The Innovation of Social Studies Journal
Vol. 8, (1), September 2026: 152-163
ISSN: 2716-2354 (p); 2723-1119 (e) DOI: https://doi.org/10.20527/iis

A Conceptual Framework for Students' Ecological Intelligence in the Merdeka Curriculum

Rusmaniah[1], Mutiani [2], M. Ridha Ilhami[3], Sovia Husni Rahmia[4], Muhammad Imam Hulaimi[5], Puteri Riska Lestari[6], Ahmad Fahrul Razi[7]

[1] Universitas Lambung Mangkurat, Indonesia; rusmaniah@ulm.ac.id
[2] Universitas Lambung Mangkurat, Indonesia; mutiani@ulm.ac.id
[3] Universitas Lambung Mangkurat, Indonesia; ridha.ilhami@ulm.ac.id
[4] Universitas Lambung Mangkurat, Indonesia; soviahusni.rahmia@ulm.ac.id
[5] Universitas Lambung Mangkurat, Indonesia; 2410128110010@mhs.ulm.ac.id
[6] Universitas Lambung Mangkurat, Indonesia; 2510128220012@ulm.ac.id
[7] Universitas Lambung Mangkurat, Indonesia; 2510128110018@ulm.ac.id

ARTICLE INFO

Keywords:

Ecological Intelligence; Merdeka Curriculum; Social Studies; Sustainability.

Article history:

Received 2026-07-10
Revised 2026-08-09
Accepted 2026-08-09
Published 2026-09-01

ABSTRACT

Various frameworks such as environmental literacy, ecological literacy, sustainability competencies, ecological intelligence, and Education for Sustainable Development have identified the knowledge, values, skills, and actions students need to address environmental issues. However, they do not operationally explain how such outcomes can be pedagogically aligned with the Merdeka Curriculum, Grade 7 Social Studies content, local socio-ecological issues, active-reflective learning, and authentic assessment. This article formulates a conceptual framework to address this gap. Using an integrative theory-building conceptual review, 18 theoretical, empirical, and policy sources published between 1975 and 2023 were purposively synthesized through conceptual comparison, thematic coding, and curriculum mapping. An author-developed Grade 7 ecological-intelligence instrument blueprint was used only as a secondary check of indicator operability and curriculum fit, not as the theoretical source of the dimensions. The resulting framework aligns six components: the Merdeka Curriculum, Grade 7 Social Studies content, local socio-ecological context, active and reflective learning, authentic assessment, and four interrelated ecological-intelligence outcomes—knowledge, sensitivity and attitudes, skills, and participation and behavior. The novelty lies not in proposing a new ecological construct, but in the integration and alignment mechanism that connects curriculum, subject content, local context, pedagogy, assessment, and multidimensional outcomes in one iterative learning pathway. The framework remains conceptual, is limited to Grade 7 Social Studies in the Indonesian context, and has not yet been empirically tested or validated as a measurement model.

Corresponding Author:
Rusmaniah
Universitas Lambung Mangkurat, Indonesia; rusmaniah@ulm.ac.id

1. INTRODUCTION

Environmental problems remain a major educational challenge because climate change, pollution, biodiversity loss, resource degradation, and disaster risk are produced through interactions between ecological processes and human decisions. Consequently, environmental learning cannot stop at the transmission of concepts. It must also develop dispositions, analytical skills, decision-making, and responsible participation so that students can connect environmental knowledge with everyday social action (UNESCO, 1977; Palmer, 1998; Goleman, 2009).

Environmental-education scholarship offers several related but nonidentical frameworks. Environmental literacy emphasizes knowledge, dispositions, competencies, and environmentally responsible behavior; ecological literacy foregrounds ecological principles, interdependence, and systems thinking; ecological intelligence stresses awareness of the ecological consequences of human choices; sustainability competence adds values, complexity, futures thinking, and action; and Education for Sustainable Development (ESD) provides a broader educational orientation that integrates environmental, social, and economic dimensions (Disinger & Roth, 1992; Orr, 1992; Goleman, 2009; Hollweg et al., 2011; Bianchi et al., 2022; UNESCO, 2020). Their relationship and the unresolved curricular issue are summarized in Table 1.

Table 1. Positioning the Proposed Framework among Related Environmental-Education Concepts

Framework	Primary emphasis	Unresolved issue / contribution
Environmental literacy (Disinger & Roth, 1992; Hollweg et al., 2011)	Knowledge, dispositions, competencies, and environmentally responsible behavior.	Broad outcome and assessment framework; it does not directly align these domains with the Merdeka Curriculum and Grade 7 Social Studies themes.
Ecological literacy (Orr, 1992)	Understanding ecological principles, interdependence, limits, and systems.	Strong ecological-systems orientation, but the curriculum–pedagogy–assessment pathway for Indonesian Social Studies remains unspecified.
Ecological intelligence (Goleman, 2009)	Recognizing ecological consequences of human choices and modifying decisions and behavior.	Connects understanding with action, but is not operationally mapped to Grade 7 content, local issues, and authentic assessment.
Sustainability competence (Bianchi et al., 2022)	Sustainability values, complexity, futures thinking, and individual or collective action.	Designed as a broad cross-curricular competence framework rather than a subject-specific architecture for Grade 7 Social Studies.
Education for Sustainable Development (UNESCO, 2020)	Transformative education integrating environmental, social, and economic dimensions.	Provides an overarching orientation, but not a detailed alignment of Social Studies content, local context, learning strategy, and assessment.
Proposed framework	Alignment of the Merdeka Curriculum, Grade 7 Social Studies, local socio-ecological contexts, active-reflective learning, authentic assessment, and four ecological-intelligence dimensions.	Provides a context-specific operational architecture linking curriculum, learning process, assessment, and multidimensional outcomes.

