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From Environmental Knowledge to Action: How Social Studies Education Develops Students' Pro-Environmental Behavior—A Systematic Review

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Abstract: The persistence of the knowledge–action gap is a central challenge in environmental education: students may understand environmental problems yet fail to translate that knowledge into consistent pro-environmental action. This systematic review analyzes how Social Studies Education contributes to transforming environmental knowledge into pro-environmental behavior. Following PRISMA, studies were searched in Scopus, Web of Science, ScienceDirect, ERIC, and Google Scholar and screened using criteria that prioritized empirical, full-text, peer-reviewed studies published from 2022 to August 2026 and relevant to environmental knowledge, awareness, attitudes, behavioral intention, or pro-environmental behavior. Twenty-one primary studies were included in the final synthesis. The findings show that environmental knowledge is a necessary cognitive foundation, but it does not linearly or automatically produce action. The knowledge-to-action transformation is multidimensional, involving environmental awareness, attitudes, values, behavioral intention, self-efficacy, personal responsibility, social norms, institutional support, and opportunities for direct practice. Problem-, project-, place-, experiential-, inquiry-, and community-based learning approaches can strengthen this transition by connecting environmental issues with students' social contexts, decision making, participation, and authentic action. Social Studies Education is strategically positioned to integrate cognitive, affective, social, pedagogical, and contextual dimensions. These findings indicate that effective environmental learning should be designed not merely to increase knowledge, but to cultivate agency, responsibility, and sustained opportunities for pro-environmental action

Keywords: *Environmental Knowledge; Environmental Action; Pro-environmental Behavior; Social Studies Education; Systematic Literature Review*

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INTRODUCTION

Climate change, environmental degradation, increasing waste generation, and the exploitation of natural resources have made the development of pro-environmental behavior an important educational agenda. Environmental education can no longer focus solely on conceptual knowledge but also needs to support students in developing environmental awareness, responsibility, and actions that contribute to sustainability. Chomać-Pierzecka et al.,[1] demonstrate that green education plays a role in fostering responsible attitudes toward the environment, while Ramírez Suárez et al.,[2] emphasize the importance of environmental education and education for sustainable development at the primary and secondary school levels. Pedagogically, these empirical findings indicate that the success of environmental education cannot be assessed solely in terms of conceptual knowledge but also in terms of its capacity to foster responsible attitudes and students' readiness to take action. This perspective is also consistent with Islamic education, in which character development involves not only knowledge but also attitudes and everyday actions.[3] Islamic character education further emphasizes values such as moral responsibility, self-awareness, discipline, and other dimensions of character that support the translation of educational values into practice.[4]

Environmental knowledge is an important foundation for developing pro-environmental behavior because it provides an understanding of environmental problems, their consequences, and possible solutions. Jiang et al.,[5] found that environmental knowledge and perceptions of ecological benefits contribute to the development of pro-environmental behavior. However, this relationship does not always lead to actual action because behavioral change involves cognitive, affective, and situational dimensions. Gazeloğlu[6] showed that climate change awareness and perceptions are associated with pro-environmental behavior. López-García et al.,[7] highlighted the role of *eco-worry* and *eco-anxiety* in explaining behavioral responses to environmental problems. Taken together, these findings position *environmental*

[1] Ewa Chomać-Pierzecka et al., "Analysis and Assessment of the Role of Green Education in Shaping Responsible Attitudes of the Potential of Human Resources," *Sustainability* 18, no. 7 (2026): 3165, https://doi.org/10.3390/su18073165.

[2] Vanessa Ramírez Suárez et al., "Current State of Environmental Education and Education for Sustainable Development in Primary and Secondary (K-12) Schools in Boyacá, Colombia," *Sustainability* 15, no. 13 (2023): 10139, https://doi.org/10.3390/su151310139.

[3] Syaifur Rohman and M Choirul Muzaini, "Pendekatan Ketauladanan Perspektif Pendidikan Islam Dalam Pembinaan Karakter Peserta Didik Sekolah Dasar," *DIMAR: Jurnal Pendidikan Islam* 4, no. 2 (January 25, 2023): 215–28, https://doi.org/10.58577/dimar.v4i2.87.

[4] Hithna Rohadatul Aisyi Mylanadia and Dewi Astuti, "Analisis Nilai-Nilai Pendidikan Karakter Dalam Kitab Ngudi Susilo Karya KH. Bisri Mustofa Dan Relevansinya Di Era Modern," *DIMAR: Jurnal Pendidikan Islam* 7, no. 1 (2025): 68–81, https://doi.org/10.58577/dimar.v7i1.419.

[5] Menglei Jiang et al., "The Role of Environmental Knowledge and Perceived Ecological Benefits in Shaping Farmers' Pro-Environmental Behaviour Towards Rural Solid Waste," *Sustainability* 17, no. 12 (2025): 5258, https://doi.org/10.3390/su17125258.

[6] Cengiz Gazeloğlu, "Impact of Climate Change Awareness and Perception on Pro-Environmental Behaviour in Türkiye: A Structural Equation Modelling Approach," *Sustainability* 18, no. 3 (2026): 1175, https://doi.org/10.3390/su18031175.

[7] Laura López-García et al., "What Drives Pro-Environmental Behavior? Investigating the Role of Eco-Worry and Eco-Anxiety in Young Adults," *Sustainability* 17, no. 10 (2025): 4543, https://doi.org/10.3390/su17104543.

knowledge as an important initial condition, while behavioral change depends on affective, perceptual, and situational processes that transform understanding into decisions to act.

The gap between knowledge and action is a significant concern in sustainability education. Students may understand environmental issues without consistently applying such knowledge in their everyday lives. Borrego-Balsalobre et al.,[8] identified a *knowledge–action gap* in the context of higher education, suggesting that transferring knowledge into action requires more contextualized and transformative learning experiences. This condition indicates that increasing knowledge needs to be accompanied by the development of attitudes, values, responsibility, and capacity to act. The gap emerges when knowledge is not accompanied by opportunities for practice, motivation, perceived capability, social support, and contexts that enable action. Therefore, learning should provide authentic experiences that directly connect understanding with practice.

