

Toward an Integrative ESD-Based Curriculum Management Model for Junior High Schools: A Systematic Literature Review

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Abstract. Abstract The junior high school level has a strategic position in the implementation of ESD. Students at this level of education are in the early phase of adolescence and begin to develop. The existing literature demonstrates that ESD implementation in junior high schools is influenced by multiple interconnected factors, which are often examined in isolation. This study aims to identify patterns of ESD integration, map the dimensions that facilitate its implementation, and develop a conceptual model of ESD-based curriculum management for junior high schools. This study uses a Systematic Literature Review following the PRISMA 2020 framework. The literature was obtained from Scopus and Google Scholar, then selected based on inclusion-exclusion criteria, yielding 31 articles that were analyzed thematically. The results of the study show five patterns of ESD integration, four facilitating dimensions, and a final synthesis that forms an integrative model connecting curriculum design, implementation, evaluation, continuous improvement, learning outcomes, and enabling factors. This study found that ESD integration at the junior high school level does not follow a linear process (content is included–teacher teaches–students understand). Future studies should refine the systematic review protocol by implementing more specific and comprehensive search strategies, while maintaining transparent and rigorous eligibility criteria.

Keywords: education for sustainable development, curriculum management, junior high school, systematic literature review, PRISMA

INTRODUCTION

Education for Sustainable Development (ESD) is increasingly a strategic agenda in the global education system as the complexity of sustainability challenges, including climate change, environmental degradation, social inequality, and economic uncertainty, increases. ESD is positioned as a systemic approach to education because its success is determined by the quality of relationships and coherence between elements in the education system (coherence between the institution's vision, formal and informal curricula, pedagogy, teacher capacity, school governance, and evaluation mechanisms that function in an integrated manner) (Holst, 2022; Kioupi & Voulvoulis, 2019; Mogren et al., 2019). Within the framework of the 2030 Agenda, ESD is positioned as a key driver of achieving the Sustainable Development Goals (SDGs), particularly through Target 4.7, which underscores its importance. This is reflected in SDG indicator 4.7.1, which assesses the extent to which ESD is integrated into education policies, curriculum, teacher education, and student assessments (UNESCO, 2020). In fact, ESD is

seen as an important means of advancing all the Sustainable Development Goals (SDGs) because it equips learners with the knowledge, skills, values, and actions needed to address complex sustainability challenges. With this position, ESD becomes the entry point to education for addressing sustainability challenges more effectively.

The junior high school level has a strategic position in the implementation of ESD. Students at this level of education are in the early phase of adolescence (12-15 years), where abstract, reflective, and systemic thinking skills begin to develop (Diggs & Akos, 2016; Lefa, 2014; Prabawani et al., 2020; Tagat et al., 2025). At this stage, students begin to understand more complex cause-and-effect relationships among human activities, the environment, society, and economic development, making it a strategic period to instill sustainability values, attitudes, and competencies. Through a longitudinal study, Davignon et al. (2022) found that pro-environmental attitudes formed in adolescence can predict pro-environmental behavior in adulthood. Krettenauer et al. (2024) also explain that the connection between nature and pro-environmental norms

reinforces each other in the process of individual development. In the context of sustainability, Sposab and Rieckmann (2024) also explained that secondary education is a strategic phase in developing sustainability competencies that include cognitive, affective, and behavioral dimensions in an integrated manner, including systems thinking, critical thinking, and action competence needed to face future sustainability challenges. These findings form the basis for a robust intervention to implement ESD in education for early adolescents, who are more likely to achieve sustained behavioral change.

Although the urgency of ESD has been widely recognized, studies at the junior high school levels show that its implementation remains uneven and highly dependent on teachers' capacity, curriculum design, and school-level support. Mulyadi et al. (2023) In a study involving 384 junior high school teachers, ESD implementation was still perceived as average, and teachers needed deeper ESD competencies to translate sustainability principles into school practices. Scheie et al. (2025) also showed that teachers were able to design interdisciplinary curriculum units integrating environmental, social, and economic dimensions, yet affective aspects of sustainability received the least attention. The study also emphasized the value of teacher-team involvement in curriculum design. Similar implementation barriers were identified by Wang et al. (2023) In Japanese public junior high schools, limited understanding of ESD, low teacher motivation, insufficient teaching materials, and restricted teaching time hindered the integration of ESD design activities into the curriculum. The existing literature demonstrates that ESD implementation in junior high schools is influenced by multiple interconnected factors, which are often examined in isolation.

This study aims to identify patterns of ESD integration, map the dimensions that facilitate its implementation, and develop a conceptual model of ESD-based curriculum management for junior high schools. The effectiveness of ESD implementation is determined more by the quality of intercomponent integration in curriculum management. This argument aims to expand the discussion in ESD studies, as many previous studies still treat certain learning strategies as the main determinants of ESD implementation success and teacher competence as the main factor for ESD success. This argument is reinforced by Chiba et al. (2021) show that the context of the school organization plays an important role in

determining the effectiveness of sustainability learning, while Ajani and Govender (2025) found that teacher professional development has a sustainable impact only when supported by an adequate school system. This study provides a foundational synthesis to inform the development of a more integrated curriculum model at the junior high school level. This framework is expected to serve as a theoretical foundation for developing more comprehensive empirical models in advanced research, as well as to strengthen understanding of how junior high schools can manage the curriculum more effectively to support the SDGs. Based on these conditions, the following are the research questions in this study:

- 1) How are patterns and approaches of Education for Sustainable Development (ESD) integration reported in junior high school curricula in the existing literature?
- 2) What dimensions facilitate the implementation of ESD in junior high school curricula
- 3) How can these dimensions and supporting factors be synthesized into an integrative ESD-based curriculum management model for junior high schools?