The comparison reveals a theoretical-to-operational gap. Existing frameworks explain desirable environmental outcomes, but they do not specify how those outcomes should be aligned with the structure of the Merdeka Curriculum and the four themes of Grade 7 Social Studies. Previous studies also leave unclear how local socio-ecological problems should function as learning resources, how

active and reflective learning should move students from understanding to action, and how authentic assessment should capture knowledge, attitudes, skills, and behavior in one coherent design. Without this alignment, environmental learning may remain fragmented: concepts are taught, projects are conducted, and attitudes are assessed, yet the relationship among curriculum content, learning experience, and multidimensional outcomes is not explicit.

The Merdeka Curriculum provides an appropriate pedagogical setting for addressing this gap because it emphasizes flexible, contextual, student-centered, and experience-based learning. Its orientation toward the Pancasila Student Profile also supports moral responsibility, critical reasoning, creativity, independence, and collaboration, all of which can be mobilized in environmental learning (Kemdikbudristek, 2022). Nevertheless, curriculum flexibility alone does not automatically produce ecological intelligence; teachers still need a framework that translates curricular opportunities into sequenced learning and assessment.

Social Studies is strategically positioned for this translation because it integrates geography, sociology, history, and economics to examine relationships among people, space, environment, culture, resources, policy, and social change. The revised Grade 7 Social Studies textbook is organized around social life and the local environment, diversity of the local environment, environmental economic potential, and community empowerment. These themes provide curricular entry points for examining climate change, disaster risk, pollution, resource use, sustainable livelihoods, and collective environmental action (Nursa'ban & Supardi, 2023).

Existing environmental-education frameworks provide strong descriptions of desirable competencies and orientations, yet the pedagogical organization of these outcomes within a specific subject and curriculum remains underdeveloped. Put differently, existing frameworks explain what students should achieve, while this framework explains how those outcomes can be pedagogically organized in Grade 7 Social Studies. This article therefore does not claim to introduce a new universal environmental construct. Its original contribution is a context-specific integration and alignment mechanism that connects the Merdeka Curriculum, Grade 7 Social Studies content, local socio-ecological contexts, active and reflective learning, authentic assessment, and four interrelated ecological-intelligence dimensions. The guiding question is: how can these six components be organized into a coherent and iterative conceptual framework for developing and assessing Grade 7 students' ecological intelligence? The framework is intended to support Social Studies teachers, learning-material developers, and researchers in designing contextual, meaningful, action-oriented, and assessable environmental learning.

2. METHODS

This study used an integrative, theory-building conceptual review. Unlike a systematic review of intervention effects, this design was intended to compare concepts, identify their boundaries and overlaps, and synthesize them into a context-specific framework (Torraco, 2005; Jaakkola, 2020). The review therefore emphasized conceptual relevance and theoretical saturation rather than exhaustive database coverage or statistical meta-analysis.

Sources were assembled through purposive theoretical sampling of foundational works and direct retrieval of official documents from UNESCO, the European Commission, and the Indonesian Ministry of Education. No single bibliographic database was designated because the review was designed as a corpus-based conceptual synthesis rather than an exhaustive systematic search. The publication period represented in the corpus was 1975–2023. Conceptual search and screening terms included combinations of "ecological intelligence," "environmental literacy," "ecological literacy," "environmental education," "sustainability competence," "education for sustainable development,"

"Merdeka Curriculum," "Grade 7 Social Studies," "local environment," and "authentic assessment," together with their Indonesian equivalents.

Sources were included when they: (1) provided a definition, dimension, assessment domain, or pedagogical implication relevant to ecological learning; (2) represented a foundational or widely used framework; (3) addressed school education, environmental behavior, sustainability, or curriculum design; and (4) were available in English or Indonesian. Sources were excluded when they were duplicates, lacked a clear conceptual contribution, discussed environmental issues without educational implications, or could not inform the Grade 7 Social Studies mapping. The purposive process produced a corpus of 18 published sources: eight journal articles, two books, five international reports or frameworks, one national curriculum document, one Grade 7 textbook, and one established environmental-literacy instrument. The corpus was considered theoretically saturated when the final stage of coding no longer generated new framework families, first-order dimensions, pedagogical components, or relationships relevant to the six-component alignment. Candidate sources examined at that point mainly reiterated categories already represented in the audit matrix rather than extending the conceptual structure. Saturation was therefore judged conceptually rather than statistically and is bounded by the article's specific purpose of constructing a Grade 7 Social Studies framework.