Social Studies Education has a multidimensional character because it connects human beings with social, economic, cultural, political, and environmental life. Pérez-Guilarte et al.,[9] emphasize the importance of a holistic approach to social studies teaching through the construction of students' understanding of social reality. This perspective provides opportunities to integrate environmental issues as part of social problems that require critical thinking, reflection, and decision-making. The integration of environmental education at the primary and secondary levels also indicates that schools have a strategic position in developing an understanding of sustainability from an early age.[10]

Social Studies Education that integrates environmental issues has the potential to connect knowledge with students' social experiences. Learning approaches that provide opportunities for *agency* can strengthen students' capacity to understand problems while taking action. Bamidele and Searle[11] demonstrated that *critical student agency* in Social Studies Education can provide students with opportunities to participate actively in learning processes and social issues. This perspective is relevant to the needs of environmental learning, which should not stop at conceptual understanding but should also promote participation and concrete action. *Agency* gives students opportunities to make choices and decisions; experience provides opportunities to try out actions; participation fosters a sense of ownership; and social engagement strengthens responsibility. Through these mechanisms, knowledge is tested and applied in real-life situations, thereby helping to narrow the *knowledge–action gap*.

Research on environmental education and pro-environmental behavior has expanded, yet the relationship between environmental knowledge and action remains complex. Empirical

[8] Francisco José Borrego-Balsalobre, Arturo Díaz-Suárez, and Frano Giakoni-Ramírez, "Beyond the Classroom: Analyzing the Gap Between Knowledge and Action in Sustainability Within Higher Education Sport Sciences Curricula," *Trends in Higher Education* 5, no. 3 (2026): 61, https://doi.org/10.3390/higheredu5030061.
[9] Yamilé Pérez-Guilarte, Francisco Xosé Armas-Quintá, and Xosé Carlos Macía-Arce, "Social Sciences Teaching: Building a Holistic Approach from Student Teachers' Social Representations," *Social Sciences* 11, no. 7 (2022): 307, https://doi.org/10.3390/socsci11070307.
[10] Ramírez Suárez et al., "Current State of Environmental Education and Education for Sustainable Development in Primary and Secondary (K-12) Schools in Boyacá, Colombia."
[11] Bolaji Bamidele and Kristin A Searle, "Critical Student Agency in an Integrated Social Studies Unit," *Education Sciences* 16, no. 2 (2026): 227, https://doi.org/10.3390/educsci16020227.

evidence is dispersed across different educational contexts and employs diverse constructs, including environmental knowledge, awareness, attitude, intention, and actual behavior. The specific role of Social Studies Education in transforming environmental knowledge into pro-environmental action has not yet been comprehensively synthesized. Evidence on psychological factors also indicates that responses to environmental issues may be influenced by emotional conditions and individual perceptions, rather than by knowledge alone.[12] A systematic literature review is therefore needed to map the mechanisms of change, learning approaches, and individual, social, and educational factors that influence this transformation. Existing literature has examined the roles of knowledge, awareness, attitudes, intentions, and social factors separately. However, there is still a lack of synthesis specifically mapping how Social Studies Education integrates these factors into a *knowledge-to-action* pathway, which learning strategies consistently support this process, and what conditions strengthen or constrain action. This systematic review addresses this gap by bringing together dispersed evidence into an integrated framework of mechanisms, pedagogies, and contexts.

This study aims to systematically analyze how Social Studies Education contributes to the transformation of *environmental knowledge* into *pro-environmental behavior* among students, including the psychological mechanisms, learning approaches, and contextual factors that influence this process. Five research questions were formulated:

RQ1: How does Social Studies Education contribute to students' environmental knowledge and awareness?

RQ2: How does environmental knowledge influence students' attitudes, intentions, and pro-environmental behavior?

RQ3: What Social Studies Education approaches contribute to the development of students' pro-environmental behavior?

RQ4: What individual, social, educational, and contextual factors influence the transformation of environmental knowledge into environmental action?

RQ5: What research gaps remain in understanding the role of Social Studies Education in developing students' pro-environmental behavior?.

METHODS

This study employed a Systematic Literature Review (SLR) approach to identify, evaluate, and synthesize empirical evidence on the contribution of Social Studies Education to the transformation of environmental knowledge into pro-environmental behavior among students. The review process followed the principles of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) to ensure that the stages of identification, screening, eligibility assessment, and study inclusion were reported transparently and systematically. The review focused on the relationships among Social Studies Education, environmental knowledge, environmental awareness, environmental attitudes, behavioral intention, and pro-environmental behavior. Operationally, the identification stage retrieved records from five

[12] López-García et al., "What Drives Pro-Environmental Behavior? Investigating the Role of Eco-Worry and Eco-Anxiety in Young Adults."

databases; screening was conducted after deduplication through title and abstract assessment; eligibility involved assessing full-text availability, topical relevance, peer-review status, and methodological quality; and inclusion determined which studies met all criteria for the final synthesis.

The search strategy was conducted across several relevant academic databases, namely Scopus, Web of Science, ScienceDirect, ERIC, and Google Scholar. The search used a combination of keywords representing the three main constructs of the study: Social Studies Education, environmental knowledge, and pro-environmental behavior. The search string was formulated using Boolean operators, with the main formulation as follows: ("Social Studies Education" OR "Social Studies Learning") AND ("Environmental Knowledge" OR "Environmental Education") AND ("Pro-Environmental Behavior" OR "Environmental Behavior" OR "Sustainable Behavior") AND ("Students" OR "Learners"). The retrieved articles were then compiled and deduplicated before proceeding to the screening stage. The search covered publications from 2022 to August 2026, with the final search conducted and documented in August 2026. Scopus and Web of Science were selected to provide multidisciplinary coverage of indexed publications, ScienceDirect to broaden access to scientific publications, ERIC to strengthen the education focus, and Google Scholar as an additional search source to minimize the possibility of missing relevant articles.

The inclusion criteria comprised empirical research articles involving students at relevant educational levels, having a connection with Social Studies Education or social science learning, and examining at least one of the following constructs: environmental knowledge, environmental awareness, environmental attitudes, behavioral intention, or pro-environmental behavior. Articles had to be available in full text and published within the specified publication period. The exclusion criteria included duplicate articles, editorials, commentaries, opinion articles, studies that did not focus on students, studies unrelated to environmental education, and articles with insufficient methodological information or empirical findings. Literature reviews and systematic reviews were not included as primary studies. The selection process consisted of four stages: identification, duplicate removal, screening, and eligibility, followed by the inclusion of studies that met all criteria in the final synthesis. These stages were presented in a PRISMA flow diagram. More specifically, publications were limited to the period from 2022 to August 2026 to capture recent evidence; articles had to be empirical studies, available in full text, peer-reviewed, and relevant to educational contexts or knowledge-to-action mechanisms. The primary focus was on students at the primary, secondary, and higher education levels. Contextual studies involving non-student populations were retained only when they provided direct evidence regarding environmental knowledge, awareness, attitudes, intention, or behavior mechanisms used to strengthen the synthesis. These criteria were selected to maintain alignment with the research questions while ensuring that the evidence analyzed could be methodologically evaluated.

