Architecture
Image Studies

Vol.6, Issue 4, pp.974-984, 2025
DOI: https://doi.org/10.62754/ais.v6i4.706

https://journals.ap2.pt/index.php/ais/index

A Bibliographic Analysis of Research Dynamics on Meaningful Learning in Elementary Schools

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Abstract

This study examines meaningful learning in elementary schools in depth using a bibliometric analysis of scholarly articles from various countries and educational institutions. The focus of this research is relevant, particularly because one of the fundamental principles of 21st-century education is the integration of learning with understanding and the acquisition of new ideas and knowledge, as well as the use of technology in the classroom. This means that learning must be meaningful and purposeful. VOSviewer software was used to examine the research data, sourced from the Scopus database covering the period 2010–2024. This study involved tracking active authors from the network of popular terms related to meaningful learning in elementary schools and recording their publication frequency. Based on the data, the number of publications has increased steadily and consistently since 2020, peaking at 68 publications in 2024 and 65 publications in 2023. This may explain why the National Taiwan University of Science and Technology (NTT) was a key participant, with Yogyakarta State University (UNY) and Universidad de Granada also producing seven and eight publications, respectively. Based on this evidence, deep learning and basic education are complementary to the meaning of learning (meaningful learning).

Keywords: *Meaningful learning, bibliometrics, elementary school, educational technology, deep learning.*

Introduction

Meaningful learning is being increasingly recognized in education studies, particularly in primary school. By combining new material with what they already know, it describes how students make it personally relevant and applicable. This approach, which emphasizes connecting new concepts to existing knowledge, is crucial in elementary schools because it fosters a deeper and more enduring comprehension of the subject matter (Cadorin et al., 2014). According to (Indrayogi, Berliana, 2025), meaningful learning at the elementary school level serves as a foundation for the development of critical thinking, reading, math, and social-emotional intelligence—all of which are essential in today's world. Internationally and domestically, curriculum changes that place a higher priority on skills have further brought attention to the necessity of implementing meaningful learning in primary education (Kemendikbudristek, 2021); (OECD, 2018).

Elementary school is a key time for children's thinking and social skills to grow. Because of this, it's really important to have a classroom that helps them learn in a way that feels relevant and important. When learning feels meaningful, kids are more excited, involved, and do better in school (Al-Jbouri et al., 2023). Making learning meaningful – where students actively build knowledge through interesting and relevant activities – should be a main goal for teachers in primary school (Hsbollah & Hassan, 2022). Thankfully, new technology and creative teaching methods can really help make learning more interesting and successful for young students.

Examining how technology might enhance worthwhile educational experiences in primary schools is essential given its increasing use in the classroom. Even though this field has seen a lot of research, we still don't fully grasp how educational technologies—such as games, mobile devices, and augmented reality—can effectively support significant learning for young students. This entails teaching

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strategies that carefully blend technology and hands-on learning to inspire students to engage with the content in a way that suits their unique learning preferences (Tong et al., 2022).

The development of digital devices also facilitates meaningful learning. Activities such as incorporating digital resources, elements such as games, and blended learning methods have been shown to increase student interest and make learning more relevant to real-world situations (Hashmi et al., 2025). However, the use of technology alone does not guarantee meaningful learning. Teachers developing effective lesson plans tailored to students' specific needs and characteristics remains crucial for success (Kalinowski et al., 2024). Furthermore, despite progress in understanding and implementing the principles of meaningful learning, efforts are still needed to identify effective practices and establish policies that can support their broader implementation.

Over the past ten years, research has shown that learning in elementary schools should be based on student-centered, activity-based, and group-oriented teaching methods. For example, activity-based learning has been shown to improve students' conceptual understanding and critical thinking skills (Al Shloul et al., 2024). Furthermore, a team-based approach that utilizes real-life experiences can help students understand the relevance of what they do in school to their daily lives (O'Neill & Short, 2025). Significant learning, beyond intellectual development, also encompasses emotional and social development. Recent studies have shown that students who participate in meaningful learning experiences are more likely to develop self-esteem, teamwork skills, and self-control (Oyelere et al., 2021). Consequently, learning is viewed not only as a means of transferring knowledge but also as a tool for developing children's character and social skills in elementary schools.

