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The Effect of Implementing Deep Learning on Improving Students' Cognitive Abilities in the Independent Curriculum at Yogyakarta High Schools

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Abstract

The application of artificial intelligence technology, especially Deep Learning, in the world of education is increasingly developing and has the potential to improve students' cognitive abilities. This study aims to analyze the effect of the application of Deep Learning on improving students' cognitive abilities in the Independent Curriculum in Yogyakarta High Schools. This study analyzes the effect of the application of Deep Learning technology on improving students' cognitive abilities in the Independent Curriculum in Yogyakarta High Schools. Using an interpretive quantitative method with simple linear regression, the results show a positive relationship between the application of Deep Learning and students' cognitive development with a contribution of 34.2%. The regression equation Y = 33.136 + 1.241X shows that the higher the application of Deep Learning, the higher the students' cognitive abilities. Although effective, challenges in infrastructure, teacher readiness, and student readiness still need to be overcome. With the support of the government and schools, this technology can be optimized to support more interactive, adaptive, and data analysis-based learning, thereby increasing the effectiveness of education and achieving the goals of the Independent Curriculum.

INTRODUCTION

The development of technology in the digital era has brought significant changes in various aspects of life, including education (Maritsa et al., 2021). One of the innovations that is increasingly being applied is Artificial Intelligence (AI), especially in the form of Deep Learning. Deep Learning, as part of machine learning, allows computer systems to analyze large amounts of data, recognize patterns, and provide adaptive solutions that can increase the effectiveness of the learning process (Yudistira, 2021). This technology has the potential to improve the quality of education by providing a more personal, interactive, and data-driven learning experience. In Indonesia, the government has implemented the Merdeka Curriculum as an effort to improve the quality of education that is more flexible, project-based, and oriented towards developing student competencies (Tunas & Pangkey,

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2024). This curriculum emphasizes student-centered learning, encourages in-depth exploration of a material, and develops critical thinking and problem-solving skills. In line with that, the application of Deep Learning-based technology can be one of the innovative strategies to support the achievement of the objectives of the Independent Curriculum (Kurniati et al., 2020).

Students' cognitive abilities, which include aspects of understanding, analysis, evaluation, and synthesis of information, are the main factors in successful learning (Karina Sulistyorini et al., 2015). The use of Deep Learning in education can help improve these cognitive aspects by providing a more adaptive learning experience that suits individual needs. Various studies have shown that Deep Learning-based systems can improve students' memory, critical thinking skills, and creativity through more interesting and interactive learning methods.

Although this technology is promising, its implementation in the Indonesian education system still faces various challenges. The readiness of school infrastructure, the ability of teachers to adopt new technologies, and the readiness of students to utilize this technology are factors that need to be considered. Therefore, this study aims to analyze the extent to which the application of Deep Learning can improve students' cognitive abilities in the context of the Independent Curriculum and identify the opportunities and challenges in its implementation. Related to previous research, there are several relevant studies, including research written by Abdur Rauf entitled Deep Learning and Its Application in Learning. This study resulted in research showing that in recent years, artificial intelligence has developed very rapidly (Raup et al., 2022). Problems that were previously very difficult for humans to solve, with artificial intelligence these problems can be solved easily. The next study was written by Ayu Anggreani entitled Application of Deep Learning Methods in Learning Applications Using the Indonesian Language Sign System Using Convolutional Neural Network (Case Study: SLB-BC Mahardika Depok) resulting in helping students with disabilities to be able to develop attitudes, knowledge, and skills well (Anggraini & Zakaria, 2023). This shows that this study is different from previous research. This study focuses on improving students' cognitive abilities, it is hoped that the results of this study can contribute to the development of technology-based learning methods that are more effective, innovative, and relevant to educational needs in the digital era.

METHOD

The method used in this study uses an interpretive quantitative method (Lexy, 2018). The quantitative method is used to calculate how much influence the method used is and to find out the difference between the method used previously and the method used now. This methodology is used as an analysis in a problem that exists in a study. This study focuses on the quantitative method because it is used to calculate how much influence deep learning learning has on improving students' cognitive abilities in Yogyakarta High School.

