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Internalization of Human Values in Physics Learning through a Love-Based Curriculum to Build Environmentally Caring Character

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A B S T R A C T

The global environmental crisis demands a fundamental transformation in science education, shifting from mere cognitive knowledge transfer to a medium for holistic character formation. This conceptual article examines the urgency of internalizing human values such as empathy, compassion, and justice into physics learning. The author proposes a "Love-Based Curriculum" as a transformative pedagogical framework to bridge the gap between abstract physics concepts and the development of environmentally caring character. This article is developed using a Systematic Literature Review (SLR) approach. Data collection was conducted by examining various credible and relevant references to obtain a comprehensive understanding of the topic. The article synthesizes various approaches, ranging from compassionate pedagogy to the integration of sustainability issues (such as climate change and waste management) into the physics curriculum. The findings indicate that a humanistic approach not only improves cognitive learning outcomes but also significantly fosters ecological awareness, environmental literacy, and students' motivation to become agents of change. The Love-Based Curriculum is argued to be a strategic intervention to ensure more equitable, inclusive, and relevant physics learning that addresses future challenges.

1. Introduction

Physics education has historically been positioned as a rigorous and objective discipline, emphasizing the mastery of concepts, natural laws, and mathematical problem-solving skills. This long standing paradigm has contributed to the perception of physics as a "hard science" that prioritizes accuracy, logic, and abstraction. However, such an orientation often creates a significant gap between the complexity of formulas and the realities of students' everyday lives, making physics appear abstract, decontextualized, and less meaningful for learners (Fang et al. 2023; Busra 2023). As a consequence, students may achieve conceptual

understanding at a superficial level without being able to relate scientific knowledge to real-world challenges, particularly those concerning environmental and social issues. This limitation has raised critical concerns among educational scholars regarding the relevance of traditional physics instruction in addressing the demands of the 21st century.

Recent developments in educational sciences emphasize that effective learning should not be confined to the cognitive domain alone but must also integrate affective and social dimensions (Siregar et al. 2022; Putri et al. 2023). In this perspective, learning is viewed as a holistic process that involves not only the acquisition of knowledge but also the development of attitudes, values, and social awareness. The urgency of this paradigm shift becomes even more evident in the context of global challenges such as climate change, environmental degradation, and energy crises, which require not only scientific understanding but also ethical responsibility and collective action. These challenges raise fundamental questions about the role of physics education: Can physics learning go beyond the transmission of knowledge to foster empathy and environmental responsibility? Is it possible for physics to contribute to the development of individuals who are not only scientifically literate but also morally and socially conscious?

One of the most critical issues in contemporary education is the persistent gap between environmental knowledge and pro-environmental behavior (Goldin et al. 2024). Students may understand concepts such as global warming, energy conservation, or sustainability, yet fail to translate this understanding into meaningful actions in their daily lives. This phenomenon suggests that knowledge alone is insufficient to drive behavioral change. From the perspective of value internalization theory, behavior is shaped not merely by cognitive understanding but by the extent to which knowledge is internalized as personal values through emotional engagement and reflective processes. Research in the Journal of Educational Sciences highlights that character based learning and structured value internalization are essential mechanisms for bridging this gap (Hidayati et al. 2021; Rahman et al. 2022). Without these processes, learning remains fragmented, and students may struggle to connect scientific concepts with ethical considerations and real-world responsibilities.

In response to this issue, the integration of sustainability into science education has gained increasing attention as an effective approach to enhancing students' environmental awareness and responsibility (Putra et al. 2023). By embedding environmental issues into the curriculum, educators can create learning experiences that are both relevant and transformative. However, the effectiveness of this approach depends largely on the pedagogical framework used to deliver it. Many existing approaches still focus primarily on cognitive understanding, with limited attention to the affective and ethical dimensions of learning. As a result, the potential of physics education to contribute to character formation remains underutilized. This study argues that the root of the problem lies in pedagogical approaches that neglect human values, thereby limiting the capacity of education to foster meaningful and sustained behavioral change.