METHODS

Review Design

This study employed a Systematic Literature Review (SLR) approach to systematically identify, evaluate, and synthesize relevant evidence from previous studies (Snyder, 2019). The review process followed the PRISMA 2020 guidelines to ensure transparency, methodological rigor, and reproducibility throughout the identification, screening, eligibility, and inclusion stages (Page et al., 2021). SLR was selected because the study aims to synthesize evidence from multiple studies to identify recurring dimensions and develop a conceptual framework for an integrative ESD-based curriculum management model for junior high schools.

Data Sources and Search Strategy

The literature search uses Scopus as the primary database and Google Scholar as the supporting database. Scopus offers a powerful search engine with strong data visualization features and comprehensive metadata, and it focuses on high-quality journal articles. Meanwhile, Google Scholar indexes various document types, including articles, theses, dissertations, and grey literature, so it can capture

studies that may not be available in Scopus and increase search coverage for primary studies by up to 96%. The simultaneous use of these two sources helps reduce publication bias and improve search result recall without significantly sacrificing precision. Hybrid strategies that combine searches in databases such as Scopus and Google Scholar have proven to provide the best balance between the quality of results and the effort of the review (Mourão et al., 2020; Yasin et al., 2020). The

Table 1. Keywords String

Keywords Scopus	Keywords Google Scholar
TITLE-ABS-KEY("Curriculum Management Model" OR "Sustainability Education Curriculum Management" OR "Education for Sustainable Development Curriculum Management" OR "Sustainability Education Curriculum" OR "Education for Sustainable Development Curriculum" OR "Junior High Education Curriculum" OR "Lower Secondary Education Curriculum" OR "Education for Sustainable Development Learning Framework" OR "Sustainable Education Learning Framework")	"Curriculum Management Model" OR "Sustainability Education Curriculum Management" OR "Education for Sustainable Development Curriculum Management" OR "Sustainability Education Curriculum" OR "Education for Sustainable Development Curriculum" OR "Junior High Education Curriculum" OR "Lower Secondary Education Curriculum" OR "Education for Sustainable Development Learning Framework" OR "Sustainable Education Learning Framework"

Based on the search results using predetermined keywords, the number of publications identified in the time range 1972 to 2026 shows variations from year to year (Figure 1). In the early period, between 1972 and around 2000, the number of publications was still very limited, with a range of 0 to 2 articles per year. In

search string (Table 1) is purposively designed to capture studies at the intersection of the curriculum, Education for Sustainable Development, and junior high school or lower secondary education. Broader terms such as school sustainability or whole-school approach were not used as keywords because the review was designed to focus on studies with an explicit link to the curriculum, rather than on school sustainability practices in general.

the next period, from 2004 to 2010, the number of publications gradually increased, with counts ranging from 2 to 8 articles per year. From 2011 to 2015, the number of publications ranged from 4 to 18 articles per year, with the highest in 2014 at 18.

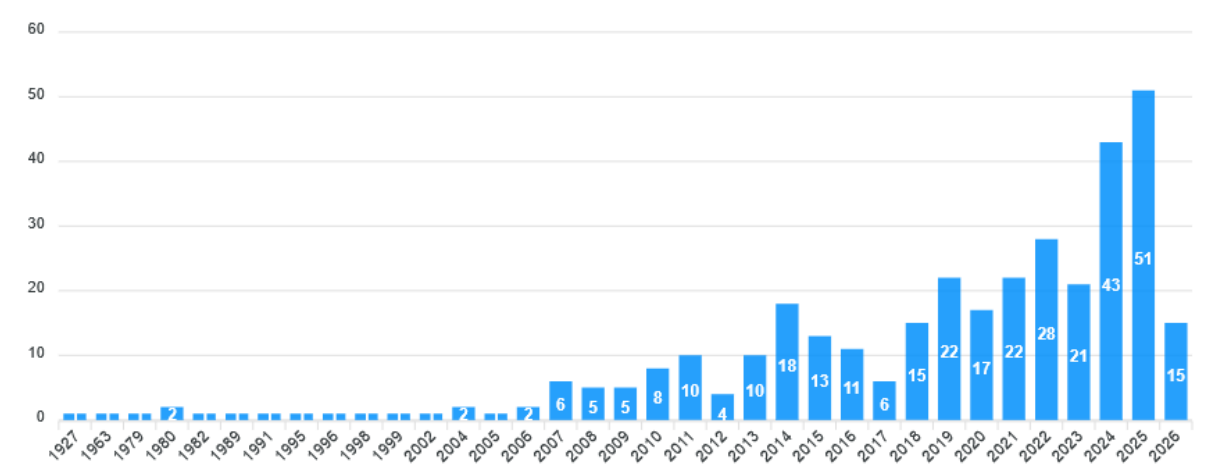


Figure 1. Result from Keyword Search

Furthermore, from 2016 to 2019, the number of publications ranged from 6 to 22 articles per year. From 2020 to 2023, the number of

publications ranged from 17 to 28 per year. A higher increase is seen in 2024, with a total of 43 articles, and the highest number is reached in

2025, at 51 articles. In 2026, the number of publications will be recorded at 15 articles.

