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Phenomenon-based learning: a bibliometric analysis towards future-ready education

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ABSTRACT

The transformation of 21st-century education demands an approach that integrates knowledge, technology, and real-world contexts to foster critical thinking and collaboration, positioning Phenomenon-Based Learning (PhBL) as an innovative model that links authentic experiences with conceptual understanding. This study aims to map and analyze global developments, thematic directions, and digital integration in PhBL research. The method used is a bibliometric approach to 352 Scopus-indexed publications from 1982 to 2024, with performance and science mapping analysis using VOSviewer software. The results show a significant increase in PhBL publications after 2016, peaking in 2024, indicating the growing relevance of this approach in contextual and technology-based learning. Keyword co-occurrence analysis identified five main clusters that describe the paradigm shift in PhBL from human-centered pedagogy to digitally integrated learning. These findings suggest that PhBL has developed into an interdisciplinary framework that integrates pedagogy and technology while addressing Indonesia's priority education issues, including climate change, health education, and financial literacy. In conclusion, PhBL is a promising learning innovation for realizing meaningful, adaptive, and sustainable learning in facing the challenges of 21st-century education.

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ABSTRAK

Transformasi pendidikan abad ke-21 menuntut pembelajaran yang mengintegrasikan pengetahuan, teknologi, dan konteks nyata untuk mengembangkan berpikir kritis dan kolaborasi, dengan Phenomenon-Based Learning (PhBL) sebagai model inovatif yang menghubungkan pengalaman autentik dan pemahaman konseptual. Penelitian ini bertujuan untuk memetakan dan menganalisis perkembangan global, arah tematik, serta integrasi digital dalam riset PhBL. Metode yang digunakan adalah pendekatan bibliometrik terhadap 352 publikasi terindeks Scopus periode 1982–2024 dengan analisis performance dan science mapping menggunakan perangkat lunak VOSviewer. Hasil penelitian menunjukkan peningkatan signifikan publikasi PhBL setelah tahun 2016 dan mengalami puncak publikasi tahun 2024, menandakan meningkatnya relevansi pendekatan ini dalam pembelajaran kontekstual dan berbasis teknologi. Analisis keterkaitan kata kunci mengidentifikasi lima klaster utama yang menggambarkan pergeseran paradigma PhBL dari pedagogik yang berpusat pada manusia menuju pembelajaran yang terintegrasi secara digital. Temuan ini menunjukkan bahwa PhBL berkembang menjadi kerangka pembelajaran interdisipliner yang mengintegrasikan pedagogik dan teknologi serta relevan dalam menjawab isu prioritas pendidikan Indonesia, yakni perubahan iklim, kesehatan, dan literasi finansial. Kesimpulannya, PhBL merupakan inovasi pembelajaran yang prospektif untuk mewujudkan pembelajaran bermakna, adaptif, dan berkelanjutan dalam menghadapi tantangan pendidikan abad 21.

Kata Kunci: *pembelajaran berbasis fenomena; pembelajaran kontekstual; pendidikan masa depan*

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INTRODUCTION

The transformation of education in the 21st century is characterised by a paradigm shift in learning that increasingly emphasises the interconnection between science, technology, and real-life contexts. When combined with Phenomenon-Based Learning (PhBL), Gen AI technology can significantly improve students' ability to create scientific explanations and provide insights for advancing technology-enhanced science education (Ratniyom et al., 2025). The 21st-century curriculum must incorporate AI to foster critical thinking and practical problem-solving skills through an interdisciplinary approach (Jaramillo & Chiappe, 2024). Experience-based learning allows students to apply what they have learned in class to real-world situations. This escalates student motivation and engagement in the learning process (Kong, 2021). One of the most prominent models is PhBL, which has its roots in the Finnish education system and emphasizes interdisciplinary learning based on real-world phenomena.

In developing countries, including Indonesia, educational challenges go beyond improving literacy and numeracy to include students' ability to think more critically and respond to problems. Empirical studies in the Indonesian context demonstrate that PhBL-oriented instructional and assessment approaches effectively enhance students' critical thinking, engagement, and competency development (Santoso et al., 2023). For instance, project-based assessment combined with a PhBL approach was found to significantly improve elementary school students' achievement of the Pancasila Student Profile, demonstrating the potential of PhBL to support contextual and value-based learning outcomes (Widiana et al., 2023). In a similar vein, PhBL-focused project-based learning assessments were found to be successful in enhancing students' mathematical computational thinking abilities, underscoring the significance of PhBL for cultivating 21st-century skills in digitally mediated learning environments (Dewi et al., 2024). Global efforts to strengthen contextual, sustainable, and real-issue-based learning are now one of the top priorities in education policy. The application of PhBL enhances students' critical thinking skills (Pratiwi et al., 2021). A critical review of the implementation of PhBL in Finland shows that real-issue-based phenomenon learning is at the core of an interdisciplinary approach (Schaffar & Wolff, 2024).

Although research on PhBL continues to evolve, most studies still focus on pedagogical applications in specific contexts, while comprehensive analyses mapping global trends in this research remain limited. Furthermore, the relationship between PhBL and technological phenomena such as AI, deep learning, and digital learning systems is rarely systematically explored using a bibliometric approach. This indicates a need to understand the evolution of PhBL research from a broader perspective, encompassing both humanistic and technological dimensions in the context of 21st-century learning.

In this context, the purpose of this study is to use a data-driven bibliometric approach to examine trends, patterns, and the effects of PhBL in the Scopus database from 1982 to 2024. Through co-occurrence, overlay, and density visualization analysis using VOSviewer software, this study aims to explain how PhBL has developed into a humanistic learning paradigm that can adapt to 21st-century technological changes, as well as to present a conceptual map of PhBL in relation to contextual learning and digital phenomena.