To address this gap, this article proposes the Love-Based Curriculum (Kurikulum Berbasis Cinta/KBC) as a conceptual and pedagogical framework that integrates compassion, empathy, and care into physics learning (Eko et al. 2025; Mathis et al. 2025). The Love-Based Curriculum is grounded in humanistic and affective learning theories, which emphasize the importance of emotional engagement and relational dynamics in the learning process. Rather than treating values as supplementary elements, KBC positions them as the foundation of knowledge construction and meaning-making. In this framework, learning is not only about understanding scientific concepts but also about developing a sense of responsibility toward oneself, others, and the environment. This approach aligns with the broader movement toward compassionate pedagogy, which highlights the role of empathy and care in creating inclusive and transformative educational experiences.

The theoretical foundation of KBC is closely related to the concept of compassionate pedagogy, which has been increasingly recognized as a powerful approach in contemporary education. Compassionate pedagogy emphasizes the importance of building meaningful relationships between teachers and students, fostering emotional engagement, and creating a supportive learning environment that promotes both academic and personal growth. Studies have shown that such approaches can enhance students' motivation, engagement, and overall learning outcomes, while also contributing to the development of empathy and social responsibility. In the context of physics education, this means that learning can be transformed from a purely analytical activity into a meaningful process that connects scientific knowledge with human values and real-world concerns.

Based on these considerations, this study aims to analyze how the Love-Based Curriculum can be implemented in physics learning to develop environmentally caring character. Specifically, the analysis focuses on three main aspects: (1) the philosophical and theoretical foundations of compassionate pedagogy as the basis of KBC, (2) strategies for integrating environmental and sustainability issues into physics content, and (3) the role of humanistic approaches in creating inclusive, meaningful, and transformative learning experiences. By synthesizing findings from relevant literature, this study seeks to provide a comprehensive conceptual framework that bridges the gap between cognitive learning and character development in physics education.

In line with previous studies in educational sciences, this research contributes to strengthening the integration of character education and sustainability within physics learning (Siregar et al. 2022; Putra et al. 2023). More importantly, it offers a new perspective on how physics education can be reoriented to address not only intellectual development but also the ethical and emotional dimensions of learners. In doing so, this study highlights the transformative potential of the Love-Based Curriculum as a strategic response to the challenges of contemporary education and the urgent need for environmentally responsible future generations.

2. Methodology

Instrument

The main instrument used in this study is a structured literature analysis framework designed to systematically organize and evaluate selected academic sources. This framework includes key components such as the title of the article, author names, year of publication, journal source, and the main focus of each study. It also incorporates analytical categories related to human values, environmental awareness, and pedagogical approaches to ensure consistency in evaluation. In addition, inclusion and exclusion criteria were developed as part of the instrument to filter relevant and high-quality studies. These criteria ensure that only studies aligned with the research objectives are included in the analysis. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol is also applied as a guiding framework for the selection process. This protocol functions as a methodological tool to enhance transparency, objectivity, and reproducibility. By using these instruments, the study ensures that the research process is systematic, rigorous, and academically reliable.

Data Collection

The data collection process was conducted through a systematic search of academic literature from two reputable databases, namely Scopus and Sinta. The process began with an initial identification stage, where a total of 150 articles were retrieved based on the predefined keywords. Following this, a data cleaning step was carried out to remove duplicate entries, resulting in 120 unique articles. These articles were then subjected to a screening process based on their titles and abstracts to assess their relevance to the research focus. During this stage, 85 articles were excluded due to mismatches in educational level, research scope, or lack of focus on character development. The remaining 35 articles were then assessed in full-text form to determine their eligibility. This eligibility phase involved a more detailed evaluation of methodological quality and conceptual relevance.

After the eligibility process, 15 additional articles were excluded, including those that were not directly related to physics learning or did not explicitly address human values or the Love-Based Curriculum. The final stage of the PRISMA process resulted in 20 articles that met all inclusion criteria. These selected articles were then used for qualitative synthesis. The use of the PRISMA framework ensured that the selection process was transparent, systematic, and methodologically accountable, thereby minimizing bias and increasing the reliability of the findings.