Inclusion and Exclusion Criteria

Based on the trend in Figure 1, the publication range for extracting articles is 2018 to 2026. The selection of this publication range is also supported by Franco et al. (2018), explaining that articles discussing the ESD curriculum have

begun to develop significantly since at least 2018, with a focus on integrating sustainability values and the Sustainable Development Goals (SDGs) into educational policies, curricula, and practices, particularly at the higher education level. Furthermore, the selected articles are determined by the inclusion and exclusion criteria presented in Table 2.

Table 2. Inclusion and Exclusion Criteria

Criterion	Details
Year limit	2018–2026
Language	English
Data source	Articles indexed in Scopus (Q1–Q4) and additional sources from Google Scholar
Study focus	Studies examining curriculum, curriculum management, sustainability education, or Education for Sustainable Development (ESD)
Education level	Junior high school (lower secondary education)
Content relevance	Studies addressing ESD integration, sustainability education, curriculum design, curriculum management, or learning framework in the junior high/lower secondary education context. The content also includes conceptual reinforcement of ESD and the curriculum to support research findings, even when they do not come from the focused level of education.
Publication type	Peer-reviewed journal articles
Full-text availability	Full-text articles accessible
Exclusion criteria	Non-English articles, duplicate records, closed-access articles, and studies that are not related at all to the topic

The screening process is carried out in three stages, namely title review, abstract review, and feasibility assessment based on the full text. In the initial screening phase, articles published outside the year range (2018–2026) were excluded to maintain the novelty and relevance of the article to current conditions. Furthermore, duplicate articles from keyword extraction, non-English articles, and inaccessible articles were excluded from the data analysis. The next step is to review the title and abstract, which are relevant to the topics of curriculum management, curriculum, ESD, and the junior high school level. After that, the selected articles are re-sorted to assess a more specific level of suitability and to address the topic raised, so that later they will form patterns and findings that are truly within the desired scope. This procedure is also carried out in the Google Scholar database, both for keyword searches and for article sorting. However, the articles generated by the Google Scholar database are fewer than those from Scopus, as most have already been covered in Scopus.

Study Selection Procedure

The quality assessment of the articles is conducted after the study selection process is complete to ensure that the included articles are not only topically relevant but also make an adequate contribution to the synthesis of findings and the development of the conceptual framework. Given that the articles analyzed have diverse characteristics, namely core studies, supporting studies, and conceptual studies, the quality assessment is based not only on the strength of the empirical method, but also on the suitability of the article with the research question and its contribution to the understanding of ESD integration in the curriculum. Core studies directly informed the synthesis of patterns and dimensions and the construction of the model, while supporting studies provided empirical and contextual reinforcement. Conceptual studies enriched the theoretical foundation of the proposed framework.

This categorization enabled a structured, systematic analysis, ensuring that each study

contributed meaningfully in proportion to its relevance and depth, rather than being uniformly treated. In this approach, core studies were primarily utilized to answer the main research questions by identifying dominant patterns of ESD integration, extracting key dimensions and components of curriculum management, and constructing a conceptual model grounded in empirical evidence. Supporting studies were employed to validate, compare, and strengthen the findings derived from core studies, particularly by highlighting variations in implementation, contextual challenges, and enabling factors across different educational settings. Meanwhile, conceptual studies were used to deepen the

analytical perspective by providing theoretical insights, expanding the understanding of sustainability concepts, and offering broader interpretive lenses that informed the development of the proposed framework. This layered classification enabled the review to balance descriptive, analytical, and constructive synthesis, thereby enhancing the study's rigor and coherence.

The entire process of finding, filtering, and assessing the feasibility of articles is visualized in the PRISMA flowchart (Figure 2), which provides a transparent representation of the inclusion and exclusion criteria and yields a final sample of 31 articles (Table 3).

