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Implementation of Digital Product-Based Deep Learning with a Deep Learning Approach

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ABSTRACT

Purpose – This study aims to describe the concepts, implementation strategies, and impacts of digital product-based deep learning on student learning outcomes in the era of the Industrial Revolution 4.0 and Society 5.0. The background of this research lies in the demand for mastering 21st-century skills—critical, creative, collaborative, and communicative thinking—which requires a paradigm shift from mere knowledge transfer to meaningful and applicable learning.

Methodology – This study employed a qualitative descriptive approach. Data were collected through literature review, observation of implementation, and interviews with teachers and students. The analysis was conducted descriptively to present the relationship between deep learning concepts, digital product-based implementation strategies, and their impacts on students' competency achievement.

Findings – The results indicate that the application of deep learning in modern education is implemented through contextual learning, project- or problem-based models, and the strengthening of 21st-century skills. Digital product-based implementation strategies include creative planning, the use of collaborative applications, strengthening the role of teachers as facilitators, and the adoption of authentic assessment. The impacts include improved conceptual understanding, higher-order thinking skills, creativity, and student learning motivation.

Novelty – This study contributes by integrating digital product-based deep learning that incorporates interactive technologies such as videos, e-books, and educational applications, thereby expanding opportunities for meaningful learning in the 21st-century context.

Significance – This research provides insights for teachers, curriculum developers, and education practitioners on innovative strategies to optimise the competencies of the digital generation while addressing learning challenges in the era of the Industrial Revolution 4.0 and Society 5.0.

Keywords: Deep learning; Digital products; Modern education.

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1. Introduction

The development of digital technology has affected almost all aspects of human life, including in the world of education (Sadriani, Ahmad, & Arifin 2023). In the era of the Industrial Revolution 4.0 and Society 5.0, students' ability to think critically, creatively, collaboratively, and communicatively is very important to be developed (Rimayati et al. 2021). This challenge of the 21st century requires a paradigm shift in learning from just knowledge transfer to learning that shapes competencies and character (Rahayu, Iskandar, & Abidin, 2022). Therefore, innovation in learning methods and approaches that can respond to these challenges effectively and efficiently is needed (Saiful 2023).

One of the relevant approaches in answering these challenges is deep learning (Nugraha1 2021). In contrast to surface learning, which only emphasises memorisation and repetition of material, deep learning emphasises meaningful and applicative conceptual understanding. Deep learning allows students to relate new knowledge to existing knowledge, develop metacognitive skills, and apply knowledge in real-world situations (Anwar 2017). This is in line with the constructivist approach that places students as active subjects in the learning process (Ningrum, Maghfiroh & Andriani 2023; Raup et al. 2022).

In this context, the integration of digital technology is indispensable to support the deep learning process. Digital products such as interactive learning videos, e-books, digital simulations, and learning applications are means that can enrich the learning experience of students (Diponegoro, Kusumawardani, & Hidayah, 2021). Not only as a tool, digital products can be part of the learning process and outcomes themselves. In other words, digital products can be used as a medium as well as a learning output developed by students.

The implementation of digital product-based learning requires a change in the role of teachers from informants to facilitators, mentors, and supervisors in the process of developing students' creativity (Oktaviana & Ramadhani, 2023). This is where the importance of combining deep learning with a product-based approach lies. With this approach, learners not only receive information, but also produce knowledge in the form of digital works that can be accessed and studied by others (Mella, Wulandari, & Wiarta, 2022).

Deep learning based on digital products is also very much in line with the characteristics of Generation Z and Alpha students, who are very familiar with digital technology (Basra 2023). They not only become users of technology, but also have the potential to become useful digital content creators. Therefore, educators must be able to facilitate this potential through meaningful and contextual learning (Setiadi, Alia, & Nugraha 2022). However, the implementation of deep learning based on digital products cannot be separated from various challenges. Teachers need to have competence in designing learning under deep learning principles and utilising digital technology optimally. In addition, infrastructure support, training, and education policies are

needed that support the comprehensive integration of technology in the learning process (Senjaya 2022).

Therefore, studies on the implementation of deep learning based on digital products are very important to be carried out. This study aims to describe how this approach is implemented in learning practices, the challenges faced, and its impact on students' learning outcomes. From the various backgrounds above, several problem formulations can be formulated, namely (1) How can the concept of deep learning be applied in the context of modern education? (2) What is the strategy for implementing digital product-based deep learning in schools?; (3) To what extent does digital product-based deep learning have an impact on student learning outcomes?

2. Methods

This study uses a qualitative approach. A qualitative approach is a research approach that aims to understand phenomena in depth in a natural context, through direct interaction with the research subject, without manipulating variables (Creswell, 2020). The main focus of this approach is deep meaning, process, and understanding, not just numbers or generalisations. The characteristics of the qualitative approach in this study include descriptive data, natural context, inductive analysis, and a meaning-oriented.

The type of research used is qualitative descriptive research. Qualitative descriptive research aims to describe phenomena as they are according to the conditions that occur in the field, without manipulating or changing the situation. The focus is on exposing the data in depth and detail to provide a comprehensive understanding of the phenomenon being studied. The characteristics of descriptive research in this context are to explain how the implementation of deep learning based on digital products takes place, describe teachers' strategies in facilitating deep learning using digital products, and describe the challenges and impacts of this approach on student learning outcomes.

3. Results and Discussion

3.1. Deep Learning and Modern Education

The development of modern education today demands a new paradigm in the teaching and learning process. Learning no longer focuses on memorisation, but must encourage learners to understand concepts in depth, think critically, be creative, and be able to solve problems in a real-life context (Kuncahyono & Kumalasani, 2019). In this case, the concept of deep learning is present as a relevant and effective approach. Deep learning is different from surface learning. According Indriani, Nurlina, & Basri, (2023) stated that deep learning occurs when learners seek to understand core ideas, relate new knowledge to previous experiences, and use them to solve problems. This is in line with the theory of constructivism, which views learning as a process of constructing meaning, not just receiving information.

