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Implementation of Deep Learning in Independent Curriculum: Literature Study and Implications for Future Education

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Abstract

In today's digital era, various significant new challenges and opportunities are faced by the world of education. The Independent Curriculum implemented in Indonesia is designed to provide freedom and comfort to students in developing their potential. In this context, the application of the Deep Learning concept is considered increasingly important. This study aims to discuss the application of Deep Learning in the Independent Curriculum and its application to future education. The literature study method with a qualitative descriptive approach is used to describe and analyze the application of Deep Learning in the Independent Curriculum. The main focus of the study is the collection and analysis of information from relevant literature sources. Based on the literature study that has been conducted, a significant impact on future education can be provided by the application of Deep Learning in the Independent Curriculum. Some important aspects include personalization of learning, data analysis, interactive content, improving the quality of teaching, the potential of artificial intelligence (AI), and preparation for the future.

Keywords: Deep Learning; Independent Curriculum; Future Education

Abstrak

Di era digital saat ini, berbagai tantangan dan peluang baru yang signifikan dihadapi oleh dunia pendidikan. Kurikulum Merdeka yang diterapkan di Indonesia dirancang untuk memberikan kebebasan dan rasa nyaman kepada siswa dalam mengembangkan potensi. Dalam konteks ini, penerapan konsep Deep Learning dianggap semakin penting. Penelitian ini ditujukan untuk membahas penerapan Deep Learning dalam Kurikulum Merdeka serta penerapannya terhadap pendidikan di masa depan. Metode studi literatur dengan pendekatan deskriptif kualitatif digunakan untuk menggambarkan dan menganalisis penerapan Deep Learning dalam Kurikulum Merdeka. Fokus utama penelitian adalah pengumpulan dan analisis informasi dari sumber-sumber literatur yang relevan. Berdasarkan studi literatur yang telah dilakukan, dampak signifikan terhadap pendidikan masa depan dapat diberikan oleh penerapan Deep Learning dalam Kurikulum Merdeka. Beberapa aspek penting meliputi personalisasi pembelajaran, analisis data, konten interaktif, peningkatan kualitas pengajaran, potensi kecerdasan buatan (AI), dan persiapan untuk masa depan.

Kata Kunci: Deep Learning; Kurikulum Merdeka; Pendidikan Masa Depan

Introduction

In today's digital era, education faces significant new challenges and opportunities. The Merdeka curriculum, implemented in Indonesia, aims to provide freedom and flexibility for students to develop their potential. In this context, the application of the concept of deep learning becomes increasingly relevant. Deep learning, which focuses on developing deep understanding and critical thinking skills, can support

the goals of the Merdeka curriculum which emphasizes more holistic and student-oriented learning. The principal's decision-making in implementing the curriculum has a significant impact on the quality of education in schools. By considering these aspects, the principal can ensure that the curriculum implemented in their school meets the needs of students and contributes to the achievement of broader educational goals. The principal's decision-making in implementing the Merdeka curriculum requires a deep understanding of education, leadership skills, and the ability to collaborate.

The implementation of the Merdeka curriculum is a significant change in the Indonesian education system that aims to better adapt education to local needs, develop student character, and promote competency-based learning. However, successful implementation requires adequate support, training, and resources for schools and educators (Wijayanti et al., 2024). Changes in the curriculum require teachers to prepare themselves through training and find out about the implementation of the independent curriculum so that it can be applied properly in the teaching process (Nofrianti et al., 2024).

Within the framework of the independent curriculum, teachers are expected to be pioneers in independent learning, where they must have a proactive, enthusiastic, creative, innovative attitude, and be skilled as a facilitator in carrying out transformation in schools. A teacher who plays a role as a driver in the independent learning curriculum not only needs to master the material and teach well in class, but must also be able to create a supportive learning atmosphere by establishing good relationships with students. In addition, teachers are required to utilize various existing technologies to improve the quality of learning methods.

Teachers also need to continue to practice and make improvements to errors and deficiencies that arise during the learning process (Dwi et al., 2024). The independent learning curriculum is a concept that demands independence for students (Baharuddin, 2021; Manalu, Sihotang and Henrika, 2022). Independence in this case, where students are given the freedom to choose and access the knowledge they obtain from formal education, in addition, this independent curriculum does not limit learning that is carried out in schools only, but can be done outside school hours and systems. Therefore, this independent curriculum directs educators and students to be as creative as possible in carrying out learning both in school and outside school.