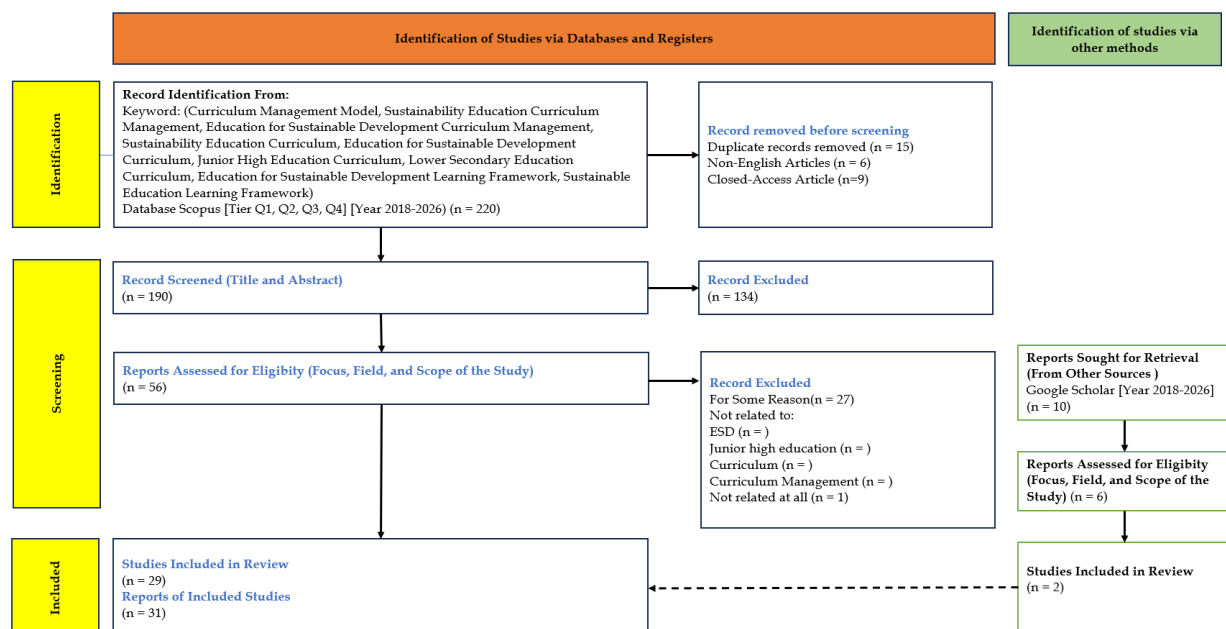


Figure 2. Article selection process according to the PRISMA approach

RESULTS AND DISCUSSION

After a systematic selection process using the PRISMA 2020 framework, 31 articles were identified that met the eligibility criteria for analysis. The articles were then extracted and classified based on the characteristics of the

research, the study's focus, the educational context, and their contributions to the development of Education for Sustainable Development (ESD). The results of the literature extraction that became the basis for the synthesis in this study are presented in Table 3.

Table 3. Featured articles

Author	Research Object	Research Findings	Classification
(Habibillah & Sakurai, 2026)	68 junior high school textbooks	Limited and less contextual distribution of learning content	Supporting
(Bai & Liu, 2025)	Multilingual education	21st-century competency development	Core

(Rushton & Walshe, 2025)	School teacher	ESD curriculum adaptation is more dominant at the grade level	Supporting
(Danageuzian et al., 2025)	26 Education Experts	Integration of cognitive, social, and behavioral dimensions	Core
(Gregersen-Hermans, 2021)	Students and programs in Higher Education	Global competency-based ESD and IoC integration	Conceptual
(Allel & McCowan, 2025)	Secondary school teachers and students	Integration is still shallow and has not changed educational practices	Supporting
(Scheie et al., 2025)	Junior High School teachers and students	Cross-subject integration in curriculum units	Core
(Tsai, 2024)	Junior High Schools	Teacher leadership and collaboration support affect the implementation of ESD	Core
(Lundvall et al., 2024)	Physical education curriculum in multiple countries	ESD has not been explicitly integrated into the curriculum	Supporting
(Swift & Smith, 2025)	Teachers in Primary school	Teacher collaboration in design improves ESD integration	Supporting
(Dieng & Norimune, 2025)	Lower Secondary Schools	Barriers to teacher resources and training	Conceptual
(Palozzi et al., 2024)	General	8 Systems Thinking-Based Approaches	Core
(Tsfamicael & Enge, 2024)	Primary-lower secondary	Integration happens implicitly through context	Supporting
(Albuquerque et al., 2024)	Multi-country, various levels of education	ESD integration is influenced by the national context	Supporting
(Brown, 2024)	English language teaching (ELT) materials in Japan	Many values in the teaching material do not support sustainability (e.g., consumptive)	Conceptual
(Munasi, 2024)	Life Sciences High School Teacher	Barriers to teacher resources and understanding	Supporting
(J. Li et al., 2024)	National curriculum (China & US)	Learning content is still fragmented	Supporting
(Vojř et al., 2025)	Lower Secondary Schools Student Textbook	Literacy integration is still low	Conceptual
(Holst et al., 2024)	Education system (policies, schools, teachers, cross-level curriculum)	ESD is still supplementary and has not been accompanied by a proper evaluation system	Core
(Yuan & Yu, 2024)	Primary and secondary education curriculum	The SDGs have been integrated but unevenly distributed between subjects	Supporting
(Chou & Wang, 2023)	Taiwan's national curriculum documents at the primary and secondary education levels	Limited representation of the SDGs	Supporting
(Grauer et al., 2022)	Formal curriculum documents for various levels of education (Elementary, Junior High, and	The time dimension is not yet integrated	Conceptual

(João et al., 2022)	Senior High School) in Germany Portugal's basic education curriculum document (Grades 1–9)	ESD as a cross-subject approach, but it is not consistent and equitable	Supporting
(Miao et al., 2022)	Middle and High Schools	Dominance of cognitive aspects	Supporting
(W.-T. Li & Shein, 2022)	School students	Local context-based ESD integration	Core
(Zguir et al., 2021)	K-12 Curriculum	Cross-curricular integration	Core
(Suárez-López & Eugenio-Gozalbo, 2021)	Primary and Secondary Schools	Dominance of environmental dimensions	Supporting
(Hadzigeorgiou, 2021)	General	Reorientation towards sustainability	Conceptual
(Fredriksson et al., 2020)	2 Senior High Schools in Japan and Sweden	Variations in ESD integration in the national curriculum	Core
(Sinakou et al., 2019)	Conceptually (ESD Theory)	A holistic, pluralistic, and actionable approach	Core
(Ajani & Govender, 2025)	High schools (teachers and school system)	Professional Development affects teacher readiness	Supporting

The extraction results in Table 3 form the basis for compiling a thematic synthesis aligned with the research questions. The next discussion focused on three main aspects: the ESD integration pattern, the dimensions of curriculum management that support implementation, and the initial development of an ESD-based curriculum management model at the junior high school level.