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LITERATURE REVIEW

Phenomenon-Based Learning (PhBL)

Mattila and Silander, in their book entitled "*How to create the school of the future: revolutionary thinking and design from Finland*" explain that PhBL is a learning model developed in Finland, in which students learn about real-world phenomena through an interdisciplinary approach. Holistic real-world phenomena serve as the foundation for learning in PhBL and instruction. Instead of separating knowledge into subjects, PhBL integrates various fields to answer specific questions or problems. With this model, students are more active in constructing knowledge and have meaningful learning experiences. PhBL promotes interdisciplinary inquiry among educators and students, challenging conventional educational paradigms (Kennedy, 2023).

Interdisciplinarity helps to understand complex phenomena from various perspectives, highlighting the complexity of this process. Teachers are essential in helping students make the shift from old to new ideas. Constructivism and phenomenon-based education have a complicated relationship. In constructivism, teachers still have duties even when students' comprehension is autonomous. This method aligns learning techniques with the interconnectedness of real-world situations, thereby increasing student engagement and comprehension (Jongyung, 2025). PhBL's all-encompassing methodology, which emphasizes cooperation and shared accountability, is a viable approach to education in a world confronting difficult problems (Schaffar & Wolff, 2024). The new PhBL model is seen as an alternative pedagogical approach to provide a nurturing learning environment where students can thoroughly evaluate and research real-life problems. PhBL helps students develop essential skills such as critical thinking, collaboration, and communication. These skills are crucial for success in the modern workforce (Kennedy, 2023).

In PhBL, educators empower students to take initiative, utilizing natural learning moments. For each distinct learning situation, teachers must make nuanced choices regarding objectives, strategies, and competencies. Finland's achievements serve as a reminder of the value of qualified teachers. Offering adaptable, relevant, and multidisciplinary education, PhBL represents a paradigm shift. Success stories from nations such as Finland, Thailand, Norway, and Vietnam demonstrate gains in critical thinking and reading skills. This method prepares students to successfully address real-world issues by fostering holistic skills such as problem-solving, creative thinking, and metacognition (Adipat, 2024). Education Finland states that the goal of PhBL is to prepare students to face real-world problems in an active learning environment using a variety of discovery methods. Since PhBL necessitates in-depth interdisciplinary understanding, strong facilitation of inquiry, and familiarity with less-structured learning situations, teacher preparation is equally important. Teachers may adopt PhBL superficially or return to conventional techniques if they are not properly trained (Saberi & Nouri, 2025).

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Contextual-Based Learning (CTL)

The CTL approach involves students actively in the learning process, uncovering concepts through their own knowledge and experiences. The theoretical foundations of CBL include constructivist theories, which posit that learners construct knowledge through active engagement and reflection (Nassim et al., 2025).

Research confirms that CTL can improve students' mathematical literacy by presenting material relevant to their lives, thereby encouraging more meaningful thinking (Amidi et al., 2025). The CTL approach is a successful teaching method for raising the standard of Indonesian language instruction in elementary schools overall (Putri et al., 2025). Students' critical thinking skills in reaction rate issues were greatly improved using the CTL paradigm (Arwin et al., 2025). These findings align with previous research showing that CTL significantly improves junior high school students' critical thinking skills through learning activities that require the analysis and application of concepts in real-world contexts (Mallika, 2024).

CTL is a versatile and effective educational approach that enhances student engagement, understanding, and application of knowledge. The application of CTL proved effective in improving students' conceptual understanding and critical thinking skills by linking learning materials to real-life contexts. It is recommended that further research apply the CTL model to other subjects and combine it with digital technology to support mastery of 21st-century skills (Ratnaningsih & Triwahyuni, 2025). By connecting learning material to real-world contexts, CBL helps students construct meaningful knowledge and develop essential skills for their academic and professional lives.

METHODS

This research uses a bibliometric approach to map and analyze the development of research on PhBL, a form of contextual learning innovation, using Scopus-indexed publications from 2024. Bibliometric analysis is a systematic study of scientific literature to identify patterns, trends, and impacts in a particular field (Passas, 2024). The Scopus database was chosen as the primary source because of its wide coverage and high reputation as a curated, reliable scientific repository (Baas et al., 2020). The search was conducted using the formula TITLE-ABS-KEY((“phenomenon based learning” OR “phenomenon based educ*”) AND (“contextual learning” OR “contextual based learning”)) and produced 352 documents in the form of journal articles and conference papers that met the inclusion criteria. The analysis in this study focused on two main stages. The first stage was bibliometric mapping, which was used to assess research trends, author productivity, and collaboration patterns in publications on PhBL. The second stage was keyword correlation analysis, which aimed to identify research groups and understand the main themes developing in the context of contextual learning. The bibliometric analysis steps in this study, as shown in the figure, consist of five steps.

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Figure 1. Bibliometric Analysis Procedure
Source: Adeoye et al. (2023)

Step 1: Defining Search Keyword

Determining pertinent search terms for the research topic is the first stage. The research's focus on PhBL in the context of contextual learning and educational innovation is reflected in the chosen keywords. The search formula used in the Scopus database is TITLE-ABS-KEY((“phenomenon based learning” OR “phenomenon based educ*”) AND (“contextual learning” OR “contextual based learning”)). The selection of this keyword combination aims to reach publications that discuss PhBL and its application in real-world learning.

Step 2: Initial Search result

The second stage involved an initial search of the Scopus database using the above keywords. Scopus was chosen because it has broad coverage and a high reputation as a curated scientific repository (Baas et al., 2020; Pranckutė, 2021). The search was conducted in October 2025, covering publications from 1982 to 2024. The initial search results yielded a number of documents, which were then reviewed for relevance.