While researchers have explored meaningful learning in elementary schools from various angles, existing studies remain fragmented across different subjects and geographical areas. This scattered landscape makes it challenging to develop a clear understanding of the overall research direction and the key themes emerging in the field. For this reason, bibliometric analysis is valuable. It helps us map out research trends, pinpoint leading researchers and institutions, and uncover areas where further investigation is needed (Hill et al., 2016).

Although meaningful learning has been recognized as important, a comprehensive bibliometric analysis is needed to understand the dynamics and current state of research. This study aims to examine the evolution of research on meaningful learning in elementary schools using a bibliometric approach. The analysis will identify key trends, the most influential publications, the most commonly used terms, and the contributions of various countries to the advancement of this field. Furthermore, this study aims to explore how technology supports meaningful learning in elementary schools and suggest potential avenues for future research. Other research questions include:

1. RQ1: What are the main trends in research on meaningful learning in elementary schools over the past few years?

2. RQ2: Which scholarly sources have produced the largest number of articles on this topic?

3. RQ3: What are the contributions of key affiliates and countries to research on meaningful learning in elementary schools?

4. RQ4: Which papers receive the highest global citations?

5. RQ5: What are the most common keywords related to this topic?

Method

This study investigates the global landscape of meaningful learning research through bibliometric analysis. This method allows for a structured examination of the existing literature, highlighting significant theoretical advances, practical applications, and promising opportunities for future research. Specifically, we use bibliometric analysis to understand the evolving landscape of meaningful learning research in elementary education. This study chose a bibliometric approach because it provides a comprehensive overview of the growth of scholarly publications, collaborative networks, and common themes across the field (Imaduddin & Eilks, 2024). Data for this analysis comes from the Scopus database, a recognized and extensive metadata source for scholarly publications across disciplines (You et al., 2024). This study focuses on the period 2013–2023 to capture relevant trends over the past decade.

This research step involved scanning the reputable Scopus database, which contains high-quality scholarly articles, for relevant material. We searched for "meaningful learning" related to "primary" or

"elementary" education, including "deep," "significant," "impactful," "purposeful," and "engaging" learning. We specifically used the "TITLE-ABS-KEY" category in Scopus to target keywords found in article titles, abstracts, and keyword lists. The information we obtained included journal titles, abstracts, author details, year of publication, institution, number of citations, and keywords provided by the authors. Using this method, we specifically identified articles relevant to our research and eliminated irrelevant ones. This search resulted in 460 relevant papers.

Data were collected using various techniques to identify developments in research on meaningful learning in elementary schools. Key topics were identified using VOSviewer software, such as the annual number of publications, their place of origin, the most prestigious journals in the field, and the most active authors. Furthermore, VOSviewer analyzed collaboration networks across authors, organizations, and countries, allowing us to identify trends in international collaboration (Nain et al., 2025). Microsoft Excel was also used to analyze citation patterns and annual publication trends, providing a quantitative perspective on the data. Combining these techniques allowed us to present our research findings more comprehensively (Lim et al., 2024). Keyword analysis also revealed new patterns and key research issues, and network maps were used to visually depict the data for easier understanding and analysis. This comprehensive approach provided us with a broad overview of the discipline, potential future directions, and emerging themes.

Result

Publication history

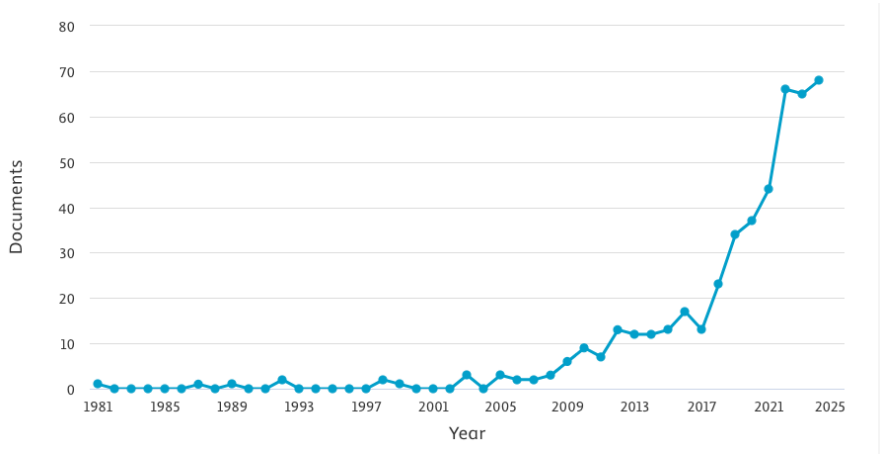

Figure 1. Journey to publish the theme of meaningful learning in elementary school

