Online Learning and Pedagogies Research Journal
Vol. 1 No. 1 (2026), p. 44-56
Available online at https://cendikianusantara.com/index.php/olped

Human-Centered Digital Pedagogy in Online Learning: Integrating Artificial Intelligence to Foster Critical Thinking and Collaborative Learning

Riski Naimah*, Diana Putri Prahasti
Universitas Nurul Jadid, Indonesia
Email: *naimah123@gmail.com*

DOI: https://doi.org/10.61987/bamj.v1i1

Article History:
Received: 02 December 2025
Revised: 14 February 2026
Accepted: 10 March 2026

Keywords:
Human-Centered Digital Pedagogy; Artificial Intelligence; Critical Thinking; Collaborative Learning

Correspondence Address:
naimah123@gmail.com

Abstract :
This study aims to examine the implementation of human-centered digital pedagogy through Artificial Intelligence (AI) integration in online learning to foster students' critical thinking and collaborative learning. A qualitative case study design was employed at madrasah. Data were collected through in-depth interviews, observations, and documentation involving school leaders, teachers, and students. Data were analyzed through data condensation, data display, and conclusion drawing and verification, while credibility was established through source, technique, and time triangulation. The findings reveal that AI supported critical thinking by encouraging students to question, verify, compare, and evaluate AI-generated information before reaching conclusions. AI also strengthened collaborative learning by providing information that students discussed, compared, negotiated, and transformed into collective solutions. The study concludes that AI becomes educationally meaningful when positioned as a pedagogical mediator rather than an autonomous knowledge provider. The findings imply that schools should strengthen teacher AI literacy, design inquiry-based collaborative activities, establish responsible AI guidelines, and maintain human oversight to ensure that technological integration supports meaningful, ethical, and learner-centered education.

INTRODUCTION

Artificial Intelligence (AI) is increasingly transforming education, making human-centered digital pedagogy an important concern for society. The central issue is how educational institutions can use AI to improve learning without weakening students' intellectual independence and social interaction. This matters because education is expected not only to transmit knowledge but also to develop critical thinkers who can evaluate information, solve complex problems, communicate ideas, and collaborate with others. Evidence from recent educational research suggests that AI can provide personalized feedback, facilitate information access, support interactive learning, and assist teachers in designing learning activities. However, technological benefits depend strongly on pedagogical design and human oversight. AI therefore should not be understood simply as an automated instructional tool, but as a resource embedded

within meaningful human interaction. Consequently, developing human-centered digital pedagogy is essential for ensuring that AI integration strengthens rather than diminishes critical thinking, collaboration, learner agency, and educational quality in contemporary learning environments worldwide.

The growing availability of AI in education also creates significant problems for learners, teachers, and institutions. Students can obtain explanations, summaries, ideas, and generated answers almost instantly, potentially reducing the need to analyze information independently. Excessive dependence on AI may encourage superficial learning, cognitive offloading, reduced originality, and limited engagement with complex problems. At the same time, teachers face difficulties in determining whether AI-supported work reflects genuine student understanding and in designing assignments that encourage meaningful intellectual participation. Institutions must additionally address concerns regarding accuracy, academic integrity, privacy, equity, and responsible technology use. These challenges demonstrate that simply providing access to AI cannot guarantee educational improvement. The broader problem concerns the absence of sufficiently integrated pedagogical frameworks that balance technological efficiency with human intellectual development. Therefore, education requires approaches that position AI within structured learning processes where students question, evaluate, discuss, create, and collaborate while teachers retain responsibility for pedagogical direction and ethical oversight.

The phenomenon emerging in educational practice indicates that AI is moving rapidly from experimental use toward everyday academic activity. Students increasingly employ generative AI to search for information, explain difficult concepts, generate ideas, complete assignments, and formulate written responses. Teachers are simultaneously exploring AI for lesson preparation, feedback, assessment, and learning-resource development. This situation creates a paradox. AI can increase students' access to knowledge and reduce barriers to learning, yet convenient access to generated answers may discourage deeper analysis and interpersonal learning if tasks are poorly designed. Classroom practices therefore increasingly require students to distinguish reliable information from generated content, justify conclusions, compare perspectives, and communicate reasoning with peers. These emerging practices suggest that the educational challenge is not AI adoption itself but the quality of human interaction surrounding its use. Understanding how teachers and students negotiate AI-supported learning is consequently important for identifying pedagogical practices that transform technological convenience into critical inquiry, meaningful collaboration, and sustained intellectual engagement.