Data Analysis

The data analysis in this study was conducted using a systematic qualitative content analysis approach to synthesize findings from the selected literature. The 20 final articles were carefully examined, categorized, and organized into a structured literature matrix. This matrix includes key components such as article title, author, year of publication, journal name, and main research focus. Through this matrix,

the researcher was able to identify patterns, similarities, and differences across studies. The analysis focused on themes such as the integration of human values, environmental awareness, and sustainability in physics education. Furthermore, the data were interpreted critically to construct a coherent conceptual framework supporting the Love-Based Curriculum.synthesis that supports the development of the Love-Based Curriculum framework.

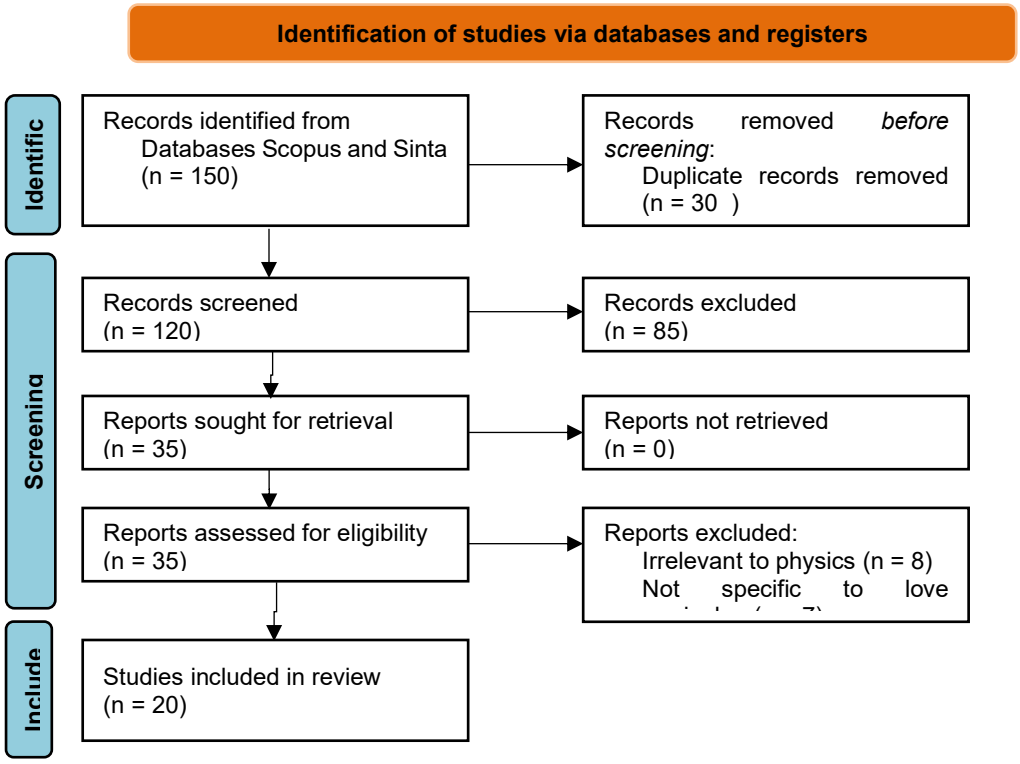

Figure 1. Flow of Systematic Literature Review using PRISMA

3. Results and Discussion

Results

The results of this study are derived from a systematic synthesis of 20 selected articles that met the inclusion criteria through a structured literature review process. The findings reveal consistent patterns regarding the integration of human values, environmental awareness, and pedagogical innovation in physics education. To support a comprehensive and systematic presentation of the findings, the results are organized into a literature matrix as presented in Table 1, which summarizes key aspects of each study, including research focus, pedagogical approaches, and relevance to value internalization and environmental character development. This matrix serves as an analytical tool to identify trends, similarities, and conceptual relationships across the selected studies, allowing for a deeper understanding of how human values are embedded within physics learning contexts.