A nineteenth document—the authors' unpublished Ecological Intelligence Instrument for Grade 7 Junior High School Students Integrated into Merdeka Curriculum Social Studies and Web-Game-Based Learning—was treated as a secondary operational artifact rather than as a theoretical source for the framework. The four dimensions were derived primarily from the reviewed literature on ecological intelligence, environmental literacy, sustainability competence, and ESD. The instrument blueprint was consulted only after this synthesis to check whether the literature-derived constructs could be expressed as Grade 7 indicators and aligned with curriculum content. It therefore did not generate the four dimensions or determine the proposed theoretical relationships, and it was not used as empirical evidence of validity or reliability.

Analysis proceeded in three coding cycles. First, descriptive coding extracted each source's definition, unit of analysis, dimensions, expected outcomes, pedagogical orientation, and assessment implications. Second, comparative categorization organized similarities and distinctions among environmental literacy, ecological literacy, ecological intelligence, sustainability competence, and ESD. Third, pattern coding synthesized six framework components: curriculum foundation, Social Studies content, local socio-ecological context, active and reflective learning, authentic assessment, and four-dimensional ecological-intelligence outcomes. An audit matrix recorded the representative source support for each category and each proposed relationship; a condensed version is presented in Table 2.

Table 2. Condensed Audit Matrix Used in the Conceptual Synthesis

Analytical category	Representative theoretical / official sources	Role in the synthesis
Ecological-intelligence outcome domains	Goleman (2009); McBeth (1997); Hollweg et al. (2011); Bianchi et al. (2022)	Grounded the four interrelated domains of knowledge, dispositions/attitudes, skills, and action/behavior.
Ecological systems and human–environment relations	Orr (1992); Palmer (1998); UNESCO (1977)	Supported interdependence, socio-ecological relationships, and environmental learning as more than factual knowledge.
Curriculum foundation	Kemdikbudristek (2022)	Provided Phase D learning outcomes and the curricular basis for contextual, student-centered learning.
Grade 7 Social Studies content	Nursa'ban & Supardi (2023)	Provided the four Grade 7 themes used as curricular entry points for ecological-intelligence development.

Analytical category	Representative theoretical / official sources	Role in the synthesis
Active-reflective and contextual pedagogy	UNESCO (1977, 2020); Sterling (2010); Bianchi et al. (2022)	Supported inquiry, reflection, action, and the use of local socio-ecological problems as learning contexts.
Assessment and operationalization	McBeth (1997); Hollweg et al. (2011); authors' instrument blueprint (secondary check)	Supported multidimensional evidence and checked whether literature-derived constructs could be operationalized in Grade 7 Social Studies.

Curriculum mapping proceeded from the literature-derived dimensions rather than from the authors' instrument. Each dimension was first checked against the official Phase D Social Studies learning outcomes and the four themes in the revised Grade 7 textbook. The instrument blueprint was then used only as a secondary operability check for whether the constructs could be expressed as Grade 7 indicators. A relationship was retained when it was supported by at least two of three evidence layers: theoretical literature, official curriculum/textbook content, and operational indicator plausibility. The audit matrix documented the sources supporting each link and any contradictory evidence; links without sufficient support were revised or removed. This rule-based source triangulation served as the internal validation of the conceptual map. No external expert validation or empirical field testing was conducted at this stage, which is acknowledged as a limitation.

3. FINDINGS AND DISCUSSION

3.1 Positioning Ecological Intelligence among Related Frameworks

The reviewed frameworks substantially overlap, but they are not interchangeable. Environmental literacy provides a broad account of what learners should know and be able to do, while ecological literacy gives stronger attention to ecological principles and systems thinking. Ecological intelligence adds an explicit concern with recognizing the consequences of human choices and translating that awareness into decisions and behavior (Disinger & Roth, 1992; Orr, 1992; Goleman, 2009; Hollweg et al., 2011).

Sustainability competence and ESD broaden the analysis beyond environmental knowledge by incorporating values, complexity, future scenarios, collective action, and relationships among environmental, social, and economic systems. These perspectives are important for Social Studies because ecological problems are also questions of consumption, inequality, policy, culture, livelihoods, and community participation (Bianchi et al., 2022; UNESCO, 2020).

This article therefore uses ecological intelligence as an organizing construct rather than as a replacement for environmental literacy, ecological literacy, sustainability competence, or ESD. Its value lies in providing a concise outcome structure that can connect ecological understanding, affective orientation, analytical capability, and action within a subject-specific learning design (Arini et al., 2026).

