy of sustainability efforts. When school authorities allocate resources and integrate environmental practices into formal policies, sustainability shifts from voluntary initiative to institutional expectation. This structural embedding reduces behavioural inconsistency by aligning intention with opportunity.

Conversely, where infrastructure is absent or poorly maintained, students may experience a disjunction between what they are taught and what they can realistically practice. Such structural gaps weaken behavioural internalisation and contribute to the persistence of the awareness–adoption divide.

6.2 Participatory Pedagogy

The pedagogical approach significantly influences the depth of sustainability adoption. Research indicates that praxis-oriented and experiential learning models generate stronger behavioural outcomes than didactic instruction alone (Xiong et al., 2025). When students actively participate in environmental audits, community campaigns, or peer-led initiatives, sustainability becomes an embodied experience rather than an abstract concept.

Participation fosters ownership. Adolescents who are entrusted with responsibility, such as managing eco-clubs or leading sustainability drives, demonstrate higher levels of commitment and behavioural consistency. Experiential engagement also strengthens self-efficacy, enabling students to perceive their actions as meaningful.

Moreover, participatory pedagogy reduces the psychological distance between environmental problems and personal responsibility. Rather than perceiving sustainability as a distant global issue, students encounter it as a local and actionable concern. This contextual immediacy enhances behavioural relevance.

However, superficial participation yields limited impact. Token involvement without decision-making authority may generate compliance without internalisation. Therefore, the quality and depth of participation matter more than the mere presence of sustainability activities.

6.3 Values and Norms

While knowledge contributes to environmental literacy, empirical modelling studies consistently demonstrate that values exert stronger predictive influence on behaviour than factual understanding alone (Maurer & Bogner, 2020). Behavioural consistency is more likely when sustainability aligns with internalised moral orientation rather than external instruction.

Environmental values function as motivational anchors. Students who perceive ecological responsibility as part of their ethical identity are less dependent on external monitoring. In contrast, knowledge without value internalisation may produce situational compliance rather than habitual adoption.

Normative frameworks further shape behavioural expression. Social norms define what is perceived as acceptable or desirable within peer groups. When sustainable practices are socially validated, they are more readily adopted. Conversely, when such practices are marginalised, behavioural adoption weakens despite positive attitudes.

Importantly, value formation is gradual. It develops through repeated exposure, emotional engagement, and social reinforcement. Educational systems that integrate reflective dialogue, ethical reasoning, and real-world application foster deeper normative commitment.

6.4 Social Modelling

Adolescents are particularly sensitive to social cues. Peer and teacher modelling, therefore, play a pivotal role in reinforcing sustainability practices (Schröder et al., 2020). Behaviour becomes socially contagious when visible role models demonstrate consistency.

Peer leadership amplifies behavioural diffusion. When student leaders exemplify sustainability practices, group norms shift accordingly. Social modelling also reduces perceived behavioural cost, as individuals are more willing to act when others do so.

Teacher behaviour is equally influential. Educators who embody sustainable habits such as conserving resources or engaging in environmental initiatives strengthen the credibility of instruction. In contrast, inconsistency between instruction and adult behaviour undermines normative influence.

Social modelling operates subtly yet powerfully. It transforms sustainability from an instructional directive into a shared culture. Without such modelling, behavioural adoption may remain isolated and fragile.

6.5 Contextual Opportunity

Behavioural adoption cannot be understood independently of contextual opportunity. Socio-economic and environmental conditions shape both the feasibility and sustainability of ecological practices (Liu & Green, 2024). Students may express strong environmental commitment yet face structural limitations that constrain implementation.

For instance, sustainable consumption practices often require financial flexibility. In low-resource settings, affordability may override environmental preference. Similarly, urban–rural differences influence exposure to environmental issues and access to infrastructure.

Contextual opportunity also includes family modelling. Household practices reinforce or weaken school-based sustainability education. When environmental responsibility is consistently practised at home, behavioural adoption strengthens through repetition and normalisation.

Therefore, sustainability adoption should not be framed solely as individual choice. It reflects the interaction between personal motivation and structural capacity. Policies aimed at strengthening adoption must therefore address environmental design, socio-economic realities, and intergenerational modelling.

7. The Awareness–Adoption Gap

Despite measurable gains in environmental literacy, behavioural adoption remains inconsistent. Meta-analytic evidence suggests that while educational programmes improve behavioural intention, effect sizes for sustained behaviour are moderate (van de Wetering et al., 2022).

This gap may be attributed to:

- Habitual inertia
- Competing adolescent priorities
- Lack of structural reinforcement
- Limited behavioural monitoring

Therefore, sustainability adoption should be framed as a systemic outcome rather than an individual moral choice.