Step 3: Data Refinement

The third stage is data refinement and harmonization to ensure the dataset used is valid and consistent. Several specific criteria were established to obtain suitable documents. First, the title, abstract, or keywords contained the terms “phenomenon-based learning” or “phenomenon-based education,” including related terms such as “contextual learning” or “contextual-based learning.” Second, the documents were written in English. Third, the documents were from journal articles, conference proceedings, reviews, or book chapters. Fourth, the documents were published between 1982 and 2024. Systematically, document selection was carried out in four stages: (1) identification, (2) screening, (3) eligibility, and (4) inclusion. After the screening process, 352 English-language documents related to PhBL published between 1982 and 2024 were identified.

Step 4: Compiling the initial data statistic

The fourth stage is the compilation of basic bibliometric data from the search results. The dataset is downloaded in CSV (Comma-Separated Values) format, which includes metadata such as author names, publication year, affiliations, keywords, and the number of citations. This data is then used to perform a performance analysis, which assesses the number of publications per year, the journals that publish the most, the main contributing countries, the types of documents published, and the distribution of institutional affiliations. This

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analysis provides an overview of the productivity and scientific impact of PhBL research (Aria & Cuccurullo, 2017; Zupic & Čater, 2015).

Step 5: Data analysis

The fifth stage is data analysis, which comprises two main dimensions: performance analysis and science mapping. The analysis was conducted using VOSviewer software to display performance analysis and science mapping. VOSviewer demonstrates the potential of this program for text network analysis across a variety of domains and is a formidable tool for visualizing text data (Bukar et al., 2023). Performance analysis was used to assess research productivity, while science mapping was conducted to map the research's conceptual structure using keyword co-occurrence analysis. This analysis aimed to identify the main themes and conceptual clusters that developed in research on PhBL. The results of the analysis were interpreted descriptively to understand the direction of evolution, intensity of collaboration, and patterns of PhBL research development in the context of contextual learning innovation.

RESULTS AND DISCUSSION

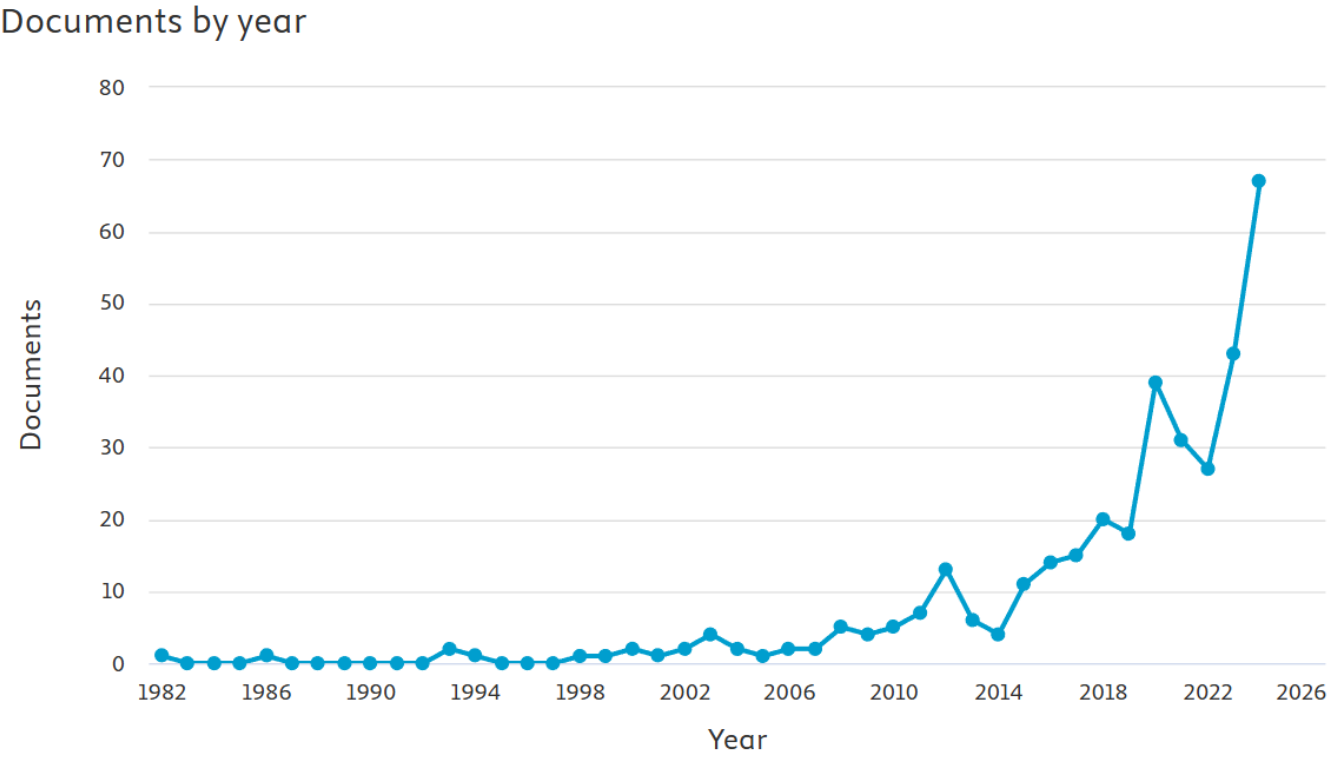

Figure 2. Annual publication trends 1982-2024
Source: Scopus Database, 2024

The figure shows the trend in research publications related to PhBL from 1982 to 2024. In general, publications in the 1980s to early 2000s were still very limited. Starting in 2010, the number of publications increased gradually, and a significant surge occurred after 2016 in line with the growing attention to contextual learning and phenomenon-based

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pedagogical innovation. The highest peak was in 2024, with 67 documents published, indicating that PhBL has become an increasingly popular and relevant research topic in the global education landscape, which emphasizes context-based learning.