For Grade 7 Social Studies, ecological intelligence is operationalized through four interrelated dimensions: ecological knowledge, ecological sensitivity and attitudes, ecological skills, and ecological participation and behavior. These dimensions are not proposed as a new ecological-intelligence theory. Rather, they are a literature-based synthesis of established domains: Goleman's emphasis on recognizing ecological consequences and changing behavior; environmental-literacy domains concerned with knowledge, dispositions, competencies, and action; and GreenComp's emphasis on values, complexity, and individual or collective action (Goleman, 2009; McBeth, 1997; Hollweg et al., 2011; Bianchi et al., 2022). The authors' instrument blueprint was consulted only after this synthesis to check whether the dimensions could be translated into Grade 7 indicators. Thus, the novelty of the article resides in how the dimensions are aligned with curriculum, subject content, local context, pedagogy, and assessment, not in the dimensions themselves.

3.2 Ecological Intelligence from the Perspective of the Merdeka Curriculum

The Merdeka Curriculum provides space for the development of ecological intelligence because it emphasizes student-centered, flexible, contextual learning based on the needs and characteristics of students. The main textbooks in the Merdeka Curriculum are designed as learning resources and sources of inspiration for teachers to develop lessons tailored to students' characteristics, potential, and needs. These textbooks are also expected to serve as the foundation for shaping the Pancasila Student Profile. (Nursa'ban & Supardi, 2023; Kemdikbudristek, 2022).

The Pancasila Student Profile is closely linked to ecological intelligence. The dimensions of faith and piety toward God Almighty and noble character can be developed through the awareness that protecting nature is part of one's moral and spiritual responsibility (Arini et al., 2026). The dimension of critical thinking can be developed through the ability to analyze the causes and impacts of environmental issues. The creative dimension can be developed through the ability to design ecological solutions. The dimension of mutual cooperation can be developed through students' involvement in collective actions to protect the school and community environments. The dimension of independence can be developed through ecological habits in daily life. (Ministry of Education, Culture, Research, and Technology, 2022).

Learning within the Merdeka Curriculum also provides space for teachers to develop project-based learning, case studies, and problem-based learning. These three approaches are relevant to the development of ecological intelligence because environmental issues are real problems that are closely related to students' lives. Students can be encouraged to observe their surroundings, identify ecological problems, analyze the causes, design solutions, and take concrete action. (Nursa'ban & Supardi, 2023; Bianchi et al., 2022).

3.3 The Relevance of Social Studies to Ecological Intelligence

Social Studies is an integrative subject because it combines perspectives from geography, sociology, history, and economics. This integrative nature allows Social Studies to address environmental issues from multiple dimensions. The issue of flooding, for example, can be analyzed in terms of geographic conditions, settlement patterns, community behavior, government policies, economic activities, and the history of land-use changes. (Nursa'ban & Supardi, 2023).

The 7th-grade Social Studies textbook includes themes that are highly relevant to ecological intelligence. The theme of social life and the surrounding environment covers discussions on residential locations, spatial connectivity, climate change, and the potential for natural disasters. The theme of environmental diversity includes discussions on the environment, pollution, and the habit of preserving the environment. The theme of environmental economic potential includes discussions on the utilization and conservation of natural resources. The theme of community empowerment includes discussions on the role of communities in society. (Nursa'ban & Supardi, 2023).

Grade 7 Social Studies curriculum can serve as a vehicle for developing ecological intelligence, as students are encouraged to understand the environment as a living space interconnected with social, economic, and cultural life. Through Social Studies, students can understand that environmental issues are not merely about nature but also involve human behavior, consumption patterns, resource use, development policies, and community participation. (Nursa'ban & Supardi, 2023; Palmer, 1998).

3.4 Dimensions of Students' Ecological Intelligence

The first dimension is ecological knowledge. Ecological knowledge encompasses students' understanding of ecosystems, biodiversity, climate change, natural disasters, natural resources, environmental pollution, and the relationship between humans and the environment. Students need to understand that the environment is an interconnected system, so damage to one component can affect others. (Goleman, 2009; McBeth, 1997).

The second dimension is ecological sensitivity and attitude. Ecological sensitivity encompasses students' concern, empathy, values, and affective orientation toward the environment. Students with

an ecological attitude will feel concerned when they see polluted rivers, damaged forests, the extinction of endangered animals, or a dirty school environment. An ecological attitude also includes the belief that small actions such as conserving water, reducing plastic use, planting trees, and maintaining cleanliness contribute to environmental sustainability. (Prokop, Prokop, & Tunnicliffe, 2007; Wray-Lake, Flanagan, & Osgood, 2010).

The third dimension is ecological skills. Ecological skills include students' ability to identify environmental problems, analyze cause-and-effect relationships, evaluate alternative solutions, and plan evidence-based actions. These skills are important because ecological issues are not always simple and are often linked to social, economic, cultural, and policy factors. (McBeth, 1997; Bianchi et al., 2022).

The fourth dimension is ecological participation and behavior. Ecological participation involves students' engagement in environmental conservation activities, whether at school, at home, or in the community. Ecological behavior can be demonstrated through habits such as disposing of trash properly, conserving energy, reducing plastic use, bringing one's own water bottle, caring for plants, participating in cleanup activities, or getting involved in environmental projects. (Akkuzu, 2013; Rustaman et al., 2018).