FINDINGS AND DISCUSSION

The application of Deep Learning technology in education opens up new opportunities to improve the quality of learning, especially in the Independent Curriculum which emphasizes a competency-based learning approach and student independence. This study aims to analyze the effect of the application of Deep Learning on improving students' cognitive abilities in Yogyakarta High Schools. The details are as follows:

Deep Learning

Deep Learning is a branch of Artificial Intelligence (AI) that has grown rapidly in recent decades. This technology focuses on the development of artificial neural networks (AI) with many hidden layers to imitate the way the human brain works in recognizing patterns and processing information (Nurhakiki et al., 2024). Unlike conventional machine learning methods, Deep Learning is able to automatically learn features from large amounts of data without the need for significant human intervention (Nurhakiki et al., 2024). With this capability, Deep Learning has transformed various industries, from health, finance, to education. The history of Deep Learning begins with the basic concept of artificial neural networks introduced by Warren McCulloch and Walter Pitts in 1943 (Humaini, 2015). Initially, the development of neural networks stagnated due to limitations in computing and data. However, in the early 2000s, with increasing computing power and the availability of Big Data, Deep Learning began to show its extraordinary potential. A major breakthrough occurred in 2012 when the Convolutional Neural Networks (CNN) model developed by Alex Krizhevsky won the ImageNet competition with much higher accuracy than previous methods (Suartika E. P, I Wayan, Wijaya Arya Yudhi, 2016). This success marked the beginning of Deep Learning's dominance in various artificial intelligence applications. The basic architecture of Deep Learning consists of three main types of layers, namely the input

layer, the hidden layer, and the output layer. The input layer receives raw data, such as images, text, or sound (Nurmani et al., 2021). The hidden layer is tasked with extracting features and learning patterns in the data through complex mathematical processes. The more hidden layers used, the deeper the model is in understanding and processing information. The output layer then produces predictions or classifications based on the processed data. The Deep Learning model training process involves backpropagation techniques to adjust weights and improve model accuracy (Cynthia & Ismanto, 2017).

One of the main advantages of Deep Learning is its ability to handle unstructured data. Models such as CNN are very effective in image and video processing, while Recurrent Neural Networks (RNN) and Long Short-Term Memory (LSTM) models are used to understand context in sequential data, such as text and voice (Wiranda & Sadikin, 2019). In addition, the development of Transformer models, such as those used in GPT and BERT, has revolutionized natural language processing (NLP) by improving the ability of machines to understand and produce more human-like text (Firmanto et al., 2024).

The implementation of Deep Learning has penetrated various sectors. In the health sector, Deep Learning is used to diagnose diseases through medical imaging, such as detecting tumors from MRI and CT scan results. (Wibowo, 2023) In the automotive industry, this technology is at the heart of the development of autonomous cars that are able to recognize their surroundings and make decisions independently. (Ardi, 2022) In the financial world, Deep Learning is used to analyze stock market data and detect suspicious transactions to prevent fraud. (Prasetyo & Dewayanto, 2024) Even in education, Deep Learning-based models have helped personalize learning by analyzing student difficulty patterns and providing appropriate material recommendations. (Pokhrel, 2024) In the context of the Industrial Revolution 4.0, Deep Learning plays an important role in increasing automation and efficiency in various sectors. This technology supports the development of Internet of Things (IoT)-based systems, robotics, and large-scale data analysis. (Purba et al., 2021) With the help of Deep Learning, machines can learn from experience, make more accurate decisions, and reduce dependence on human intervention. This not only increases productivity but also opens up opportunities for new innovations in the development of AI-based technologies.

Despite its many advantages, the application of Deep Learning still faces a number of challenges. One of the main obstacles is the need for large amounts of high-quality data to train the model properly (Putri et al., 2023). In addition, the Deep Learning training

process requires very high computing power, often requiring the use of graphics processing units (GPUs) or tensor processing units (TPUs) to speed up calculations. In addition to technical challenges, there is also the problem of model interpretability, where decisions made by Deep Learning are often difficult to explain transparently, which can be an obstacle in applications that require high accountability, such as legal or medical systems.

Along with the development of technology, various innovations continue to be developed to overcome challenges in Deep Learning. Techniques such as transfer learning allow models to learn from smaller datasets by utilizing knowledge from previously trained models. The federated learning approach is also starting to become popular, where models can be trained decentralized without having to collect data in one place, thereby increasing user privacy (Saputra et al., 2023). In the future, research in the field of AI interpretability will be increasingly emphasized so that Deep Learning models become more understandable and trustworthy to humans.

