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Deep Learning in the Formation of Students' Nationalist Attitudes

A Bibliometric Analysis Study

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ABSTRACT

This study addresses the limited role of deep learning in fostering students' national pride, as existing research largely emphasizes technical aspects of artificial intelligence rather than value-based education. This gap highlights the need for integrating national values and character development into deep learning research. The study aims to examine publication trends, research directions, and patterns of scientific collaboration related to deep learning and student nationalism in the digital era. A bibliometric approach was employed to analyze scholarly publications indexed in Google Scholar, Scopus, and Web of Science (WoS) from 2019 to 2025. The analysis focused on research growth, thematic connections, author productivity, and keyword co-occurrence to map the development of the field. The findings indicate a significant increase in publications during the early period, followed by a decline in recent years, suggesting a possible shift or saturation in research focus. The most frequent keywords identified were attitudes (228), teacher (120), and deep learning (96), alongside related terms such as value, artificial intelligence, critical thinking, university, and student learning. These results reveal that deep learning research remains predominantly oriented toward general technological and pedagogical applications, with limited emphasis on cultivating national values and pride. This study underscores the need for future research that integrates deep learning with value-based education to strengthen students' national awareness and character development in higher education contexts.

Keywords
Character Building
Deep Learning
Higher Education
Nationalism

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Introduction

The 21st century has transformed the world, as evidenced by the development of digital technology, which has fundamentally altered the way humans learn, think, and interact [1]. Higher education, as a platform for developing an intellectually gifted young generation, faces new challenges in instilling national values in an era of information overload and globalization [2],[3]. Students, as consumers of information seeking insight and knowledge, must actively participate in the digital age as producers of knowledge in cyberspace. Education has continued to advance and develop since the digital transformation, driving a shift from conventional to technology-based learning [4]. Deep learning emerged as a learning approach that integrates traditional learning systems with digital technology, fostering in-depth, reflective, and contextual thinking [5].

Deep learning has been used in colleges and universities for some time, but new ways of teaching have emerged alongside advances in computer technology and learning tools. Instead of just memorizing facts or learning ideas, students now learn more through activities [6],[7]. Deep learning helps students keep improving and avoid doing the same things over and over, pushing them to think in new and smarter ways when solving problems [8],[9]. With this approach, students not only build their thinking skills in class but also learn about social issues, build character, and understand national values in a complicated world.

Nationalism is a pattern for understanding a nation's collective identity [10]–[12]. However, in the current digital era, nationalism faces serious challenges, as evidenced by the phenomena of intolerance and social apathy in online spaces, which can threaten the resilience of national values. Students, as a generation of change, must be able to interpret nationalism not merely as a symbolic act but as a moral commitment and concrete action in life [13],[14]. Universities, as places of learning, need to integrate learning models that foster critical thinking, social empathy, and national responsibility [15],[16].

Nationalism provides students with a moral and ideological foundation as they help shape the nation in a fast-changing, competitive world [17],[18]. For students, nationalism is not just about loving their country. It also means being aware, working to keep unity, respecting diversity, and making real contributions to national progress. However, in reality, nationalism is not a concept that ends; it is dynamic and always requires conscious effort to be nurtured, maintained, and adapted to ongoing social and technological changes [19],[20]. This

challenge is increasingly severe amidst the rapid influence of external cultures, digital individualism, and shifting values resulting from the development of information technology [21].

The deep learning approach presents a learning strategy that connects reflective thinking patterns with the digital environment, thereby helping students better understand the meaning of nationalism [22],[23]. Deep learning, through critical, collaborative, and contextual thinking, enables students not only to understand national values as knowledge but also to internalize them into concrete attitudes and actions in social, academic, and digital life [24]. Several previous studies show that fostering nationalist attitudes in education often focuses on cognition. This is usually done through textbook discussion, without connecting to real-life experiences. Such methods miss opportunities to foster a deep sense of national identity. National values are often conveyed normatively and informatively, rather than through reflection and application that ignite patriotism in students' daily lives [25].

