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Research Article

Pedagogical Deep Learning for Student Character Formation: A Systematic Literature Review and Conceptual Synthesis

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Abstract

The growing emphasis on character-oriented education requires pedagogical approaches that move beyond knowledge transmission toward reflective, contextual, and value-laden learning experiences. This study aims to synthesize how deep learning approaches are conceptualized and implemented in education and how they contribute to student character formation. A Systematic Literature Review was conducted using PRISMA procedures. Articles were searched in the Scopus database on November 4, 2025, covering publications from 2016 to 2025 with the keywords "deep learning approach" and "character education." After screening 4,244 initial records through title, abstract, document type, language, and eligibility criteria, 41 articles were included for thematic qualitative synthesis. The findings show that deep learning is implemented through diverse pedagogical models, including project-based learning, problem-based learning, contextual learning, flipped classroom, technology-supported media, reflective activities, and collaborative learning. Across the reviewed studies, deep learning supports character formation by promoting mindful engagement with content, meaningful connections to real-life contexts, and joyful learning experiences. These processes strengthen discipline, responsibility, independence, empathy, tolerance, collaboration, integrity, and critical thinking. This study contributes a conceptual synthesis that positions deep learning as an integrative pedagogical mechanism linking cognitive depth, reflective self-regulation, and character development, thereby offering a foundation for future empirical research and classroom-based innovation.

Keywords: Deep Learning Approach; Character Education; Student Character Building; Joyful Learning; Systematic Literature Review.

INTRODUCTION

21st century education requires students to have critical thinking, creative, collaborative, and strong character skills. Changes in the era marked by the development of information technology and globalization require schools to be able to provide meaningful, contextual, and in-depth learning experiences so that students not only master the subject matter, but also internalize positive character values [1], [2], [3].

These educational requirements also demand a learning process that focuses not only on knowledge (learning to know) but also on character development and higher-order thinking skills (learning to be and learning to live together). One approach that is relevant to these requirements is deep learning, which emphasizes deep understanding, reflection, and the connection between knowledge and its application in real life. This approach focuses on how students understand the meaning of what they are learning, rather than simply memorizing facts or procedures. According to Biggs & Tang (2011) in Hariandi, deep learning occurs when students try to understand key ideas, relate new knowledge to existing knowledge, and apply it in real-life contexts. Thus, the learning process does not stop at a low cognitive level but develops to the stage of deep reflection and meaning [4].

The deep learning approach is closely related to strengthening students' character. Through a deep learning process, students are trained to take responsibility for their own learning, manage their time, work together in groups, and develop an awareness of moral and social values. Meaningful learning will help students understand why values such as discipline, responsibility, honesty, hard work, and empathy are important in their lives. Thus, deep learning can be an effective means of integrating cognitive, affective, and psychomotor aspects in a balanced manner [4], [5], [6], [7].

The Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia, through the Character Education Strengthening (PPK) program, emphasizes the importance of five core character values, namely religious, nationalistic, independent, cooperative, and integrity. These values can only be developed through habit formation and learning oriented towards meaningful experiences, not merely cognitive teaching. The deep learning approach allows students to interpret these values through a process of reflection and application in real life, not just through lectures or memorization [8].

In practice, with a deep learning approach requires teachers to act as facilitators who encourage students to explore ideas, analyze phenomena, and find solutions based on their own understanding. Teachers do not only provide information, but also guide students to ask questions, discuss, and reflect on their learning experiences. Through this process, students' character can be strengthened because they directly experience how to think critically, work together, and appreciate the learning process [9].

In the context of primary and secondary education, the application of deep learning is very potential for shaping students' character, especially their discipline. Discipline is one of the main values in character education reinforcement (PPK), which is the focus of the Ministry of Education, Culture, Research, and Technology [10].

Through a deep learning approach, students are not only required to memorize and repeat information, but also to understand meaning, analyze consequences, and build personal and social responsibility in the learning process. The reflective and collaborative process in

deep learning can train students to manage time, obey rules, and be consistent in completing tasks aspects that are the tangible manifestations of disciplined character [6], [11], [12], [13], [14], [15].