Data were extracted systematically by recording the authors and publication year, research country, study design, participant characteristics, educational level, learning approach, environmental knowledge, environmental awareness, environmental attitudes, behavioral intention, pro-environmental behavior, and key findings. The methodological quality of the

studies was assessed based on the appropriateness of the research design, sample quality, instrument validity, clarity of the analysis, and consistency among the research objectives, methods, and findings. Data were synthesized using narrative synthesis and thematic synthesis by grouping findings according to study characteristics, the knowledge-to-action pathway, Social Studies Education approaches, and individual, social, educational, and contextual factors. Comparisons across findings were conducted to identify consistent patterns, divergent results, and research gaps.

RESULTS AND DISCUSSION

Characteristics of the Included Studies

The identification and selection stages of the literature for the Systematic Literature Review on the role of Social Studies Education in developing pro-environmental behavior began with searches across multiple academic databases, yielding a total of 514 records. The retrieved literature covered studies on Social Studies Education, environmental education, environmental knowledge, environmental awareness, environmental attitudes, behavioral intention, pro-environmental behavior, sustainability education, environment-based learning, environmental action, and individual and social factors influencing the transformation of knowledge into action. The initial screening excluded 68 records, comprising 42 duplicate articles, 17 articles deemed irrelevant during the initial assessment, and 9 records excluded due to technical or administrative issues. The five databases collectively yielded 514 records before deduplication; all records were subsequently treated as a single initial corpus to ensure consistent identification of overlaps across databases. Substantively, the initial corpus comprised studies on environmental education and behavior, with an emphasis on knowledge, awareness, attitudes, intentions, practices, agency, and social and institutional support relevant to the focus of the review.

A total of 446 articles subsequently underwent title and abstract screening. The screening process excluded 343 articles because they did not meet the inclusion criteria, including studies that did not address Social Studies Education and pro-environmental behavior in a relevant manner, did not examine environmental issues within an educational context, focused on non-student populations, or otherwise fell outside the scope of the review. Full-text assessment was then conducted for the 103 articles that passed the screening stage. Nineteen articles could not be included because of limited access to the full text or other technical constraints, leaving 84 articles for further evaluation. A more detailed assessment resulted in the exclusion of 63 articles, comprising 21 articles that had no direct relevance to Social Studies Education, environmental knowledge, and pro-environmental behavior; 29 articles originating from publication sources that were not indexed or had not undergone peer review; and 13 articles that did not meet the specified design and methodological quality requirements. The entire process of identification, screening, eligibility assessment, and final selection is presented in Figure 1.

The 19 articles excluded during the retrieval stage were removed solely because their full texts could not be obtained or accessed and therefore did not proceed to methodological quality assessment. Methodological assessment was conducted only for the 84 articles with accessible full texts; at this stage, 13 articles were excluded because they did not meet the established design and methodological quality standards.

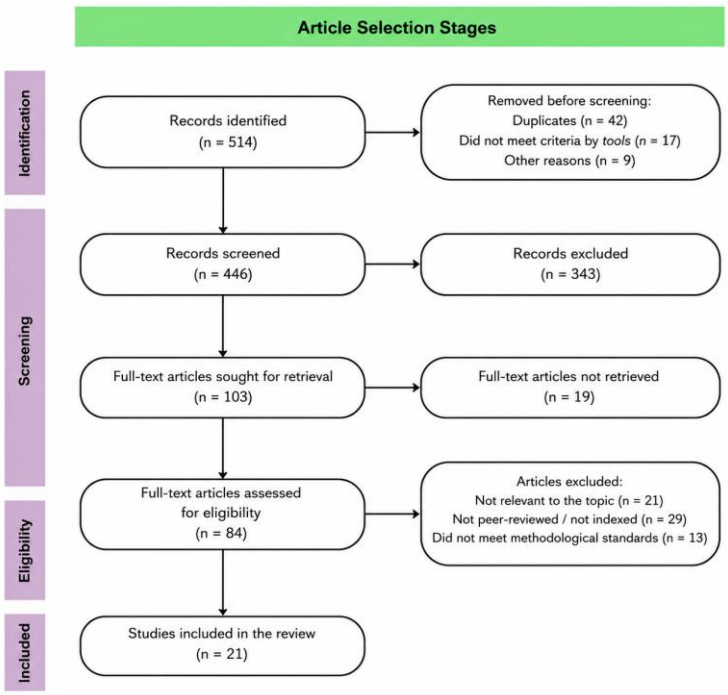


Figure 1. Article Selection Stages

Based on the selection process, 21 articles met all the inclusion criteria and were used as the primary literature for the synthesis, as presented in Table 1. The inclusion of all selected articles ensures consistency between the PRISMA selection process and the synthesis stage, while also providing a comprehensive overview of the contribution of Social Studies Education to *environmental knowledge* and *environmental awareness*, the relationship between knowledge, attitudes, and behavioral intentions, learning strategies that promote environmental action, and individual, social, educational, and contextual factors influencing the transition from knowledge to pro-environmental behavior. The diversity of student characteristics and units of analysis, educational levels, learning contexts, pedagogical approaches, environmental variables, behavioral indicators, and research designs provides a basis for synthesizing the *environmental knowledge-to-action* mechanisms in Social Studies Education