The deep learning approach offers a new perspective. It goes beyond transferring knowledge from educators to students. It encourages students to internalize national values through active involvement, the interpretation of experiences, and critical reflection on social reality [25],[26]. This turns learning from a doctrinal process into a dialogue among understanding, feeling, and action rooted in national consciousness. This research expands on limited studies of deep learning and nationalism, especially in higher education, which integrate technology, values, and national character.

This study analyzes the progression of research on deep learning and its influence on students' nationalist attitudes through a bibliometric approach. The analysis aims to provide a comprehensive overview of the application of deep learning technology to foster national awareness among the younger generation. The findings may inform the development of educational policies and strategies that integrate technological advancements with efforts to strengthen national character. This research contributes to the fields of education and technology, as well as to the cultivation of national character in a competitive, globalized digital era.

Material and Methods

This research uses a bibliometric analysis approach to systematically examine publication patterns, research development directions, and scientific collaboration networks derived from international academic articles and journals. According to Ahmid [27], this method enables researchers to understand the research landscape by analyzing quantitative data from the scientific literature. Consistent with Passas [28] perspective, bibliometric analysis uses statistical techniques to assess the dynamics of knowledge within a field, including measuring citation counts, author productivity, and collaborative relationships

between institutions and countries. This approach falls into the quantitative research category because it emphasizes the processing of objective, measurable numerical data [29].

Bibliometric analysis, known as scientometrics, maps the influence, interconnectedness, and relevance of a scientific work to the development of a particular discipline [30]. Through this analysis, researchers can identify trends in research themes, emerging topics, and journals that serve as reference centers in the field under study. This research focuses on reputable international publications that examine the application of deep learning in shaping student nationalism in higher education settings. By applying strict inclusion criteria and comprehensive literature selection, this study aims to describe the scientific map of the relationship between deep learning and nationalism, while also identifying the most prominent scientific contributions that enrich the discourse on character education in the digital era.

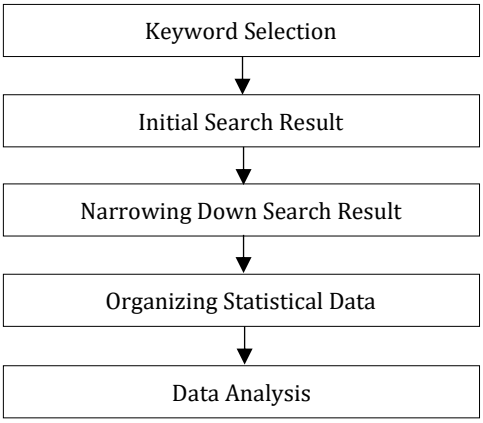


Fig. 1. Bibliometric Analysis Flow

Data collection in this study was conducted using Publish or Perish (PoP) software version 8.0. Data sources were drawn from three major scientific publication databases: Google Scholar, Scopus, and Web of Science, with the search period 2019–2025 and a maximum of 1,000 articles. The search focused on the keywords "deep learning," "nationalism," and "higher education" to ensure direct relevance to the research topic. All data obtained was stored in Research Information System (RIS) format for more efficient processing in subsequent analysis stages.

The data processing phase was conducted using Microsoft Excel and VOSviewer. Excel was used to organize and refine the CSV-formatted metadata, including correcting misspelled author names, completing keywords, and ensuring the abstract's relevance to the study topic. Next, data from various sources—primarily Google Scholar exports—was combined into a single, integrated database to avoid duplication and ensure the dataset's completeness.

The cleaned data were then imported into VOSviewer using the "read data from reference manager files" feature. In this stage, the researchers chose the binary counting

method for co-occurrence analysis, setting a minimum threshold for term co-occurrence to ensure the mapping remains relevant. The processing results produced three main types of visualizations: network, density, and overlay visualizations, each providing a different view of the structure of relationships among publications, topic density, and temporal trends in research.

