PEDAGOGIK JURNAL PENDIDIKAN
P-ISSN : 2528-5793
E-ISSN : 2354-7960

FOSTERING EDUCATIONAL INNOVATION THROUGH HUMAN-MACHINE PARTNERSHIP IN AI-BASED LEARNING SPACES

Izzatul Munawwaroh [1]; Hasan Jali [2]*
[1] Nurul Jadid University, East Java, Indonesia
[2] Universiti Kuala Lumpur, Kuala Lumpur, Malaysia
** Correspondence Author: 2352600002@unuja.ac.id*

Received: November 2024	**Accepted:** June 2025	**Published:** July 2025
DOI: https://doi.org/10.33650.pjp.v12i1.9799		

Abstract : *This study aims to investigate how artificial intelligence (AI) drives educational innovation by enabling human-machine partnerships in AI-based learning environments. This study addresses a critical gap in the current literature, specifically the lack of empirical understanding of how AI transforms pedagogical strategies and enhances student engagement in faith-based educational institutions. Using a qualitative case study approach, this study was conducted in a Madrasah that has integrated AI technology into its teaching practices. Data were collected through semi-structured interviews, participant observation, and document analysis. Findings reveal that AI enables more personalized and data-driven teaching strategies by analyzing students' learning patterns in real time. In addition, AI-powered teaching tools provide timely feedback and adaptive guidance, which accelerates students' understanding processes. The study concludes that AI integration not only improves the quality of teaching and learning but also creates more inclusive and flexible learning spaces. Implications highlight the need for educational institutions to invest in teacher training and digital infrastructure to support sustainable and ethical human-machine partnerships in future learning systems.*

Keywords : *Educational Innovation; Human-Machine; AI-Based Learning.*

Abstrak : *Penelitian ini bertujuan untuk menyelidiki bagaimana kecerdasan buatan (AI) mendorong inovasi pendidikan dengan memungkinkan kemitraan manusia-mesin dalam lingkungan pembelajaran berbasis AI. Penelitian ini membahas kesenjangan kritis dalam literatur saat ini, khususnya kurangnya pemahaman empiris tentang bagaimana AI mengubah strategi pedagogis dan meningkatkan keterlibatan siswa di lembaga pendidikan berbasis agama. Dengan menggunakan pendekatan studi kasus kualitatif, penelitian ini dilakukan di Madrasah yang telah mengintegrasikan teknologi AI ke dalam praktik pengajarannya. Data dikumpulkan melalui wawancara semi-terstruktur, observasi partisipatif, dan analisis dokumen. Temuan mengungkapkan bahwa AI memungkinkan strategi pengajaran yang lebih personal dan berbasis data dengan menganalisis pola pembelajaran siswa secara real time. Selain itu, alat pengajaran bertenaga AI memberikan umpan balik tepat waktu dan panduan adaptif, yang mempercepat proses pemahaman siswa. Penelitian ini menyimpulkan bahwa integrasi AI tidak hanya meningkatkan kualitas pengajaran dan pembelajaran tetapi juga menciptakan ruang belajar yang lebih inklusif dan fleksibel. Implikasinya menyoroti perlunya lembaga pendidikan untuk berinvestasi dalam pelatihan guru dan infrastruktur digital untuk mendukung kemitraan manusia-mesin yang berkelanjutan dan etis dalam sistem pembelajaran masa depan.*

Kata Kunci : *Inovasi Pendidikan; Manusia-Mesin; Pembelajaran Berbasis AI.*

INTRODUCTION

AI can enhance learning, making it more interactive and personalized. However, the irreplaceable role of teachers in providing moral and psychological guidance is still vital(Alwina, 2023). Therefore, human-AI collaboration should be used cautiously because both can work together to create a more rewarding learning experience(Yimit et al., 2024). Empirical evidence from Lee & Kwon, (2024), in several AI-based schools in California showed that 78% of students who used a collaborative learning approach between humans and AI showed significant improvements in both their academic performance and their level of engagement and desire to learn. Because AI allows more time for substantial interaction, teachers who change their instruction experience a deeper connection with their students(Al Shloul et al., 2024). Therefore, empowering education through human-machine collaboration in AI-based learning spaces is about optimizing the delivery of material and creating a deep emotional connection between teachers and students, leading to better learning outcomes.