The presence of this independent curriculum aims to answer and the possibility of future education, so that in its manifestation it must form critical thinking, creative thinking, imaginative thinking, holistic thinking, communication and collaboration skills for students (Risdianto, 2019; Hadiansyah and Muhtar, 2023). Independent curriculum provides flexibility in learning, so that students have enough time to understand concepts and strengthen competencies. Teachers also have the freedom to choose learning media that suit students' needs. In addition, the Pancasila Student Profile project was developed based on a specific theme with flexibility in its implementation, not tied to certain learning outcomes (Anggraini et al., 2022).

The deep learning model focuses on developing a deeper understanding of the subject matter through holistic learning experiences, where students become more emotionally and cognitively involved in their learning process. This approach seeks to change the traditional learning paradigm that often focuses on memorizing and repeating information into more constructive and reflective learning. In line with this concept, mindful learning, as proposed by Ragoonaden (2015) plays an important role in ensuring that students not only understand the material in theory, but also relate it to their personal experiences and real-life contexts (Putri, 2024).

The independent curriculum introduces flexibility, teacher autonomy, and digital-based support into the Indonesian education system. However, local governments have not adequately prepared stakeholders with the knowledge needed to implement the curriculum. As a result, gaps in the dissemination and utilization of knowledge hinder effective implementation, especially in improving teacher competency (Alhapip et al., 2024). The implementation of deep learning not only affects the way students learn, but also has an impact on teachers' teaching methods.

With a more understanding and reflection-based approach, teachers can encourage students to be more active in the learning process, and better able to face complex global challenges. This article aims to determine the impact of the implementation of deep learning in the independent curriculum on future education. Thus, this article is expected to contribute to improving the quality of education in Indonesia by developing a better understanding of teacher pedagogy in implementing the independent curriculum.

Methode

This study uses a literature study research method using a qualitative descriptive approach, namely using an approach to describe and analyze the application of deep learning in the independent curriculum. The main focus is on collecting and analyzing information from relevant literature sources. Data sources taken using academic literature Collecting journal articles, books, research reports, and policy documents related to deep learning and the independent curriculum, Online Sources Using academic databases such as Google Scholar, Science Direct, and ERIC to find relevant studies. Official documents relevance source selection criteria the selected sources must be relevant to the topic of implementing deep learning in the independent curriculum, Quality Prioritizing sources from accredited journals, international conferences, and leading publications in the field of education. Year of publication Focusing on the latest publications (the last 5-10 years) to ensure that the information obtained is up to date. Data collection procedures, Topic Identification determining the sub-topics to be studied, such as the definition of deep learning, implementation in education, and the challenges faced. Literature search conducting a systematic search using keywords such as deep learning, independence curriculum, Indonesian education, and active learning. Data collection collecting and storing relevant articles, books, and documents for further analysis, Data analysis categorization grouping information from the literature based on themes and sub-themes, such as deep learning concepts, implementation strategies, impacts on students, and challenges. Synthesis integrating findings from various sources to produce a comprehensive understanding of the application of deep learning in the independent curriculum. Conclusion drawing drawing conclusions based on the analysis conducted, and formulating recommendations for future educational research and practice.

Results and Discussion

Based on the literature study that has been conducted, the application of deep learning in the independent curriculum can have a significant impact on future education. Here are some important aspects:

1. Personalized Learning: Deep learning allows the system to analyze student data and adjust learning materials according to individual needs, so that each student can learn in the way that is most effective for them. The Independent Curriculum implemented in Indonesia is designed to provide freedom and comfort to students in developing their potential. In this context, the application of the Deep Learning concept becomes increasingly important. This study aims to discuss the application of Deep Learning in the Independent Curriculum and its application to education in the future. The

literature study method with a qualitative descriptive approach is used to describe and analyze the application of Deep Learning in the Independent Curriculum. The main focus of this study is the collection and analysis of information from relevant literature sources.

Based on the literature study that has been conducted, the implementation of Deep Learning in the Independent Curriculum can have a significant impact on education in the future. One very important aspect is the personalization of learning. Deep Learning allows the system to analyze student data and adjust learning materials according to individual needs, so that each student can learn in the most effective way. Research by Hwang et al., (2020) supports this, showing that an adaptive learning system based on Deep Learning can significantly improve student learning outcomes compared to conventional learning methods. In the study, the Deep Learning algorithm was used to predict students' level of understanding based on their interactions with the learning materials, then adjust the level of difficulty of the material automatically. Another important aspect is the potential of Deep Learning in creating interactive content. This system can be used to produce learning materials that are more interesting and relevant to students, such as personalized learning videos or interactive simulations. This has the potential to increase student motivation and make the learning process more effective. In addition, the implementation of Deep Learning can also improve the quality of teaching. Teachers can use the deep learning system to get feedback on their performance and identify areas that need skill improvement.