A review of research on meaningful learning in elementary schools reveals a growing body of published work. Publication numbers have generally risen over time, peaking in 2024 with 68 publications and closely followed by 2023 with 65. A marked increase began around 2020, with the number of publications jumping to 37, then continuing upward to 44 in 2021 and 66 in 2022. Before this, publication rates were less consistent, with lower figures recorded between 2017 and 2019. From 2010 to 2016, publication numbers were quite modest, typically below 20, with 2015 and 2016 both showing 13 publications. Overall, this data suggests an increasing focus on the topic of meaningful learning in primary education since the 1980s, although publication rates dipped in the 1990s and 2000s.

Scientific sources

This study's findings reveal that research on meaningful learning in primary schools is primarily disseminated through a select group of prominent journals and conference proceedings. The Journal of Physics Conference Series emerges as the leading source with 16 publications, closely followed by the ACM International Conference Proceeding Series, which contains 12 publications. Computers and Education, with nine publications, and Lecture Notes in Computer Science (and its associated subseries), with ten publications, are other noteworthy publications. AIP Conference Proceedings and Lecture Notes in Networks and Systems both make substantial contributions, with seven and six articles, respectively. Additionally, Retos contributes six papers, while Education Sciences contributes five. Although they are less common, the International Journal of Learning, Teaching, and Educational Research, Interactive Learning Environments, and Communications in Computer and Information

Science all include four pertinent publications. Overall, the data shows that publications that focus on computer science, education in general, and technology in education are more likely to publish research on meaningful learning.

Tabel 1. Scientific Source

	SOURCE TITTLE	
	Journal of Physics Conference Series	16
	ACM International Conference Proceedings Series	12
	Lecture Notes In Computer Science Including Subseries Lecture Notes In Artificial Intellegences and Lecture Notes in Bioinformatics	10
	Computers And Education	9
	Lecture Notes in Networks and Systems	7
	Aip Conference Proceedings	6
	Retos	6
	Education Sciences	5
	Communications In Computer and Information Science	4
	Interactive Learning Environtments	4
	International Journal of Learning Teaching and Educational Research	4

Affiliate

According to our analysis, with eight papers on meaningful learning in primary schools, the National Taiwan University of Science and Technology is the leading author. With seven papers apiece, the State University of Yogyakarta in Indonesia and the University of Granada in Spain have also made significant contributions. Six papers have been submitted by The Education University of Hong Kong, South China Normal University (China), and Nanyang Technological University (Singapore). The State University of Jakarta (Indonesia) mirrors this with six publications, highlighting the active research in Indonesia. The University of Valencia and the National Institute of Education have each produced five publications, further emphasizing the international scope of research in this area. Overall, the findings point to a global interest in meaningful learning, particularly within higher education institutions across Asia and Europe, which are playing a key role in exploring and promoting this concept in elementary education.

Table 2. Top Affiliation

	AFFILIATION	
	National Taiwan University of Science and Technology	8
	Universidad de Granada	7
	Universitas Negeri Yogyakarta	7
	Nanyang Technological University	6
	South China Normal University	6
	The Education University of Hongkong	6
	Universitas Negeri Jakarta	6
	Universitat de Valencia	5
	National Institute of Education	5

Country

This research analyzed the global distribution of publications concerning meaningful learning in elementary education. Our findings reveal that Spain leads in publication volume with 63 documents, followed by China (49) and the United States (44). Indonesia (36), Australia (22), and Taiwan (20) also made substantial contributions. Several other nations, including Brazil, Malaysia, Turkey, and India, had fewer publications, ranging between 14 and 17 each. While publication numbers differ, Taiwan and Singapore demonstrate significant impact through high citation counts, with Taiwan reaching 847 citations. The United States also received a considerable number of citations (640), whereas Indonesia and Malaysia had fewer. As indicated by the overall link strength, the level of cooperation between nations also differed. Strong connectedness was seen in China, the UK, and Singapore, whereas weaker connections were seen in Norway, Mexico, and Thailand, suggesting less cooperation in this

field of study. All things considered, the study highlights a range of international contributions to the understanding of meaningful learning in primary schools. Based on their publication output and the significance of their research as indicated by citations, some nations seem to have more sway.