Based on the above description, this study formulates two problems, namely (1) how is the learning model with a deep learning approach and (2) how can the learning model with a deep learning approach contribute to strengthening student character. In accordance with these research questions, the objectives of this study are to describe the concept of a learning model with a deep learning approach and to analyze the influence and contribution of learning with a deep learning approach to strengthening student character.

This research benefits teachers, students, schools, and other researchers. For teachers, this research serves as a reference in designing meaningful, reflective learning that is oriented towards shaping student character. For students, this research provides learning experiences that encourage deep understanding and shape positive character values such as discipline, responsibility, and hard work. For schools, this research provides a basis for developing a character-based school culture and student-centered learning. For other researchers, this research provides references and a theoretical basis for further research related to the implementation of deep learning in the context of character education.

METHODS

This study employed a Systematic Literature Review (SLR) method to identify, evaluate, and synthesize relevant research on learning models using a deep learning approach to strengthen student character. The SLR protocol was designed to ensure transparency, objectivity, and reproducibility, thereby minimizing potential bias [16]. Research questions were formulated using the PICOC (Population, Intervention, Comparison, Outcome, Context) framework and refined through a thematic approach to address the multidimensional nature of the topic. The main questions focused on (1) how learning models with a deep learning approach are implemented and (2) how such approaches contribute to strengthening student character.

The literature search was conducted in the Scopus database on November 4, 2025, covering publications from 2016 to 2025. The keywords used were “deep learning approach” AND “character education.” The initial search yielded 4,244 documents. After title-based filtering for relevance to learning contexts focused on character development, 99 documents were retained for further screening.

Selection followed strict inclusion and exclusion criteria. The inclusion criteria were: (1) accredited national (SINTA-indexed) and international (Scopus-indexed) scientific journal articles; (2) published between 2016 and 2025; (3) contained empirical studies or in-depth literature reviews; (4) were written in Indonesian or English; and (5) explicitly discussed the theme of learning with a deep learning approach, the challenges and opportunities of learning with a deep learning approach in strengthening students' character. The exclusion criteria included conference papers, conference reviews, book chapters, and books. Following abstract screening and eligibility assessment based on the PRISMA guidelines (identification, screening, eligibility, inclusion), 41 articles were selected for analysis (Figure 1).