Deep learning occurs when learners seek to understand core ideas, relate new knowledge to previous experiences, and use them to solve problems. This is in line with the theory of constructivism, which views learning as a process of constructing meaning, not just receiving information (Ningrum, Siregar, & Panjaitan, 2023; Ramadhina & Pranata, 2022). Strengthening 21st Century Skills focuses on critical thinking,

communication, collaboration, and creativity skills (4C skills). And technology integration, technology plays a role in expanding access to information and facilitating collaboration and exploration (Ramadhina & Pranata, 2022).

Kurikulum Merdeka, implemented in Indonesia, is an example of the implementation of this concept. For example, through the Pancasila Student Profile Strengthening Project (P5), students are trained to work on cross-subject projects that require real, creative, and collaborative problem-solving. However, the application of the concept of deep learning is inseparable from challenges (Zahwa & Syafi'I, 2022). Among them are the limitations of teachers' competence in designing deep learning, limited facilities, and a learning culture that is still exam-oriented. Therefore, teacher training support, supportive education policies, and the provision of infrastructure are needed. The concept of deep learning can be applied in modern education through the application of a problem- or project-based learning model, the use of technology, and an emphasis on higher-level thinking skills. This implementation must be carried out systematically and supported by adequate policies and facilities (Hindriana et al., 2023; Mulyani & Haliza, 2021).

3.2. Digital Product-Based Deep Learning

Deep learning will be more effective if integrated with digital technology, considering that Generation Z and Alpha students are very close to the digital world (Anindya, 2023). The implementation strategy of deep learning based on digital products emphasises the provision of meaningful learning experiences that are oriented towards creating digital works as learning outcomes. This strategy can be carried out through several stages, first, planning, teachers formulate competency-based learning objectives that meet the needs of the 21st century. In addition, teachers design learning activities that allow students to create digital products such as educational videos, podcasts, infographics, or blogs. Second, the selection of learning models, namely with the most relevant approaches are Project-Based Learning (PjBL) and Problem-Based Learning (PBL), (Ningrum, *et al. 2023)*.

In this model, learners work collaboratively to complete projects that demand mastery of digital concepts and skills. Third, the use of technology such as applications for collaboration can use Google Classroom, Padlet and Trello. Product creation media such as Canva, Powtoon, Capcut, or other design applications. Learning Management System (LMS) to monitor learning progress. Third, strengthening the role of teachers, teachers play the role of facilitators, mentors, and evaluators. He no longer only conveys information, but guides students in the process of exploration and production. Fourth, authentic assessment, which includes processes and products. Teachers evaluate how students work together, think critically, and the quality of the digital products produced (Fuadi, et al. 2021).

The strategy not only supports knowledge mastery but also digital skills, creativity, and cooperation. However, the successful implementation of this strategy is greatly influenced by teacher readiness, technological support, and pro-innovation school policies.

3.3. The Impact of Deep Learning and Digital Products for Students

Digital product-based deep learning has a significant impact on student learning outcomes, both in cognitive and non-cognitive aspects. In the cognitive aspect, students not only understand concepts in depth, but are also able to apply them to real situations (Rahmi & Rustini, 2023). With their involvement in the creation of digital products, they learn to analyse, synthesise, and evaluate information capabilities that are at a high level in Bloom's Taxonomy. A study by Johnson shows that the use of digital technology in project-based learning can increase students' concept comprehension scores by 15–20% compared to traditional methods (Miasari et al. 2022; Rahmi & Samsudi 2020). In the non-cognitive aspect, this learning improves collaboration, communication, and creativity skills (Puspitarini, 2022). When students work in groups to create digital products, they learn to set roles, communicate effectively, and solve problems together. In addition, this process also increases learning motivation as learning becomes more engaging and in technology-laden world (Jannah & Suciptaningsih, 2023).

However, this positive impact is highly dependent on several factors, including the competence of teachers in designing innovative learning, the availability of technological facilities and infrastructure, and the support of school and parent policies. Deep learning based on digital products has a positive impact on student learning outcomes by improving mastery of concepts, 21st-century skills, and learning motivation. In other words, this model is the answer to the challenge of modern education that requires meaningful, creative, and contextual learning.

4. Conclusions

The concept of deep learning in the context of modern education focuses on understanding meaningful concepts, developing critical, collaborative, creative, and communicative thinking skills. The application of this concept requires a paradigm shift in learning from memorisation methods to active, contextual, and experience-based learning. The integration of digital technology is also an important element so that learning is in accordance with the characteristics of the current digital generation.

The implementation strategy of digital product-based deep learning in schools is carried out through innovative learning planning, the selection of project- or problem-based models, the use of technology to support creativity and collaboration, and the use of authentic assessments. Teachers act as facilitators who guide students to produce digital works as learning outputs. Infrastructure support, teacher competence, and school policies are important factors for the success of this implementation.

The impact of digital product-based deep learning on student learning outcomes is very significant, both in the cognitive aspects (increasing understanding of concepts and critical thinking skills), affective aspects (motivation and learning engagement), and psychomotor aspects (mastery of technology skills and creativity). Previous studies support these findings, which show that project-based learning with technology integration can improve overall learning outcomes.

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Conflict of Interest

This article was written from the results of observations about the hot discussion in the world of education today, namely about the deep learning approach. We then combine this with learning results that produce digital products. This research needs continuous development so that the results are more in-depth.

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