Patterns and approaches of ESD integration reported in junior high school curricula

In the state-of-the-art synthesis, ESD integration is described as a process of transforming how schools plan, run, and evaluate learning, rather than simply incorporating sustainability issues into curriculum documents. The first pattern is explicit integration, in which the concepts of ESD, the SDGs, or sustainability are included directly in curriculum documents, learning objectives, competency standards, or teaching materials. This pattern is evident in the study by Chou and Wang (2023), which shows that the SDGs are represented in Taiwan's national curriculum, although their scope remains limited and has not been systematically organized. João et al. (2022) also show that ESD has been integrated into basic education curriculum documents in Portugal as a cross-subject approach, but its implementation has not been evenly distributed. Yuan and Yu (2024) found that the SDGs have been integrated into the education curriculum in

China, but their distribution remains unbalanced across subjects. This pattern suggests that the presence of ESD in curriculum documents is an important early stage, but not yet sufficient to guarantee deep and consistent integration.

The second pattern is implicit and contextual integration, in which the value of sustainability is not always mentioned directly but is present through the learning context, local issues, or activities that connect the subject matter to real life. Tesfamichael and Enge (2024) show that the value of sustainability can emerge in mathematics learning through a context close to students' lives, although the term sustainable development is not always explicitly mentioned. Lundvall et al. (2024) also found that, in the physical education curricula of the Nordic countries, sustainable development has not always been explicitly addressed, but some of its values and prerequisites can emerge through learning practices. Li and Shein (2022) reinforce this pattern through a place-based education approach, which suggests that ESD is more meaningful when it is connected to students' places, communities, and local experiences. This pattern shows that ESD integration can occur through teachers' flexibility in linking subjects to sustainability issues relevant to students.

The third pattern is interdisciplinary and cross-subject integration. This pattern arises because sustainability issues cannot be adequately

understood through a single discipline. Scheie, Arntzen, and Haug (2025) show that teachers in lower secondary schools can design interdisciplinary curriculum units that integrate environmental, social, and economic dimensions in learning. Zguir, Dubis, and Koç (2021) also show that integrating ESD into the K-12 curriculum requires a cross-curricular approach that connects policies, curriculum content, and implementation. Miao et al. (2022) emphasized that the geography curriculum has great potential to develop ESD competencies, but it still tends to be stronger in cognitive than in affective or behavioral domains. This interdisciplinary pattern shows that stronger ESD integration requires interconnections among subjects so that students can see the relationships among the environment, society, economy, and human actions.

The fourth pattern is action-based, project-based integration and real learning experiences. In this pattern, ESD is not only taught as a concept, but also developed through activities that encourage students to think critically, collaborate, and take action on sustainability issues. Fredriksson et al. (2020) show that the implementation of ESD in Sweden and Japan is largely related to project-based learning, local-global networking, and active school involvement. Swift and Rawlings Smith (2025) also emphasized that curriculum design for sustainability requires teacher collaboration and the development of learning experiences that enable students to understand sustainability issues more critically. Sinakou et al. (2019) reinforce this pattern by proposing a powerful learning environment that makes action competence the main goal of ESD. Thus, action-based patterns show that ESD is more effective when students are not only aware of sustainability issues, but also practice responding to them through active and reflective learning experiences.

The fifth pattern is integration supported by the school system, particularly through teachers, school leadership, professional learning communities, and institutional support. Tsai (2024) shows that the success of curriculum implementation is greatly influenced by the support of school management and the professional learning community. Rushton and Walshe (2025) found that teachers serve as curriculum developers at the grade level, but their practices are strongly influenced by curriculum flexibility, school support, teacher motivation, and structural barriers. Ajani and Govender (2025) also show that professional development plays an

important role in helping teachers integrate sustainability education, although its effectiveness depends on system support and continuous training. This pattern shows that the integration of ESD in the junior high school curriculum is inseparable from the capacity of school actors and the organizational conditions that enable teachers to translate sustainability principles into learning practices.

Based on this synthesis, the pattern of ESD integration in the junior high school curriculum is reported through five main approaches: explicit integration in curriculum documents; implicit-contextual integration through local subjects and issues; interdisciplinary integration across disciplines; action- and project-based integration; and integration supported by the school system. The five patterns do not stand alone, but are interconnected. Explicit integration gives formal legitimacy; implicit and contextual integration provide room for adaptation; interdisciplinary integration provides conceptual depth; action-based integration provides real experience; while school system support ensures that implementation does not depend on individual teacher initiatives. This synthesis is in line with the state of the art, which affirms that ESD integration requires integration between learning design, teacher capacity, school leadership, curriculum flexibility, and school organizational support.