The overall data analysis flow in this study followed a systematic bibliometric approach consisting of three main stages. First, the search stage, which involves collecting scientific publications using the PoP based on relevant keywords. Second, the selection and filtering stage, in which data is examined for relevance to the theme, year of publication, and document type. Third, the bibliometric analysis stage, conducted using Microsoft Excel for tabulation and VOSviewer for mapping scientific networks. This approach provides a comprehensive overview of the research landscape on deep learning and nationalism in higher education. Through a combination of quantitative bibliometric analysis and visual mapping, this study explored patterns of scientific collaboration, emerging thematic trends, and the position of previous research within the global scientific context.

Results

The research findings indicate that studies on deep learning and its role in shaping students' nationalist attitudes remain limited and have not yet become a primary focus in international scientific literature. Based on a bibliometric analysis, the majority of publications with the keyword "deep learning" focus on artificial intelligence (AI) technology, including algorithm development, data processing, machine vision, and the optimization of digital learning systems. Meanwhile, the integration of deep learning into character education, national values, and national identity has rarely been explored in depth. This limitation indicates a conceptual and thematic gap, where the term "deep learning" is understood more as a technological approach than as a pedagogical strategy that encourages reflective thinking and value formation. Bibliometric mapping results also show that the number of publications linking deep learning to national values is very small compared to those in science and technology.

The trend in publications on deep learning and its shaping of students' nationalist attitudes in higher education during 2019–2025 shows a marked increase. The bibliometric search revealed approximately 1,000 publications on this topic, reflecting the growing academic attention to integrating deep learning technology and strengthening national values. This increase signals a shift in research focus, where deep learning is increasingly understood not only as an artificial intelligence technology but also as a reflective learning approach with the potential to strengthen student nationalism in the digital age. Details of publication developments by year are shown in the following table.

Table 1. Publication Trends 2019-2025

Years	Publication
2019	115
2020	126
2021	136
2022	122
2023	148
2024	184
2025	169

Analysis of publication data from the Publish or Perish application for the 2019–2025 period shows an upward trend. At the beginning of the period, the number of studies on deep learning and the formation of students' nationalist attitudes increased significantly, particularly in the middle three quarters of the observation period. Publications increased from 148 to 184 articles, indicating that the integration of deep learning technology and strengthening national character is gaining increasing attention among academics. This trend illustrates that the deep learning approach is increasingly viewed not only as a technical aspect of artificial intelligence but also as a pedagogical tool for deepening national values, reflection, and awareness in higher education.

However, by the end of 2025, the number of publications had decreased slightly to 169 articles. This decline cannot be considered a decline in research interest but is more likely due to administrative factors, such as delays in indexing and data updates in international publication databases. Many articles are still in the publication stage or have not yet been fully registered in the analyzed data systems. The publication trend in this field still has potential to grow, given that interest in developing deep learning models grounded in national values is increasingly relevant to the needs of 21st-century education. The following is a summary of the publication trend diagram.