Table 1. Literature Matrix

Article Title	Author (Year)	Journal Name	Main Focus
Curriculum of Love as Epistemology of Character Education in the Society 5.0 Era	Eko, N.S., Budiyono, S., Miftahuddin., Azizah, T.M., Fais, M. (2025)	Jurnal Pendidikan Dasar	Positions love, empathy, and care as the fundamental foundation in shaping human character.
Comparing Environmental Awareness Between Chemistry Education Students and Non-Chemistry Education Students	Ridha, I., Hasan, M., Sulastri (2020)	Journal of Physics Conference Series	Science education inherently has a responsibility to foster environmental awareness.
Indonesia Local Wisdom-Based Physics Learning: Strategy and Media	Fitriah, L., Yulianti, L., Parno, P., Sudaryono, S., Taufiq, A. (2025)	Journal of Education Culture and Society	Innovation in science learning strategies and media, integrating cultural values, identity, language, religion, and local wisdom in education.
Can Assessment for Learning Effectively Measure Critical Thinking in Physics Education?	Viyanti et al. (2025)	Journal of Physics Conference Series	Evaluation of physics learning toward solving environmental problems through student-centered assessment processes.
Implementation of Education for Sustainable Development and Pupils' Sustainability Consciousness in Adiwiyata and ESD-Based Schools	Suwarto et al. (2021)	Journal of Physics Conference Series	Deep internalization of sustainability values into the learning curriculum.
Adiwiyata School: An Environmental Care Program as an Effort to Develop Indonesian Students' Ecological Literacy	Febriani et al. (2020)	Journal of Physics Conference Series	Analysis of the effectiveness and important role of Adiwiyata programs in improving students' ecological literacy and environmental awareness.
Integrating Plastic Waste Issues into Physics Learning Design on Students' Environmental Awareness	Susanti et al. (2025)	Journal of Physics Conference Series	Effectiveness of integrating plastic waste issues into physics learning in improving environmental awareness and cognitive understanding.
Climate Change Education in Sustainable Physics Learning: A Systematic Literature Review	Lestari, N.A., Susanti, F.M., Deta, U.A., Hariyono, E., Madlazim (2024)	E3S Web of Conferences	Integration of climate change issues into experimental-based physics learning.
Pedagogy of Tele-Proximity for Learning: Bridging the Distance with Social Physics	Themelis, C. (2022)	Pedagogy of Tele-Proximity	Emphasizes emotional and social aspects in learning, fostering collective intelligence and interpersonal relationships while internalizing human values.

Article Title	Author (Year)	Journal Name	Main Focus
The Living Environmental Education: Sound Science Toward a Cleaner, Safer, and Healthier Future	Fang, W., Hassan, A., Lepage, B.A. (2023)	Sustainable Development Goal Series	Environmental education to bridge the gap between ecological issues and educational practices, especially in Asia.
Perception of Physics Education Students at Universitas Negeri Medan on the Role of Physics Education in Sustainable Development Goals	Yanthy, L., Aswin, R. M., Tuti, H. (2025)	Physics Education Sustainable Development	Discusses the role of physics education in addressing global issues such as climate change and the lack of sustainability values in traditional curricula.
Tracing Different Forms of Politicized Care in Teaching Physics to Students Traditionally Underserved in Science	Mathis, C., Southerland, S.A., Jaber, L.Z. (2025)	Physical Review Physics Education Research	Internalization of human values in physics learning to ensure equity and student empowerment.
Integrated Environmental Education Physics Project to Enhance Student Creativity	Nurita, A., Fajaria, M., Madlazim, E., Eko, H., Rizki, F. (2024)	Momentum: Physics Education Journal	Integration of environmental issues (e.g., climate change) in physics projects significantly enhances creativity and ecological awareness.
Compassionate Pedagogy in Higher Education: A Scoping Review	Killingback, C., Tomlinson, A., Stren, J. (2025)	Journal of University Teaching and Learning Practice	Understanding how compassionate pedagogy is conceptualized and applied in contemporary higher education.
The Role of Compassion in Higher Education Practices	Narelle, L., Heidi, J. W., Sandra, G. W. (2023)	Journal of University Teaching and Learning Practice	Practical integration of compassion within higher education ecosystems.
Compassion in Higher Education: Fashion or Future for Relational Pedagogies?	Waddington, K., Bonaparte, B. (2025)	Higher Education Research and Development	Compassion as a measurable academic and organizational strategy, not merely a soft attitude.
Humanization in Learning Physics	Zoze, W., Restu, J., Ahmad, J., Agus, M. (2022)	Klasikal: Journal of Education, Language Teaching and Science	Humanistic science approaches influence students' cognitive learning outcomes.
Literature Review: Character Analysis of Caring for the Environment in Physics Learning	Busra, S.K. (2023)	Jurnal Edufisika	Environmental care values are internalized through physics learning, including the use of recycled materials as learning media.
Curriculum 2013 and Love-Based Curriculum of the Ministry of Religious Affairs: Integrative Strategy in Character and Spiritual Education	Ahmad, S., Sukiman, S., Raudhatul, H. (2025)	E-Jurnal Pendidikan	Integration of national curriculum with religious values to shape disciplined character based on love for God, humans, and the environment.

