

## DEEP LEARNING PEDAGOGY GROUNDED IN DAVID AUSUBEL'S LEARNING THEORY: A LITERATURE STUDY

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### ABSTRACT

The development of education in the global era requires learning approaches that emphasize not only rote memorization but also conceptual understanding, critical thinking skills, and problem-solving abilities. The concept of deep learning in education emerged as a response to this need. David Ausubel's meaningful learning theory is highly relevant in addressing these challenges, as it emphasizes the importance of linking new knowledge with the learner's existing cognitive structure. This article aims to analyze the relationship between deep learning and Ausubel's theory through a literature review of various national and international studies. The findings show that deep learning can be optimized through the implementation of advance organizers, activation of prior knowledge, and progressive differentiation. Therefore, Ausubel's theory provides a philosophical and methodological foundation for developing meaningful learning practices in schools and universities.

**Keywords:** ausubel's learning theory, meaningful learning, deep learning

### INTRODUCTION

The paradigm shift in education from traditional approaches toward learning that emphasizes deeper understanding has become a central concern in the field of education. In the era of the Industrial Revolution 4.0, (Qomarudin 2024) and Society 5.0 (Hidayat et al. 2023), students are required not only to master factual knowledge but also to integrate, (Watson et al. 2022) critique, and apply knowledge in real-life contexts. Therefore, the concept of *deep learning* has become one of the key strategies that must be implemented in the education system. (Abas and Susetio 2022)

In contemporary education, characterized by rapid technological advancement and the demands of 21st-century skills, (Neu et al. 2022) the *deep learning* approach has gained increasing attention as a strategy to develop students' deep understanding and critical thinking skills (Amalia Arum 2022). *Deep learning*, as a pedagogical paradigm, does not merely emphasize the superficial acquisition of knowledge (Levin 2024) but also encourages students to analyze (Agyeman 2024), synthesize, and apply concepts in real contexts, thereby fostering sustainable and adaptive learning. This concept is rooted in cognitive learning theory, which highlights the active construction of knowledge, wherein learners play the central role in the learning process.

One of the most relevant theoretical foundations often integrated with *deep learning* is David Ausubel's theory of learning, introduced in 1963 through his work *The Psychology of Meaningful Verbal Learning* (Ausubel 1963). Ausubel promoted the concept of *meaningful learning*, where the key factor for successful learning lies in the ability to connect new information with prior knowledge in the learner's cognitive structure (Massang 2025). According to Ausubel, *meaningful learning* occurs through the process of *subsumption*, in which new concepts are integrated into existing cognitive frameworks,

either derivatively (by adding details) or correlatively (by modifying concepts). This approach stands in contrast to *rote learning*, which often results in short-term retention and limited transfer of knowledge.(Bryce and Blown 2024)

The importance of integrating Ausubel's theory with *deep learning* lies in its potential to address modern educational challenges, such as low student motivation, reliance on passive learning, and difficulties in developing higher-order thinking skills (HOTS). In the post-pandemic era (Shaleh and Mahmudi 2022), where digital technology and social media increasingly dominate, this approach can help students differentiate scientific information from pseudoscience through critical thinking and in-depth dialogue. In the Indonesian context, this integration aligns with the *Merdeka Curriculum*, which emphasizes project-based and collaborative learning to build connections between new knowledge and students' experiences, thereby enhancing the relevance and meaningfulness of learning. Literature reviews indicate that *deep learning* grounded in Ausubel's *meaningful learning* theory can improve long-term retention and the ability to apply knowledge, as evidenced in studies across both primary and higher education.

David Ausubel, an educational psychologist, developed the theory of *subsumption* or *meaningful learning* in 1963. According to Ausubel, *meaningful learning* occurs when new information is connected non-arbitrarily with concepts that already exist in the learner's cognitive structure. Its main principles include: Subsumption: The integration of new knowledge into the existing cognitive structure, either through derivative subsumption (adding details) or correlative subsumption (modifying concepts).