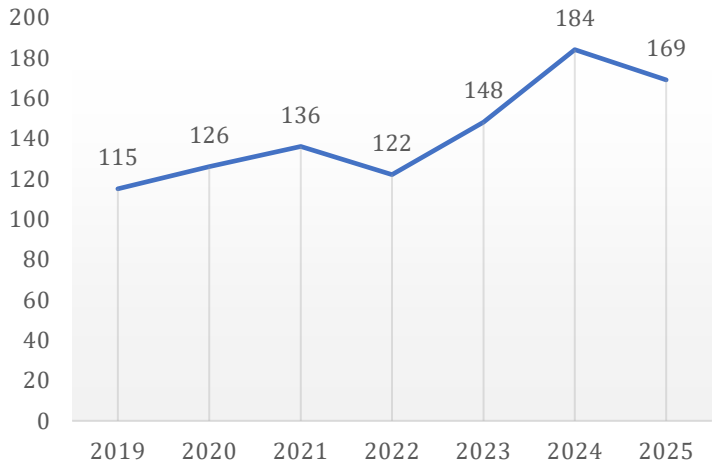


Fig. 2. Temporal Distribution Diagram of Publications

Fig. 2 shows that the trend in publications on deep learning shaping students' nationalistic attitudes in higher education increased steadily during 2019–2025. Since 2019, the number of studies has increased, peaking in 2023 and 2024, indicating growing interest in this topic among researchers. Although the number of publications decreased slightly in 2025, the level remains higher than in earlier years. This overall trend indicates a shift in research focus, from merely developing technology to applying deep learning to foster students' national values and character. Details of the distribution of citations during this period are presented in the following table to illustrate the influence and applicability of this research in subsequent studies.

Table 2. Publication Citation Trends

Year	TP	TC	NCP	H	G
2019	115	1408	234.67	23	36
2020	126	1145	229.00	18	32
2021	136	1010	252.50	17	30
2022	122	502	167.33	13	17
2023	148	480	240.00	11	19
2024	184	416	416.00	10	18
2025	169	65	65.00	4	7

Note:
TP: total of publications, **TC:** total citations, **NCP:** number of cited publications, **H:** h-index, **G:** g-index

Table 2 presents the dynamics of citation growth for publications on deep learning and student nationalism in higher education during the 2019–2025 period. At the beginning of the period, specifically in 2019, the number of cited publications (NCP) reached its highest value with 234.67 citations from 115 publications, reflecting a strong academic influence and serving as the initial foundation for research on this topic. However, in subsequent years, citations have declined despite continued increases in the number of publications. This phenomenon indicates that, while new research is emerging, it is not yet fully leveraging the results of previous research. In 2025, the citation rate dropped sharply to 65 citations with an H-index of only 4 and a G-index of 7, indicating a decrease in the intensity of citations to previous research. This condition indicates that, despite increased publication productivity, the relevance and interconnectedness of research remain weak, necessitating strengthening research continuity to deepen scientific influence in this field. The following table provides further details regarding publications and citations.

The study by Ferrer et al. [31] entitled "Students' Motivation and Engagement in Higher Education: The Importance of Attitude to Online Learning," has received 226 citations, demonstrating a significant impact on understanding student motivation and engagement in online learning. This study emphasizes that successful learning in digital spaces depends heavily on students' positive attitudes toward online learning, not just on the technology used.

Table 3. Top-Cited Research Trends (2019–2025)

Author's	Title's	Journal's	Number of Citations
Ferrer et al. [31]	Students' motivation and engagement in higher education: the importance of attitude to online learning	Higher Education	226
Tomlinson & Jackson [32]	Professional identity formation in contemporary higher education students	Studies in Higher Education	146
Alenezi [33]	Deep Dive into Digital Transformation in Higher Education Institutions	Education Sciences	129
Jivet et al. [34]	From students with love: An empirical study on learner goals, self-regulated learning and sense-making of learning analytics in higher education	The Internet and Higher Education	109
Wang & Chang Zhu [35]	MOOC-based flipped learning in higher education: students' participation, experience, and learning performance	International Journal of Educational Technology in Higher Education	98

Researchers highlight the crucial role of educators in creating adaptive, interactive, and inclusive digital learning environments that enable every student to feel emotionally and cognitively engaged. These findings reinforce the notion that meaningful learning experiences emerge from reflective interactions between learners and humanistically designed learning systems. Meanwhile, research by Tomlinson and Jackson [32] in their article "Professional Identity Formation in Contemporary Higher Education Students," which has been cited 146 times, highlights how professional identity formation is a crucial factor in students' readiness for the workforce. They explain that the strength and stability of self-identity influence students' self-confidence, emotional closeness, and their ability to navigate their intended career fields. These findings underscore that higher education aims not only to transfer academic knowledge but also to serve as a space for the formation of professional identity and character, which determine students' positions in society and the modern workplace. Previous research indicates that applying deep learning to foster students' nationalist attitudes has transformative potential for higher education, particularly in instilling national values in a more contextual and meaningful way for the younger generation. This approach not only deepens students' conceptual understanding of nationalism but also encourages them to internalize national values through critical reflection and active engagement in learning. Deep learning acts as a bridge between technological mastery and character building, presenting a new way to foster national awareness in the digital era, which is fraught with global identity challenges. The following table presents the most dominant keywords in the analyzed research.