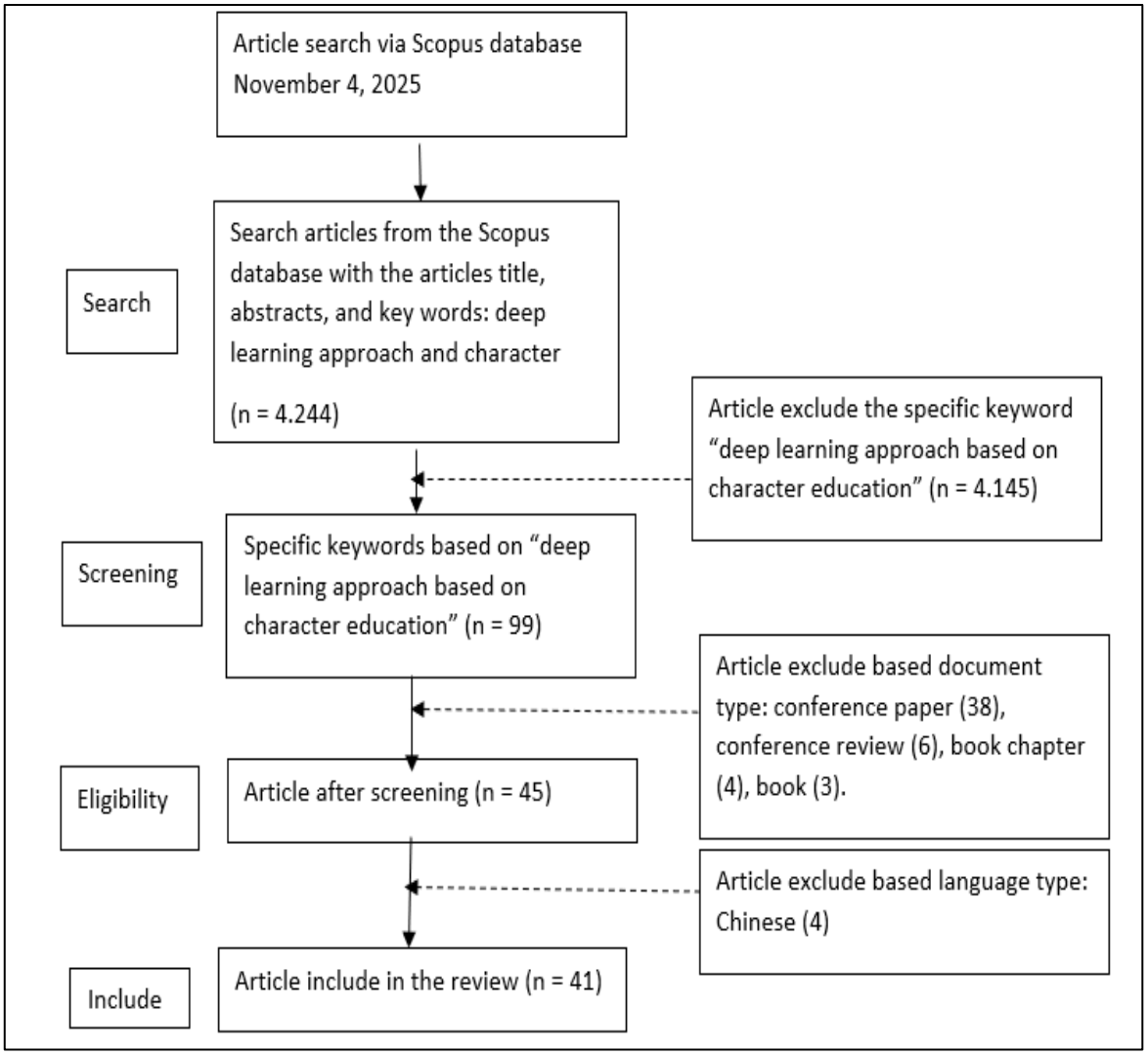

Figure 1. PRISMA diagram of the learning approach with deep learning

Data extraction was conducted using a structured matrix that included publication details, research methodology, objectives, and main findings. The extracted data were analyzed using thematic qualitative analysis. Relevant information was coded, grouped into categories, and synthesized to identify recurring themes, patterns, and conceptual relationships related to deep learning and character strengthening.

Finally, the results of the thematic synthesis were systematically presented in the findings and discussion sections. The analysis aimed to demonstrate how learning models with a deep learning approach contribute to student character development and to provide a conceptual foundation for future empirical research.

RESULTS AND DISCUSSION

Results

The results of this review are presented in two complementary forms. First, the descriptive mapping of the selected literature is used to show the development of scholarly attention to deep learning approaches in character education, including publication trends, author contributions, and country distribution. Second, the thematic synthesis is presented to identify how deep learning has been conceptualized and implemented across different educational contexts, as well as how it contributes to student character formation. This structure allows the findings to move from a general overview of the reviewed literature toward a more interpretive understanding of the pedagogical patterns, learning principles, and character-related outcomes emerging from the selected studies.