8. Implications

The literature collectively indicates that adoption strengthens when:

- Sustainability practices are embedded into daily school routines
- Students hold participatory leadership roles
- Infrastructure supports action
- Environmental identity is nurtured through experiential engagement

Event-based awareness campaigns, while valuable, are insufficient to institutionalise behaviour.

9. Conclusion

The decadal evidence from 2016 to 2025 demonstrates measurable progress in sustainability education at the secondary level. However, adoption of environmental development practices among high school students remains moderate and context-sensitive. Behavioural internalisation is strongest when cognitive learning is reinforced through participatory structures, institutional systems, and social modelling.

For sustainability education to achieve a transformative impact, it must evolve from informational dissemination to behavioural institutionalisation. Only through structural embedding within school culture can environmental responsibility become habitual rather than aspirational.

Acknowledgement

The authors express sincere gratitude to the advisor who provided intellectual guidance and encouragement during the preparation of this manuscript. The constructive insights received during the development of the review are gratefully acknowledged.

References

1. Boonchieng, W., et al. (2023). Development of a school-based intervention program for waste management in a rural school in Northern Thailand. *The Open Public Health Journal, 16*, Article 72. https://doi.org/10.2174/18749445-v16-230810-2023-72
2. Hoang, T. T. P., & Kato, T. (2016). Measuring the effect of environmental education for sustainable development at elementary schools: A case study in Da Nang city, Vietnam. *Sustainable Environment Research, 26*(6), 274–286. https://doi.org/10.1016/j.serj.2016.08.005
3. Kiss, G., Lazányi, O., Taxner, T., Veress, T., & Neulinger, Á. (2024). The transformation of sustainable lifestyle practices in ecoclubs. *Cleaner and Responsible Consumption, 13*, 100189.

https://doi.org/10.1016/j.clrc.2024.100189

4. Liu, J., & Green, R. J. (2024). Children's pro-environmental behaviour: A systematic review of the literature. *Resources, Conservation & Recycling, 205*, 107524. https://doi.org/10.1016/j.resconrec.2024.107524
5. Maurer, M., & Bogner, F. X. (2020). Modelling environmental literacy with environmental knowledge, values and behaviour. *Studies in Educational Evaluation, 65*, 100863. https://doi.org/10.1016/j.stueduc.2020.100863
6. Nurwidodo, N., Amin, M., Ibrohim, I., & Sueb, S. (2020). The role of the eco-school program (Adiwiyata) towards environmental literacy of high school students. *European Journal of Educational Research, 9*(3), 1089–1103. https://doi.org/10.12973/eu-jer.9.3.1089
7. Olsson, D., Gericke, N., & Chang Rundgren, S.-N. (2016). The effect of implementation of education for sustainable development in Swedish compulsory schools—Assessing pupils' sustainability consciousness. *Environmental Education Research, 22*(2), 176–202. https://doi.org/10.1080/13504622.2015.1005057
8. Otto, S., & Pensini, P. (2017). Nature-based environmental education of children: Environmental knowledge and connectedness to nature are related to ecological behaviour. *Global Environmental Change, 47*, 88–94. https://doi.org/10.1016/j.gloenvcha.2017.09.009
9. Schröder, L. M. U., et al. (2020). Analysing the state of student participation in the Eco-Schools programme in secondary schools. *Environmental Education Research, 26*(9–10), 1299–1318. https://doi.org/10.1080/13504622.2020.1779186
10. Sprague, N. L., Okere, U. C., Kaufman, Z. B., & Ekenga, C. C. (2021). Enhancing educational and environmental awareness outcomes through photovoice. *International Journal of Qualitative Methods, 20*, 1–11. https://doi.org/10.1177/16094069211016719
11. Torres-Pereda, P., Parra-Tapia, E., Rodríguez, M. A., Félix-Arellano, E., & Riojas-Rodríguez, H. (2020). Impact of an intervention for reducing waste through educational strategy: A Mexican case study. *Waste Management, 119*, 166–176. https://doi.org/10.1016/j.wasman.2020.06.027
12. van de Wetering, J., Leijten, P., Spitzer, J., & Thomaes, S. (2022). Does environmental education benefit environmental outcomes in children and adolescents? A meta-analysis. *Journal of Environmental Psychology, 81*, 101782. https://doi.org/10.1016/j.jenvp.2022.101782
13. Xiong, Z., et al. (2025). Pedagogical strategies for teaching environmental literacy in secondary school education: A systematic review. *Sustainability, 17*(20), 9104. https://doi.org/10.3390/su17209104