Table 1. Bibliometric Overview of Publications by Country, Document Type, and Affiliation

No	Type	Description	Documents
1	Documents by Country or Territory	China	90
		United States	83
		United Kingdom	29
		Germany	18
		India	16
		Indonesia	15
		Italy	15
		Australia	12
		Canada	11
		France	11
2	Documents by type	Articles	264
		Conference paper	86
		Book Chapter	14
		Review	12
		Conference review	5
		Book	1
		Short survey	1
3	Documents by affiliation	Chinese Academy of Sciences	7
		Zhejiang University	4
		National University of Singapore	4
		University of Science and Technology of China	4
		University of Colorado Boulder	3
		Shenzhen University	3
		The City University of New York (CUNY)	3
		Northwestern University	3
		Standford University	3
		Oulun Yliopisto	3

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No	Type	Description	Documents
4	Documents per year by source	Lecture Notes in Computer Science Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics	12
		Journal of Image and Graphics	6
		Plos One	6
		IEEE Access	5
		IEEE Transactions on Geoscience and Remote Sensing	5
		ACM International Conference Proceeding Series	4
		Journal of Physics Conference Series	4
		BMC Bioinformatics	3
		Frontiers in Psychology	3
		IEEE Journal of Biomedical and Health Informatics	3

Source: Scopus Database, 2025

The graph shows the distribution of PhBL publications by source from 1998 to 2024. Until 2018, publications were still limited and dominated by proceedings such as Lecture Notes in Computer Science. Since 2019, publications have begun appearing in various new sources, including IEEE Access, PLOS One, and ACM Proceedings. The surge in 2023–2024, particularly in IEEE Transactions on Geoscience and Remote Sensing, indicates an increase in interdisciplinary interest in this topic.

The table shows the distribution of research publications on PhBL and contextual learning across the 10 countries with the highest numbers of publications. China ranks first with 90 publications, followed by the United States with 83 publications. These two countries are the main centers of global research on PhBL and play an important role in expanding the application of PhBL approaches in various educational contexts. The United Kingdom ranks third with 29 publications, followed by Germany with 18, and by India and Indonesia, each with 16 publications. Italy has also contributed 15 publications, Australia 12, and Canada and France 11 each. This pattern shows that research on PhBL and contextual learning has now developed globally, with the main centers of research activity located in East Asia and North America, and increasing participation from Asian countries such as Indonesia and India.

The table shows the distribution of document types regarding PhBL in the Scopus database. Publications are dominated by scientific articles, with 237 documents, or about 67.3 percent of the total, indicating that this topic is mostly studied through formal research in reputable journals. The next most common type of document is conference papers, with 86 publications (24.4%), reflecting academics' enthusiasm for presenting PhBL research results in international scientific forums. In addition, there are 12 book chapters (3.4%), 10 review publications (2.8%), and 5 conference review publications (1.4%). Meanwhile, publications in the form of books and short surveys only amount to one document each. This composition shows that research on PhBL is still dominated by empirical approaches published in scientific journals. However, it has begun to develop in other forms of scientific dissemination, such as proceedings and academic books.

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Distribution of research publications on PhBL and contextual learning based on the authors' institutional affiliations. The Chinese Academy of Sciences ranks first with 7 publications, making it the most productive institution in PhBL-related research. Next are Zhejiang University, National University of Singapore, and University of Science and Technology of China, each with 4 publications, demonstrating the active involvement of higher education institutions in East Asia in developing phenomenon-based studies. Meanwhile, the emergence of several American universities, such as the University of Colorado Boulder, Shenzhen University, CUNY, Stanford University, and Northwestern University, indicates that PhBL is strongly integrated with the traditions of inquiry-based and project-based learning in the United States (Walker & Nouri, 2025). Overall, this distribution of affiliations indicates that PhBL research is developing in global research centers that emphasize curriculum innovation, contextual learning, and the integration of real-world phenomena.

This section presents the results of a bibliometric keyword analysis using VOSviewer. This visualization aims to illustrate the structural and temporal relationships among keywords that frequently appear in the literature on PhBL. This analysis covers three dimensions: keyword co-occurrence, chronological overlap of keyword occurrence, and keyword usage density. These three visualizations have been combined into a single comprehensive image to provide a holistic view of keyword distribution.