These four dimensions are interrelated. Ecological knowledge serves as the foundation for the development of attitudes and awareness. Ecological attitudes encourage students to care about environmental issues. Ecological skills help students analyze problems and design solutions. Participation and ecological behavior demonstrate that knowledge, attitudes, and skills have been translated into concrete actions. (Goleman, 2009; UNESCO, 1977; Bianchi et al., 2022).

Table 3. Theoretical Grounding and Social Studies Manifestation of the Four Ecological-Intelligence Dimensions

Dimension	Theoretical source(s)	Core construct	Manifestation in Grade 7 Social Studies
Ecological knowledge	Goleman (2009); McBeth (1997); Hollweg et al. (2011)	Understanding ecological systems, human–environment relations, and consequences of human choices.	Analyzing climate change, disaster risk, pollution, biodiversity, and resource use within social and spatial contexts.
Ecological sensitivity and attitudes	UNESCO (1977); Prokop et al. (2007); Wray-Lake et al. (2010)	Concern, values, empathy, responsibility, and affective orientation toward environmental conditions.	Reflecting on local environmental problems, evaluating responsibility, and expressing reasoned sustainability-oriented attitudes.
Ecological skills	McBeth (1997); Bianchi et al. (2022)	Problem identification, causal and systems analysis, evaluation of alternatives, and evidence-based solution planning.	Investigating socio-ecological causes and impacts, comparing options, mapping stakeholders, and designing feasible actions.
Ecological participation and behavior	Goleman (2009); Akkuzu (2013); Rustaman et al. (2018); Bianchi et al. (2022)	Translation of understanding and values into individual and collective environmental action.	Participating in projects, campaigns, community action, and daily practices that respond to local environmental issues.

3.5 Mapping Ecological Intelligence in 7th-Grade Social Studies Curriculum

Ecological intelligence can be integrated into the four main themes of Grade 7 Social Studies, but the mapping is deliberately non-exclusive. The themes are curricular entry points rather than fixed containers for a single ecological-intelligence dimension. Any theme can develop several or all four dimensions depending on the environmental problem selected, the learning task, the reflective process, and the evidence collected through assessment (Mutiani et al., 2026). Table 4 therefore identifies dimensions that may be especially visible in each theme, not a one-theme–one-dimension relationship (Arini et al., 2026).

The theme of Diversity of the Local Environment can especially foreground ecological sensitivity and attitudes through observations of water, air, and soil pollution and reflection on the relationship

between human behavior and environmental degradation. At the same time, the same theme can build knowledge through the interpretation of ecological processes, skills through problem analysis, and participation through conservation or waste-management activities (Prokop et al., 2007; Wray-Lake et al., 2010).

The theme of Environmental Economic Potential can especially develop ecological knowledge and analytical skills by asking students to examine resource use, compare sustainable and exploitative practices, assess environmental impacts of economic activities, and consider alternative livelihoods or production choices. When these analyses are connected to values and action projects, the theme can also strengthen ecological attitudes and participation (Akkuzu, 2013; Bianchi et al., 2022).

The theme of Community Empowerment can especially foreground ecological participation and behavior by examining the roles of communities, civic groups, schools, families, and government in addressing environmental problems. Yet meaningful participation also depends on ecological knowledge, sensitivity, and problem-solving skills; therefore, projects such as waste-bank activities, school greening, energy-saving campaigns, or local environmental observations can be designed to integrate all four dimensions (UNESCO, 1977; Rustaman et al., 2018).

This non-exclusive mapping shows that ecological intelligence does not need to be treated as supplementary material outside the Social Studies curriculum (Auliya et al., 2026). The four dimensions can be developed through material already present in the Merdeka Curriculum, while different themes may emphasize different dimensions at different stages of learning. The pedagogical task is therefore not to assign one dimension to one topic, but to coordinate content, local context, active-reflective learning, and assessment so that multiple dimensions can develop together.

Table 4. Illustrative, Non-Exclusive Mapping of Ecological Intelligence in the Grade 7 Social Studies Curriculum

Grade 7 Social Studies Theme	Ecological Content	Illustrative dimensions emphasized (non-exclusive)
Social Life and the Local Environment	Place of residence, spatial connectivity, climate change, and the potential for natural disasters.	Ecological knowledge and risk-analysis skills, with possible development of attitudes and participation through local disaster inquiry.
Diversity of the Local Environment	Environmental pollution, conservation of air, water, and soil, and an introduction to the SDGs.	Ecological sensitivity and attitudes, together with knowledge, problem-analysis skills, and conservation behavior.
Environmental Economic Potential	Utilization and conservation of natural resources as well as economic activities in the surrounding environment.	Knowledge of resource use, sustainability attitudes, impact-assessment skills, and potential action-oriented behavior.
Community Empowerment	The role of the community, sociocultural issues, and community participation.	Ecological participation and behavior supported by knowledge, sensitivity, analytical skills, and collective reflection.

Note. The dimensions shown are illustrative emphases rather than exclusive assignments. Each Grade 7 theme can develop multiple ecological-intelligence dimensions through different learning and assessment designs.