The application of Deep Learning also opens up opportunities to utilize artificial intelligence (AI) in education. AI systems can be used to automate administrative tasks, provide feedback to students, and in some cases, even replace the role of teachers. However, it should be noted that AI cannot completely replace the role of teachers, but rather should be used as a tool to support teachers in providing better education. Finally, the application of Deep Learning can help prepare students for the future. In today's digital era, skills related to AI and Deep Learning are increasingly important. By introducing Deep Learning to students at an early age, they can develop the skills needed to achieve success in the future.

Personalized learning is an approach to learning that aims to personalize the learning experience according to the unique needs, goals, and skills of individuals which can be achieved using the latest instructional technologies that provide unique learning experiences in various learning environments. Technology is a key component that will enable and enrich personalized learning experiences however, although technology is available to personalize learning experiences, there is still a lack of unified agreement on what components need to be considered for a dynamic personalized learning approach that is able to provide a unique and effective learning experience for each learner. (Shemshack and Spector, 2021).

A new approach to enhance personalized learning experiences in e-learning recommender systems by leveraging deep learning for content understanding. Personalized learning aims to tailor educational content and strategies to individual learner needs, enhancing engagement and learning outcomes. However, existing e-learning recommender systems often struggle to provide truly personalized recommendations due to limited content understanding (Babu et al., 2024).

2. Data Analysis: By using deep learning algorithms, educators can evaluate student performance in more depth. This helps in identifying areas for improvement and developing better teaching strategies. In addition to personalized analysis, learning data is also a crucial aspect in the implementation of Deep Learning. Deep Learning systems are able to analyze student data to identify patterns and trends that may not be

detected by teachers or school administrators. This information can be used to improve the quality of teaching, identify students at risk of falling behind, and develop appropriate interventions. Another important aspect is the potential of Deep Learning in creating interactive content. This system can be used to produce learning materials that are more engaging and relevant to students, such as personalized learning videos or interactive simulations.

The application of this kind of content has the potential to increase student motivation and make the learning process more effective. A study by Kim et al., (2019) showed that the use of interactive learning content generated by Deep Learning systems can improve student engagement and their learning outcomes. Furthermore, the application of Deep Learning also has the potential to improve the quality of teaching. Through deep learning systems, teachers can get feedback on their performance and identify areas that require skill improvement. The rapid development of deep learning methods presents a potentially game-changing opportunity in the field of education, especially in promoting student engagement and understanding of subject matter.

To exemplify the learning movement and address educational challenges, this exploratory study investigates the operation of deep learning algorithms to determine student interests. Our deep learning model can provide direct predictions on areas of interest for individual students by analyzing a large amount of educational data. This data includes student relationships, performance standards, and student behavior patterns. By aligning teaching tactics with student preferences, this strategy not only makes it easier for students to become familiar with newly presented educational materials but also encourages active learning (Jothi et al., 2024).

3. Interactive Content Deep learning: can be used to develop more interactive and engaging learning materials, such as AI-based applications that can simulate real-world situations, increasing student engagement. In addition to personalized analysis, learning data is also a crucial aspect in the application of Deep Learning. Deep Learning systems are able to analyze student data to identify patterns and trends that may not be detected by teachers or school administrators. This information can be used to improve the quality of teaching, identify students at risk of falling behind, and develop appropriate interventions.

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it. The growth of the internet and greater digital technology has given rise to various difficulties. The larger amount of data on the internet may be unorganized and unstructured, making it difficult to utilize and manipulate the data process. Deep learning, as well as machine learning mechanisms to classify text, are the importance of PCK (Tatavarthy and Lakshmi, 2022).

4. Improving Teaching Quality: Through automated analysis, educators can gain feedback on their teaching methods, enabling continuous improvement and implementation of best practices. Furthermore, the application of Deep Learning also has the potential to improve the quality of teaching. Through automated analysis, educators can gain feedback on their teaching methods, enabling continuous improvement and implementation of best practices. The Merdeka Curriculum aims to rejuvenate the education system by focusing on the development of the character of students who are raised through the Pancasila profile and mastery of basic competencies to achieve 21st century skills.