Article Title	Author (Year)	Journal Name	Main Focus
Pedagogy with a Heartbeat: The Transformative Potential of Citizen Science in Education	Goldin, J., Suransky, C. (2024)	Perspectives in Education	Engaging students in real-world science projects makes learning more meaningful and transformative.

Based on the literature matrix in Table 1, several dominant trends emerge that characterize current developments in physics education. First, a substantial number of studies emphasize the importance of integrating human values such as empathy, compassion, and care into the learning process. These values are not positioned merely as supplementary components but as essential foundations in shaping students' character and attitudes toward the environment. Second, many studies highlight the strategic use of environmental and sustainability issues as contextual entry points for physics learning. Topics such as climate change, renewable energy, and waste management are frequently utilized to bridge the gap between abstract scientific concepts and real-world applications, thereby enhancing the relevance and meaningfulness of learning experiences for students.

In addition, the results indicate that innovative pedagogical approaches play a crucial role in facilitating both cognitive and affective learning outcomes. Approaches such as project-based learning, contextual learning, and compassionate pedagogy are consistently reported as effective in increasing student engagement, creativity, and environmental awareness. These approaches encourage active student participation and provide opportunities for learners to apply physics concepts in authentic and socially relevant contexts. Furthermore, several studies underscore the importance of integrating cultural values and local wisdom into physics education, as this not only enhances contextual relevance but also strengthens students' identity and connection to their environment. Such integration demonstrates that physics learning can be both scientifically rigorous and culturally responsive.

Another important finding is the increasing recognition of the need to shift from a purely cognitive-oriented paradigm toward a more holistic educational approach that incorporates affective and ethical dimensions. This shift is reflected in the growing adoption of humanistic and value-based learning frameworks, including the Love-Based Curriculum. The literature consistently shows that when physics education integrates emotional and ethical aspects, students are more likely to develop a deeper understanding of concepts as well as a stronger sense of responsibility toward environmental issues. Overall, the results suggest that physics education has significant potential to function not only as a medium for knowledge transmission but also as a platform for character formation and the development of environmentally responsible behavior.

Discussion

The findings of this study reinforce the argument that the integration of human values into physics learning is essential for bridging the gap between conceptual understanding and pro-environmental behavior. From the perspective of value

internalization theory, this gap occurs because knowledge does not automatically translate into action unless it is processed through meaningful emotional and reflective experiences. In many traditional physics classrooms, learning remains focused on formulas and problem-solving, which limits opportunities for students to connect knowledge with personal values and real-life implications. Therefore, the incorporation of human values into physics education should be understood as a fundamental pedagogical necessity rather than an optional enhancement, as it enables learners to transform cognitive understanding into ethical awareness and responsible behavior.

The Love-Based Curriculum provides a relevant and theoretically grounded framework for facilitating this process of internalization. Within this framework, learning begins with emotional engagement, where students are encouraged to develop empathy toward environmental and social issues related to physics concepts. This emotional dimension plays a critical role in capturing students' attention and fostering a sense of personal connection to the learning material. The process then continues through contextual meaning-making, in which abstract physics concepts are linked to real-world situations, allowing students to construct deeper and more meaningful understanding. This stage is followed by reflective internalization, where students engage in critical reflection on their values, beliefs, and responsibilities through discussions, questioning, and reflective activities. Finally, these internalized values are translated into concrete actions, such as participation in environmental projects or sustainable practices, demonstrating that learning has moved beyond cognition into behavioral transformation.