Table 4. Dominant Topic Clusters

No	Term	Link	Strength	Occurence	Relevance Score
1	Attitudes	153	2790	228	0.7111
2	Teacher	140	1663	120	0.6152
3	Deep Learning	101	911	96	0.5298
4	Assesment	119	724	73	0.5241
5	Value	129	768	53	0.869
6	Artificial Intelligence	90	319	36	0.6726
7	Critical Thinking	88	388	35	0.4938
8	College Student	68	295	35	0.6141
9	Awareness	109	408	34	0.4616
10	Service Learning	45	272	33	12.521
11	Higher Learning Institution	27	114	15	10.964
12	Student Learning	49	168	13	0.9711
13	Academic Integrity	40	122	12	0.8702
14	Gamification	23	103	11	14.093
15	Digital Literacy	19	66	10	11.207

Table 4 shows that the three most frequently occurring keywords were deep learning, attitudes, and teacher. This indicates that learning methods and attitudes remain the primary focus of various related studies. The dominance of these three keywords indicates that deep learning is positioned not only as a technological innovation but also as a pedagogical strategy with the potential to shape students' affective dimensions. While the emergence of the term "assessment" reinforces the importance of attitude evaluation in modern learning processes, the term "value" appears less frequently, underscoring that the integration of deep learning with the formation of national values remains a minimally explored area of research. This keyword map identifies new research opportunities to deepen the relationship among artificial intelligence, value reflection, and student character development. A summary of the keyword-mapping results is shown in the following diagram.

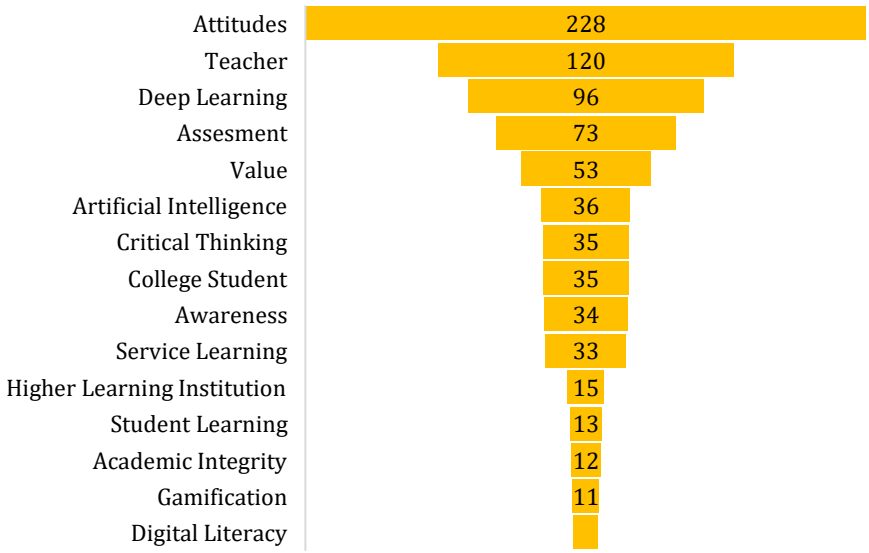


Fig. 3. Most Dominant Keyword Diagram

Fig. 3 shows that the keyword "attitudes" has the highest frequency in research on deep learning and the formation of students' nationalist attitudes, indicating that attitudes are the main focus of this study. This finding illustrates a shift in research direction from a purely technical to a humanistic approach that emphasizes the internalization of national values through deep learning. The Network Visualization results also identified 237 interconnected terms, demonstrating a strong relationship between deep learning, education, student engagement, and national identity, indicating the emergence of new academic interest in deep learning as a means of character building and national awareness in higher education environments. The following Network Visualization presents a map of the connections between keywords identified in the bibliometric analysis. The figure provides a more comprehensive understanding of the thematic relationships among terms frequently used in publications, while also indicating the direction of emerging research foci.