Table 1. Characteristics of The Analyzed Articles

No.	Authors (Year)	Country/ Context	Research Design	Participants/Unit of Analysis	Main Focus	Relevant Key Findings
1	Pérez-Guilarte et al. (2022)	Spain	Empirical study, social representation study	*Student teachers*	Social Studies, socio-environmental issues, sustainability	Prospective teachers viewed socio-environmental issues as multidimensional problems requiring a holistic learning approach and sustainability education.
2	Ramírez Suárez et al. (2023)	Colombia	Quantitative survey	Primary and secondary K–12 schools	Environmental Education and Education for Sustainable Development	Environmental education has been implemented in relation to conservation issues, while the integration of social, economic, and sustainability aspects still needs to be strengthened.
3	Zhang & Cao (2025)	Higher education	Quantitative	University students	Environmental attitudes, self-efficacy, social norms	Environmental attitudes, *self-efficacy*, and social norms serve as mechanisms linking sustainability education to pro-environmental behavior.
4	Qi et al. (2025)	Higher education	Quantitative, *mediated moderation model*	University students	Sustainability education and institutional support	Sustainability education and institutional support contribute to strengthening students' pro-environmental behavior.
5	Alharbi et al. (2025)	Saudi Arabia	Quantitative	Engineering students at Shaqra University	Sustainability awareness, attitude, behavior	Sustainability awareness, attitudes, and behavior are interconnected in the process of change from knowledge/awareness to action.
6	Burgos-Espinoza et al. (2025)	Mexico	Quantitative comparative study	Engineering and professional students	Environmental knowledge, attitudes, behaviors	*Environmental knowledge* is associated with attitudes and pro-environmental behavior, with group characteristics also influencing these relationships.
7	Gazeloğlu (2026)	Türkiye	Structural Equation Modeling	Respondents in Türkiye	Climate-change awareness, perception, pro-environmental behavior	Climate-change awareness and perceptions are important factors in explaining variations in pro-environmental behavior.
8	Gal (2026)	Child education	Structural Equation Model	Children/students	Environmental communicative agency and knowledge–action gap	Children's *communicative agency* plays a role in bridging environmental knowledge and sustainable action.
9	Jotaworn et al. (2026)	Higher education	Solomon Four-Group Experimental Design	First-year university students	Innovative teaching and pro-environmental behavior	Innovative teaching provides experimental evidence of the potential of learning to improve pro-environmental behavior.
10	Bamidele	United	Qualitative case	Grade 6 students	Integrated Social Studies	Integrated Social Studies learning encourages students

No.	Authors (Year)	Country/ Context	Research Design	Participants/Unit of Analysis	Main Focus	Relevant Key Findings
	& Searle (2026)	States	study		and student agency	to become *experts*, *investigators*, and *advocates*, enabling knowledge to be directed toward social participation and action.
11	Borrego-Balsalobre et al. (2026)	Spain, higher education	Quantitative cross-sectional study; nonparametric analysis	170 undergraduate students in sports sciences	*Sustainability consciousness*, *knowledge–action gap*, and sustainable behavior	Students' sustainability knowledge was high, but actual behavior was lower, indicating a significant *knowledge–action gap* and the need for reflective and experiential pedagogy.
12	Jiang et al. (2025)	China, rural waste management	Quantitative survey; regression and PLS-SEM	240 farmers in Guizhou Province	*Environmental knowledge*, *perceived ecological benefits*, and *pro-environmental behavior*	Environmental knowledge and perceived ecological benefits strengthen environmental commitment, subjective norms, and attitudes, which subsequently contribute to *pro-environmental behavior*.
13	Rampedi & Ifegbesan (2022)	South Africa	Survey data analysis; Structural Equation Modeling (SEM)	Respondents from the International Social Survey Programme (ISSP) Environmental III	*Environmental awareness*, knowledge, attitudes, risk perception, activism, and *pro-environmental behavior*	Pro-environmental behavior is associated with concern, awareness, and willingness to make sacrifices; the strength of these relationships also varies according to educational background, place of residence, ethnic identity, and province.
14	Uygur et al. (2025)	Türkiye, higher education and nature-based recreation	Correlational survey; Confirmatory Factor Analysis and SEM	Academics from various universities in Türkiye with experience in nature-based recreation	*Environmental attitudes*, *eco-recreational attitudes*, and *environmental behavior*	Environmental attitudes and ecological recreation experiences help explain environmental behavior, highlighting the importance of evaluative and experiential dimensions in action development.
15	Kochanek et al. (2025)	Poland, Małopolska mountain region	Quantitative survey; nonparametric tests, correlation, and PCA	423 car owners and active drivers from six mountain districts	Pro-environmental attitudes and behaviors related to energy conservation and transportation	Simple actions such as waste separation and energy conservation are more frequently undertaken than actions requiring investment or lifestyle changes; the findings also reveal an *attitude–behavior gap*.
16	Težak Damijanić et al. (2023)	Croatia, Adriatic hotel tourism	Quantitative survey; Structural Equation Modeling (SEM)	1,124 hotel guests	*Environmental knowledge*, *eco-labeling perception*, *pro-environmental behavior*, and	Environmental knowledge is positively associated with pro-environmental behavior and eco-label perceptions; pro-environmental behavior and eco-label perceptions serve as mechanisms linking knowledge to the

No.	Authors (Year)	Country/ Context	Research Design	Participants/Unit of Analysis	Main Focus	Relevant Key Findings
					travel intention	intention to choose environmentally labeled accommodation.
17	Vaznonis et al. (2026)	Western and Eastern European Union	ESS secondary data analysis; regression and cluster analysis	European Social Survey respondents aged 15 and above in 10 EU countries	*Pro-environmental behavior*, *subjective well-being*, and demographic and structural factors	Pro-environmental behavioral orientations differ between Western and Eastern European contexts; social and demographic factors, subjective well-being, and structural conditions contribute to variations in behavior.
18	Smadi & Al Rawwad (2026)	Jordan	Telephone survey; path analysis	417 Jordanian adults	*Environmental awareness*, attitudes, *behavioral intention*, and ecologically and socially responsible behavior	Environmental awareness has significant direct and indirect effects on ecologically and socially responsible behavior through attitudes and *behavioral intention*.
19	Muna et al. (2025)	Indonesia, Bali tourism	Cross-sectional survey; PLS-SEM	300 domestic and international tourists	*Environmental knowledge*, *pro-environmental behavior*, *environmental concern*, and *green purchase intention*	Pro-environmental behavior mediates the relationship between environmental knowledge and green purchase intention and strengthens environmental concern, indicating that knowledge needs to be translated into more specific action orientations.
20	Yang et al. (2025)	China, higher education in Zhejiang	Quantitative survey; CatBoost and *SHAP/Explainable AI*	463 students from six universities	*Knowledge–action gap*, environmental practices, knowledge, attitudes, and *pro-environmental behavior*	Habits, participation in environmental practices, and resource investment are dominant predictors of pro-environmental behavior, whereas knowledge and attitudes have relatively lower importance.
21	Shen & Zhang (2024)	Cross-cultural, 48 regions	World Values Survey analysis; hierarchical linear model	60,557 respondents from 48 regions	*Social identity*, *green orientation*, culture, and *pro-environmental behavior*	Global identity is a stronger predictor of green orientation and pro-environmental behavior than other local identities; long-term cultural orientation strengthens the relationship between green orientation and behavior.