Philosophically, Ausubel's theory is rooted in cognitive constructivism, which emphasizes the active role of learners in building knowledge. The central principle that learning is influenced by what the learner already knows serves as a strong foundation for understanding the essence of *deep learning*. Thus, Ausubel provides a philosophical basis that learning is not a process of transferring information but rather a process of constructing meaning. This philosophical implication is crucial in the context of modern education, as it affirms that teachers are no longer the sole source of knowledge but facilitators who help students connect prior knowledge with new information. Advance Organizer: An abstract introduction presented before the main material to link prior knowledge with new knowledge,(Rohmah et al. 2024) thereby enhancing retention and understanding. Progressive Differentiation and Integrative Reconciliation: Materials are taught from the most inclusive to the more specific, while reconciling concepts to avoid conflict.

Ausubel distinguished *meaningful learning* from *rote learning* (memorization), where the former results in long-term understanding and knowledge transfer. Modern critiques from neuroscience perspectives highlight that memory is dynamic and non-representational, thus requiring Socratic dialogue to explore prior knowledge in depth.

## METHODS

This study employs a systematic literature review approach with keyword searches such as "deep learning based on Ausubel's theory" and "teaching deep learning using Ausubel's meaningful learning theory" (Ausubel 1963) (Cottingham 2023) . Thematic analysis was conducted to identify patterns of theory integration and educational applications.(Sugiyono, 2019) Primary sources were analyzed, focusing on publications after 2018 for contemporary relevance, including perspectives from neuroscience and

## RESULT AND DISCUSSION

### The Concept of Deep Learning in Education

Deep learning in the context of education refers to an approach that promotes deep understanding through critical thinking, analysis, and application (Fauziati 2025). Unlike surface learning, which focuses on memorization, deep learning involves higher-order thinking skills (HOTS) such as analysis, evaluation, and creation. In principle, it includes: active student engagement in exploration, collaboration, and problem-solving; the use of strategies such as in-depth discussions, case studies, and authentic projects; and the goal of developing 21st-century skills such as creativity, communication, and critical thinking. Deep learning is closely related to constructivism, in which students build knowledge through social interaction and real-life experiences, as supported by Piaget, and also Vygotsky.

### Integrating Ausubel's Theory into Deep Learning

The integration of Ausubel's theory with deep learning emphasizes that deep learning must be based on meaningful learning. Ausubel argues that learning is effective if students can connect new concepts with existing cognitive structures, which aligns with deep learning that encourages relational analysis and application. Ausubel's advance organizers can be used as tools to prepare students for complex concepts in deep learning, such as in AI learning where the concept of neural networks is linked with basic mathematical knowledge.

Studies show that deep meaningful learning (DML) combines critical depth with personal meaning, utilizing inquiry and problem-solving to build patterns and conceptual associations. In elementary education, this approach supports the *Kurikulum Merdeka* in Indonesia, where students are encouraged to connect new knowledge with prior experiences.

## Results and Discussion

The findings of the literature review indicate that integrating David Ausubel's learning theory with deep learning approaches provides a strong foundation for meaningful learning at various educational levels. Specifically, Ausubel's subsumption principle (Sexton 2025) which involves integrating new information into existing cognitive structures, aligns with the essence of deep learning that emphasizes deep understanding through higher-order thinking skills (HOTS) such as analysis (Yapıcı et al. 2019) synthesis, and authentic application. Empirical studies reveal that the use of advance organizers abstract introductory tools linking prior and new knowledge can enhance students' retention and understanding even in complex subjects like mathematics and science, as confirmed by related meta-analyses. In the context of deep meaningful learning (DML), which combines elements of meaningful (Cottingham 2023), mindful, and joyful learning (Nafiah et al. 2024), this integration facilitates the construction of conceptual patterns through inquiry and problem-solving (Dolmans et al. 2016), allowing students not only to memorize but also to transfer knowledge into real-life situations.