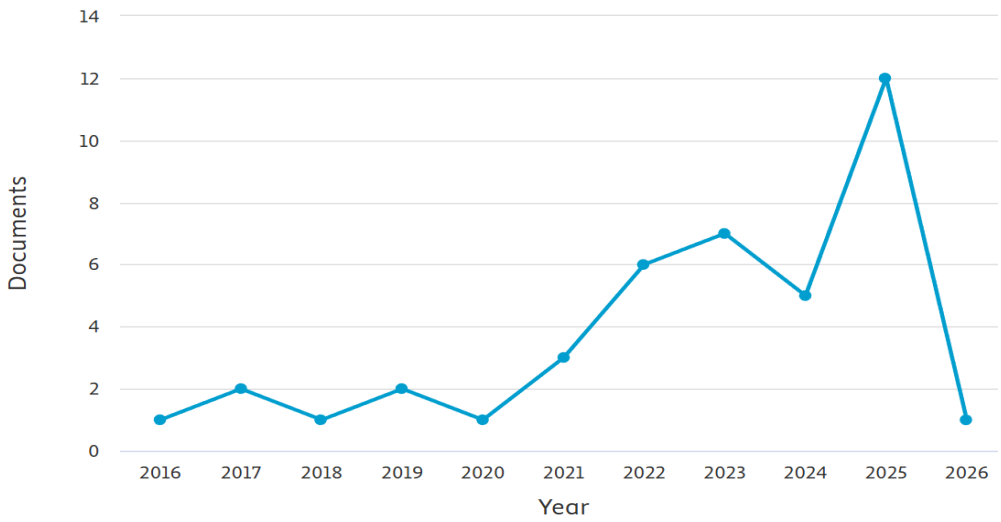

Figure 2. The Last Ten Years of Deep Learning Documents

From Figure 2, it can be seen that the use of deep learning in education to strengthen student character began to be researched in 2016. Buford states that the use of deep learning in education to strengthen student character results in a broader and more comprehensive coverage of critical thinking or learning to learn. Students come to understand concepts more thoroughly so that they can apply them in real life.

This research experienced ups and downs until 2020. Research on learning with a deep learning approach based on character education has seen an increase in the number of documents since 2020, with the number of documents increasing from one to seven in 2022. It dropped to only five documents in 2024, but then experienced a significant increase in 2025 to 12 documents. This shows that this research has attracted worldwide attention. After identifying the publication trend, the analysis proceeded to examine the distribution of scholarly contributions among the authors represented in the reviewed literature.

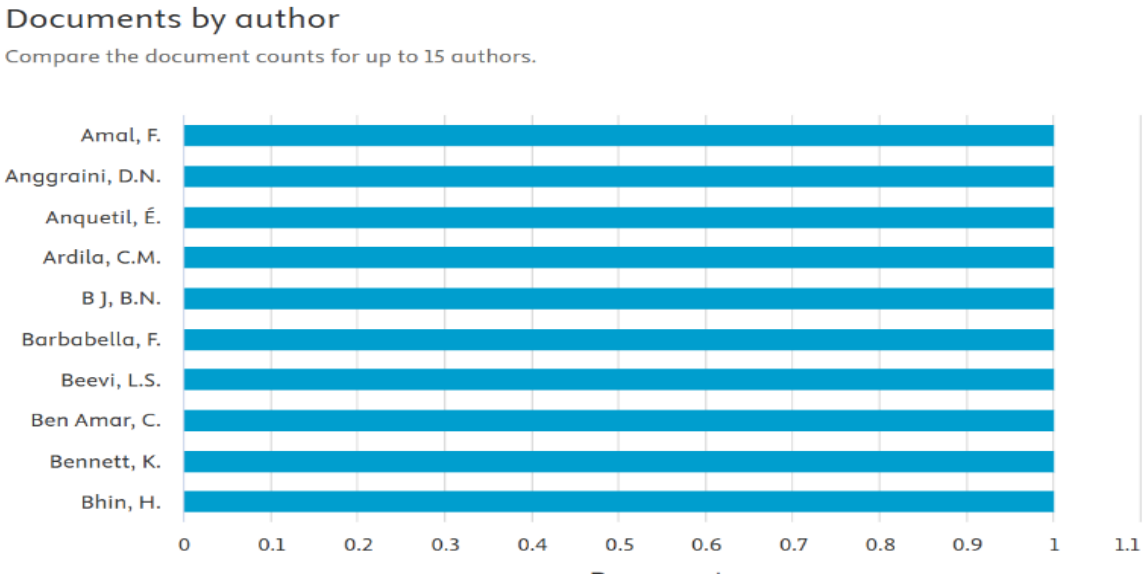

Figure 3. Comparison of the number of documents from 15 authors

Ten researchers have proven that learning with a deep learning approach provides a meaningful learning experience for students (Figure 3). Hadith teaching in Islamic boarding schools is carried out systematically by prioritizing deep learning of the sanad to verify the authenticity (validity) of the hadith. In addition, this learning focuses on the transfer of textual knowledge as well as the development of the character and spiritual values of students. Students are encouraged to actively discuss, understand the historical context, and apply hadith in their daily lives. This teaching method effectively preserves the tradition of hadith scholarship, maintains the authenticity of Islamic teachings, and strengthens students' belief in the truth [17].