The dimensions facilitate the institutionalization of ESD in the junior high school curriculum

In the state-of-the-art file, ESD is described as a transformation in how schools design, run, and assess learning, rather than simply adding sustainability materials to the curriculum. Meanwhile, SLR narrative files show that various studies place ESD implementation as a multidimensional process that includes policy, curriculum design, learning practices, teacher capacity, school support, and evaluation. The first dimension is the curricular dimension. The literature shows that implementing ESD requires a curriculum that integrates sustainability principles into learning objectives, teaching materials, competencies, and cross-subject structures. Chou and Wang (2023) show that the representation of the SDGs in the national curriculum remains limited and not systematically organized, so that the integration of sustainability has not yet become a coherent part of the curriculum structure. João et al. (2022) also show that ESD has emerged as a transversal approach in curriculum documents, but

it has not been applied consistently and equitably across levels and subjects. In another context, Danageuzian, Barakat, and El Hage (2025) emphasize that the ESD curriculum needs to encompass cognitive, social-emotional, and behavioral dimensions to build sustainability competencies holistically. These findings show that the curricular dimension refers to how the objectives, content, competencies, and structure of the curriculum are organized to support sustainability learning as a whole.

The second dimension is pedagogical. Studies have shown that ESD is more effective when translated through active, interdisciplinary, contextual, and action-based learning approaches. Fredriksson et al. (2020) show that the implementation of ESD in Sweden and Japan is largely associated with project-based learning, global-local collaboration, and active involvement of students in school activities. Sinakou et al. (2019) emphasized that ESD learning needs to be designed as a powerful learning environment that is holistic, pluralistic, and action-competence-oriented. Li and Shein (2022) show that place-based education can strengthen students' connection to local contexts and increase the meaning of sustainability learning. In addition, Palozzi et al. (2024) identify systems thinking as an important approach in environmental education because it helps students understand the relationships among components within a sustainability system. The pedagogical dimension serves as a bridge between the concept of sustainability in the curriculum and concrete learning experiences that enable students to develop knowledge, attitudes, and actionable skills.

The third dimension is the organizational dimension. The literature shows that the institutionalization of ESD is determined not only by curriculum design and learning strategies but also by the capacity of school organizations to create a conducive environment. Tsai (2024) shows that the success of curriculum institutionalization is influenced by the support of the school management team and the professional learning community of teachers. Rushton and Walshe (2025) found that teachers' curriculum development practices are influenced by teacher motivation, school support, curriculum flexibility, and structural barriers. Ajani and Govender (2025) also emphasized that professional development can improve teachers' ability to integrate sustainability education, but its success still requires system support and continuous training.

In this context, teachers not only serve as curriculum implementers but also as actors who adapt, develop, and translate ESD into classroom practice. Therefore, supporting factors such as school leadership, teacher collaboration, school culture, resources, and stakeholder engagement are important elements in facilitating the implementation of ESD.

The fourth dimension is the evaluative dimension. The institutionalization of ESD requires an evaluation mechanism that not only measures students' cognitive achievement but also assesses the depth of ESD's integration into the curriculum, learning practices, teacher training, and student assessments. Holst et al. (2024) show that ESD is still often positioned as an add-on in the education system, with integration moving from isolated mentions to partial integration, and educator training being one of the weakest aspects. Grauer et al. (2022) also show that the time dimension, as part of sustainability, still rarely appears in formal curricula, highlighting limitations in evaluating the depth of sustainability integration. Vojř and Svobodová (2025) found that environmental literacy in lower secondary science textbooks remains relatively limited, underscoring the importance of evaluating teaching materials as representations of the institutionalized curriculum. Thus, the evaluative dimension ensures that ESD is not only present as a theme but is also monitored in curriculum documents, teaching materials, learning practices, student competencies, and curriculum improvement on an ongoing basis.

These four dimensions are also supported by several cross-dimensional factors. The first factor is teachers' capacity, as they are the main link between the formal curriculum and learning practices. The second factor is school leadership, as leadership support determines the space for collaboration, the direction of implementation, and the program's sustainability. The third factor is curriculum flexibility, as ESD requires room for adaptation to link global issues to students' local contexts. The fourth factor is ongoing resources and training, as limitations in teaching materials, time, and teacher understanding often impede implementation. The fifth factor is school culture and stakeholder participation, as ESD occurs not only in formal learning but also in the norms, habits, and social relationships that shape the student learning experience. This synthesis aligns with the state-of-the-art file, which emphasizes that ESD management models need to connect learning design, teacher competency

strengthening, and school organizational conditions to systematically achieve ESD goals.

Implementation of ESD is facilitated by four main dimensions. The curricular dimension provides the direction, content, and structure of sustainability competencies; the pedagogical dimension translates ESD into active, contextual, and action-based learning experiences; the organizational dimension provides leadership, collaboration, school culture, and resource support; while the evaluative dimension ensures that ESD integration can be monitored, assessed, and improved on an ongoing basis. These findings indicate that the quality of ESD implementation depends on the alignment among curriculum structure, pedagogical practice, organizational support, and evaluative mechanisms.