Previous studies on human-AI collaboration in education have mostly emphasized conceptual potentials, such as AI's disruptive capacity when combined with human ethical oversight (Dwivedi et al., 2023) or the importance of maintaining teacher centrality in AI-supported learning (Li et al., 2024). However, these works lack empirical grounding, particularly in culturally specific settings like religious-based schools. This study offers a distinct contribution by applying a qualitative case study approach to examine actual interactions among teachers, students, and AI tools within a madrasah. Theoretically, it introduces a hybrid partnership model that positions AI and humans not merely as tools or aides but as complementary actors in co-creating inclusive, adaptive, and student-centered learning environments expanding current discourse with a culturally grounded and pedagogically integrative perspective.

This research aims to explore and develop a model for a synergistic human-artificial intelligence (AI) partnership in the reimagined learning space. This research focuses on discovering how teachers and AI systems can work together to create more adaptive, inclusive, and student-centered learning experiences(Ubaidillah & Mundiri, 2023). Key outcomes of this research are expected to include the best strategies for leveraging AI as an educational partner, rather than just an automation tool, and its impact on personalizing learning and increasing student engagement(Mundiri & Firdausy, 2022). In addition, this research will reveal how the integration of AI can enrich the pedagogical dimension while maintaining the humanistic aspect of education. The result will be a broader and more sustainable learning ecosystem.

This study aims to explore how artificial intelligence (AI) can foster a synergistic partnership between humans and machines in the context of Islamic education, particularly

in Madrasah Aliyah. Rather than positioning AI as a replacement for teachers, this research emphasizes the importance of designing human-AI collaboration in a way that enhances, rather than displaces, the pedagogical role of educators(Listrianti, 2020). With thoughtful integration, AI has the potential to support teachers in creating more inclusive, adaptive, and data-informed learning environments, where educators remain central as the designers and facilitators of learning(Hasanah, Azizah, Hasanah, et al., 2024). AI's role in this context is not to take over instruction, but to catalyze more personalized learning and improve student engagement through real-time analytics and automated feedback mechanisms.

What makes this study unique is its focus on Madrasah Aliyah Bahrul Ulum in Probolinggo, a religious-based educational institution that has taken progressive steps toward integrating AI into its learning processes. This site represents a significant and underexplored context where technology and tradition intersect, offering insights into how Islamic schools, often perceived as conventional, are adapting to the demands of digital transformation. By situating the research within a madrasah environment, the study sheds light on the cultural and institutional dynamics that influence AI adoption in non-mainstream educational settings. This adds a critical dimension to current discussions on educational technology by demonstrating that innovation can emerge from diverse and locally grounded educational ecosystems.

METHOD

The study aims to explore and analyze how partnerships between humans and artificial intelligence (AI) in enhanced learning spaces can optimize the learning process and identify the benefits and challenges that arise in implementing such collaboration. Therefore, this study uses a qualitative approach with a case study type. This type of research was chosen because it allows researchers to investigate complex phenomena in authentic contexts and collect rich and in-depth data from multiple perspectives. The research site is at MA Bahrul Ulum Besuk Probolinggo, which has implemented AI as an educator partner. It can explore various strategies, collaborative dynamics, and the results obtained to create a more inclusive and adaptive learning space. With this method, researchers can gain a comprehensive understanding of the impact of human-AI integration in education and how teaching approaches can be developed to harness the potential of AI without ignoring humanistic values in learning.

Participants were selected using purposive techniques, namely the determination of those selected with certain considerations and purposes. The reason for using this technique is that researchers need data in the form of information that can only be obtained from informants who certainly have more knowledge about the data that researchers want to

obtain, so as to produce data that is in accordance with expectations and relevant to the predetermined title. This study involved 10 participants from the Bahrul Ulum Besuk Probolinggo Islamic Senior High School Educational Institution, consisting of the Head of Madrasah, Deputy Curriculum, IT Manager, Class Teacher, and Students. Among the informants have different job backgrounds, education, and gender, so it is expected to provide accurate information about the research theme.