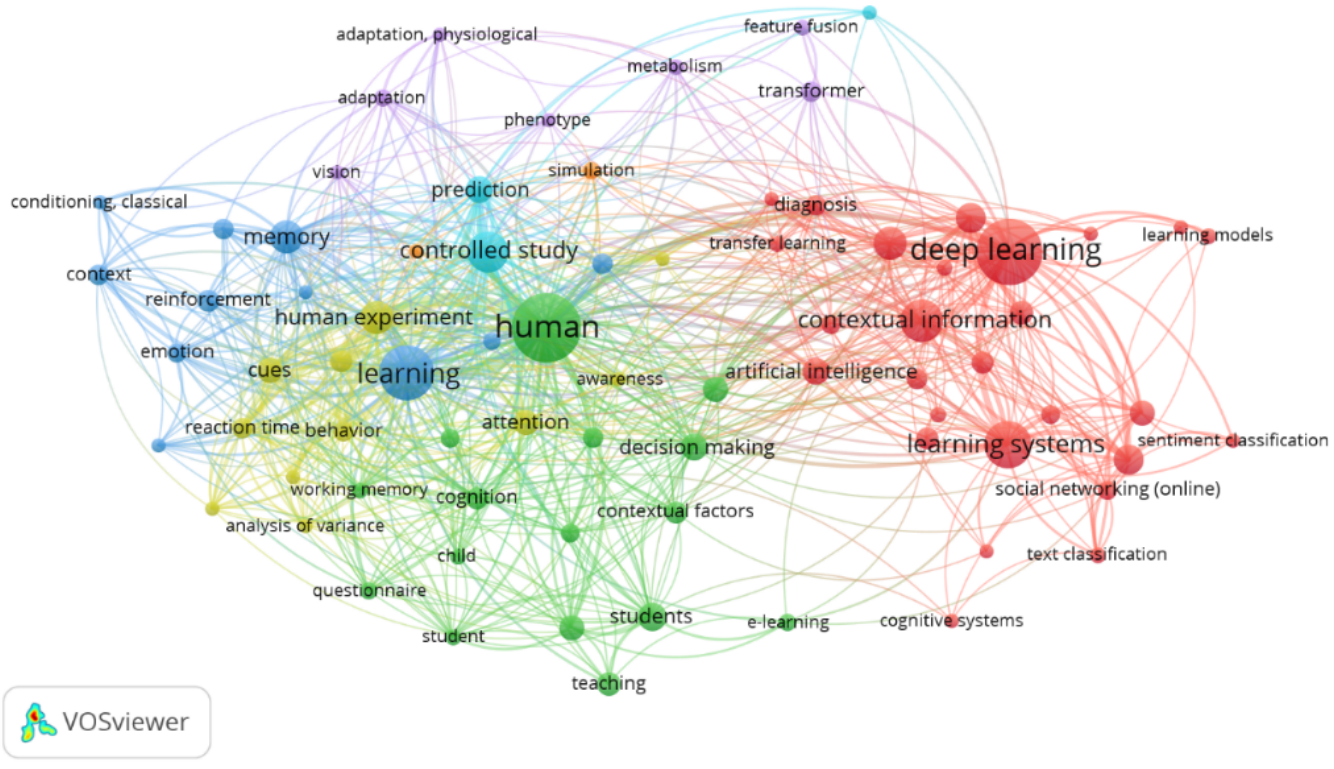

Figure 3. Composite Visualization of Keyword Networks: Co-occurrence.
Source: VOSviewer Analysis Result, 2025

The results of keyword co-occurrence analysis using VOSviewer show that this research. The map's visual structure shows five large, interconnected clusters that illustrate the interrelationships among the human, psychological, and technological dimensions of 21st-

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century education. At the center of this network are two dominant and interrelated concepts: "learning" and "human," which serve as the core of this research's thematic landscape. These two terms are surrounded by sub-themes such as students, teaching, motivation, decision making, and contextual factors, which reflect the pedagogical roots of PhBL in developing contextual understanding, cognitive engagement, and the active role of learners. Spreading out from this center, clusters containing keywords such as "deep learning," "learning systems," "contextual information," and "artificial intelligence" indicate new thematic domains in which technological advances are not only seen as tools, but also as educational phenomena in themselves. The relationship between AI, contextual learning, and social networking (online) indicates how the digital environment is increasingly becoming a medium for collaborative and contextual learning. This visualization confirms that PhBL research is evolving from a human-centered pedagogical perspective toward integration with the digital context and technology, indicating that learning in the 21st century now encompasses both human and artificial dimensions.

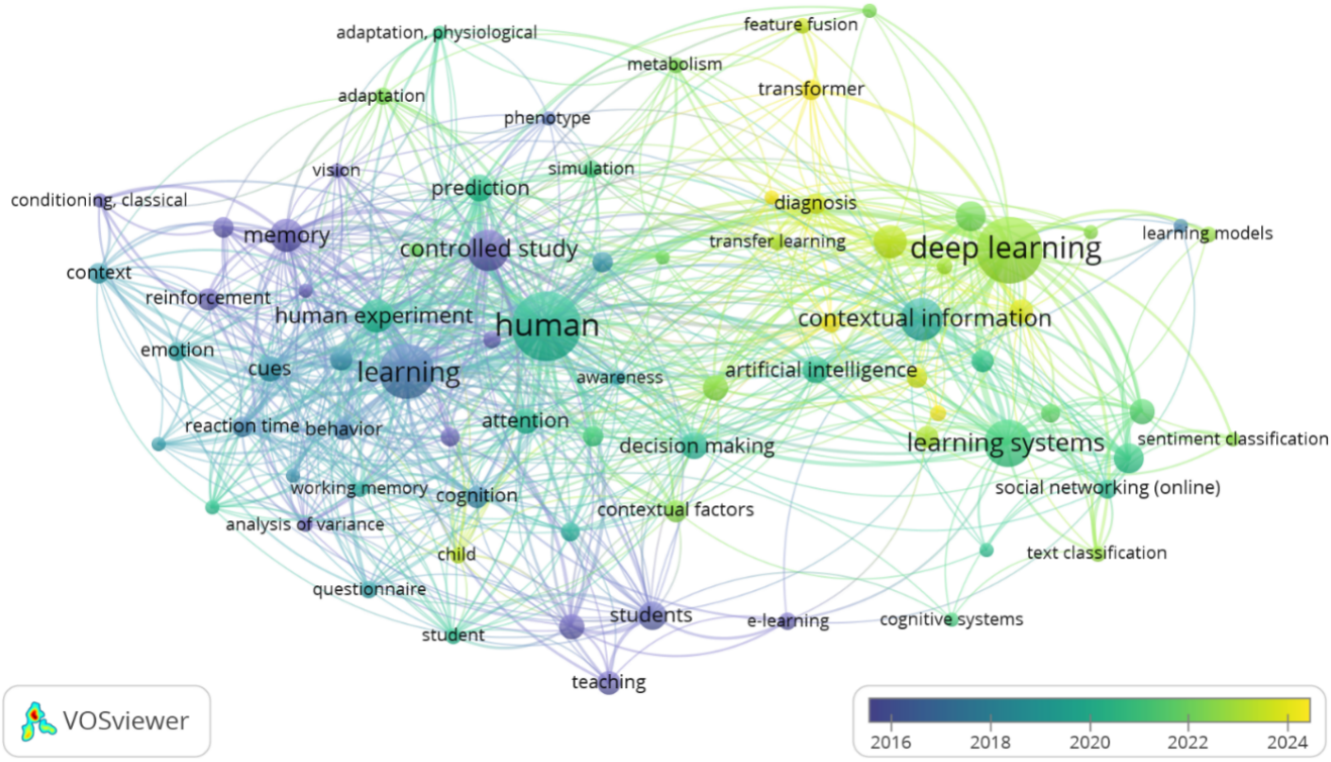

Figure 4. Composite Visualization of Keyword Networks: Co-occurrence, Overlay by Year, and Density Map
Source: VOSviewer Analysis Result, 2025