Meanwhile, Anggraini D.N et al. [18] researched that changes in life values have caused a decline in the character quality of the global community, including the character of Indonesia's younger generation. Therefore, it is important to optimize character education through various learning media. In line with this statement, Anquetil et al. [19] stated that learning media greatly helps children in practicing copying writing in dictation tasks. Ardila et al. [20] argues that online videos help in the learning process as long as they are managed responsibly by users so that the comment section is filled with positive comments.

In addition to author distribution, the geographical origin of the selected studies was mapped to understand how research on deep learning and character education has developed across different national contexts.

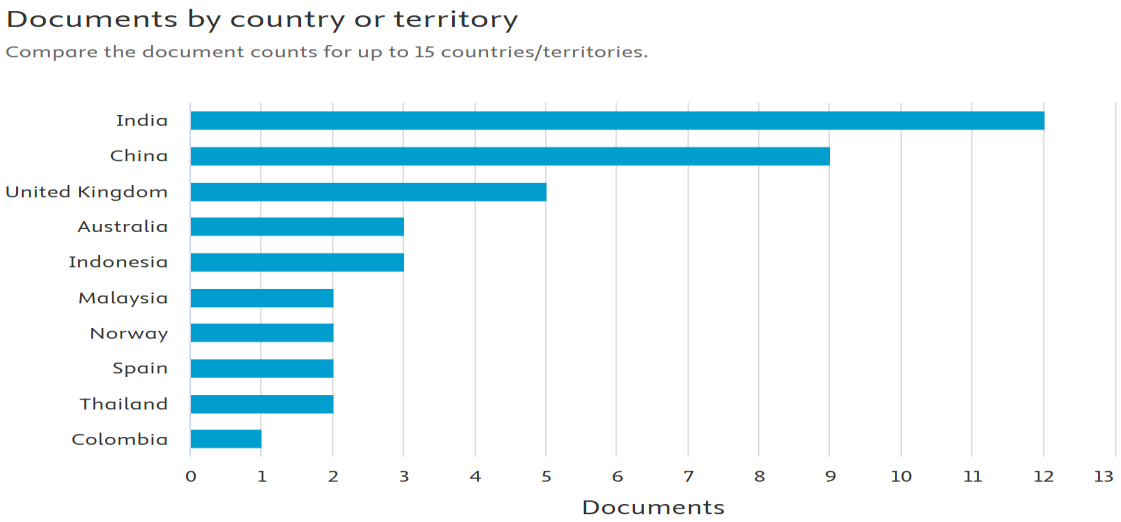

Figure 4. Plot of countries implementing deep learning approaches with written documents

Looking at the bar chart in Figure 4, it appears that ten countries have contributed to research on learning with a deep learning approach that focuses on student characteristics. The largest number of documents came from India with 12 articles. China ranked second with 9 articles. Meanwhile, the United States ranked third with 5 articles. Next were Australia and Indonesia with 3 articles. Malaysia, Norway, Spain, and Thailand contributed 2 articles each. Colombia contributed one article.

These countries have deep learning learning models that are similar on average, namely the use of technology to facilitate the transfer of knowledge in educating students. Various technologies are used, both simple and sophisticated. Beyond descriptive mapping, the reviewed articles were further synthesized to identify the dominant pedagogical orientations, forms of implementation, and character-related outcomes associated with deep learning in educational settings.