Table 1. Research informants

Informant	Education		Gender		Amount	Material
	S1	S2	L	P		
Head of Madrasah		1	1		1	Specific policies that support AI-based learning.
Deputy Head of Curriculum	1			1	1	Application of AI usage and training strategies for educators and students
IT Manager	1		1		1	Infrastructure readiness and technical challenges in AI implementation
Classroom teacher	3		2	1	3	The effectiveness of AI in improving student understanding
Student	-	-	2	2	4	The influence of AI on motivation and engagement in learning.
Total	5	1	6	4	10	-

Data collection techniques through in-depth interviews, observations, and documentation studies. In-depth interviews will be conducted with various informants, including teachers, principals, curriculum vice principals, and AI managers, to explore their views, experiences, and understandings regarding the implementation of AI in learning (Ying & Jin, 2024). This technique was chosen to obtain rich and comprehensive data on how AI can function as a partner in the adaptive and inclusive learning process. In addition, direct observations in classrooms and educational environments will be conducted to see the application of AI in real contexts, as well as to assess the interactions between teachers, students, and technology. Documentation studies are also used to analyze policies, curricula, and reports related to the integration of AI in education. The combination of these techniques allows researchers to gain a holistic understanding of the challenges, benefits, and impacts of implementing AI in enhanced learning spaces.

In this study, data analysis was carried out through three stages from (Miles et al., 2014), consisting of three stages applied contextually to the AI-enhanced learning environment. First, in the data reduction stage, interview transcripts, observation notes, and documentation related to the use of AI in the classroom were coded and categorized based on emerging themes such as personalization, real-time feedback, and teacher adaptation.

Irrelevant or repetitive information—such as general comments not related to AI—was excluded to focus on meaningful patterns in teacher and student experiences. Second, during data display, the refined data were organized into thematic matrices comparing teacher perceptions, student engagement indicators, and specific AI tools used (e.g., chatbot assistants, automated assessments). This allowed for a clearer visualization of how AI influenced pedagogical strategies and classroom interactions. Finally, in the conclusion drawing and verification stage, researchers interpreted the data to identify consistent patterns, contradictions, and contextual nuances. This step led to the formulation of insights regarding the nature of human-AI collaboration in the madrasah context, particularly how it supports inclusivity and adaptive teaching, contributing to theory building on AI integration in culturally rooted educational settings.

To ensure the validity of the data, several strategies were employed. Member checking was conducted by returning interview summaries to key participants (teachers and administrators) for confirmation and correction. In addition, peer debriefing was carried out by discussing emerging themes and interpretations with fellow researchers to reduce personal bias. Triangulation of data sources interviews, observations, and document analysis was also applied to cross-verify findings. These combined techniques ensured that the analysis remained credible, contextually grounded, and theoretically robust.

RESULT AND DISCUSSION

The discussion results in this study reveal several significant findings related to implementing artificial intelligence (AI) in enhanced learning spaces. These findings include how partnerships between humans and machines can optimize the learning process and the challenges faced in integrating AI into existing educational practices. In addition, this study also found that although AI has great potential to support the personalization of learning and increase student engagement, the success of its implementation is highly dependent on effective collaboration between educators and technology. The following discussion will discuss in more detail the positive and negative impacts that arise and recommendations for maximizing human-AI cooperation in creating more inclusive and effective learning spaces.

1. Partnerships Between Humans and Machines Can Optimize The Learning Process

The partnership between humans and machines has great potential in optimizing the learning process. AI can provide real-time data analysis, personalized learning recommendations, and automation of administrative tasks, while teachers remain focused on pedagogical aspects and interpersonal relationships with students. AI not only functions as an aid, but also as a strategic partner that can enrich the learning experience, increase student engagement, and provide adaptive support according to

individual needs. As conveyed by one of the teachers at MA Bahrul Ulum, he said "AI is a very helpful partner, especially in adjusting the learning material to the needs of each student. For example, AI provides a quick analysis of student progress, so that teachers can focus on giving more attention to students who need additional guidance." He also added that the presence of AI does not replace the role of teachers, but rather strengthens the effectiveness of teaching by reducing the burden of administrative tasks.