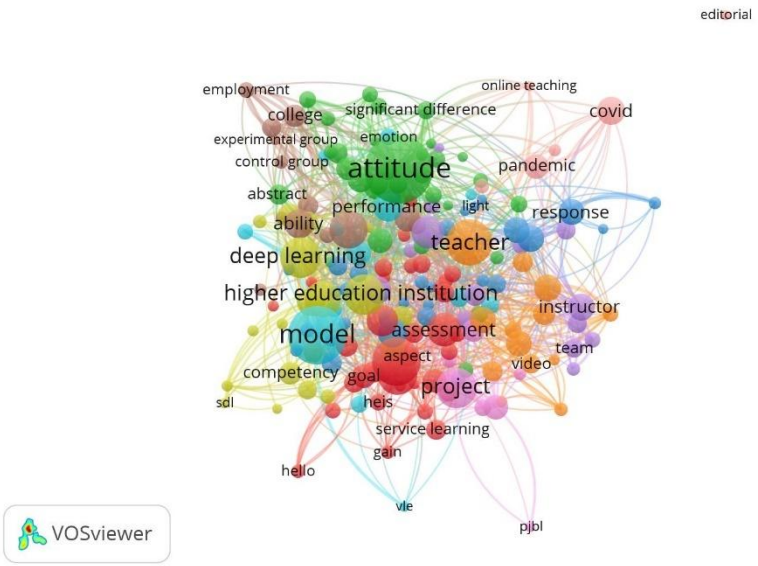


Fig. 4. Research Network Visualization Results

Fig. 4 shows the relationships among keywords frequently used in publications on deep learning and its role in shaping students' nationalist attitudes. Each cluster is marked with a different color, indicating a group of topics with related meanings and a specific research direction. Of the 184 keywords mapped into ten clusters, research appears to be concentrated in areas that are still predominantly technological. Cluster 1 (37 items) highlights issues such as academic integrity, access, and artificial intelligence, indicating a strong orientation toward academic ethics and the application of AI in education. Cluster 2 (31 items) contains terms such as attitude, abstract, and academic years, indicating attention to attitude formation and the context of formal learning. Cluster 3 (30 items) focuses on academic achievement and success, confirming the research trend linking deep learning to academic achievement. Clusters 4 to 10 cover topics such as student careers, academic culture, learning performance, lecturer

engagement, and online education during the pandemic. The relationships between keywords in the network map demonstrate that the integration of deep learning with national values remains peripheral and has not yet become a primary focus of research. This pattern opens up new space for academic exploration, positioning deep learning not only as an artificial intelligence technology but also as a reflective learning approach to fostering nationalism in higher education. The results of this research's overlay visualization are shown in the following image.