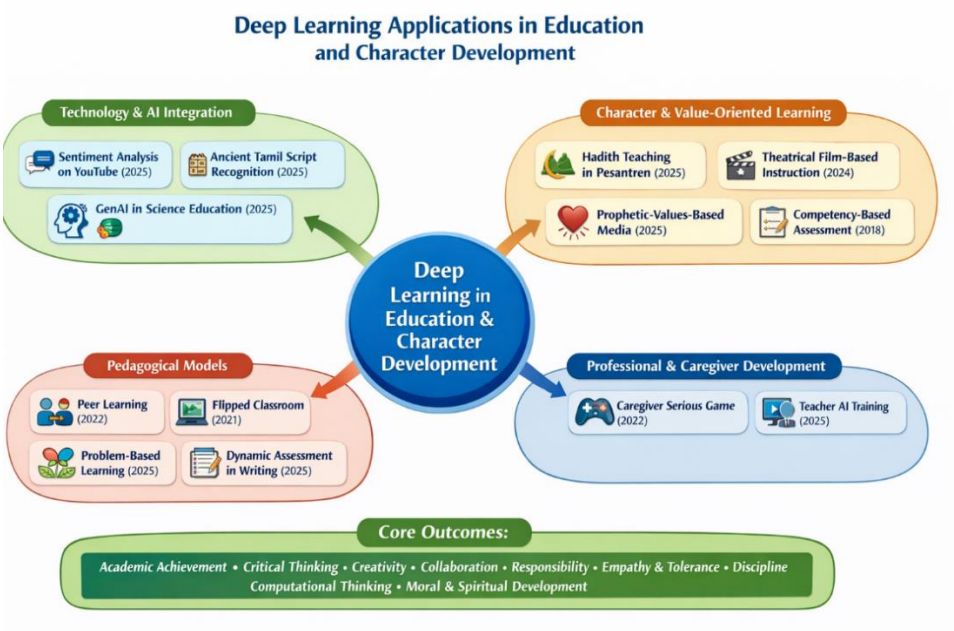

Figure 5. Mapping articles and findings relevant to the research

The figure 5 above shows deep learning approaches in education. These studies explain that deep learning approaches can be implemented in various ways as long as they include the principles of learning, namely focusing on the material (mindful learning), aligning with everyday life (meaningful learning), and being enjoyable (joyful learning).

In addition, learning media also plays an important role in helping students understand. Learning media in hadith learning, for example, is applied by boarding school teachers to their students through active discussions to verify the authenticity of a hadith.

Discussion

Learning can be done using various media, including online videos. It is important to note the use of positive words by online video users when writing in the comments section (Yadalam et al., 2025. Meanwhile, to express the richness of cultural heritage and historical knowledge of civilization, interpretation of ancient scripts is needed. This activity requires a deep learning approach. Its relationship with learning in elementary school is to present interesting material to students so that they do not get bored when translating foreign words [21].

The knowledge of educators influences the ability of students to understand the subject matter. Therefore, learning needs to be organized so that students focus on the material (mindful learning), can relate the material to their daily lives (meaningful learning), and find learning enjoyable (joyful learning) [22]. Meanwhile, Finbråten et al. [23] states that the use of concept cartoons accommodates various learning styles, encourages deep learning, and improves the learning environment.

Learning strategies with a deep learning approach can be implemented in the form of a flipped classroom. This strategy brings benefits and learning effectiveness. The competencies that emerge from this learning model include character building, collaboration, communication, citizenship, critical thinking, and creativity [24]. In line with this, Miguel et al. [25] states that the design of assessments to improve the quality of student learning is not only assessment of learning but also assessment for learning.

Theater films are increasingly being applied in the field of education. As a visual and situation-based learning tool, films can effectively convey abstract concepts, while increasing students' emotional resonance and enhancing deep learning. Through observation and imitation of the behavior of characters in films, students can develop problem-solving and creativity skills [26]. In addition, one concrete form of character education that is the focus of the deep learning approach is environmental education projects. Students are trained to be responsible, disciplined, and cooperative in creating learning resources together with guidance from teachers. The butterfly garden is an environmental education project where the Project Based Learning (PjBL) methodology is applied [27].

Learning media is developed using deep learning technology to help students understand the subject matter. For example, in IPAS (Natural and Social Sciences) learning, teachers can create learning media by taking material from the internet, not just from textbooks. Students are directed to search for information through the virtual world, of course with the cooperation of their parents [28]. It is important for students to be introduced to Computational Thinking (CT) because it is a problem-solving skill for the 21st century. This skill is not only for those working in the field of technology but also for everyone. The CT method is a problem-solving method that applies computer science techniques to formulate problems and solutions in a structured manner, which can be executed by both computers and humans. This is not just about coding, but about a way of thinking that encompasses four main pillars: decomposition

(breaking down problems), pattern recognition, abstraction (identifying important information), and algorithms (steps to solve problems)[29].