The statement from the informant above, it can be understood that the partnership between humans and machines has proven to have a significant impact on optimizing the learning process in madrasahs. AI technology plays a role more than just an aid, it acts as a strategic partner that enriches classroom dynamics. Teachers can focus more on more meaningful pedagogical aspects, such as fostering interpersonal relationships with students, without being burdened with administrative tasks that can be automated by AI. This shows that AI strengthens the effectiveness of teaching, increases student engagement, and provides space for teachers to play a greater role as creative and responsive learning facilitators. Ultimately, collaboration not only drives efficiency but also creates a more dynamic and inclusive learning experience.

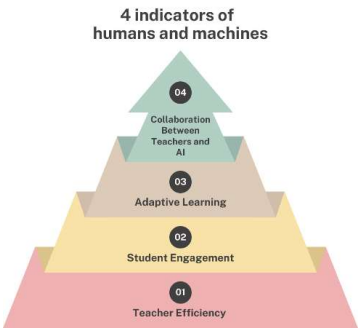

Figure 1: Partnership Between Humans and Machines

From Figure 1 above, explaining the efficiency aspect, AI has proven to be successful in lightening the administrative burden of teachers, such as the automation of assessment and analysis of student development, so that teachers can focus more on more meaningful pedagogical aspects. This is in line with the finding that AI is able to increase active student participation, where the material presented becomes more interesting and relevant, according to their learning preferences. In addition, AI enables adaptive learning, where the level of difficulty of the material can be dynamically changed based on student performance, thus providing the right challenges and deepening understanding of concepts. Interestingly, AI is not just an additional tool, but a strategic partner that strengthens the role of teachers. Facts on the ground show that collaboration between teachers and AI has succeeded in creating richer teaching methods, without

eliminating the personal touch of the teacher, proving that the integration of this technology not only enriches the learning experience but also makes it more inclusive and responsive to student needs.

2. Challenges Faced in Integrating AI into Education Practices

The challenges of integrating AI into educational practice reveal several obstacles that need to be overcome in order to make the most of this technology. While AI offers great potential in improving the efficiency and personalization of learning, its implementation in the field has not always been smooth. One of the main challenges is the skills gap among teachers, with many educators feeling ill-equipped to adapt this advanced technology into their teaching methods. Additionally, there are concerns about the privacy and security of student data, which require educational institutions to be more careful in handling sensitive information.

Data from interviews with sources regarding challenges in integrating AI into educational practices at MA Bahrul Ulum Besuk, Probolinggo;

Table 2: Interview Results

Informant	Code	Statement
Head of Madrasah	Data Security	"The biggest challenge is ensuring the security of student data when using AI-based platforms."
Classroom teacher	Teacher Skills	"Not all teachers have the necessary technology skills, so training is crucial."
AI Manager	Infrastructure	"Infrastructure issues in remote schools are a major barrier to AI implementation."
Deputy Head of Curriculum	Madrasah Culture	"AI adoption requires a cultural change in schools, which is not always easy for staff to accept."

From table 2, It is understandable that the integration of AI in education faces a number of critical challenges that cannot be ignored. The main challenge is the lack of training for teachers, causing a skills gap in effectively utilizing AI technology. Many educators feel unprepared to adapt new teaching methods due to the lack of training support. In addition, the issue of student data security and privacy is a serious concern, given that the use of AI-based platforms is vulnerable to data breaches. Limited infrastructure in schools, especially in remote areas, worsens the situation, making access to AI technology unequal. Therefore, a comprehensive approach is needed that includes intensive training, infrastructure improvements, and strict regulations to ensure the effective, safe, and sustainable implementation of AI in education.

The partnership between humans and machines in education holds transformative potential to optimize learning, a point reinforced by research emphasizing the benefits of AI in enhancing instructional practices and learner engagement (Rico-Juan et al., 2024; Sabran et al., 2023). Field data from interviews and observations indicate that AI acts not only as a technical tool but also as a strategic partner, enabling teachers to personalize instruction, deliver real-time feedback, and automate routine tasks(Dias et al., 2024). This collaboration allows educators to concentrate more on humanistic aspects of teaching—guidance, dialogue, and student motivation which aligns with theories of human-centered learning and socio-constructivism. Theoretically, this study adopts the Human-Centered AI (HCAI) framework, which emphasizes designing AI systems that augment human agency, preserve user autonomy, and reflect ethical and contextual values (Xia, 2021).