Tabel 3. Country

Country	Documents	Citattions	Total Link Strenght
Spain	63	485	4
China	49	263	17
USA	44	640	16
Indonesia	36	90	3
Australia	22	186	15
Taiwan	20	847	7
UK	18	226	17
Brazil	17	68	3
Malaysia	16	37	7
Turkey	16	552	3
India	14	38	3
Greece	11	89	5
Italy	11	93	2
Singapore	11	508	5
Netherlands	10	563	2
Portugal	10	23	3
Hongkong	9	92	10
Israel	9	167	1
Norway	9	41	0
South Korea	8	43	6
Canada	6	32	4
Cyprus	6	318	2
Finland	6	208	1
Japan	6	31	4
Mexico	6	17	0
Peru	6	21	1
Saudi Arabia	6	114	3
Thailand	5	8	0

Top cites

Our analysis reveals that the most frequently referenced publication in the area of meaningful learning within primary education is a 2009 study by Tüzün and colleagues. This research, which has been cited 423 times, investigated how using computer games impacts primary students' academic performance and enthusiasm for learning geography. Closely following in terms of citations (295) is a 2011 study by Chai et al., focusing on the use of TPACK (Technological Pedagogical Content Knowledge) to enhance meaningful learning experiences with technology. Another highly cited work (291 citations) is Vos et al.'s 2011 research, which compared the effects of constructing and playing educational games on student motivation and more thorough learning techniques. Furthermore, Angeli and Valanides' 2020 study on teaching children computational thinking through educational robotics has garnered 252 citations. Other notable studies include Maldonado & De Witte's 2022 work on the effects of school closures on student test scores and Hwang et al.'s 2014 research on enhancing learning outcomes through a game development and peer assessment approach. Collectively, these studies highlight a wide variety of creative and modern strategies for incorporating technology to foster meaningful learning, boost student motivation, and cultivate thinking skills in primary school settings.

Tabel 5. Top cites

Cites	Authors	Title	Year	Source
423	Tüzün, H., Yılmaz-Soylu, M., Karakuş, T., Inal, Y., & Kızılkaya, G.	The effects of computer games on primary school students' achievement and motivation in geography learning	2009	Computers and Education
295	C.S. Chai, J.H. Ling Koh, C.-C. Tsai, L. Lee Wee Tan	Modeling primary school pre-service teachers' Technological Pedagogical Content Knowledge (TPACK) for meaningful learning with information and communication technology (ICT)	2011	Computers and Education
291	N. Vos, H. Van Der Meijden, E. Denessen	Effects of constructing versus playing an educational game on student motivation and deep learning strategy use	2011	Computers and Education
252	C. Angeli, N. Valanides	Developing young children's computational thinking with educational robotics: An interaction effect between gender and scaffolding strategy	2020	Computers in Human Behavior
177	J.E. Maldonado, K. De Witte	The effect of school closures on standardised student test outcomes	2022	British Educational Research Journal
174	G.-J. Hwang, C.-M. Hung, N.-S. Chen	Improving learning achievements, motivations and problem-solving skills through a peer assessment-based game development approach	2014	Educational Technology Research and Development
168	Furió, D., Juan, M. C., Seguí, I., & Vivó, R	Mobile learning vs. traditional classroom lessons: A comparative study	2015	Journal of Computer Assisted Learning
148	P. Nokelainen	An empirical assessment of pedagogical usability criteria for digital learning material with elementary school students	2006	Educational Technology and Society
111	M. Barak, T. Ashkar, Y.J. Dori	Learning science via animated movies: Its effect on students' thinking and motivation	2011	Computers and Education
109	J.H.L. Koh, C.S. Chai, C.-C. Tsai	Demographic factors, TPACK Constructs, and teachers' perceptions of constructivist-Oriented TPACK	2013	Educational Technology and Society
108	M. Alkhattabi	Augmented reality as e-learning tool in primary schools' education: Barriers to teachers' adoption	2017	International Journal of Emerging Technologies in Learning
100	Y.B. Kafai, M.L. Franke, C.C. Ching, J.C. Shih	Game design as an interactive learning environment for fostering students' and teachers' mathematical inquiry	1998	International Journal of Computers for Mathematical Learning