Based on the discussion, there are several topics that will be detailed into the following subtopics.

Deep Learning as a mechanism for internalizing values

The synthesis results show that deep learning does not directly teach moral values, but rather creates pedagogical conditions that allow values to be internalized naturally. Unlike normative approaches that emphasize the declaration of values, deep learning integrates values into meaningful activities.

This process in deep learning occurs through three stages, namely 1) deep cognitive engagement, 2) contextual experience, and 3) metacognitive reflection. In addition, the results show that there are three general patterns of implementation, namely contextual-based, structured reflection, and social collaboration. Contextual-based implementation will provide valuable experiences for students in authentic situations that require decision-making and responsibility. Meanwhile, structured reflection includes deep learning that requires the use of reflection journals, metacognitive discussions, and formative feedback. Social collaboration includes working together with clear roles and responsibilities.

The internalization of values occurs when students understand the relevance of learning to real life. Thus, character is formed as a consequence of learning experiences, not as a result of indoctrination. This character will be an implementation of a change in thinking style combined with the experiences and reflections received during learning.

In a case study, a student will change the positive behavior of a character who likes to bully because he uses logical thinking, cause and effect arising from the experiences of others due to bullying, and empathy from his logical thinking. Next, the student will reflect on the environment that caused him to become a victim of bullying. Then, he will make an effort to prevent or respond positively if he or his environment is bullied.

The Role of Metacognitive Reflection in Self-Regulation for Sustainable Learning Autonomy

Most of the articles analyzed show that structured reflection is a key component of deep learning. Reflection encourages students to 1) evaluate their thinking processes, 2) identify mistakes, and 3) adjust their learning strategies. This process contributes to the formation of self-regulated learning, which correlates with discipline, responsibility, and perseverance. These findings reinforce that self-regulation is the bridge between deep learning and character formation.

Furthermore, studies show that deep learning encourages learning autonomy. When students are given the space to determine strategies and solutions, they learn to manage their own time and responsibilities. The discipline that emerges is internal (self-discipline), not due to external control. This is important because effective character education should build self-regulation, not just obedience.

In a case study, for example, the teacher gave a simple project assignment: students were asked to adjust a drink recipe for different numbers of people. Before starting, students were asked to write down the strategies they would use. After finishing, they filled out a reflection sheet containing questions about their thought processes, difficulties encountered, and plans for improvement. One student realized that he had made a mistake because he had rushed and not double-checked his answers.

Through this reflection, the student learned to evaluate his thinking process, identify mistakes, and devise more effective strategies for the next task. At the next meeting, when given the freedom to choose a method of completion, he used a diagram to ensure his answers were more accurate. He also began to get into the habit of double-checking his work without being asked by the teacher.

This process shows that metacognitive reflection encourages the formation of continuous self-regulation. Discipline develops not because of external control, but because of an internal awareness to learn better. Thus, learning autonomy in elementary school students can grow through consistent reflection exercises in deep learning.

Social Collaboration as a Space for Character Building

Deep learning is often implemented through collaborative projects. In this context, students learn to: 1) Negotiate, 2) Share responsibilities, 3) Appreciate differences. These social interactions accelerate the formation of social characters such as empathy, tolerance, and integrity. Thus, character is not only formed individually, but through structured social dynamics.

For example, in a problem-based learning project, students were asked to design solutions to reduce plastic waste in the school environment. They were divided into several groups and each member had a different role, such as data researcher, campaign poster designer, report writer, and presenter. At first, there were differences of opinion regarding the solution to be chosen. One student insisted on using a digital campaign approach, while others proposed the creation of separate trash bins. Through a structured discussion process facilitated by the teacher, students learned to present arguments rationally, listen to their friends' views, and find common ground. Finally, they agreed on a combination of both solutions.

In this process, students not only practiced critical thinking and problem-solving skills, but also learned to negotiate, share responsibilities according to their roles, and respect differences of opinion. When one group member was late in completing their task, the group collectively reminded them in a supportive manner, rather than blaming them. This situation shows that character traits such as empathy, tolerance, responsibility, and integrity develop through real and structured social interactions. Thus, character building in the context of deep learning occurs through authentic collaborative experiences, not just through the verbal instilling of values.