This mechanism is closely aligned with the principles of affective-based learning and humanistic education, which emphasize the importance of addressing learners as whole individuals with cognitive, emotional, and social dimensions. Emotional engagement has been shown to enhance motivation, strengthen memory retention, and deepen conceptual understanding, indicating that the integration of affective elements does not compromise academic rigor but rather supports it. In this sense, the Love-Based Curriculum does not replace traditional physics instruction but enriches it by making learning more meaningful, relevant, and transformative. As a result, physics education can evolve into a learning space that not only develops scientific competence but also nurtures empathy, responsibility, and ethical awareness among students.

Furthermore, the integration of environmental and sustainability issues into physics learning serves as a key mediator in the process of value internalization. By contextualizing topics such as energy, thermodynamics, and mechanics within real-world environmental challenges, students are able to see the direct relevance of physics in addressing global issues. Experiential learning approaches, particularly project-based learning, further strengthen this connection by providing opportunities for students to engage actively with environmental problems in their communities. Through these experiences, students are not only able to apply their knowledge but also develop a sense of agency and responsibility. This combination of contextual understanding and direct experience plays a crucial role in transforming knowledge into meaningful and sustained behavioral change.

Despite these promising findings, the implementation of the Love-Based Curriculum in physics education faces several important challenges that need to be acknowledged. One significant limitation is the difficulty experienced by teachers in integrating affective values into abstract and mathematically oriented physics content. Many educators are trained within a traditional paradigm that prioritizes conceptual mastery, which can make it challenging to adopt more holistic and value-based approaches. In addition, limited instructional time often constrains the use of reflective and experiential learning activities, as teachers are required to meet curriculum demands and complete extensive content coverage. These structural constraints can hinder the effective implementation of innovative pedagogical strategies.

Another challenge lies in the potential resistance from students, particularly those who are accustomed to conventional, formula-based learning approaches. Some students may initially perceive reflective activities or discussions on values as less relevant to physics, which can reduce engagement if not carefully facilitated. Moreover, the assessment of value internalization and character development remains a complex issue, as these outcomes are not easily measured using traditional testing methods. This highlights the need for the development of alternative assessment strategies that can capture both cognitive and affective dimensions of learning in a more holistic manner. Without appropriate evaluation tools, it becomes difficult to systematically measure the impact of value-based learning approaches.

From a practical perspective, these challenges indicate that the successful implementation of the Love-Based Curriculum requires strong institutional and pedagogical support. Teachers need access to professional development programs that equip them with the skills to integrate values into physics teaching effectively. Curriculum design also needs to be more flexible to allow space for reflective and experiential learning activities. In practice, educators can begin by incorporating small but meaningful strategies, such as linking physics concepts to environmental issues, facilitating guided reflection, and designing context-based learning tasks. Over time, these incremental changes can contribute to a broader transformation of physics education into a more holistic and character-oriented learning experience.

In conclusion, the discussion demonstrates that the Love-Based Curriculum offers a comprehensive and theoretically grounded approach to transforming physics education. By explicitly integrating processes of value internalization, emotional engagement, and contextual learning, this framework addresses the limitations of traditional instruction and responds to contemporary global challenges. Physics education, therefore, should not be viewed solely as a domain of abstract knowledge but as a powerful medium for shaping students' character and fostering environmentally responsible behavior in a meaningful and sustainable way.

4. Conclusion

This article proposes the Love-Based Curriculum (KBC**)** as a comprehensive and strategic pedagogical framework to internalize human values in physics learning, with the ultimate goal of developing environmentally responsible character. The literature synthesis indicates that the Love-Based Curriculum, supported by the principles of compassionate pedagogy and educational equity, is capable of transforming physics learning into a more relevant, meaningful, and empowering experience. By consciously integrating sustainability issues into physics content and adopting a humanistic approach, educators can effectively bridge the gap between conceptual understanding and ethical action. The implementation of the Love-Based Curriculum is not an easy task; it requires a shift in educators' mindsets, institutional support, and innovative curriculum design. However, the urgency of the ecological crisis and the need to prepare future generations to face complex challenges make this transformation essential. Future research should focus on developing more concrete and measurable models for implementing KBC, as well as conducting empirical studies to evaluate its impact on students' sustainability competencies across various educational contexts.

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