Keywords

The results of this study highlight recurring trends in studies on meaningful learning in elementary school. The terms "deep learning" and "primary education," which are most often mentioned, suggest that these topics are highly prioritized. "Primary education" shows a stronger correlation with other keywords in the research, even if "deep learning" appears more frequently. "Artificial intelligence," "elementary school," and "meaningful learning" itself are other recurring themes in the literature that show a great deal of interconnection. Though they have fewer links to other ideas, keywords like "learning," "mobile learning," and "augmented reality" also show up frequently. Interestingly, the terms

"game-based learning," "machine learning," and "physical education" appear frequently, indicating a desire to integrate contemporary tools and techniques into basic education. Also, the use of terms like "COVID-19," "curriculum," and "motivation" emphasizes how current issues and developments—especially those brought on by the pandemic—have an impact on the path of study. The terms "computational thinking," "children," "concept maps," and "creativity," which are less common but nonetheless pertinent, are also noted. Overall, these findings point to a growing body of research on meaningful learning in elementary schools that embraces cutting-edge technologies like augmented reality and deep learning as well as game-based approaches to make learning environments more effective and engaging for students.

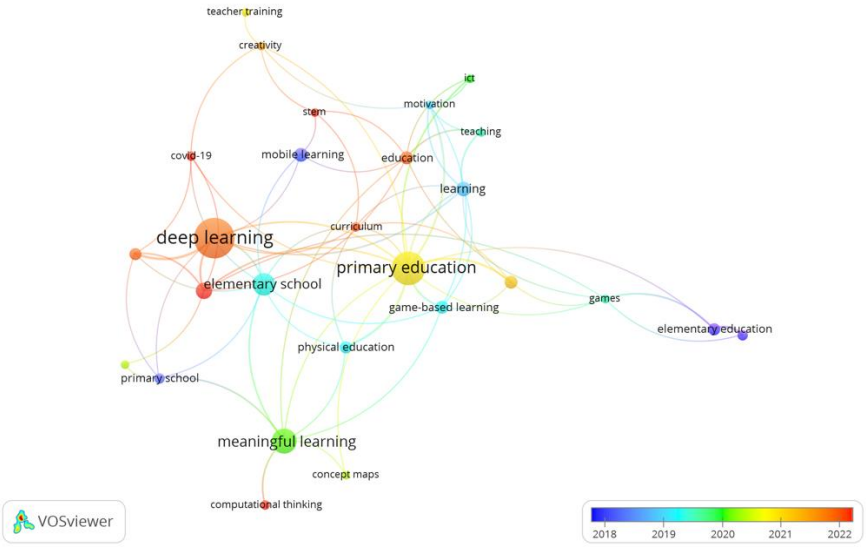

Figure 2. Author Keywords

Discussion

This study's findings reveal a notable rise in publications focusing on meaningful learning in elementary schools, particularly since 2020. We observed a sharp increase in these publications during 2021 and 2022. This trend suggests growing interest in the significance of making learning more relevant and engaging, possibly spurred by the re-evaluation of teaching methods following the COVID-19 pandemic, including the incorporation of technology and online tools. Before 2020, publications on this topic were generally less frequent and varied. The recent increase indicates progress in educational thinking and practice, with a greater emphasis on relevant and contextual learning experiences for young students. However, research into meaningful learning in elementary schools is still in its early stages, creating possibilities for future investigations into its application in different educational settings.

Bibliometric analyzes have shown a significant increase in the number of publications focusing on meaningful learning in primary education over the last decade. This publication surge began in 2020, with a total of 37 articles. This rise continued in the following years, reaching 44 releases in 2021, 66 in 2022, 65 in 2023, and 68 in 2024. Before 2020, the number of publications was relatively low3 and stable thexefiar, as the annual production was recorded in 2015 and Hi 2016. increased interest reflects a growing focus on meaningful learning contexts, especially since the COVID-19 pandemic, which has led to a shift toward more flexible, interactive, and technology-based approaches to education (Haleem et al., 2022).

Beyond the curriculum, this research focus is also driven by the increasing emphasis on integrating technology into education. Digital resources, gamification, and blended learning are some strategies that have been shown to improve student engagement and learning experiences (Priante & Tsekouras, 2025). The significant increase in published research between 2020 and 2024 is likely due to the growing popularity of distance learning and hybrid learning methods. This shift has inspired educators and researchers to explore effective teaching strategies for students, especially in this unprecedented situation.