However, beyond technical affordances, the study also explores underlying structural factors that challenge AI adoption in madrasah settings. Cultural and religious values, organizational conservatism, and resistance to change emerge as critical barriers(Bellaire et al., 2023). Many educators express concerns about the alignment between AI and Islamic educational principles, fearing that automation may conflict with spiritual goals or reduce the teacher's moral authority. This reveals a gap between technological innovation and the prevailing organizational culture rooted in tradition and communal values (Nadiroh et al., 2024). Thus, AI adoption is not merely a matter of infrastructure but also of cultural negotiation, requiring frameworks that reconcile innovation with religious and institutional identity (Putri, 2024). These findings highlight the need for context-sensitive policy interventions and leadership strategies that build technological trust, promote pedagogical adaptation, and preserve the core values of madrasah education.

Significant challenges in integrating AI into educational practices confirm previous research findings highlighting similar barriers. Interview data revealed that many teachers need help with adaptation difficulties due to inadequate training, leaving them unprepared to use AI effectively in teaching (Munif & Baharun, 2018). Concerns about the security and privacy of student data are also crucial issues, especially since AI-based platforms are at risk of data leakage (Hasanah, Munawwaroh, Qushwa, et al., 2024). Field observations show that limited infrastructure, especially in remote schools, results in gaps in access to this technology. Previous research emphasizes that with adequate teacher skill readiness and infrastructure support, the implementation of AI in education can be improved.

The findings of this study have significant implications for the development of AI-based educational ecosystems. First, the evidence that AI can enhance personalization and real-time responsiveness in learning highlights the urgent need for a comprehensive and strategic policy framework. This framework must include targeted investment in teacher

training programs that not only focus on technical skills but also on pedagogical adaptation to AI-supported environments (Adeoye, 2024). Without proper teacher preparedness, AI integration risks becoming a superficial innovation lacking meaningful pedagogical impact. Second, the study reveals that the sustainability of AI implementation in madrasah settings depends heavily on robust technological infrastructure and strict data governance. This implies that policymakers and school leaders must prioritize infrastructure development particularly in under-resourced religious-based schools while also enforcing clear regulations to protect student data privacy (Tessema et al., 2024). The implication is that AI must be treated not as a mere add-on, but as a transformative force requiring structural readiness, regulatory oversight, and cultural acceptance (El Ouahabi et al., 2024; Ho et al., 2024). When these elements align—teacher competence, infrastructure, and ethical safeguards—AI has the potential to build inclusive, adaptive, and secure learning environments that meet the evolving needs of 21st-century education.

The implications of this research's findings mark the birth of a contextual and integrative theory of human-machine partnerships in AI-based learning spaces, particularly in faith-based educational settings. The findings also enrich the Human-Centered AI (HCAI) framework by adding cultural and spiritual dimensions as crucial factors in technology design and implementation. AI is not merely a technical tool, but rather a strategic actor collaborating with educators to create adaptive, inclusive, and meaningful learning experiences. These findings pave the way for the development of a new theory of human-AI collaborative learning rooted in local values and educational ethics. The implication is that educational institutions must build structural readiness through pedagogically oriented teacher training, strengthening digital infrastructure, and establishing ethical regulations that guarantee data security and cultural acceptability. Thus, AI integration not only addresses the challenges of digitalization but also broadens the horizons of contextually relevant and sustainable educational innovation.

CONCLUSION

The conclusion of this study emphasizes the importance of collaboration between humans and artificial intelligence (AI) in improving the quality of education. Based on a preliminary review, this study explores the potential of AI in going beyond the limitations of traditional learning methods, especially in the madrasah environment that prioritizes a holistic approach. Integrating AI in education allows for a more personalized and adaptive approach, with the ability to provide real-time data analysis that helps teachers design more effective learning strategies. AI is a tool and a strategic partner that can accelerate the

learning process through automated feedback and direct guidance, which positively impacts student motivation and engagement.

The implications of these findings suggest that adopting AI in education requires comprehensive readiness regarding teacher training and technological infrastructure. Schools need to invest in improving educator competencies to maximize the potential of AI. In addition, there needs to be an education policy that supports student data protection and privacy and ensures equal access to technology across all regions. This study makes a significant contribution to the literature on AI in education, highlighting the importance of synergistic partnerships between humans and machines in creating more inclusive and adaptive learning spaces. This study also provides practical guidance for educational institutions in implementing AI as part of a long-term teaching strategy rather than just a temporary innovation to strengthen the education system in an increasingly dynamic digital era.