Previous research has identified substantial potential for AI-supported education to personalize instruction, provide immediate feedback, automate selected teaching tasks, and facilitate access to learning resources. Studies of generative AI have also highlighted opportunities to support problem solving, creativity, reflection, and independent learning. Research on collaborative digital learning further demonstrates that meaningful interaction among learners can strengthen knowledge construction and social learning. Nevertheless, much of the existing literature examines AI personalization, learning outcomes, critical thinking, or collaboration as separate dimensions. Some studies primarily evaluate students' attitudes toward AI, while others emphasize technological functionality or efficiency. Consequently, limited attention has been given to how AI can be pedagogically integrated while simultaneously preserving human agency, developing critical thinking, and strengthening collaborative learning. This

fragmentation constitutes an important research gap because educational transformation requires more than individual productivity. It requires learning environments in which technological assistance contributes to collective knowledge construction, intellectual dialogue, and reflective judgment rather than replacing these processes with automated responses.

A further limitation concerns the tendency to frame AI integration through technological capability rather than pedagogical relationships. Although previous studies recognize the importance of human oversight, fewer investigations explain how teachers can structure AI-supported activities that require students to verify information, articulate reasoning, negotiate different perspectives, and construct knowledge collaboratively. Critical thinking cannot be assumed simply because students interact with sophisticated AI systems, and collaboration cannot be guaranteed merely because digital platforms connect learners. Both require intentional instructional design. The present research addresses this gap by positioning human-centered digital pedagogy as the connecting framework between AI capabilities and higher-order learning processes. In this perspective, AI provides informational and interactive support, students remain active decision makers, and teachers organize learning experiences that demand analysis, evaluation, dialogue, and cooperation. Addressing this gap is important because without such integration, AI may increase efficiency while unintentionally weakening the very intellectual and social capacities education seeks to cultivate.

The state of the art of this study lies in integrating AI within a human-centered digital pedagogy framework that simultaneously targets critical thinking and collaborative learning. Rather than evaluating AI only according to efficiency or individual learning achievement, this approach emphasizes the quality of interactions generated around AI-supported learning activities. Students are encouraged to question AI-generated information, compare alternative explanations, justify their conclusions, discuss findings with peers, and collectively solve problems. Teachers function as facilitators who establish learning objectives, provide contextual guidance, monitor AI use, and encourage critical reflection. This integrated model is important because it shifts the focus of AI research from technological adoption toward pedagogical transformation. Its novelty lies in conceptualizing AI as a mediating resource connecting individual inquiry with collective knowledge construction. Such an approach can help educational institutions respond to the rapid expansion of AI while maintaining human agency, intellectual responsibility, communication, and collaboration as central principles of meaningful digital learning.

The research problem addressed in this study concerns how artificial intelligence can be integrated into online learning through human-centered digital pedagogy to foster critical thinking and collaborative learning. The central question is not whether AI can provide information, generate content, or support learning tasks, but how its use can be organized so that students remain intellectually active and socially engaged. This problem requires examining how AI-supported activities encourage students to analyze information, evaluate generated responses, formulate arguments, solve problems, and collaborate with peers. It also requires understanding the teacher's role in maintaining pedagogical direction, ethical boundaries, and meaningful interaction. The study therefore argues that AI will contribute positively to online learning when technological assistance is embedded within intentionally designed learning processes that prioritize questioning, verification, reflection, dialogue, and cooperation. This argument provides the conceptual basis for examining human-centered digital pedagogy as a mechanism for

transforming AI from an answer-producing technology into a catalyst for deeper learning and collective intellectual development.

The study proposes that human-centered digital pedagogy can maximize the educational value of AI when technology, teacher facilitation, and student agency operate as an integrated learning ecosystem. AI can provide rapid access to diverse information, generate alternative perspectives, and support iterative inquiry, while teachers can guide students in evaluating evidence, identifying limitations, and connecting AI-generated information with disciplinary knowledge. Collaborative activities can then require learners to compare interpretations, negotiate meanings, distribute responsibilities, and construct shared solutions. The expected argument is that such integration strengthens critical thinking because students are required to question and evaluate rather than merely accept AI outputs, while collaboration develops through structured interaction around AI-supported tasks. Theoretically, the study positions human-centered pedagogy as a mediating framework between technological capability and higher-order learning. Practically, it offers educational institutions a basis for designing responsible AI-supported online learning that preserves human agency, promotes intellectual rigor, strengthens collaboration, and supports sustainable digital transformation across contemporary education.