Integrative ESD-based curriculum management model

The findings in RQ1 show that ESD integration occurs through a variety of patterns, ranging from explicit integration in curriculum documents to implicit integration through learning contexts, interdisciplinary approaches, action- and project-based learning, and support from school systems. Meanwhile, the findings in RQ2 show that institutionalization of ESD is facilitated by 4 main dimensions: curricular, pedagogical, organizational, and evaluative. The first dimension in the synthesized model is curriculum design. The literature suggests that the success of ESD depends on the curriculum's ability to integrate sustainability principles into learning objectives, competencies, content, and cross-disciplinary learning structures. Chou and Wang (2023) show that the representation of the SDGs in the curriculum is often still limited and not systematically organized, while Scheie et al. (2025) show that stronger integration occurs when the environmental, social, and economic dimensions are designed in an interdisciplinary manner. These findings show that curriculum design serves as the foundation that determines the direction of ESD implementation at the school and grade levels.

The second dimension is the implementation process, which includes pedagogical practice and learning. The literature consistently shows that ESD is more effective when applied through active learning, problem-based learning, project-based learning, place-based learning, and approaches that encourage systems thinking and

action competence (Sinakou et al., 2019; Li & Shein, 2022; Fredriksson et al., 2020). Implementation is understood as the process of translating sustainability goals into meaningful learning experiences for students.

The third dimension is evaluation and continuous improvement. The literature shows that successful ESD implementation requires continuous evaluation of curriculum, learning, student competencies, teaching materials, and teacher development. Holst et al. (2024) point out that many education systems still treat ESD as an add-on, making evaluation important to ensure that sustainability principles are truly integrated into educational practices. Grauer, Fischer, and Frank (2022) also show that some aspects of sustainability are still underrepresented in formal curricula, so evaluation serves as a mechanism for reflection and continuous improvement.

In addition to these three main dimensions, the literature synthesis also identifies cross-dimensional supporting factors that serve as enablers. These factors include teacher capacity, school leadership, school culture, curriculum flexibility, availability of resources, professional learning community, and stakeholder engagement (Tsai, 2024; Ajani & Govender, 2025; Rushton & Walshe, 2025). These factors do not form a single dimension, but affect the effectiveness of the entire ESD integration process. In other words, good curriculum design will not lead to effective implementation without the support of teachers and school leadership, whereas evaluation will not lead to improvement without an organizational culture that fosters continuous learning.

Based on this synthesis, the proposed integrative model presents ESD implementation as a cycle that connects curriculum design, implementation, evaluation, and improvement in a sustainable manner. The three components operate within a school environment influenced by supporting factors such as leadership, teacher capacity, school culture, resources, and stakeholder participation. This model shows that ESD implementation is not just the process of incorporating sustainability issues into the curriculum, but rather a management process that connects planning, implementation, evaluation, and sustainable development into a single interconnected education system. This model provides a conceptual framework that can serve as a basis for developing empirical models in future research.

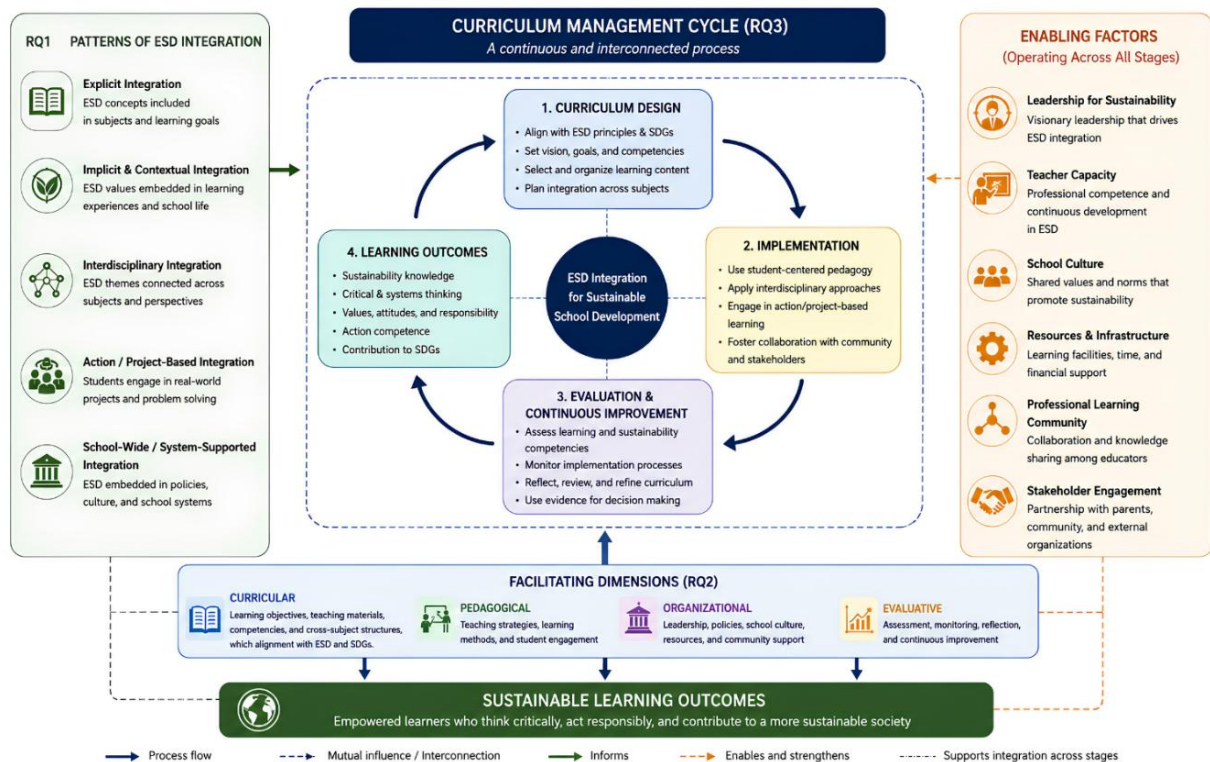


Figure 3. Conceptual Framework of Integrative ESD-Based Curriculum Management (RQ3)