ACKNOWLEDGMENT

We would like to thank all parties who have contributed to this research, especially Madrasah Aliyah Bahrul Ulum Besuk Probolinggo, for their support and participation.

BIBLIOGRAPHY

Adeoye, M. A. (2024). *AI-Enhanced Learning Experiences : Moving Beyond Traditional Textbook Approaches in Global Education*. *2*(3), 169–177. https://doi.org/10.70437/educative.v2i3.825

Al Shloul, T., Mazhar, T., Abbas, Q., Iqbal, M., Ghadi, Y. Y., Shahzad, T., Mallek, F., & Hamam, H. (2024). Role of activity-based learning and ChatGPT on students' performance in education. *Computers and Education: Artificial Intelligence*, *6*(August 2023), 100219. https://doi.org/10.1016/j.caeai.2024.100219

Alwina, S. (2023). Implementasi Bimbingan Konseling dalam Meningkatkan Kesejahteraan Psikologis Siswa Sekolah Dasar. *Jurnal Ilmu Pendidikan Dan Keguruan*, *3*(2), 53–63.

Bellaire, L. L., Lee-Rey, E. T., Payares-Lizano, M., & Bidar-Sielaff, S. (2023). Two Sides to Every Conversation: Communication Strategies and Appropriate Interpreter Utilization in Pediatric Orthopaedics. *Journal of the Pediatric Orthopaedic Society of North America*, *5*(1), 648. https://doi.org/10.55275/jposna-2023-648

Dias, P., Gonçalves, H., Silva, F., Duque, J., Martins, J., & Godinho, A. (2024). Blockchain Technologies: A scrutiny into Hyperledger Fabric for Higher Educational Institutions". *Procedia Computer Science*, *237*, 213–220. https://doi.org/10.1016/j.procs.2024.05.098

Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koohang, A., Raghavan, V., Ahuja, M., Albanna, H., Albashrawi, M. A., Al-Busaidi, A. S., Balakrishnan, J., Barlette, Y., Basu, S., Bose, I., Brooks, L., Buhalis, D., … Wright, R. (2023). "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for

research, practice and policy. *International Journal of Information Management*, *71*(March). https://doi.org/10.1016/j.ijinfomgt.2023.102642

El Ouahabi, F. Z., El Bouzaidi, R. D., Chaiba, A., Hamdaoui, L., & Erragragui, M. (2024). Effective Teaching Strategies for Multilevel Classes: A Focus on Alternating Instructional Modes. *Journal of Curriculum and Teaching*, *13*(2), 22–32. https://doi.org/10.5430/jct.v13n2p22

Hasanah, R., Azizah, N., Hasanah, M., & Mundiri, A. (2024). *FOSTERING INCLUSIVITY : STRATEGIES FOR SUPPORTING STUDENTS WITH SPECIAL NEEDS IN MAINSTREAM*. *15*(01).

Hasanah, R., Munawwaroh, I., Qushwa, F. G., & Agus R, A. H. (2024). Pengembangan Career Adaptability Melalui Inovasi Sumber Daya Manusia. *EDUKASIA: Jurnal Pendidikan Dan Pembelajaran*, *5*(1), 169–178. https://doi.org/10.62775/edukasia.v5i1.734

Ho, M. T., Mantello, P., & Vuong, Q. H. (2024). Emotional AI in education and toys: Investigating moral risk awareness in the acceptance of AI technologies from a cross-sectional survey of the Japanese population. *Heliyon*, *10*(16), e36251. https://doi.org/10.1016/j.heliyon.2024.e36251

Humaidi, Achmad., Mudarris, Badrul., & Muhammad, Muhammad. (2022). The Visionary Leadership of Headmaster in Improving School Achievement. *Journal of Research in Educational Management*, *1*(1), 11-21. https://doi.org/10.71392/jrem.v1i1.3

Kulsum, Ummi., & Sugiono, Sugiono. (2025). Optimizing Digital Platforms in Improving Public Relations Performance of Islamic Elementary Schools in the Digital Era. *Journal of Research in Educational Management*, *3*(2), 65-74. https://doi.org/10.71392/jrem.v3i2.85