Source: Data processed by the authors (2026)

RQ1. Contribution of Social Studies Education to Environmental Knowledge and Awareness

The synthesis results indicate that *environmental knowledge* is a cognitive foundation for developing pro-environmental behavior because it enables individuals to understand the characteristics of environmental problems, the consequences of human activities, and alternative, more sustainable actions. Jiang et al.,[13] showed that environmental knowledge is associated with individuals' tendencies to engage in pro-environmental behavior, particularly when such knowledge is accompanied by an understanding of ecological benefits. This finding indicates that knowledge functions as an initial resource that shapes individuals' capacity to recognize the rationale and consequences of environmental actions. Thus, *environmental knowledge* serves as a cognitive entry point: students first need to understand environmental problems, their causes, consequences, and possible courses of action before they can develop environmental awareness and a pro-environmental behavioral orientation.

The relationship between knowledge and behavior is not linear. Burgos-Espinoza et al.,[14] found that *environmental knowledge* is associated with pro-environmental attitudes and behaviors among university students and professionals, while also indicating the importance of group characteristics in shaping the strength of these relationships. High levels of knowledge can enhance cognitive capacity to evaluate environmental issues, but behavioral enactment still requires affective and motivational processes. This condition emphasizes that environmental education needs to move beyond the transfer of information toward developing understanding that can influence individuals' attitudes and decisions. These findings suggest that knowledge is a necessary but not sufficient condition; behavioral enactment requires the involvement of affective and motivational factors such as concern, attitudes, perceived ability to act, and willingness to apply knowledge.

Environmental awareness is an important mechanism linking knowledge to environmental evaluation. Awareness enables individuals to recognize the effects of personal actions on ecological conditions and to understand the social consequences of environmental problems. Rampedi and Ifegbesan[15] demonstrated that pro-environmental behavior is influenced by several interrelated determinants, indicating that behavioral development cannot be explained solely by the level of knowledge. This perspective reinforces the need to position awareness as part of the cognitive-affective process toward environmental responsibility.

RQ2. From Environmental Knowledge to Attitudes, Intentions, and Pro-Environmental Behavior

Environmental attitudes provide an evaluative dimension to knowledge and awareness. Attitudes determine how individuals evaluate the importance of environmental protection and the extent to which they are willing to direct their behavioral choices toward sustainability goals. Uygur et al.,[16] showed that environmental attitudes are associated with *environmental*

[13] Jiang et al., "The Role of Environmental Knowledge and Perceived Ecological Benefits in Shaping Farmers' Pro-Environmental Behaviour Towards Rural Solid Waste."

[14] Ingrid Iovana Burgos-Espinoza et al., "Effect of Environmental Knowledge on Pro-Environmental Attitudes and Behaviors: A Comparative Analysis between Engineering Students and Professionals in Ciudad Juárez (Mexico)," *Journal of Environmental Studies and Sciences* 15, no. 4 (2025): 861–75, https://doi.org/10.1007/s13412-024-00991-5.

[15] Isaac Tebogo Rampedi and Ayodeji Peter Ifegbesan, "Understanding the Determinants of Pro-Environmental Behavior among South Africans: Evidence from a Structural Equation Model," *Sustainability* 14, no. 6 (2022): 3218, https://doi.org/10.3390/su14063218.

[16] Akyay Uygur et al., "The Effect of Eco-Recreational and Environmental Attitudes on Environmental Behavior," *Sustainability* 17, no. 23 (2025): 10660, https://doi.org/10.3390/su172310660.

behavior, suggesting that behavioral change requires the internalization of positive views toward environmental protection. Kochanek et al.,[17] lso demonstrated an association between attitudes and behavior in the contexts of energy conservation and transportation, indicating that attitudinal orientations can be reflected in various forms of everyday action. Within the *knowledge-to-action* pathway, *environmental attitudes* function as an evaluative mechanism that transforms what individuals know and are aware of into action preferences. Thus, attitudes determine whether knowledge is directed toward more environmentally friendly behavioral choices.

Environmental values and perceptions of ecological consequences further strengthen this process. Težak Damijanić et al.,[18] demonstrated associations among *environmental knowledge*, *pro-environmental behavior*, and perceptions of environmental labeling in the context of travel decisions. This finding suggests that knowledge becomes more meaningful when individuals can connect it with value considerations and consequences in decision-making. Vaznonis et al.,[19] further showed that pro-environmental behavior is influenced by social factors and characteristics of the societal context, indicating that behavioral development needs to be understood within a broader social environment.

The synthesis of these findings produces the following pattern: Environmental Knowledge → Environmental Awareness → Environmental Attitudes → Environmental Responsibility → Pro-Environmental Behavior. Environmental knowledge provides the basis for understanding, environmental awareness strengthens recognition of ecological consequences, while environmental attitudes guide evaluation and action preferences. Environmental responsibility serves as an orientation that encourages knowledge and attitudes to be translated into behavioral decisions. This pathway indicates that increasing environmental knowledge is important but insufficient without strengthening awareness, values, attitudes, and responsibility. Social Studies Education has a strategic opportunity to develop this process by connecting environmental issues with students' social realities. For Social Studies Education, this pattern calls for learning designs that integrate knowledge, awareness, attitudes, values, responsibility, and opportunities for action; strengthening one element without the others risks maintaining the gap between knowing and doing.

Knowledge-to-Action Synthesis Model

The synthesis indicates that the transformation of *environmental knowledge* into *pro-environmental behavior* occurs through cognitive, affective, intentional, and action stages. Environmental knowledge provides the capacity to understand ecological problems but does not automatically lead to behavioral change. Jiang et al.,[20] showed that environmental knowledge becomes more meaningful when individuals understand the ecological benefits resulting from particular actions. This finding indicates that perceptions of environmental

[17] Anna Kochanek, Tomasz Zacłona, and Mariusz Cembruch-Nowakowski, "Pro-Environmental Attitudes and Behaviors Toward Energy Saving and Transportation," *Energies* 18, no. 23 (2025): 6137, https://doi.org/10.3390/en18236137.