The overlay visualization map shows the temporal evolution of this research from 2016 to 2024. In the early period, marked in blue, the research focused on human-centered and cognitive themes such as learning, students, memory, and teaching. Over time, the research's focus shifted towards digital and contextual learning dimensions, reflected in the emergence of keywords such as e-learning, contextual factors, and decision-making in the 2019–2021 period. In the current period (2022–2024), marked in yellow, new themes such as deep learning, artificial intelligence, learning systems, and contextual information have emerged, indicating a paradigm shift in which technological advances are now part of the

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learning phenomenon itself. This evolution shows that PhBL has transformed from a pedagogical and psychological approach to integration with digital, social, and technological phenomena that influence how humans learn in the 21st century.

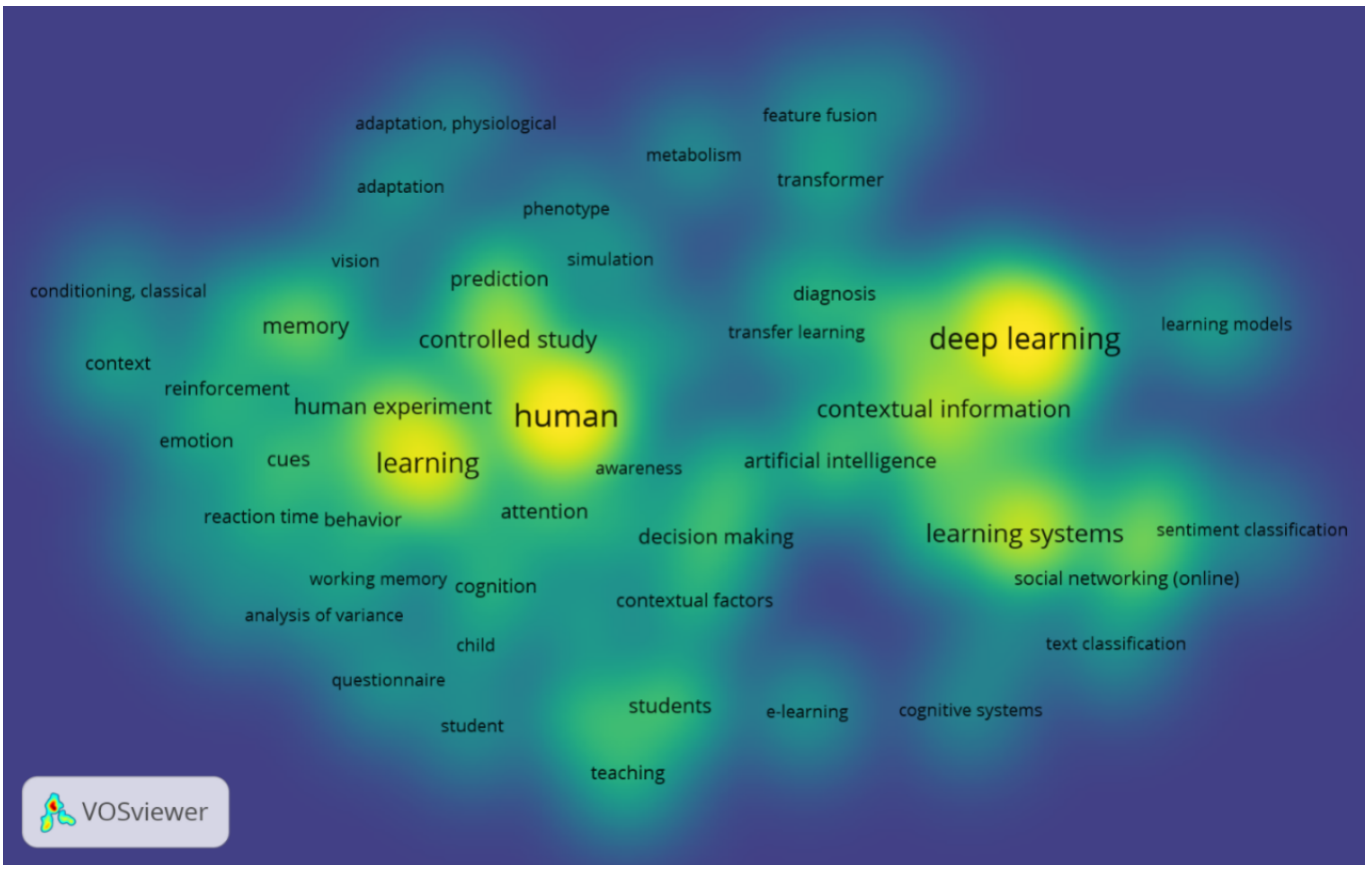

Figure 5. Composite Visualization of Keyword Networks Density Map
Source: VOSviewer Analysis Result, 2025

The density visualization map illustrates the intensity of this research. The bright yellow zone indicates the area of highest density, centered on the keywords human, learning, and deep learning, suggesting that human-centered and artificial intelligence-based learning are now dominant themes in research. The medium-density zone, marked in green, includes words such as "contextual information," "learning systems," "artificial intelligence," and "teaching," reflecting the increasing intersection between pedagogical frameworks and digital phenomena. Meanwhile, the blue zone depicts themes with low density, such as memory, physiology, and reaction time, which indicate the roots of experimental and cognitive research in the early stages of PhBL development. Overall, this map shows a clear thematic shift from traditional pedagogical studies towards the integration of human learning phenomena and technological phenomena, confirming that PhBL now encompasses the two main dimensions of modern learning: humans and technology.