Lee, S. J., & Kwon, K. (2024). A systematic review of AI education in K-12 classrooms from 2018 to 2023: Topics, strategies, and learning outcomes. *Computers and Education: Artificial Intelligence*, *6*(October 2023), 100211. https://doi.org/10.1016/j.caeai.2024.100211

Li, L., Fengchao, Y., & Zhang, E. (2024). A systematic review of learning task design for K-12 AI education: Trends, challenges, and opportunities. *Computers and Education: Artificial Intelligence*, *6*(October 2023). https://doi.org/10.1016/j.caeai.2024.100217

Listrianti, F. (2020). Transformation of Curriculum Development Based on Nationality-Oriented. *Jurnal Ilmiah Peuradeun*, *8*(1), 37–52. https://doi.org/10.26811/peuradeun.v8i1.380

Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook. 3rd*. Thousand Oaks, CA: Sage.

Mundiri, A., & Firdausy, A. (2022). PESANTREN-BASED EXPERIENTIAL MARKETING ; SENSE EMOTIONAL ANALYSIS IN BUILDING Customer Loyality. *Managere : Indonesian Journal of Educational Management*, *4*(3), 259–269.

Munif, M., & Baharun, H. (2018). Perguruan Tinggi Berbasis Pesantren: Menggagas Interkoneksi Agama dan Sains. *Jurnal Penelitian*, *12*(1), 137–160. https://doi.org/10.21043/jp.v12i1.4928

Nadiroh, U., Qibtiyah, M., Ulfa, H., & Maulana, M. A. (2024). Dinamika Kreatif Manajemen Strategis TRANSFORMASI BUDAYA ORGANISASI LEMBAGA PENDIDIKAN Dinamika Kreatif Manajemen Strategis. *Journalpedia*, *06*(2), 361–379.

Putri, D. F. (2024). Enhancing Critical Thinking Through the Integration of Self- Directed Learning in Sustainable Education in Madrasah. *AFKARINA: Jurnal Pendidikan*

Agama Islam, *9*(1), 1–10.

Rico-Juan, J. R., Peña-Acuña, B., & Navarro-Martinez, O. (2024). Holistic exploration of reading comprehension skills, technology and socioeconomic factors in Spanish teenagers. *Heliyon*, *10*(12). https://doi.org/10.1016/j.heliyon.2024.e32637

Sabran, S., Riswadi, R., Baharun, H., Hidayah, S. N., & Aminah, S. (2023). Learning Burnout; Teacher's Strategy in Creating Effective Learning. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *7*(4), 5005–5015. https://doi.org/10.31004/obsesi.v7i4.4155

Tessema, A. M., Zahir-Ul-Hassan, M. K., & Ahmed, A. (2024). Corporate governance, earnings management and the moderating role of political connections: evidence from the Gulf Co-operation Council countries. *International Journal of Ethics and Systems*. https://doi.org/10.1108/IJOES-02-2024-0056

Ubaidillah, U., & Mundiri, A. (2023). Empowering Teacher Competence through Guidance in Religion-Moderated Literacy. *GEMEINSCHAFT: Journal of Social and Community Engagement*, *1*(1), 37–49.

Xia, P. (2021). Design of Personalized Intelligent Learning Assistant System Under Artificial Intelligence Background. In *Advances in Intelligent Systems and Computing* (Vol. 1282, pp. 194–200). https://doi.org/10.1007/978-3-030-62743-0_27

Yimit, Y., Yasin, P., Tuersun, A., Wang, J., Wang, X., Huang, C., Abudoubari, S., Chen, X., Ibrahim, I., Nijiati, P., Wang, Y., Zou, X., & Nijiati, M. (2024). Multiparametric MRI-Based Interpretable Radiomics Machine Learning Model Differentiates Medulloblastoma and Ependymoma in Children: A Two-Center Study. *Academic Radiology*, 1–13. https://doi.org/10.1016/j.acra.2024.02.040

Ying, Y., & Jin, S. (2024). Artificial intelligence and green product innovation: Moderating effect of organizational capital. *Heliyon*, *10*(7), e28572. https://doi.org/10.1016/j.heliyon.2024.e28572