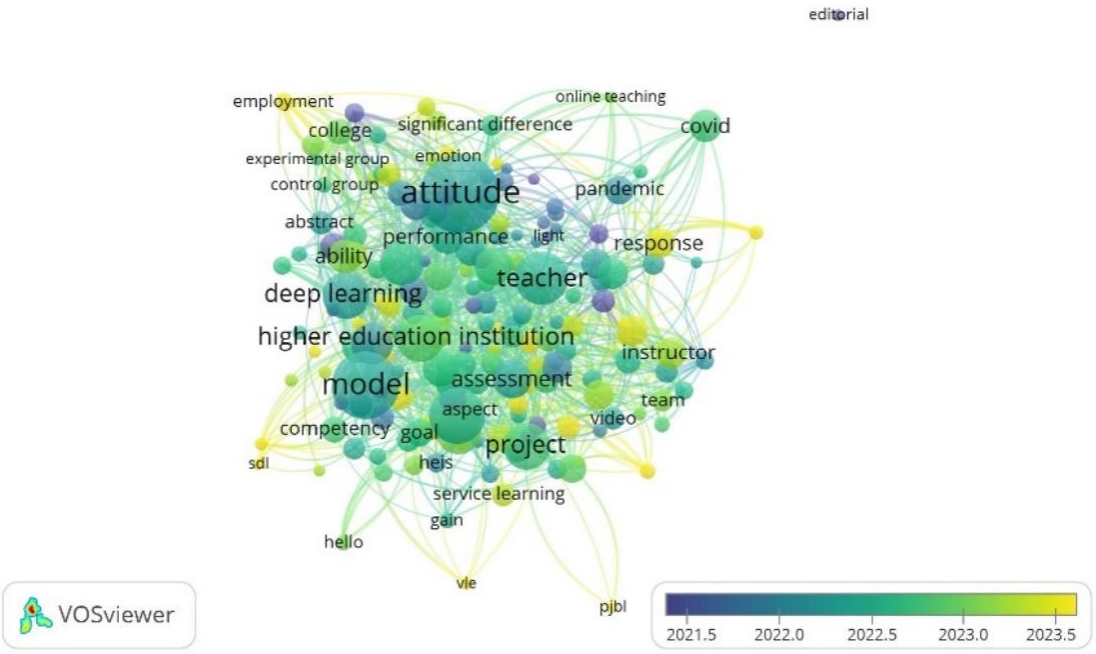


Fig. 5. Research Overlay Visualization Results

Fig. 5 presents an overlay visualization of the evolution of research on deep learning in shaping students' nationalistic attitudes in higher education. The colors on the map indicate the temporal dynamics of publication, with blue representing research from the early period (around 2021) and yellow representing newer, emerging topics through 2023. Keywords such as attitude, teacher, model, higher education, and project dominate the network, indicating that deep learning studies are largely focused on the development of learning models, attitude evaluation, and the role of educators in higher education contexts. Conversely, the emergence of terms such as pandemic, online teaching, and response demonstrates the strong influence of the COVID-19 era on deep learning practices in digital classrooms. However, terms directly related to nationalism have not yet become dominant, indicating that the integration of deep learning technology and the formation of national values remain underdeveloped areas. These results open up opportunities for further research that examines deep learning not only as a technological innovation but also as a strategic tool for instilling national awareness and character in the digital education era.

Discussion

In the modern educational landscape, the application of deep learning is crucial for fostering students' nationalism, representing a conceptual innovation that seeks to connect technological advances with national character values [36]–[37]. A bibliometric analysis was used to explore global research trends and map the extent to which deep learning is used to strengthen national values in higher education. Through this approach, it was identified that the topic remains underexplored and tends to focus on technical aspects such as algorithms, machine learning, and the development of artificial intelligence systems. The analysis revealed a conceptual gap between deep learning as a technology-based learning method and deep learning as a learning philosophy that emphasizes in-depth, reflective, and value-oriented thinking [38],[39]. This gap indicates the need for a paradigm shift in education so that technology becomes not merely a tool, but a vehicle for building students' national awareness.

Deep learning, in instilling national values, can be understood not merely as artificial intelligence but as a pedagogical approach that focuses on the internalization of values through meaningful learning experiences [40],[41]. This approach is still relatively new and has not been systematically implemented in university learning. Most national education still emphasizes memorization and cognitive assessment, while the reflective and affective dimensions—which should be the foundation for developing nationalism—are often neglected [42]. If implemented consistently, deep learning has the potential to transform students' understanding of national concepts, moving from mere knowledge to concrete action. This approach can foster a natural sense of ownership of national identity rather than mere indoctrination.

Deep learning, within the framework of developing an Indonesian educational paradigm, can be constructed based on three main pillars: meaningful learning, mindful learning, and joyful learning [43]. These three principles complement each other as the foundation for values-oriented learning. Meaningful learning guides students to connect theory with social reality; mindful learning guides them to learn with full awareness of the impact of national values; while joyful learning ensures the learning process takes place in a positive atmosphere and fosters intrinsic motivation [44]. When these three pillars are implemented in an integrated manner, learning not only produces intellectually competent graduates but also morally and emotionally mature individuals.