In addition to technical challenges, the ethical aspects and social implications of Deep Learning are also major concerns (Siti Masrichah, 2023). The use of AI in decision-making that affects human life, such as in job recruitment, the justice system, or credit analysis, can lead to bias if the model is trained with imbalanced data. In addition, concerns have arisen regarding data privacy and security, especially with the increasing use of Deep Learning in facial recognition and AI-based monitoring. Therefore, appropriate regulations and policies are urgently needed to ensure that this technology is used ethically and responsibly. Overall, Deep Learning has revolutionized the world of artificial intelligence and has great potential to continue to grow in the future. With increasing computing power and more efficient training methods, this technology will continue to expand its application in various fields. However, to ensure that its benefits can be widely felt, collaborative efforts are needed from various parties, including academia, industry, and government, in developing policies and infrastructure that support the sustainable growth of Deep Learning.

Student Cognitive Ability

Students' cognitive ability refers to the ability to think, understand, process, and store information they obtain during the learning process (Marinda, 2020). This cognition includes various aspects, such as memory, problem solving, critical thinking, and the ability to connect concepts that have been learned. In the world of education, students' cognitive

development is a major concern because it determines how effective they are in understanding lessons and applying knowledge in everyday life (Artawijaya & Saptiari, 2023).

Students' cognitive development does not occur instantly, but rather through stages that are influenced by age, experience, and learning environment (Bujuri, 2018). Jean Piaget, a famous psychologist, put forward a theory of cognitive development that divides children's thinking stages into four main stages, namely sensorimotor, preoperational, concrete operational, and formal operational (Ismail, 2019). In the context of school, the concrete operational and formal operational stages are important phases where students begin to be able to think logically and understand abstract concepts. In addition to age factors, the learning environment also has a major influence on students' cognitive development (Almadani & Setiabudi, 2022). Learning strategies applied in schools also play a role in improving students' cognitive abilities. Problem-solving and critical thinking-based approaches can train students to think more deeply (Liska et al., 2021). For example, in learning mathematics, it is not just about memorizing formulas, but also understanding concepts and applying logic in solving problems. This approach helps students develop their analytical skills and creativity.

In addition, students' cognitive abilities are also influenced by learning motivation (Yogi Fernando et al., 2024). Students who have high motivation tend to be more active in seeking information, asking questions, and developing their understanding of a material. This motivation can come from internal factors, such as curiosity and interest in a field, or external factors, such as encouragement from teachers, parents, or the surrounding environment (Hidayat et al., 2019). With strong motivation, students find it easier to understand and remember the information obtained.

Physical and mental health also play an important role in students' cognitive development. A good diet, adequate sleep, and a stable emotional condition can support brain function in absorbing and processing information. Students who experience excessive stress or lack of sleep tend to have difficulty concentrating, which has an impact on their cognitive abilities (Andini et al., 2023). Therefore, the balance between academics and mental well-being must be considered so that students can learn optimally.

The current digital era makes technology a factor that influences students' cognitive development. Access to various learning resources via the internet allows students to broaden their horizons more quickly. However, on the other hand, if not used wisely,

technology can hinder students' critical thinking because they tend to only look for instant answers without going through a deep thinking process. Therefore, the use of technology in learning must be directed to continue to encourage students to think independently and analytically. Overall, students' cognitive development is the result of various interacting factors, ranging from age, learning environment, learning strategies, motivation, health, to the influence of technology. By understanding how these factors work, educators and parents can create conditions that support optimal student cognitive development. This is because good thinking skills not only affect academic achievement, but also in forming individuals who are able to think critically and creatively in the future.

The Influence of Deep Learning on Improving Students' Cognitive Abilities

The way to find out the effect of the Deep Learning method on improving students' cognitive abilities is to conduct a simple linear regression test by prioritizing the correlation test first. The regression test can be continued if the assumption of the data is normally distributed and there is a relationship between the two variables.

a. Normality test

One-Sample Kolmogorov-Smirnov Test

		Student Cognitive Development	Deep Learning Method
N		45	45
Normal Parameters[a]	Mean	83.72	42.15
	Std. Deviation	5.211	3.311
Most Extreme Differences	Absolute	.134	.122
	Positive	.157	.151
	Negative	-.066	-.072
Kolmogorov-Smirnov Z		1.152	.835
Asymp. Sig. (2-tailed)		.123	.251

a. Test distribution is Normal.