Despite the increasing number of studies, the focus remains on the areas they have studied. Most research is conducted in developed countries, with fewer coming from developing countries, particularly Southeast Asia and Africa. This highlights the importance of funding regional studies, which will continue to provide in-depth information on meaningful learning in diverse social and cultural contexts (Martiny et al., 2024). Therefore, this analysis highlights the growing international interest in critical learning and the urgent need to expand the research community to enhance its internationalization.

Research on ways to make primary school learning more meaningful primarily comes from publications in the fields of education, technology, and computer science. It is clear that physics and technology have a significant impact on basic education because so many of these publications are published in the Journal of Physics Conference Series (16). Furthermore, with 12 and 10 publications, respectively, the ACM International Conference Proceeding Series and Lecture Notes in Computer Science, along with associated publications, provide significant contributions to this discipline. The use of computer systems and information technology to promote meaningful learning is highlighted here. The use of technology to improve learning in primary school is also emphasized by journals such as Computers and Education (9 publications). Despite their smaller publication counts, sources such as Retos and Education Sciences continue to provide insightful information about education in general. According to the research, platforms that combine education and technology are where conversations about meaningful learning in elementary schools are most common (Mustafa et al., 2024). This emphasizes how crucial it is to use technology to provide students with more interesting and relevant learning experiences.

Research on Meaningful Learning in Elementary Schools often focuses on computer science and technology. Much of the research on this subject has been published in the Journal of Physics Conference Series (16), demonstrating that technology and physics provide a powerful perspective for elementary school teaching. Similarly, the ACM International Conference Proceedings Series and Lecture Notes in Computer Science, along with their related publications, have contributed significantly to this field (12 and 10 publications, respectively). These highlight the role of information technology and computer systems in fostering meaningful learning. Journals such as Computers and Education (9 publications) also emphasize the integration of technology to enhance the learning experience in elementary schools. Although sources such as Retos and Education Sciences have fewer publications, both still provide important insights into the broader field of education. In conclusion, research on meaningful learning in elementary schools is largely found in sources that connect technology and education, underscoring the important role of technology in developing relevant and engaging learning for young students.

Asia has made significant contributions to the field of meaningful learning research; The Education University of Hong Kong, South China Normal University (China), and Nanyang Technological University (Singapore) have each produced six articles. These two institutions dominate Asia in terms of their research participation, particularly in blended learning strategies and technology-based learning (Zhao, 2015). This is certainly in line with how educational strategies in these countries prioritize the development of 21st-century skills through relevant and practical learning experiences. In Indonesia, along with UNY, Jakarta State University has also made significant contributions with six publications, demonstrating the active participation of Indonesian universities in the global discussion on meaningful learning in primary education. This is supported by national policies that promote educational research, and UNJ's participation further expands Indonesia's impact on international research (Kemendikbudristek, 2021).

The National Institute of Education in Singapore and the University of Valencia in Spain each produced five articles, alongside impressive performances from Asian institutions. European institutions, particularly those from Spain, also highlighted advanced research into innovative teaching strategies that foster student engagement. A highly regarded study by the National Institute of Education in Singapore focused on curriculum development and primary education (Carmo, 2017). The involvement of these institutions demonstrates the global collaboration in the pursuit of meaningful learning. In conclusion, these results demonstrate that research on meaningful learning in primary schools encompasses a diverse range of universities and colleges from around the world. Research on primary education is increasingly focused on Asia, with Taiwan, Singapore, Hong Kong, and Indonesia playing leading roles. This trend is offset by contributions from Europe, particularly through institutions in Spain. Consequently, partnerships between universities worldwide are proving crucial in advancing global understanding of effective learning (Liu et al., 2025).

A review of research on meaningful learning in elementary schools reveals a clear emphasis on incorporating new technologies and creative educational strategies. The term "deep learning" appears most often (49 times), suggesting a growing interest in using artificial intelligence to enhance students' learning. "Elementary education" and "meaningful learning" are also prominent (37 and 24 times, respectively), highlighting the importance of relevant and context-based learning for young students. The connection between these key terms implies that elementary schools are viewed as an important setting for applying deep learning methods to help students better understand concepts (Lambert & Jacobsen, 2020).