3.6 Conceptual Framework of Students' Ecological Intelligence

The conceptual framework of students' ecological intelligence in the Merdeka Curriculum is organized as a six-component alignment mechanism rather than as a linear hierarchy. The six components are the Merdeka Curriculum, Grade 7 Social Studies content, local socio-ecological context, active and reflective learning, authentic assessment, and ecological-intelligence outcomes. The first three components establish curricular and contextual alignment, while the last three operate iteratively so that learning generates evidence, assessment interprets that evidence, and the resulting outcome profile informs further reflection and redesign.

First, the Merdeka Curriculum serves as the pedagogical foundation. It provides teachers with the flexibility to design learning experiences that are adaptable, student-centered, and aligned with the students' environmental context. This curriculum also promotes the development of the Pancasila Student Profile, which is relevant to fostering ecological character. (Ministry of Education, Culture, Research, and Technology, 2022).

Second, Social Studies serves as an integrative space. Social Studies enables students to understand ecological issues from the perspectives of geography, sociology, economics, history, and culture. Thus, students view the environment not only as a natural phenomenon but also as a social space influenced by human actions and collective societal decisions. (Nursa'ban & Supardi, 2023).

Third, the local environment serves as a learning resource. The areas surrounding schools—such as homes, rivers, markets, residential neighborhoods, farmland, green open spaces, and landfills—can be transformed into socio-ecological laboratories. Through the local environment, students can connect social studies material to real-life experiences in their daily lives (UNESCO, 1977; Goleman, 2009).

Fourth, active and reflective learning provides the pedagogical process through which the aligned curriculum, subject content, and local context are transformed into learning experience (Arini et al., 2026). Relevant strategies include project-based learning, problem-based learning, case studies, environmental observation, reflective discussion, game-based learning, and real-world action. The key mechanism is not activity alone but the movement between inquiry, experience, analysis, reflection, and action, allowing students to reconsider assumptions and revise responses as new evidence emerges (Kemdikbudristek, 2022; Bianchi et al., 2022).

Fifth, authentic assessment is embedded within the learning cycle as a feedback mechanism rather than positioned only at the end of instruction. Knowledge tests can be combined with observation sheets, analytical tasks, project products, reflective journals, self-assessment, peer assessment, and records of environmental participation. Because ecological intelligence includes knowledge, attitudes, reasoning, skills, and behavior, assessment evidence should indicate both what students have achieved and what needs to be revisited in subsequent learning (McBeth, 1997; Hollweg et al., 2011).

Sixth, ecological intelligence is the intended multidimensional learning outcome. It comprises the four literature-derived dimensions of ecological knowledge, ecological sensitivity and attitudes, ecological skills, and ecological participation and behavior. These dimensions are treated as interrelated outcomes rather than as a new theory; their function in this framework is to provide a traceable outcome structure for evaluating whether curriculum-based learning has moved from understanding toward reasoned judgment and responsible action (Goleman, 2009; McBeth, 1997; Bianchi et al., 2022).

The framework's novelty lies in the integration and alignment mechanism rather than in any isolated component or in the four ecological-intelligence dimensions themselves. It creates a traceable pathway from curriculum expectations to Grade 7 Social Studies content, from content to a local socio-ecological problem, and from that problem to active-reflective learning. Authentic assessment then connects learning evidence with the four-dimensional outcome profile. The model is intentionally cyclical: assessment evidence and observed outcomes feed back into reflection, task redesign, and the next learning cycle. This iterative relation among active-reflective learning, authentic assessment, and ecological-intelligence outcomes is the framework's central pedagogical mechanism.

Figure 1. Conceptual Framework of Students' Ecological Intelligence in the Merdeka Curriculum