Based on the analysis above, it can be seen that the data is normally distributed, both student cognitive development data and deep learning methods. This can be seen

by comparing the significance of the data with a significance level of 5%, namely 0.05. If the data significance is more than 0.05, the data is normally distributed. If the data significance is less than 0.05, the data is not normally distributed. From the SPSS output table, it can be seen that the comparison of the significance of children's social development and play methods with a significance level of 5% is 0.122> 0.05 <0.251.

b. Linearitas test

ANOVA Table

			Sum of Squares	df	Mean Square	F	Sig.
Child Social Development* Play Method	Between Groups	(Combined)	2206.734	15	147.562	4.730	.000
		Linearity	1512.681	1	1512.681	44.320	.000
		Deviation from Linearity	683.053	14	52.312	1.697	.108
	Within Groups		2369.677	67	34.378		
	Total		4375.433	83			

From the table, it can be seen the significance to measure the relationship between two variables. If the significance is greater than 0.05 (significance level 5%) then the relationship between the two variables is linear. If the significance is less than 0.05 then the relationship between the two variables is not linear. From the table, the significance is 0.108> 0.05 so it can be concluded that there is a linear relationship between the deep learning method variables and students' cognitive development.

c. Korelasi test

The results of the correlation test using the SPSS version 24 program can be seen in the following table.

Table Korelasi Test

		Student Cognitive Development	Deep Learning Method
Student Cognitive Development	Pearson Correlation	1	.552**
	Sig. (2-tailed)		.000
	N	50	50
Deep Learning Method	Pearson Correlation	.523**	1
	Sig. (2-tailed)	.000	
	N	45	55

**. Correlation is significant at the 0.01 level (2-tailed).

Whether or not there is a relationship between the scientific approach and self-confidence variables can be seen by comparing r count with r table. If r count > r table then there is a relationship between the two variables. If r count < r table then there is no relationship between the two variables. From the table, it is known that r count is 0.581. The amount of r table can be known based on df where df = N ¬– 2 = 50 ¬– 2 = 48. By looking at r table on df 48, the amount of r table can be known with a significance level of 5% of 0.216. Thus, it can be seen that r count (0.523) > r table (0.216) so that it can be concluded that there is a significant relationship between the deep learning method variable and the student cognitive development variable and the relationship is positive because r count is positive. The strength of the relationship between the two variables can be seen by looking at the following table.

Interval Koefisien	Relationship Level
0,00 – 0,199	Very Low
0,20 – 0,399	Low
0,40 – 0,599	Enough
0,60 – 0,799	Strong
0,80 – 1,00	Very strong

Based on the table, it can be seen that there is a sufficient or moderate relationship between the deep learning method variable and the student cognitive development variable.

d. Regresi Test

After it was known that there was a relationship between the scientific approach variable and students' cognitive development in the independent curriculum, a simple linear regression test was then carried out to determine the effect of the scientific approach variable on students' cognitive development in the independent curriculum. The regression test is used to predict the dependent variable if the independent variable is known.

The output of the simple linear regression test through the SPSS version 24 program can be seen in the following table.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	33.136	7.959		4.468	.000
	Deep Learning Method	1.241	.178	.571	6.441	.000

a. Dependent Variable: Self Confidence

Based on the table, it can be seen that the constant (α) = 33.136, the regression coefficient (b) = 1.241. The constant and regression coefficient can be used to create an estimated regression equation. The estimated regression equation obtained from the calculation is Y' = 33.136 + 1.241X.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.571[a]	.382	.350	6.078

a. Predictors: (Constant), Playing Method

a. Dependent Variable: Child Social Development

The coefficient of determination (R Square) is used to determine the percentage of the influence of the independent variable on the change in the dependent variable. From the table, the coefficient of determination

is 0.382. This means that the influence of the independent variable on the dependent variable is 34.2%, while the remaining 65.8% is influenced by other variables. Thus, it can be concluded that the application of the play method affects the social development of students by 34.2%. While the remaining 65.8% is influenced by factors other than the play method.