[18] Ana Težak Damijanić, Marija Pičuljan, and Smiljana Goreta Ban, "The Role of Pro-Environmental Behavior, Environmental Knowledge, and Eco-Labeling Perception in Relation to Travel Intention in the Hotel Industry," *Sustainability* 15, no. 13 (2023): 10103, https://doi.org/10.3390/su151310103.

[19] Bernardas Vaznonis, Algirdas Justinas Staugaitis, and Gintarė Vaznonienė, "Factors of Pro-Environmental Behaviour in Western and Eastern European Union Countries: Evidence from the European Social Survey," *Sustainability* 18, no. 5 (2026): 2524, https://doi.org/10.3390/su18052524.

[20] Jiang et al., "The Role of Environmental Knowledge and Perceived Ecological Benefits in Shaping Farmers' Pro-Environmental Behaviour Towards Rural Solid Waste."

consequences and benefits serve as important links between knowledge and behavioral decisions.

The next stage involves *environmental awareness* and the development of environmental attitudes and values. Alharbi et al.,[21] found an association between sustainability awareness, attitudes, and behavior among university students, indicating that awareness needs to be translated through an evaluative orientation before leading to action. Smadi and Al Rawwad[22] juga menempatkan kesadaran sebagai salah satu jalur menuju perilaku yang bertanggung jawab secara ekologis dan sosial. Also positioned awareness as one pathway toward ecologically and socially responsible behavior. This process suggests that individuals need to understand the relevance of environmental issues to their social lives before developing a commitment to action. Awareness transforms knowledge into a personal recognition of ecological consequences, attitudes provide evaluations of the importance of action, and values provide a normative basis for choosing actions; together, these elements function as links before behavioral intention and actual action are formed.

Behavioral intention serves as a transitional stage between attitudes and actual action. Intention indicates an individual's readiness to direct behavior toward environmental goals, but the realization of intention remains influenced by ability, opportunity, and social context. Muna et al.,[23] demonstrated an association between pro-environmental behavior and environmental concern in shaping tendencies toward green consumption choices. This pattern reinforces the view that concern needs to be translated into a specific action orientation.

The *knowing–doing gap* represents a critical point in this pathway. Yang et al.,[24] emphasized the importance of practice in explaining the gap between knowledge and pro-environmental behavior. High levels of knowledge can produce good understanding without resulting in action when individuals lack experience, motivation, or conditions that support the application of knowledge. Gal[25] showed that environmental communicative agency among children can help bridge the knowledge–action gap, indicating that students' capacity to express their views and engage with sustainability issues constitutes an important part of the behavioral change process.

Self-efficacy and perceived responsibility further strengthen the transition from intention to action. Individuals who understand environmental issues while also feeling capable of and responsible for taking action are more likely to actualize pro-environmental behavior. Evidence concerning the pathways involving awareness, attitudes, concern, and practice indicates that behavioral change requires a combination of cognitive capacity and readiness to act.[26]

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[21] Hani S Alharbi, Basil H Alotaibi, and Sanad S Alotaibi Alotaibi, "From Knowledge to Action: Investigating Sustainability Awareness, Behavior, and Attitude Among Engineering Students at Shaqra University," *Sustainability* 17, no. 13 (2025): 5854, https://doi.org/10.3390/su17135854.

[22] Lojayn Smadi and Tamara Al Rawwad, "From Awareness to Action: Pathways to Eco-Socially Responsible Behavior Among Jordanians," *Sustainability* 18, no. 15 (2026): 7635, https://doi.org/10.3390/su18157635.

[23] Nilna Muna, I Kadek Rio Yasanta, and Vithyacharan Retnasamy, "Pathways to Green Purchase: Pro-Environmental Behavior and Concern in Bali Tourism," *Tourism and Hospitality* 6, no. 4 (2025): 208, https://doi.org/10.3390/tourhosp6040208.

[24] Xun Yang et al., "Practice Primacy: Revisiting the Knowledge–Action Gap in Pro-Environmental Behavior with EXplainable AI," *Sustainability* 17, no. 21 (2025): 9916, https://doi.org/10.3390/su17219916.

[25] Adiv Gal, "Children's Environmental Communicative Agency for Sustainability: A Structural Equation Model Bridging the Knowledge–Action Gap," *Sustainability* 18, no. 12 (2026): 5814, https://doi.org/10.3390/su18125814.

[26] Gal.

Based on this synthesis, the conceptual knowledge-to-action pathway can be formulated as follows. This model is derived from a synthesis of findings across multiple studies rather than adopted from a single study: the relationship between knowledge and ecological benefits is supported by Jiang et al.; the awareness–attitude–behavior pathway by Alharbi et al. and Smadi and Al Rawwad; the role of practice by Yang et al.; and the role of agency by Gal

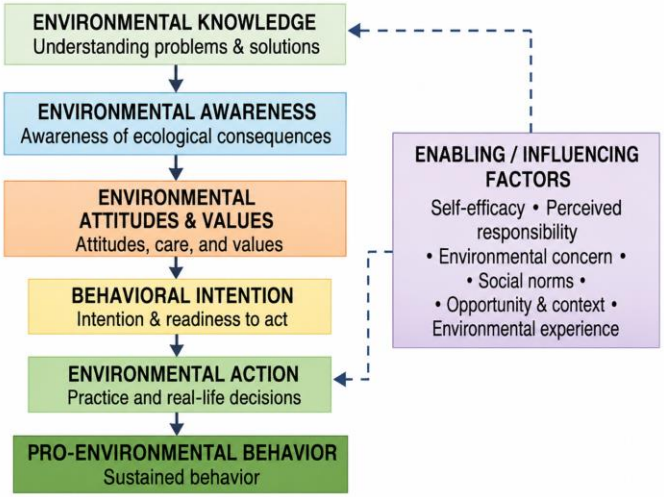


Figure 2. Environmental Knowledge-to-Action Pathway

The model shows that *environmental knowledge* serves as the starting point, while *pro-environmental behavior* represents the final outcome of a multidimensional transformation process. Social Studies Education can contribute at each stage by developing understanding, awareness, values, responsibility, decision-making skills, and action-based experiences. This perspective positions the success of environmental education not merely in terms of increased knowledge scores, but in students' ability to translate knowledge into consistent and meaningful action.