RESEARCH METHOD

This study employed a qualitative approach with a case study design to explore human-centered digital pedagogy in online learning through the integration of Artificial Intelligence (AI) to foster critical thinking and collaborative learning. The qualitative case study was selected because the research examines a contemporary educational phenomenon within its natural context and seeks to understand the experiences, practices, interactions, and perspectives of educational actors in depth. This design enables the researcher to examine how AI is integrated into learning activities, how teachers facilitate AI-supported learning, and how students engage in critical analysis and collaboration. The case study approach also allows the researcher to combine information from multiple sources and develop a comprehensive contextual interpretation. Thus, the design was considered appropriate for identifying pedagogical practices, supporting factors, challenges, and mechanisms through which human-centered digital pedagogy operates in AI-supported online learning.

The research was conducted at MA Nurul Jadid, which was purposively selected because it provides a relevant educational context for investigating the integration of AI into digital learning. The school was selected based on its engagement with technology-supported educational practices and its potential to demonstrate how AI can be incorporated into learning while maintaining teacher facilitation and student interaction. The educational environment of MA Nurul Jadid also provides a distinctive context because digital innovation operates alongside established academic and institutional values. Research participants were selected purposively based on their direct involvement in AI-supported learning activities. The informants included school leaders, teachers, and students who possessed relevant experiences and could provide substantive information concerning AI integration, critical thinking, collaborative learning, teacher facilitation, student participation, and challenges encountered during implementation.

Data were collected through in-depth interviews, participant observation, and documentation. In-depth interviews were conducted with selected informants to explore

their experiences, perceptions, strategies, and challenges related to AI-supported online learning. Interviews focused particularly on how teachers designed learning activities, how students interacted with AI, and how these interactions influenced critical thinking and collaborative learning. Participant observation was conducted to examine learning practices directly, including students' participation, questioning, information evaluation, peer interaction, problem-solving activities, and teacher facilitation. Documentation was used to complement interview and observation findings through relevant learning materials, lesson plans, student assignments, digital learning records, and other supporting documents. The collected data were analyzed interactively through data condensation, data display, and conclusion drawing and verification. During data condensation, relevant information was selected, coded, categorized, and organized according to themes related to AI integration, critical thinking, collaboration, and human-centered pedagogy.

Data credibility was established through source, technique, and time triangulation. Source triangulation was conducted by comparing information obtained from school leaders, teachers, and students to identify consistencies and differences in their perspectives regarding AI-supported learning. Technique triangulation involved comparing interview findings with observations and documentation to ensure that the results were supported by multiple forms of evidence. Time triangulation was conducted by collecting and comparing information at different stages of the research process to determine the consistency of observed practices and participant responses. The researcher also conducted member checking by presenting selected interpretations and preliminary findings to relevant informants for confirmation. Peer discussion was additionally employed to examine the logic and consistency of the researcher's interpretation. These procedures were applied to strengthen the credibility, dependability, confirmability, and transferability of the findings and to ensure that the conclusions accurately represented the educational practices investigated at MA Nurul Jadid.

RESULT AND DISCUSSION

Result

Human-Centered AI Integration for Critical Thinking and Collaborative Learning

Human-centered AI integration in online learning is operationally defined as the use of Artificial Intelligence as a supporting learning resource while maintaining teacher facilitation, student agency, critical inquiry, and peer interaction as central components of the learning process. At MA Nurul Jadid, this sub-finding was identified through learning activities in which students used AI to explore information, examine alternative explanations, formulate arguments, and support problem-solving activities conducted individually and collaboratively. The implementation did not position AI as an independent source of knowledge or a substitute for teachers. Instead, AI functioned as a learning mediator whose outputs were discussed, compared, evaluated, and refined through teacher guidance and peer interaction. Critical thinking was reflected in students' ability to question, verify, compare, and evaluate AI-generated information, whereas collaborative learning appeared through group discussion, exchange of perspectives, division of tasks, and collective construction of solutions.

An interview with a teacher revealed that AI was intentionally positioned as a starting point for critical inquiry rather than as a final source of answers. The teacher

stated, “I ask students not to immediately accept the answers generated by AI. They have to compare the information with learning materials and discuss whether the answer is reasonable.” This statement indicates that AI use was embedded within a verification-oriented learning process. The researcher interprets this finding as evidence that teacher facilitation was essential in transforming AI from an answer-generating technology into a stimulus for critical thinking. Students were encouraged to question the accuracy and relevance of AI-generated information rather than simply reproduce it. Such practices demonstrate that human-centered pedagogy emerged through the teacher’s ability to establish boundaries and learning procedures that required students to exercise intellectual judgment when interacting with AI.