   Research by Nguyen et al., (2022) shows that a deep learning-based automated feedback system can provide teachers with accurate and relevant information about the effectiveness of their teaching methods. This feedback can be used to identify areas where teachers can improve their skills and implement best practices in teaching. The Merdeka Curriculum aims to rejuvenate the education system by focusing on the development of the character of students through the Pancasila profile and mastery of basic competencies to achieve 21st century skills.

   However, the implementation of the independent curriculum in learning is still relatively low, so that there is an assumption that teacher competence plays a less important role, especially in pedagogical and professional competence. Improving the pedagogical and professional competence of teachers is very important for the successful implementation of the independent curriculum. It is recommended that educational authorities and related institutions focus on strengthening this competence among teachers. By paying attention to these aspects, curriculum implementation can be improved, thereby providing a better educational experience with significant meaning for students (Ockta and Mardesia, 2023).

5. Current potential of artificial intelligence (AI) to support personalized learning (PL). Personalized learning can provide a customized learning environment to support students' learning process based on individual needs, competencies, and interests. Hwang et al., (2021) in their research showed that AI-based learning systems can effectively adapt learning content and activities to students' individual needs, leading to increased motivation and learning outcomes. This system uses deep learning algorithms to analyze student data and make personalized recommendations. Personalized learning can provide a customized learning environment to support students' learning process based on individual needs, competencies, and interests.

   One way to do personalized learning is to use a recommendation system that uses deep learning, an AI technique (Junus and Brophy, 2023). Academic efforts to improve erhu teaching reflect broader educational reforms that combine advanced technologies and innovative frameworks to enrich the learning of traditional Chinese musical instruments. The role of immersive learning in erhu education promises to revolutionize teaching methods through personalized learning pathways and adaptive strategies, enhancing student experience. This study focuses on building a personalized erhu teaching system based on immersive learning. It mentions utilizing immersive learning to offer customized learning pathways and adaptive teaching frameworks, aiming to improve the quality of music education and provide students with personalized learning experiences (Sharma et al., 2024).

6. Future-proofing: Integrating deep learning technologies into education helps prepare students for an increasingly tech-dependent workforce, enhancing critical skills needed in the digital age. A report by the World Economic Forum (2020) highlights the importance of skills such as complex problem-solving, critical thinking, creativity, and emotional intelligence in the future job market. The application of deep learning in education can help students develop these skills through personalized and interactive learning experiences. The report also highlights that automation and the adoption of technology by businesses will transform tasks, jobs, and skills by 2025.

With the implementation of deep learning, the independent curriculum can be more responsive to students' needs and prepare them for future challenges. Deep learning is an active and critical learning method. Based on understanding learning, new ideas and knowledge are integrated into the original cognitive structure, and existing knowledge is transferred to new situations to make decisions or solve problems (Yang and Yu, 2019). The independent curriculum (Mandiri) is a crucial element for the sustainability of education in Indonesia. Teachers need to have significant readiness to ensure optimal implementation. However, many teachers still need clarification and assistance to understand and need assistance to integrate the independent curriculum with existing conditions (Syofyan et al., 2024).

The independent curriculum as a response to the challenges of Indonesian education policy in the digital and globalization era. This policy aims to increase the flexibility and quality of education through a more adaptive approach to student needs and technological advances. The independent curriculum provides greater flexibility for teachers in designing learning programs tailored to student needs. However, implementation in the field faces various challenges, such as lack of technological infrastructure and teacher training. In conclusion, although the independent curriculum has the potential to improve the quality of education, stronger support in technology and training is needed for its success (Saa, 2024).

Conclusion

Based on the literature review, it can be concluded that this study shows that the implementation of deep learning in the independent curriculum has great potential to improve the quality of education in Indonesia. In a more flexible and student-focused way, this curriculum provides opportunities for students to learn independently and creatively. Through the use of various data sources, including official documents and academic literature, this study has successfully identified a number of important aspects of the implementation of deep learning, such as learning adjustments, the development of critical thinking skills, and the application of educational technology. However, to achieve the best results, sufficient support is needed from all related parties, including training for teachers, provision of resources, and supportive policies. In this way, the implementation of deep learning in the independent curriculum can not only improve students' abilities but also prepare them to face global challenges in the future. Recommendations for future educational research and practice also need to focus on developing better teaching methods for educators.

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