RQ3. Social Studies Education Approaches for Developing Pro-Environmental Behavior

The synthesis indicates that learning approaches oriented toward experience, participation, problem-solving, and institutional support are more relevant for translating environmental knowledge into actual behavior. Jotaworn et al.,[27] using an experimental design, showed that innovative teaching can be used to improve pro-environmental behavior among university students. This perspective emphasizes the importance of learning designs that go beyond the delivery of conceptual content. The experimental evidence from Jotaworn et al. further supports the view that innovative learning can produce behavioral change when students not only receive information but also engage in structured experiences that encourage practice, reflection, and environmental decision-making.

Problem- and project-based approaches enable students to analyze environmental problems as social issues while also designing actions to address them. *Place-based* approaches connect learning content with local environmental conditions, making learning more concrete

[27] Surasak Jotaworn, Wanjai Lamprom, and Issara Siramaneerat, "Innovative Teaching for Enhancing Pro-Environmental Behavior Among First-Year University Students: Evidence from a Solomon Four-Group Experimental Design," *Social Sciences* 15, no. 3 (2026): 162, https://doi.org/10.3390/socsci15030162.

and relevant. Zárate Rueda et al.,[28] position environmental education as an instrument that can connect educational processes with sustainable development. Experiential learning also provides greater opportunities for students to apply knowledge through direct action. Problem-based learning guides students to diagnose the causes and consequences of problems before selecting solutions, project-based learning provides opportunities to implement solutions through products or actions, while place-based learning connects action with local issues that are close to students' everyday lives. Together, these approaches increase the likelihood of actual action because knowledge is applied to authentic problems.

Table 2. Social Studies Education Approaches and Their Contributions to Pro-Environmental Behavior

Learning Approach	Main Focus	Contribution to Pro-Environmental Behavior	Synthesis Basis from the 21 Studies
Problem-Based Learning	Analysis of environmental problems as social issues	Enhances problem-solving and decision-making	Pérez-Guilarte et al. (2022); Bamidele & Searle (2026); Yang et al. (2025)
Project-Based Learning	Environmental projects and actions	Connects knowledge with real-world practice	Jotaworn et al. (2026); Zárate Rueda et al. (2023); Bamidele & Searle (2026)
Place-Based Learning	Local environmental issues	Strengthens connections with the environment	Ramírez Suárez et al. (2023); Pérez-Guilarte et al. (2022); Zárate Rueda et al. (2023)
Experiential & Community-Based Learning	Experience and community engagement	Promotes participation and social responsibility	Borrego-Balsalobre et al. (2026); Gal (2026); Qi et al. (2025)
Inquiry & Critical Learning	Investigation and evaluation of issues	Develops critical thinking and agency	Bamidele & Searle (2026); Yang et al. (2025); Jiang et al. (2025)

Note: The categories of learning approaches in Table 2 were developed through *thematic synthesis* of recurring patterns across the 21 selected studies. The approaches were not comparatively tested across all studies; the synthesis basis column identifies the studies that most directly support the mechanisms and contributions of each approach

Institutional support is an important component of the success of these approaches. Qi et al..,[29] showed that sustainability education and institutional support can strengthen university students' pro-environmental behavior. Zhang and Cao[30] identified environmental attitudes, self-efficacy, and social norms as psychological mechanisms involved in behavioral development. The influence of the social environment also needs to be considered, as Shen

[28] Ruth Zárate Rueda, Yolima Ivonne Beltrán Villamizar, and Luis Eduardo Becerra Ardila, "A Retrospective Approach to Pro-Environmental Behavior from Environmental Education: An Alternative from Sustainable Development," *Sustainability* 15, no. 6 (2023): 5291, https://doi.org/10.3390/su15065291.

[29] Shuyu Qi, Mu Niu, and Ziyuan Guan, "Promoting Pro-Environmental Behavior Among University Students Through Sustainability Education and Institutional Support: A Mediated Moderation Model," *Sustainability* 17, no. 22 (2025): 10069, https://doi.org/10.3390/su172210069.

[30] Jianyang Zhang and Aochen Cao, "The Psychological Mechanisms of Education for Sustainable Development: Environmental Attitudes, Self-Efficacy, and Social Norms as Mediators of Pro-Environmental Behavior Among University Students," *Sustainability* 17, no. 3 (2025): 933, https://doi.org/10.3390/su17030933.

and Zhang[31] demonstrated an association between social identity and pro-environmental behavior across different cultural contexts.

The synthesis indicates that Social Studies Education needs to integrate knowledge, experience, critical reflection, collaboration, and concrete action. This sequence of learning enables environmental issues to be understood not merely as academic content but as social problems that require students' participation and responsibility.

RQ4. Individual, Social, Educational, and Contextual Factors in the *Knowledge-to-Action* Transformation

The transformation of environmental knowledge into action is influenced by a combination of individual, social, educational, and contextual factors. Individual factors include environmental concern, environmental values, personal responsibility, self-efficacy, and motivation. The process of knowledge transformation requires the capacity to process and utilize knowledge appropriately. Hasanein and Al-Romeedy[32] emphasized the importance of knowledge utilization capacity in generating change and innovation, while Alharthi[33] showed that knowledge management practices can support sustainability by enhancing individual and organizational capacities.

Social factors, including norms, group identity, peer influence, family, and community involvement, also influence the actualization of knowledge. Knowledge transfer does not occur automatically, as it is influenced by interaction mechanisms and the context of knowledge recipients.[34] Educational environments need to provide teacher support, a supportive school culture, curriculum integration, environmental facilities, and opportunities for direct experience so that knowledge can be applied in real-world situations.

A transformational perspective positions behavioral change as a systemic process. Hennen et al.,[35] explained that transformation requires changes in the relationships among individuals, institutions, knowledge, and social contexts. Collaborative capacity is also relevant to building sustainable processes of change. Umarin et al.,[36] showed that knowledge management can strengthen collaboration through mechanisms of knowledge exchange and utilization.

[31] Junxian Shen and Hongfeng Zhang, "Individuals' Social Identity and Pro-Environmental Behaviors: Cross-Cultural Evidence from 48 Regions," *Sustainability* 16, no. 24 (2024): 11299, https://doi.org/10.3390/su162411299.