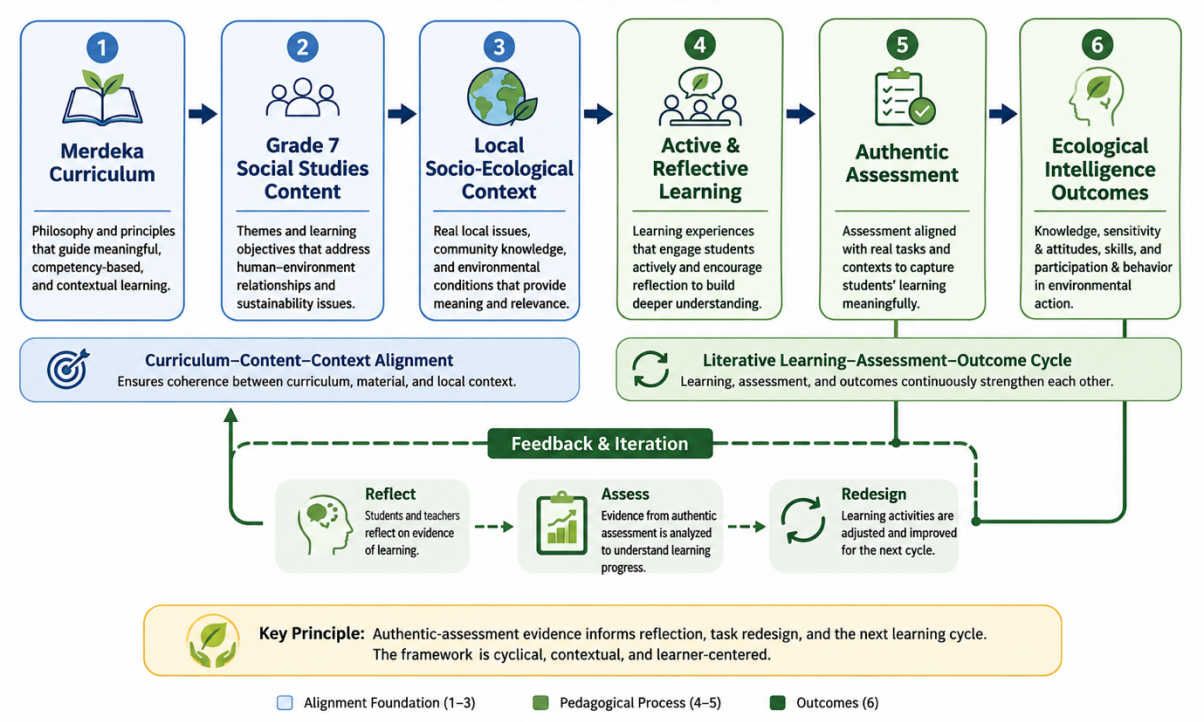

Figure 1 shows the framework as both sequenced and cyclical. The Merdeka Curriculum, Grade 7 Social Studies content, and local socio-ecological context establish the learning foundation; active-reflective learning then generates multidimensional evidence that is interpreted through authentic assessment and represented in ecological-intelligence outcomes. Crucially, the process does not end with the outcome profile. Authentic-assessment evidence feeds back into reflection, task redesign, and the next learning cycle, allowing teachers and students to revisit content, deepen inquiry, or modify action when evidence shows that one or more dimensions remain underdeveloped. Authentic assessment therefore connects pedagogy and outcomes while sustaining the iterative character of the framework (Hollweg et al., 2011; UNESCO, 2020).

3.7 Implications for Social Studies Education

The implications below are limited to consequences directly derived from the six-component framework. Broader environmental-education recommendations may support implementation, but they should not be treated as additional components of the model. First, lesson planning should begin with curriculum–content–context alignment: teachers identify a relevant Grade 7 Social Studies theme, connect it to Phase D learning outcomes, and select a local socio-ecological issue that makes the theme meaningful in students' lived environment (Kemdikbudristek, 2022; Nursa'ban & Supardi, 2023).

Second, the selected issue should be organized through active and reflective learning rather than through activity for its own sake. Observation, interviews, problem mapping, case analysis, project work, discussion, and environmental action become pedagogically relevant when students are required to move between evidence, interpretation, reflection, solution development, and reconsideration of their decisions. This directly operationalizes the framework's active-reflective component and links Social Studies inquiry to ecological-intelligence outcomes (Kemdikbudristek, 2022; Bianchi et al., 2022).

Third, authentic assessment should collect evidence across the four ecological-intelligence dimensions and should be used formatively as well as summatively. Knowledge tests may document conceptual understanding, while analytical tasks, observations, project products, reflective journals, self- or peer-assessment, and participation records can provide evidence of attitudes, skills, and

behavior. The central implication is that assessment results should feed back into learning decisions rather than merely produce a final score (McBeth, 1997; Hollweg et al., 2011).

Fourth, implementation should be iterative. If assessment evidence shows strong ecological knowledge but limited sensitivity, skills, or participation, teachers can revisit the local case, redesign the task, deepen reflection, or provide a new opportunity for action. Conversely, evidence of participation without adequate analysis can prompt renewed attention to cause–effect reasoning and socio-ecological complexity. This feedback loop is a direct implication of the relationship among active-reflective learning, authentic assessment, and ecological-intelligence outcomes in the proposed framework.

School-wide ecological policies, waste management, greening initiatives, energy conservation, and community partnerships can strengthen the conditions in which the framework is implemented. However, these are best treated as enabling contexts rather than as direct implications or additional components of the six-part conceptual model. Keeping this distinction helps preserve the article's contribution as a subject-specific pedagogical alignment framework rather than a general program for whole-school environmental education.

4. CONCLUSION

Ecological intelligence in this article is positioned as a multidimensional organizing construct that is compatible with environmental literacy, ecological literacy, sustainability competence, and ESD. Its four dimensions—ecological knowledge, ecological sensitivity and attitudes, ecological skills, and ecological participation and behavior—are synthesized primarily from the reviewed literature and are not proposed as a superior or entirely new theory. The authors' instrument blueprint serves only as a secondary operational check of whether these literature-derived dimensions can be translated into Grade 7 indicators.

Grade 7 Social Studies provides a strong curricular setting because its themes address the local environment, climate change, disaster risk, pollution, resource use, economic activity, and community empowerment. These themes allow students to analyze environmental issues as socio-ecological problems shaped by human behavior, culture, livelihoods, policy, and collective participation (Nursa'ban & Supardi, 2023).