Furthermore, the findings reveal practical applications of this integration in modern education. For example, in science learning, advance organizers can be used to connect

everyday concepts such as gravity with scientific theories (Agyeman 2024) encouraging students to engage in deep exploration through authentic projects (Bakhmat et al. 2025) In mathematics education, Ausubel's theory supports a deductive approach where students link new formulas with foundational knowledge, aligning with deep learning to develop critical thinking. In the Indonesian context, this integration supports the implementation of the *Kurikulum Merdeka*, (Nadawina et al. 2025), where deep learning based on Ausubel's meaningful learning is applied through project-based and collaborative learning. A systematic literature review found that this approach improves critical thinking skills in elementary to secondary students, enabling them to connect new concepts with personal experiences, thereby increasing intrinsic motivation and long-term retention. In addition, in AI education, Ausubel's principles can be applied to connect concepts such as neural networks with probabilistic foundations, allowing students to conduct in-depth analysis and innovation.

However, the discussion of these findings also highlights modern challenges and critiques of Ausubel's theory. From a neuroscience perspective, memory is no longer viewed as static and representational as Ausubel assumed, but rather dynamic and non-representational, where concepts are contextually activated through neural re-entry processes. This implies that advance organizers need to be combined with Socratic dialogue to more deeply explore prior knowledge, since static assumptions may lead to misinterpretations of student understanding. Neuroscience studies show that conceptual change involves the coexistence of old and new ideas rather than replacement, requiring more flexible scaffolding such as Vygotsky's Zone of Proximal Development (ZPD). Other critiques include Ausubel's limited emphasis on group dynamics and collaboration, which are crucial in digital-era deep learning where students often interact through social media and technology. In online education, such as MOOCs, this challenge is even more apparent since student isolation can reduce motivation, thus necessitating strategies like game-based learning and virtual reality to reinforce joyful and mindful elements in DML.

Further discussion emphasizes implications for teaching practice. To overcome these challenges, educators are advised to use hybrid strategies: combining advance organizers with active learning activities such as problem-based learning (PBL) and project-based learning, which allow students to build meaning through collaboration and metacognitive reflection. Research shows that this approach enhances student achievement in elementary education, with improved recall ability and intrinsic motivation, especially when linked to authentic experiences. In Indonesia, teacher training is necessary to implement this integration, since many teachers still rely on traditional explanatory methods. A systematic review of 20 articles found that Ausubel-based deep learning is effective in reducing attrition rates in distance education, by improving cognitive, social, and teaching presence. In addition, adaptation to student diversity, including emotional and motivational factors, is key where joyful learning elements such as gamification can enhance engagement.

Overall, the findings confirm that integrating Ausubel's theory with deep learning not only enriches theoretical understanding but also provides practical benefits, such as the development of HOTS and lifelong learning. However, modern reinterpretation is required to accommodate neuroscience and technological dynamics so that the approach remains relevant. In the Indonesian context, this supports the holistic vision of education in the *Kurikulum Merdeka*, but further empirical research is needed to test effectiveness



across various subjects. Challenges such as teacher workload can be addressed through competency-based curriculum design, which prioritizes the quality of interaction over the quantity of content. Ultimately, this integration encourages educational transformation toward a more student-centered model, where meaning and depth are the primary priorities.

## CONCLUSION

This study concludes that deep learning based on Ausubel's theory is effective in creating meaningful understanding through the integration of knowledge. Deep learning as a learning paradigm requires the meaningful connection between new knowledge and prior knowledge. David Ausubel's theory of meaningful learning provides a strong conceptual foundation for realizing deep learning, particularly through the application of advance organizers, activation of prior knowledge, and progressive differentiation. The recommendation from this study is that educators should integrate Ausubel's theory-based learning strategies into instructional planning and practice. Furthermore, policymakers need to promote the implementation of curricula that support meaningful learning in order to prepare students to face the challenges of the 21st century and the era of society.

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