Thus, deep learning serves as a meeting point between the cognitive and affective dimensions in education. The process of deep thinking that requires analysis, reflection, and meaning connection cannot be separated from the formation of attitudes and values in students. When learning is designed to encourage contextual exploration, reflective dialogue, and self-regulation, character building is no longer a separate agenda, but is inherently integrated into the learning experience. These findings confirm that character is not the result of declarative delivery of norms, but grows through meaningful intellectual engagement and reflective internalization processes. Therefore, deep learning-oriented educational transformation has the potential to present a learning model that integrates knowledge mastery and character building into a holistic and sustainable pedagogical ecosystem.

CONCLUSION

Deep learning integrates technological sophistication and human control. Students need to experience the learning process through three stages, namely understanding the material (mindful learning), being able to relate it to real life (meaningful learning), and enjoying it (joyful learning). Students are not simply left to enjoy the sophistication of technology, but must be accompanied by adults (teachers and parents). This is where character building comes in. Deep learning models in various countries are basically the same, namely PjBL, PBL, and CTL. These three learning models lead students to learn through three stages of the learning process (mindful learning, meaningful learning, and joyful learning). These three learning models strengthen character because they incorporate the values of mutual cooperation, discipline, independence, empathy, and responsibility. Therefore, every teacher must adapt to these developments in education. Teachers should not be confined by closed-minded thinking but must have an open mindset (growth mindset). Teachers must continue to learn and adapt to the times. Teachers must master the use of technology as part of learning with a deep learning approach because they are the ones who guide students to use technology wisely.

LIMITATIONS

This study is subject to several limitations. The review was confined to indexed journal articles published between 2016 and 2025 and retrieved through a specific search strategy using the terms “deep learning approach” and “character education”; consequently, relevant studies employing adjacent concepts such as meaningful learning, reflective learning, transformative learning, moral education, values education, or social-emotional learning may not have been fully captured. The exclusion of conference papers, book chapters, books, and other grey literature also means that practical innovations, policy-based initiatives, and locally grounded pedagogical practices may remain underrepresented. In addition, the reviewed studies varied considerably in terms of educational level, national context, instructional model, learning media, and character outcomes, which limits the extent to which the synthesis can be generalized across all educational settings. Since the study relied on thematic qualitative synthesis rather than meta-analysis, its findings should be interpreted as conceptual and interpretive, not as evidence of measurable causal effects. The strength of the synthesis is also dependent on the methodological quality and reporting clarity of the included studies. Therefore, future research should validate the conceptual relationship between deep learning, mindful learning, meaningful learning, joyful learning, and student character formation through classroom-based empirical studies, longitudinal designs, mixed-method approaches, or experimental research across diverse educational and cultural contexts.

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AUTHOR CONTRIBUTION

N.L. served as the principal author and was responsible for conceptualizing the study, formulating the research problems, developing the theoretical orientation of the review, and drafting the initial manuscript. M.S. contributed to the refinement of the Systematic Literature Review design, the development of the search strategy, the application of inclusion and exclusion criteria, and the organization of the PRISMA-based article selection process. K. contributed to data extraction, thematic coding, synthesis of the reviewed literature, and interpretation of findings related to deep learning and student character formation. N.L., M.S., and K. jointly discussed the analytical categories, reviewed the coherence of the results and discussion, revised the manuscript for academic clarity, and approved the final version of the article for publication.

CONFLICT OF INTEREST

"The authors declare no conflict of interest."

DECLARATION OF USE OF AI IN SCIENTIFIC WRITING

The authors used ChatGPT Plus during the preparation of this manuscript solely to improve language clarity, grammar, readability, and academic expression. The tool was not used to generate research data, conduct the literature search, determine the inclusion and exclusion criteria, perform the analysis, or formulate the scholarly interpretation of the findings. All intellectual content, conceptual arguments, methodological decisions, and final revisions were critically reviewed, verified, and approved by the authors. Therefore, the authors take full responsibility for the accuracy, integrity, and originality of the content presented in this manuscript.

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