The article's original contribution is the integration and alignment mechanism connecting six components: the Merdeka Curriculum, Grade 7 Social Studies content, local socio-ecological contexts, active and reflective learning, authentic assessment, and four-dimensional ecological-intelligence outcomes. The framework provides a traceable route from curriculum expectations to learning experiences and assessment evidence, while its iterative structure allows evidence from authentic assessment and ecological-intelligence outcomes to feed back into reflection and subsequent learning design.

The framework remains limited by its conceptual and purposive source base, its bounded judgment of theoretical saturation, its focus on Grade 7 Social Studies in Indonesia, and its use of an unpublished instrument blueprint only as an operationalization check. It has not yet been externally validated or empirically tested as a pedagogical or measurement model. Future research should therefore conduct expert validation, classroom trials, construct-validity and reliability testing where measurement claims are made, and comparative implementation across schools and local environmental contexts before claims of effectiveness or transferability are advanced.

REFERENCES

Akkuzu, N. (2013). Understanding the role of ecological intelligence in sustainable consumption. Journal of Environmental Education Research, 19(3), 341-356.

Arini, A., Sari, R., Mutiani, M., Syarifuddin, S., & Nur'aini, F. (2026). Rubber farmers' activities in Maruta Anjir Serapat Village. *The Kalimantan Social Studies Journal, 7*(2), 127–139. https://doi.org/10.20527/kss.v7i2.16631

Auliya, D., Rusmaniah, Jumriani, Syarifuddin, & Nur'aini, F. (2026). Utilization of kelotok as a means of river tourism transportation in Siring Tendean Banjarmasin. *The Kalimantan Social Studies Journal, 7*(2), 154–167. https://doi.org/10.20527/kss.v7i2.18018

Bianchi, G., Pisiotis, U., & Cabrera Giraldez, M. (2022). GreenComp: The European sustainability competence framework. Publications Office of the European Union.

Bromberg, N., Martens, P., & Longnecker, N. (2009). Ecological intelligence: Bridging knowledge and action for environmental sustainability. Ecology and Society, 14(1), 1-12.

Disinger, J. F., & Roth, C. E. (1992). *Environmental literacy*. ERIC Clearinghouse for Science, Mathematics, and Environmental Education.

Goleman, D. (2009). *Ecological intelligence: How knowing the hidden impacts of what we buy can change everything*. Broadway Books.

Hollweg, K. S., Taylor, J. R., Bybee, R. W., Marcinkowski, T. J., McBeth, W. C., & Zoido, P. (2011). *Developing a framework for assessing environmental literacy*. North American Association for Environmental Education.

Jaakkola, E. (2020). Designing conceptual articles: Four approaches. *AMS Review, 10*, 18–26.

Kemdikbudristek. (2022). Capaian pembelajaran mata pelajaran Ilmu Pengetahuan Sosial Fase D. Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia.

Lawshe, C. H. (1975). A quantitative approach to content validity. Personnel Psychology, 28(4), 563-575.

Literacy Survey (MSELS). National Environmental Literacy Assessment Project.

McBeth, W. (1997). *Middle School Environmental Literacy Survey (MSELS)*. National Environmental Literacy Assessment Project.

Mutiani, M., Rifiana, R., Septiana, N., Amelia, R., & Robby, F. (2026). Strategic transformation toward world-class university: The Quacquarelli Symonds (QS) ranking system implementation at a public university in South Kalimantan. *The Kalimantan Social Studies Journal, 7*(2), 183–192. https://doi.org/10.20527/kss.v7i2.17491

Nursa'ban, M., & Supardi. (2023). *Ilmu Pengetahuan Sosial untuk SMP/MTs Kelas VII: Edisi revisi*. Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi Republik Indonesia.

Orr, D. W. (1992). *Ecological literacy: Education and the transition to a postmodern world*. State University of New York Press.

Palmer, J. A. (1998). *Environmental education in the 21st century: Theory, practice, progress and promise*. Routledge.

Prokop, P., Prokop, M., & Tunnicliffe, S. D. (2007). Is biology boring? Student attitudes toward biology. *Journal of Biological Education, 42*(1), 36–39.

Rustaman, N. Y., et al. (2018). Ecological intelligence level of high school students in Cimahi City. *SHS Web of Conferences, 42*, 00062.

Sterling, S. (2010). Transformative learning and sustainability: Sketching the conceptual ground. *Learning and Teaching in Higher Education, 5*, 17–33.

Torraco, R. J. (2005). Writing integrative literature reviews: Guidelines and examples. *Human Resource Development Review, 4*(3), 356–367.

UNESCO. (1977). *The Tbilisi Declaration: Intergovernmental Conference on Environmental Education*. UNESCO.

UNESCO. (2020). *Education for sustainable development: A roadmap*. UNESCO.

Wray-Lake, L., Flanagan, C. A., & Osgood, D. W. (2010). Examining trends in adolescent environmental attitudes, beliefs, and behaviors across three decades. *Environment and Behavior, 42*(1), 61–85.