Additionally, the terms "meaningful learning" (24 times) and "primary school" (20 times) are frequently used, indicating a persistent focus on basic education research that covers both the theoretical underpinnings and real-world applications. The expanding importance of integrating technology into meaningful learning experiences is highlighted by the frequency of "artificial intelligence" (13 instances) and "mobile learning" (10 appearances). This trend is consistent with international educational programs that support technology-enhanced learning as a way to improve overall learning outcomes and create individualized, accessible learning experiences (Aria & Cuccurullo, 2017). Moreover, "augmented reality" (9 times), "game-based learning" (8–9 times), and "machine learning" reflect innovative endeavors to create relevant, interactive, and captivating learning opportunities for students. Evidence suggests that incorporating these strategies enhances student motivation, creativity, and involvement in the learning process, thereby reinforcing the key aspects of meaningful learning (Oo et al., 2024).

Ausubel's idea is no longer the sole focus of serious learning research today. They are currently investigating how well-established theories and new technologies can work together (Tian et al., 2020). Additionally, the growing usage of specialized terminology such as "children," "computational thinking," "concept maps," and "creativity" suggests a change in the focus of study, with a stronger focus on 21st century abilities. The emphasis on creativity and computational thinking is in line with the requirements of modern educational systems, which call for students to be able to think critically, solve problems, and be innovative in real-world situations (Chen et al., 2025). As a result, research on meaningful learning in elementary schools is looking at a broader set of skills required to solve global problems, rather than just conceptual understanding.

The focus of current research on elementary school meaningful learning is changing. Although motor skills and physical education are increasingly recognized as essential components of a holistic educational experience, psychological elements such as motivation and creativity are also recognized for their role in creating stimulating and productive learning settings. Global concerns, like the COVID-19 pandemic, are clearly having an impact and are propelling the use of technology and online education. This trend is further supported by keywords related to curriculum development, information and communication technology (ICT), and STEM, signifying an emphasis on relevant instruction and technology integration in various subjects. In essence, the research landscape is evolving to prioritize technology's potential to create more impactful and relatable learning opportunities for young students. This marks a transition from a conceptual understanding of interconnectedness to a practical application of cutting-edge technology and innovative strategies. This evolution not only enriches educational practices but also provides a fresh perspective for developing and implementing meaningful learning strategies that are well-suited to the demands of the digital age.

Conclusion

This study's findings reveal a notable rise in publications related to meaningful learning at the elementary level since 2020, peaking in 2024. This upward trend suggests growing scholarly interest in this topic, aligning with ongoing shifts in global education. Analysis of academic literature reveals that prominent international journals serve as key outlets for these publications, indicating greater opportunities for knowledge sharing in this area. This reinforces the idea that meaningful learning has evolved into a global topic of discussion across various academic and technological fields. The contribution of different institutions and countries varies considerably, with institutions such as the National Taiwan University of Science and Technology, Universidad de Granada, and Yogyakarta State University, alongside leading universities in Asia and Europe, making significant contributions to the existing research. This international distribution points to collaborative efforts in advancing research on this subject. Citation analysis highlights several core documents that serve as frequently cited references, suggesting the existence of foundational literature providing a theoretical and methodological basis for future research on meaningful learning. The most prominent keywords are "deep learning" and "primary education," closely associated with artificial intelligence, mobile learning,

and augmented reality. This reflects the increasing integration of technology as a central focus in research on meaningful learning.

Research suggests that using technology to support meaningful learning in elementary schools is becoming more common. Tools like computer games, augmented reality, and integrating technology effectively into teaching practices (TPACK) are driving this trend. Key studies indicate that technology can boost students' academic performance and their interest in learning. Interactive strategies, such as learning through games, and building computational thinking skills with tools like robotics, have demonstrably improved learning in elementary schools. Furthermore, this research highlights that technology-based methods are valuable for creating more interesting and engaging learning experiences for students.

While this study offers valuable insights, it's important to acknowledge certain limitations. Specifically, we need more research on how this technology works across different cultures and educational settings. Furthermore, there's a lack of long-term studies evaluating the technology's influence on student growth over time. Despite these limitations, the findings indicate that incorporating technology into basic education can improve the learning process. However, successful implementation requires addressing obstacles like inadequate resources and insufficient teacher preparation. Therefore, we recommend improved training programs for educators in using educational technology, along with collaboration among stakeholders to create supportive policies for its effective classroom use.

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