After obtaining the results of this study, it supports the research results of Warren McCulloch and Walter Pitts and Jean Piaget. Waren and Walter studied the concept of artificial neurons which are the main foundations in AI and Deep Learning that we know today. While Jean Piaget studied cognitive development and divided it into four main stages, namely sensorimotor, preoperational, concrete operational, and formal operational

Deep Learning, as part of Artificial Intelligence (AI), enables more personal, interactive, and adaptive learning. This technology can identify student learning patterns and adjust materials based on individual needs. From the results of the simple linear regression test, it is known that the application of Deep Learning has a significant influence on students' cognitive development. The regression equation obtained shows that the higher the application of the Deep Learning method, the higher the students' cognitive abilities.

CONCLUSION

The application of Deep Learning in education has been proven to contribute positively to improving students' cognitive abilities, especially in understanding, analysis, and critical thinking. With a more adaptive and data-based learning approach, students can gain a more effective learning experience that is tailored to individual needs. However, challenges such as infrastructure readiness, limited teacher understanding, and student adaptation to technology are still major obstacles. Therefore, a comprehensive strategy is needed, including training of educators, provision of adequate technology facilities, and integration of technology-based education policies. With collaboration from various parties, the application of Deep Learning in education can be further optimized, provide long-term benefits, and support the achievement of the goals of the Independent Curriculum in creating more flexible, innovative, and quality learning.

REFERENCES

Abrori, M Sayyidul, dan Moh. Solikul Hadi, "Integral Values in Madrasah: to Foster Community Trust in Education," *Istawa : Jurnal Pendidikan Islam*, 5.2 (2020), 160 https://doi.org/10.24269/ijpi.v5i2.2736

Afifah, L. N., Masnawati, E., & Pd, M. (n.d.). *The Role of Technology in Learning and Cognitive Development of School-Age Children*. https://qjurnal.my.id/index.php/educurio

Andini, E. P., Rochmawati, D. H., & Susanto, W. (2023). Hubungan antara tingkat stres dengan kejadian insomnia pada mahasiswa fik yang akan menjelang ujian akhir semester. *Jurnal Ilmiah Sultan Agung*, *2*(1), 272–282.

Anggraini, A., & Zakaria, H. (2023). Penerapan metode deep learning pada aplikasi pembelajaran menggunakan sistem isyarat bahasa indonesia menggunakan convolutional neural network (studi kasus : slb-bc mahardika depok. *JURIHUM : Jurnal Inovasi Dan Humaniora*, *1*(4), 452–464. https://jurnalmahasiswa.com/index.php/jurihum

Ardi, R. N. (2022). KENDARAAN DI INDONESIA DENGAN JERMAN DAN KOREA SELATAN Rama Novtian Ardi Indri Fogar Susilowati. *Jurnal Hukum, 161-170.*, 1–13.

Artawijaya, A. A. N. B., & Saptiari, N. M. (2023). Hubungan Perkembangan Kognitif Peserta Didik Dengan Proses Belajar. *Metta : Jurnal Ilmu Multidisiplin*, *3*(4), 504–515. https://doi.org/10.37329/metta.v3i4.3401

Bujuri, D. A. (2018). Analisis Perkembangan Kognitif Anak Usia Dasar dan Implikasinya dalam Kegiatan Belajar Mengajar. *LITERASI (Jurnal Ilmu Pendidikan)*, *9*(1), 37. https://doi.org/10.21927/literasi.2018.9(1).37-50

Cynthia, E. P., & Ismanto, E. (2017). Memprediksi Ketersediaan Komoditi Pangan Provinsi Riau. *Jurnal Teknologi Dan Sistem Informasi Univrab*, *2*(2), 196–209.

Fahmi Husein, Moh Solikul Hadi, Edi Kurniawan, "Strategi Digital Detox untuk Siswa : Efektivitas Pendidikan Islam melalui Program Bimbingan Konseling pada Anak SMA / SMK di Yogyakarta Penerbangan AAG Adisutjipto , penerapan strategi Digital Detox melalui program," 13 (2024), 358–69

Firmanto, B., Aziz, S., & Sesoca, J. (2024). *Tinjauan Perkembangan Kecerdasan Buatan Berbasis Arsitektur Transformer*. *10*(1), 33–38.