The proposed model differs from broader Whole Institution Approaches by positioning curriculum management as the central mechanism for organizing ESD at the junior high school level. Whole Institution Approaches emphasize institutional coherence by linking governance, formal and informal curricula, organizational culture, capacity building, community engagement, and long-term commitment. This perspective is useful for understanding ESD as a school-wide transformation, but it does not specifically explain how curriculum components are sequenced, enacted, evaluated, and improved within the curriculum cycle. The model developed in this study narrows that analytical focus by situating curriculum design, implementation, evaluation, and continuous improvement, learning outcomes, and enabling factors within a curriculum-management logic. This distinction is important because junior high schools require a model that is institutionally aware but curriculum-operational. At this level, ESD must be translated into learning objectives, cross-subject structures, classroom practices, teacher collaboration, student experiences, and evaluative mechanisms that are manageable within school routines. Therefore, the model does not replace the Whole Institution

Approach; rather, it specifies one of its most critical operational pathways.

The main significance of this study lies in the shift in the interpretation of ESD in junior high schools: from content integration to systemic connectivity among curriculum elements. A synthesis of 31 articles shows that strong ESD integration emerges when the five integration patterns are understood as a series of mutually reinforcing ones. The significance of this study lies in identifying coherence as the central explanatory construct that links curriculum legitimacy, teacher adaptation, student learning experiences, and organizational support in ESD implementation. Significance is also evident in a sharper conceptual mapping of ESD-based curriculum management at the junior high school level. The resulting model integrates curriculum design, implementation, evaluation, and continuous improvement, as well as learning outcomes and enabling factors, into a single curriculum workflow. This position contributes to the ESD literature, which has tended to be scattered between pedagogical studies, student competence, teacher development, and institutional transformation. By bringing these elements together, the study expands the ESD

discussion towards a more operational and worthy curriculum management model as a basis for empirical testing in the context of junior high schools.

The practical implications of this research lead to the need to develop a school action plan based on the curriculum cycle. Schools need to start with a curriculum audit to map ESD's position across learning objectives, competencies, teaching materials, and assessments, and then design interdisciplinary learning units that connect global issues to students' local contexts. At the implementation stage, teacher empowerment should focus on the ability to design learning approaches. At the organizational level, school principals need to build professional learning communities, provide resources, and open up spaces for collaboration with local stakeholders. At the evaluation stage, schools need to develop a monitoring mechanism to assess the depth of ESD integration in curriculum documents, learning practices, teaching materials, student competencies, and the periodic curriculum revision process.

CONCLUSION

This study found that ESD integration at the junior high school level does not follow a linear process that can be explained by the sequence "content is included–teacher teaches–students understand". The main challenge in the institutionalization of Education for Sustainable Development (ESD) lies not in the lack of learning strategies or sustainability materials, but in schools' ability to build coherence across all components of curriculum management. These findings shift the perspective on ESD implementation from an approach that has tended to focus on partial interventions to one that views the curriculum as an interconnected system. From this perspective, the effectiveness of ESD is determined by the integration of the required curriculum management components and processes, as well as organizational support that enables the entire process to run consistently. The resulting model is not intended as a universal implementation procedure, but rather as a conceptual framework that helps explain how the relationship among appropriately managed curriculum components can be a determining factor in strengthening ESD institutionalization.

The limitations of this study are mainly related to the methodological constraints of the PRISMA screening process, which requires a

balance between the focus's accuracy and the breadth of the literature scope. The inclusion criteria focused on the intersection of ESD, curriculum, curriculum management, and junior high school levels, which allows the study to produce a more focused synthesis, but at the same time means that the developed model rests on articles with varying education levels, national contexts, curriculum structures, and methodological orientations. In the SLR tradition, this kind of variation is not just an obstacle, but a consequence of efforts to construct cross-contextual synthesis in a transparent and traceable manner through the PRISMA 2020 procedure (Page et al., 2021; Snyder, 2019). Therefore, the resulting model is better understood as a conceptual framework that highlights recurring relational patterns, rather than as a causal explanation directly applicable to every school condition. This limitation is important because ESD-based curriculum management is very likely to be influenced by school autonomy, teacher workload, leadership style, assessment policies, resources, and sustainability priorities at the local level (Peng et al., 2024). Future studies should refine the systematic review protocol by implementing more specific and comprehensive search strategies, while maintaining transparent and rigorous eligibility criteria. This may include expanding the scope of databases, adding search terms and synonyms, and considering gray literature and conference proceedings when appropriate to reduce publication bias and improve the representativeness of the evidence base.

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