[32] Ahmed Mohamed Hasanein and Bassam Samir Al-Romeedy, "Turning Knowledge into Innovation: The Systemic Role of Knowledge Management Capability, Intellectual Capital, and Knowledge Utilization," *Systems* 14, no. 2 (2026): 179, https://doi.org/10.3390/systems14020179.

[33] Sager Alharthi, "Harnessing Knowledge: The Robust Role of Knowledge Management Practices and Business Intelligence Systems in Developing Entrepreneurial Leadership and Organizational Sustainability in SMEs," *Sustainability* 17, no. 14 (2025): 6264, https://doi.org/10.3390/su17146264.

[34] Xinying Cao et al., "Research on Influencing Factors of Knowledge Transfer among Prefabricated Construction Workers," *Buildings* 14, no. 5 (2024): 1410, https://doi.org/10.3390/buildings14051410.

[35] Leonhard Hennen et al., "Ways towards Transformation—Conceptual Approaches and Challenges," *Sustainability* 15, no. 20 (2023): 14867, https://doi.org/10.3390/su152014867.

[36] Siri-on Umarin, Thanwadee Chinda, and Takashi Hashimoto, "Use of Knowledge Management to Enhance International Research Collaboration," *Administrative Sciences* 16, no. 5 (2026): 219, https://doi.org/10.3390/admsci16050219.

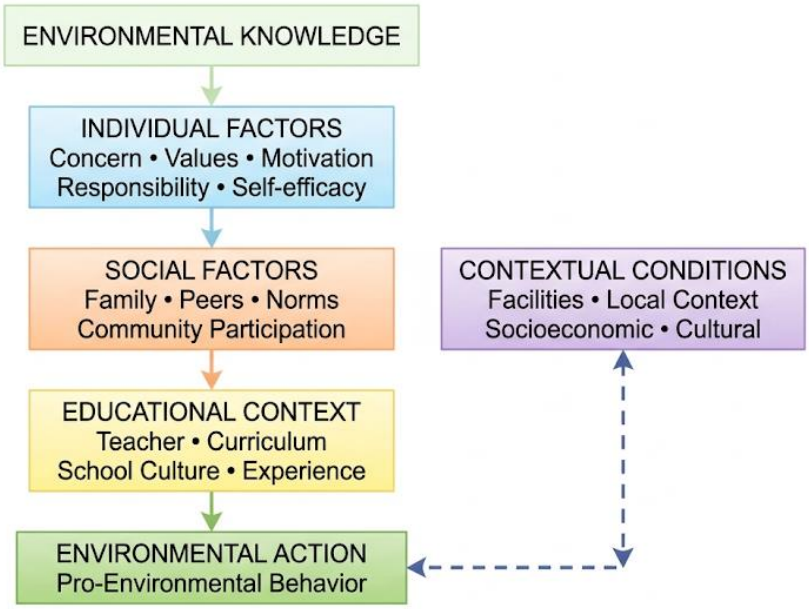


Figure 3. Integrated Framework of Social Studies Education and Pro-Environmental Behavior

RQ5. Research Gaps and Directions for Future Research

Research gaps are evident in the dominance of *cross-sectional* designs, the limited number of longitudinal studies, and the inconsistent measurement of *actual behavior*. Variations in measurement instruments and cultural contexts also limit the comparability of findings. Future research should integrate cognitive, affective, social, and educational factors through longitudinal designs and the measurement of actual behavior. Such approaches are needed to provide a more comprehensive explanation of the process through which knowledge is transformed into action.

The main limitations of this systematic review are the dominance of *cross-sectional* designs, which limits the ability to explain behavioral changes over time; variations in measurement instruments, which reduce comparability across findings; and the inconsistent and relatively limited measurement of *actual behavior* compared with measures of knowledge, attitudes, or intentions. Future research should prioritize longitudinal or *multi-wave* designs, use more objective indicators of actual behavior through observation or behavioral records, and apply measurement triangulation to enable more robust examination of *knowledge-to-action* change.

CONCLUSION

This Systematic Literature Review shows that environmental knowledge is an important foundation for developing pro-environmental behavior, but knowledge acquisition alone does not guarantee actual environmental action. The transformation from knowledge to action involves a series of processes encompassing environmental awareness, attitudes, values, personal responsibility, behavioral intention, and individuals' capacity to translate decisions into action in real-world contexts. This pattern confirms that environmental behavioral change is a multidimensional process that cannot be explained solely by improvements in the cognitive domain. The main finding of this review, therefore, is not merely that knowledge is associated with behavior, but that environmental knowledge is a necessary but insufficient condition: action emerges when affective, motivational, social, pedagogical, and opportunities for practice operate in an integrated manner.

Social Studies Education has a strategic position in this transformation process because its characteristics allow environmental issues to be integrated with the social, economic, cultural, and community dimensions of life. Social Studies Education can develop students' ability to understand environmental problems while also evaluating the social consequences of different courses of action. Approaches such as problem-based learning, project-based learning, place-based learning, experiential learning, community-based learning, and inquiry and critical learning provide opportunities for students to connect concepts with experience and concrete action.

The success of the knowledge-to-action transformation is influenced by individual, social, educational, and contextual factors. Environmental concern, environmental values, motivation, self-efficacy, and personal responsibility operate at the individual level. Social norms, family, peers, and communities shape the social environment, which can strengthen or weaken the tendency to engage in pro-environmental behavior. Teacher support, school culture, curriculum integration, facilities, and opportunities for concrete action are important components at the educational and contextual levels.

The SLR findings also reveal research gaps related to the measurement of actual behavior, the limited number of longitudinal studies, variations in measurement instruments, and differences in cultural contexts. Future research should develop longitudinal designs and multidimensional approaches to examine behavioral change more objectively. Strengthening Social Studies Education through experiential, action-oriented, and locally contextualized learning represents a strategic direction for developing students who not only understand environmental problems but are also able to translate such knowledge into sustainable action. Specifically, the dominance of cross-sectional studies limits inferences about changes over time, variations in measurement instruments reduce comparability, and actual behavioral indicators have not been measured consistently. Future research should employ longitudinal or multi-wave designs, combine self-report measures with observation or more objective behavioral indicators, and examine the consistency of the knowledge-to-action model across different educational levels and cultural contexts.

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