Hadi, Moh. Solikul, "Implementasi Model Pengembangan Multiple Intellegence Dalam

Meningkatkan Kecerdasan Natural Peserta Didik Melalui Metode Project Based Learning Di Kelas X Manpk Yogyakarta Pada Mata Pelajaran Fikih," 2018, 152 <https://digilib.uin-suka.ac.id/id/eprint/33289/>

Hadi, Moh. Solikul, M. Sayyidul Abrori, dan Dwi Noviatul Zahra, "Pengembangan Multimedia Interaktif Macromedia Flash Profesional 8 Pada Pembelajaran Al-Qur'an Hadis Kelas X Semester Genap Di Man 1 Yogyakarta," *At-Tajdid : Jurnal Pendidikan dan Pemikiran Islam*, 3.2 (2020), 148 <https://doi.org/10.24127/att.v3i2.1123>

Hadi, Moh Solikul, Abdul Kahfi Amrullah, dan Khoerul Anwar, "Journal of Islamic Scriptures in Non-Arabic Societies Membentuk Peserta Didik Menjadi Pribadi Ulul al-bab Prespektif," 1.1 (2024), 61–62

Hidayat, R., Ag, S., & Pd, M. (2019). *Buku Ilmu Pendidikan Rahmat Hidayat & Abdillah*.

Humaini, Q. (2015). Jaringan Syaraf Tiruan Extreme Learning Machine (ELM) Untuk Memprediksi Kondisi Cuaca di Wilayah Kota Malang. *Skripsi*, 1–86.

Ismail, I. (2019). Perkembangan Kognitif Pada Masa Pertengahan Dan Akhir Anak-Anak. *Jurnal Pendidikan Dasar Dan Keguruan*, *4*(1), 15–22. https://doi.org/10.47435/jpdk.v4i1.90

Karina Sulistyorini, A., Yusliana Ekawati, E., Ayu Karina Sulistyorini, A., Prodi Pendidikan Fisika Jurusan PMIPA FKIP UNS, M., & Prodi Pendidikan Fisika Jurusan PMIPA, D. (2015). *Analisis Pencapaian Kompetensi Kognitif Tingkatan Aplikasi (C 3) Dan Analisis (C 4) Dalam Pembelajaran Fisika Pada Siswa Kelas Xi Sma Program Rsbi 1) Analysis Cognitive Competence Achievement of the Application Level (C 3) and Analysis Level (C 4) in* . *1*(1), 19–26.

Kurniati, P., Lenora Kelmaskouw, A., Deing, A., & Agus Haryanto, B. (2020). Model Proses Inovasi Kurikulum Merdeka Implikasinya Bagi Siswa Dan Guru Abad 21. *Jurnal Citizenship Virtues*, *2022*(2), 408–423.

Lexy, J. M. (2018). *Metodologi Penelitian Kualitatif*. PT Remaja Rosdakarya.

Liska, L., Ruhyanto, A., & Yanti, R. A. E. (2021). Penerapan Model Pembelajaran Problem Solving Untuk Meningkatkan Kemampuan Berpikir Kritis Siswa. *J-KIP (Jurnal Keguruan Dan Ilmu Pendidikan)*, *2*(3), 161. https://doi.org/10.25157/j-kip.v2i3.6156

Marinda, L. (2020). Kognitif dan Problematika. *An-Nisa' : Jurnal Kajian Perempuan Dan Keislaman*, *13*(1), 116–152.

Maritsa, A., Hanifah Salsabila, U., Wafiq, M., Rahma Anindya, P., & Azhar Ma'shum, M. (2021). Pengaruh Teknologi Dalam Dunia Pendidikan. *Al-Mutharahah: Jurnal Penelitian*

Dan Kajian Sosial Keagamaan, *18*(2), 91–100. https://doi.org/10.46781/al-mutharahah.v18i2.303

Nurhakiki, J., Yahfizham, Y., William, J., Ps, I. V, Estate, M., Percut, K., Tuan, S., & Serdang, K. D. (2024). Studi Kepustakaan: Pengenalan 4 Algoritma Pada Pembelajaran Deep Learning Beserta Implikasinya. *Jurnal Pendidikan Berkarakter*, *1*, 270–281. https://doi.org/10.51903/pendekar.v2i1.598

Nurmani, S., Darmawahyuni, A., Sapitri, A. I., Rachmatullah, M. N., Firdaus, & Tutuko, B. (2021). *Pengenalan Deep Learning dan Implementasinya*. 137.