Higher education, as a center for the development of knowledge and national character, plays a central role in maintaining the sustainability of national values. Campuses are not only spaces for the transmission of knowledge but also arenas for the cultivation of critical awareness of national identity amid the currents of globalization [45],[46]. In its application, lecturers and institutions can design learning processes that emphasize social problem-solving,

value reflection, and cross-disciplinary collaboration to strengthen national pride. The challenge is to synergize digital technological advancements with the strengthening of humanitarian values so that they do not run counter to each other [47],[48]. Higher education must serve as a moral anchor, ensuring that innovation remains aligned with the nation's well-being.

Student nationalism is an expression of love for the homeland that is not merely embodied in national rhetoric but also reflected in critical thinking, social awareness, and concrete contributions to the nation's progress. Students act as drivers of change, bridging intellectual traditions with societal needs [49]. Students are expected not only to understand national history and culture but also to reinterpret these values to make them relevant to global challenges. Nationalism in the digital era must move beyond mere symbols and slogans to a reflective awareness that gives rise to concrete actions—such as maintaining academic integrity, participating in social activities, and utilizing technology to strengthen the nation's competitiveness [50],[51]. This attitude is a crucial foundation for students to maintain Indonesian identity amid globalization, which often erodes national boundaries.

Nationalism for a nation functions as an identity defense system that safeguards the sustainability of cultural values and moral sovereignty. Deep learning is a strategic approach to strengthening students' collective consciousness as the nation's next generation [52],[53]. Deep learning, as a profound and reflective learning approach, enables students to understand nationalism not as a political slogan, but as a conscious practice lived out in everyday actions—from thinking and behaving to contributing to society. Therefore, integrating deep learning into national education is not merely a methodological innovation but also a civilizational strategy to ensure that technological progress remains grounded in the noble values of the Indonesian nation.

Deep learning can be a strategic approach to instilling national values more deeply and sustainably. Unlike superficial learning models that merely transfer information, deep learning emphasizes the process of interpreting, reflecting, and applying values in real-life contexts [54]–[56]. Through this approach, students are not only encouraged to understand the concept of nationalism theoretically but also to internalize it through learning experiences that touch on emotional, social, and moral aspects. Collaborative projects, cross-cultural discussions, and community-based activities can serve as a medium to foster empathy and national responsibility. Deep learning serves not only as an academic method but also as a means of character development, enabling students to think critically, act consciously, and be oriented towards national progress without losing their sense of humanity and Indonesian identity.

Conclusion

The deep learning approach to developing students' nationalist attitudes in higher education is a conceptual strategy that seeks to bridge the gap between knowledge mastery and the strengthening of national character. This in-depth, understanding-oriented learning not only teaches students to master concepts but also guides them in interpreting the meaning of national values in academic and social contexts. This study, through bibliometric analysis, traces the dynamics of publications on this topic over time, showing an increasing trend until 2024, followed by a decline in 2025. This decline indicates that studies on integrating deep learning and nationalism still face limitations in developing applicable models in higher education. These results open new avenues for exploration, broadening the research focus to emphasize not only the cognitive aspects of technology but also its affective and moral dimensions.

The implications of this research underscore the need to develop a deep learning model grounded in national values and tailored to the character of Indonesian students. The developed model goes beyond instilling nationalism to also strengthen national insight, tolerance, and the spirit of Pancasila as the embodiment of the Indonesian student profile. The application of values-based deep learning can lay the foundation for more reflective, collaborative, and humanity-oriented learning. Through this integration, universities can play a more active role in developing a generation that excels not only intellectually and digitally but also possesses strong character, national awareness, and is capable of maintaining national integrity and unity amidst the challenges of globalization.

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Conflict of Interest

The authors declare no conflict of interest.

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