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Discussion

The results of bibliometric analysis show that research on PhBL has grown rapidly, especially in the last decade. The surge in publications after 2016, peaking in 2024, indicates that PhBL is gaining attention as a pedagogical innovation that responds to the challenges of 21st-century education, especially in the context of contextual and interdisciplinary learning. These findings align with the global trend towards student-centered learning and highlight the connection between real-world phenomena and classroom learning experiences. This trend is aligned with an identified increase in publications over the last decade (Supriyadi et al., 2024). Geographically, the dominance of publications from China and the United States indicates that these two countries are prominent research centers in developing learning approaches aligned with the principles of PhBL. In China, 21st-century curriculum reforms emphasize interdisciplinary learning, inquiry, and authentic experiences, which are substantively aligned with the characteristics of PhBL (Chen et al., 2025). Meanwhile, the United States emphasizes the application of PhBL in project-based learning and inquiry-based education. PhBL in U.S. science education is positioned within a broader shift toward learning that mirrors scientific practice through authentic investigation and problem-driven inquiry (Walker & Nouri, 2025). The active participation of Asian countries such as Indonesia and India indicates that this approach is gaining relevance in education in developing countries, especially in linking learning to social and ecological issues at the local level.

Keyword analysis provides a deeper insight into the thematic direction of PhBL research. Five major clusters were identified that represent a paradigm shift from pedagogical to technological integration. Two central concepts, which are learning and human, describe the humanistic roots of PhBL that focus on meaningful learning processes. Asserts that global education research trends are moving toward interdisciplinarity, integrating humanistic perspectives with smart technology (Chen et al., 2025). Furthermore, PhBL grounded in interdisciplinary theory integrates multiple subject areas to support students in comprehending complex real-world issues, thereby strengthening the relevance of PhBL in contemporary education (Marvi et al., 2025).

Generative AI within a PhBL framework enhances students' scientific explanation skills through cognitive scaffolding, contextualized inquiry, and collaborative learning, indicating that PhBL is evolving into a technology-responsive and future-ready pedagogical paradigm (Ratniyom et al., 2025). The growing prominence of concepts such as artificial intelligence, deep learning, and learning systems reflects a shift in educational practice, where learning is no longer centered solely on human interaction but increasingly involves intelligent digital systems as integral components of the learning ecosystem. Empirical evidence further demonstrates that AI-assisted PhBL strengthens preservice teachers' interdisciplinary understanding and speaking abilities (Adipat, 2023). Thus, PhBL not only highlights social or natural phenomena, but also digital phenomena as a new context for 21st-century learning. Indonesia's educational environment, being prepared or not, is irrelevant in the digital age; it is a result of advancement rather than an option. The national education system can be ready to face the challenges of the twenty-first century

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by including digital media education and qualified literacy into the curriculum (Sukmayadi & Yahya, 2020).

The temporal changes seen in the overlay visualization also reinforce this argument. The early period of research (2010–2016) was more oriented towards cognitive and pedagogical dimensions, while recent research (2022–2024) reflects a strong integration between education, data, and technology. These findings confirm that PhBL research is moving towards digital phenomenon-based education, in which digital phenomena such as artificial intelligence, online social networks, and intelligent learning systems are integrated into contextual learning.

CONCLUSION

The results of a bibliometric analysis show that research on PhBL and contextual learning has grown rapidly over the last two decades, reaching a peak in 2024. This increase in publications indicates that PhBL is increasingly recognized as an innovative pedagogical approach capable of responding to the challenges of 21st-century education through contextual learning. Overall, this study shows that PhBL has the potential to be an important innovation in the development of learning that is relevant to priority education issues. For example, in Indonesia, priority education issues such as climate change education, health education, and financial literacy are considered to be better prepared for the future. Through its interdisciplinary, context-based characteristics and emphasis on active student engagement, PhBL offers a learning approach that aligns with global demands while responding to local challenges, thereby strengthening the direction of educational transformation towards an adaptive, sustainable, and meaningful system in the 21st century.

It is advised that future studies examine the long-term effects of PhBL on higher-order thinking and cross-disciplinary competencies in a variety of educational situations, especially in developing countries. Furthermore, to understand PhBL's conceptual relationship with contextual learning and related pedagogical frameworks in future-ready education, as well as to investigate its integration with emerging digital technologies such as artificial intelligence and learning systems, empirical and conceptual research is required.

AUTHOR'S NOTE

The author declares that there is no conflict of interest related to the publication of this article and confirms that the data and content of the article are free from plagiarism.

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REFERENCES

Adeoye, R. I., Okaiyeto, K., & Oguntibeju, O. O. (2023). Global mapping of research outputs on nanoparticles with peroxidase mimetic activity from 2010–2019. *Inorganic and Nano-Metal Chemistry, 53*(2), 199-211.

Adipat, S. (2023). An artificial intelligence-enhanced phenomenon-based learning approach for interdisciplinary understanding and speaking skills. *International Journal of Instruction*, *16*(3), 531–550.

Adipat, S. (2024). Transcending traditional paradigms: the multifaceted realm of phenomenon-based learning. *Frontiers in Education*, *9*(1), 1-5.

Amidi, A., Kartono, K., Mulyono, M., & Pudjiastuti, E. (2025). The effectiveness of contextual teaching and learning with articulate storyline in improving mathematical literacy: a perspective of high self-confidence students. *Educational Process: International Journal, 16*(1), 1-24.

Aria, M., & Cuccurullo, C. (2017). Bibliometrix: an R-tool for comprehensive science mapping analysis. *Journal of informetrics*, *11*(4), 959-975.