Pokhrel, S. (2024). No TitleΕΛΕΝΗ. *Αγαη*, *15*(1), 37–48.

Prasetyo, S., & Dewayanto, T. (2024). Penerapan Machine Learning, Deep Learning, Dan Data Mining Dalam Deteksi Kecurangan Laporan Keuangan-a Systematic Literature Review. *Diponegoro Journal of Accounting*, *13*(3), 1–12. http://ejournal-s1.undip.ac.id/index.php/accounting

Purba, N., Yahya, M., & Nurbaiti. (2021). Revolusi Industri 4.0 : Peran Teknologi Dalam Eksistensi Penguasaan Bisnis Dan Implementasinya. *Jurnal Perilaku Dan Strategi Bisnis*, *9*(2), 91–98.

Putri, V. A., Sotyawardani, K. C. A., & Rafael, R. A. (2023). Peran Artificial Intelligence dalam Proses Pembelajaran Mahasiswa di Universitas Negeri Surabaya. *Prosiding Seminar Nasional Universitas Negeri Surabaya*, *2*, 615–630.

Ramadhan Almadani, & , Dede Indra Setiabudi. (2022). Pengembangan Kognitif Pada Siswa Sekolah Dasar Dengan Literatur Harian. *Jurnal Riset Sosial Humaniora Dan Pendidikan*, *1*(1), 34–42. https://doi.org/10.56444/soshumdik.v1i1.72

Raup, A., Ridwan, W., Khoeriyah, Y., Supiana, S., & Zaqiah, Q. Y. (2022). Deep Learning dan Penerapannya dalam Pembelajaran. *JIIP - Jurnal Ilmiah Ilmu Pendidikan*, *5*(9), 3258–3267. https://doi.org/10.54371/jiip.v5i9.805

Saputra, Y. M., Alfian, G., & Octava, M. Q. H. (2023). Perancangan Federated Learning Berbasis Homomorphic Encryption untuk Perangkat Internet of Things. *Journal of Internet and Software Engineering*, *4*(1), 1–5. https://doi.org/10.22146/jise.v4i1.6378

Siti Masrichah. (2023). Ancaman Dan Peluang Artificial Intelligence (AI). *Khatulistiwa: Jurnal Pendidikan Dan Sosial Humaniora*, *3*(3), 83–101. https://doi.org/10.55606/khatulistiwa.v3i3.1860

Suartika E. P, I Wayan, Wijaya Arya Yudhi, S. R. (2016). Klasifikasi Citra Menggunakan Convolutional Neural Network (CNN) Pada Caltech 101. *Jurnal Teknik ITS*, *5*(1), 76.

http://repository.its.ac.id/48842/

Tunas, K. O., & Pangkey, R. D. H. (2024). Kurikulum Merdeka: Meningkatkan Kualitas Pembelajaran dengan Kebebasan dan Fleksibilitas. *Journal on Education*, *6*(4), 22031–22040. https://doi.org/10.31004/joe.v6i4.6324

Wibowo, G. (2023). *Implementasi Deep Learning Dalam Pengolahan Citra Medis : Meningkatkan Deteksi Dan Diagnostik*. *3*(12), 1–20.

Wiranda, L., & Sadikin, M. (2019). Penerapan Long Short Term Memory pada Data Time Series untuk Memprediksi Penjualan Produk PT. Metiska Farma. *Jurnal Nasional Pendidikan Teknik Informatika (JANAPATI)*, *8*(3), 184–196.

Yogi Fernando, Popi Andriani, & Hidayani Syam. (2024). Pentingnya Motivasi Belajar Dalam Meningkatkan Hasil Belajar Siswa. *ALFIHRIS : Jurnal Inspirasi Pendidikan*, *2*(3), 61–68. https://doi.org/10.59246/alfihris.v2i3.843

Yudistira, N. (2021). Peran Big Data dan Deep Learning untuk Menyelesaikan Permasalahan Secara Komprehensif. *EXPERT: Jurnal Manajemen Sistem Informasi Dan Teknologi*, *11*(2), 78. https://doi.org/10.36448/expert.v11i2.2063