Arwin, M., Pikoli, M., Sihaloho, M., Kunusa, W. R., Tangio, J. S., & Munandar, H. (2025). The effect of Contextual Teaching and Learning (CTL) model on reaction rate material on critical thinking ability and character of student. *Jambura Journal of Educational Chemistry*, *7*(1), 1-11.

Baas, J., Schotten, M., Plume, A., Côté, G., & Karimi, R. (2020). Scopus as a curated, high-quality bibliometric data source for academic research in quantitative science studies. *Quantitative Science Studies*, *1*(1), 377-386.

Bukar, U. A., Sayeed, M. S., Razak, S. F. A., Yogarayan, S., Amodu, O. A., & Mahmood, R. A. R. (2023). A method for analyzing text using VOSviewer. *MethodsX*, *11*(1), 1-9.

Chen, G., Yin, C., & Wang, D. (2025). Research hotspots and trends on interdisciplinary teaching and learning in china: a bibliometric analysis. *Future in Educational Research*, *3*(4), 640-654.

Dewi, L. N. G. A., Widiana, I. W., & Jayanta, I. N. L. (2024). The project-based learning assessment guide (project-based learning) is oriented towards phenomenon-based learning. *Journal of Education Research and Evaluation*, *8*(2), 362-372.

Jaramillo, J. J., & Chiappe, A. (2024). The AI-driven classroom: a review of 21st century curriculum trends. *Prospects*, *54*(3), 645-660.

Jongyung, T. (2025). Approaches and techniques of phenomenon-based learning: PheBL. *Journal of Education and Learning Reviews*, *2*(1), 39-50.

Kennedy, T. J., & Fields, D. L. (2023). Augmenting upper and early-learning STEM lessons through phenomenon-based learning projects. *Journal of Higher Education Theory & Practice*, *23*(18), 1-12.

https://doi.org/10.17509/curricula.v5i1.93737

Kong, Y. (2021). The role of experiential learning on students' motivation and classroom engagement. *Frontiers in Psychology*, *12*(1), 1-4.

Mallika, A. I. (2024). The influence of the Contextual Teaching and Learning (CTL) model on improving critical thinking skills in Mathematics among junior high school students. *Journal of Education Innovation and Curriculum Development*, *2*(2), 41-48.

Marvi, K. M. H., Lodhi, I. S., Ahmed, Q., & Liaqat, H. (2025). A comprehensive analysis of phenomenon-based learning with scientific literacy in teaching and learning process for 21st century educational demands. *The Critical Review of Social Sciences Studies*, *3*(4), 2852-2870.

Nassim, S., Abdelfattah, M., & Ayadi, H. (2025). Impact of contextualized e-book as a sustainable pedagogical method in teaching psychology: a case study. *AI and IoT: Driving Business Success and Sustainability in the Digital Age, 2*(1), 453-467.

Passas, I. (2024). Bibliometric analysis: the main steps. *Encyclopedia*, *4*(2), 1014–1025.

Pranckutė, R. (2021). Web of Science (WoS) and Scopus: the titans of bibliographic information in today's academic world. *Publications*, *9*(1), 1-59.

Pratiwi, B., Copriady, J., & Anwar, L. (2021). Implementation of phenomenon-based learning e-module to improve critical thinking skills in thermochemistry material. *Jurnal Pendidikan Sains Indonesia, 9*(4), 579-589.

Putri, M. A., Suprapto, I., & Mahendra, Y. (2025). Implementing the Contextual Teaching and Learning (CTL) learning model in Indonesian language learning in elementary schools. *Jurnal Penelitian dan Pengembangan Pendidikan*, *9*(2), 253-262.

Ratnaningsih, D., & Triwahyuni, E. (2025). Improving high school students' critical thinking and learning outcomes through the Contextual Teaching and Learning (CTL) model. *Jurnal Pedagogi dan Pembelajaran*, *8*(2), 251-258.

Ratniyom, J., Panmas, W., Rattanakorn, P., & Tientongdee, S. (2025). Generative AI-assisted phenomenon-based learning: exploring factors influencing competency in constructing scientific explanations. *European Journal of Educational Research, 14*(4), 1087-1103.

Saberi, M., & Nouri, N. (2025). Three-dimensional learning through phenomenon-based science education and its application via the collapsed container phenomenon. *Physics Journal Farhangian University*, *2*(1), 73-91.

Santoso, A. N., Sunarti, T., & Wasis, W. (2023). Effectiveness of contextual phenomena-based learning to improve science literacy. *International Journal of Current Educational Research*, *2*(1), 17-26.

Schaffar, B., & Wolff, L. A. (2024). Phenomenon-based learning in Finland: a critical overview of its historical and philosophical roots. *Cogent Education*, *11*(1), 1-15.

https://doi.org/10.17509/curricula.v5i1.93737

Sukmayadi, V., & Yahya, A. (2020). Indonesian education landscape and the 21st century challenges. *Journal of Social Studies Education Research*, *11*(4), 219-234.

Supriyadi, S., Suhandi, A., Samsudin, A., Setiawan, A., Susilawati, A., Isnawati, I., & Ismail, I. (2024). Analysis scopus article on phenomenon-based learning through bibliometric analysis. *KnE Social Sciences*, *9*(13), 1301-1310.

Walker, K. I., & Nouri, N. (2025). Phenomenon-based learning and storylines in K-12 science education: a systematic review of current research, implementation, and future directions. *Frontiers in Education*, *10*(1), 1-20.

Widiana, I. W., Kristiantari, M. G. R., & Widiani, N. K. (2023). Project based assessment with a phenomenon-based learning approach on achieving the Pancasila student profile in elementary school. *International Journal of Elementary Education*, *7*(4), 586-593.

Zupic, I., & Čater, T. (2015). Bibliometric methods in management and organization. *Organizational Research Methods, 18*(3), 429-472.

https://doi.org/10.17509/curricula.v5i1.93737