A student provided a complementary perspective, stating, “When we work in groups, we use AI to find different explanations, but we discuss them with our friends before deciding which answer is appropriate.” This statement demonstrates that AI was incorporated into collaborative knowledge construction rather than used solely for individual task completion. The researcher interprets this finding as indicating that AI expanded the range of information available to students while peer interaction remained necessary for evaluating and negotiating that information. Students were required to communicate their interpretations, compare perspectives, and reach a shared conclusion. Consequently, AI served as an informational catalyst, while collaboration provided the social and intellectual mechanism through which information was transformed into shared understanding. This pattern suggests that the educational value of AI depended on the interaction between technological assistance, student agency, and collaborative dialogue.

Classroom observations showed that students interacted with AI in different stages of learning activities. During problem-solving tasks, students initially used AI to identify information and generate alternative explanations. They then discussed the obtained information with group members, compared it with learning materials, and presented their conclusions to the class. Several students questioned the accuracy of AI-generated responses and modified their initial conclusions after receiving feedback from peers or teachers. The researcher interprets this observation as evidence of a cyclical learning pattern involving inquiry, AI-supported exploration, verification, discussion, and revision. The observed activities also demonstrated that collaboration was not merely the physical division of assignments among students. Instead, students engaged in exchanging interpretations and collectively evaluating information. Therefore, AI-supported learning at MA Nurul Jadid encouraged both individual cognitive processing and social knowledge construction when accompanied by structured teacher guidance.

The overall findings can be restated as showing that AI integration supported critical thinking and collaborative learning when students were required to actively process and evaluate AI-generated information. Three main practices consistently emerged from the data: questioning and verification, peer discussion, and collective problem solving. Students did not simply receive information from AI but used it as a stimulus for further inquiry and discussion. Teachers played an important role in establishing learning procedures that prevented students from treating AI outputs as unquestionable answers. At the same time, group activities enabled students to compare interpretations, challenge one another’s ideas, and construct shared conclusions. These findings indicate that human-centered digital pedagogy transformed AI from a technological convenience into a pedagogical resource that supported higher-order

thinking and social learning. Thus, the effectiveness of AI was determined by how learning activities organized human interaction around technological assistance.

The pattern emerging from the data demonstrates a sequential relationship of AI-supported inquiry → information verification → peer interaction → critical evaluation → collaborative decision-making → shared learning construction. The pattern shows that AI initially expanded students' access to information and alternative perspectives, while teacher guidance encouraged students to evaluate the reliability and relevance of those outputs. Peer discussion then provided a social space for challenging assumptions, comparing interpretations, and negotiating conclusions. The final stage involved collectively constructing and communicating solutions based on information that had been critically examined. This pattern demonstrates that critical thinking and collaboration were not independent outcomes but interconnected processes within AI-supported learning. Critical evaluation strengthened the quality of group discussion, while collaborative dialogue encouraged students to reconsider and refine their individual interpretations. Therefore, human-centered AI integration was most effective when technological interaction was deliberately embedded within inquiry-based, dialogic, and collaborative learning activities.

Student Engagement through Generative AI

Student engagement through Generative Artificial Intelligence (GenAI) refers operationally to the active involvement of students in learning activities through behavioral, cognitive, and emotional dimensions facilitated by AI-supported interaction. At SMP Nurul Jadid, student engagement was identified through students' willingness to ask questions, participate in learning discussions, explore additional information, complete learning tasks, and interact repeatedly with digital learning resources. GenAI provided an interactive environment in which students could obtain immediate responses and explore topics according to their interests and learning difficulties. Consequently, engagement was not limited to physical participation during classroom activities but also extended to students' independent learning outside direct teacher interaction. The findings indicate that GenAI created additional opportunities for students to become active participants in learning by encouraging questioning, exploration, and independent problem solving. Thus, GenAI functioned as a complementary learning medium that strengthened students' behavioral participation, cognitive involvement, and emotional interest in learning.

An interview with a teacher revealed that the use of GenAI changed students' participation patterns during learning activities. The teacher stated, "Students who were usually quiet became more willing to ask questions after using AI because they could first explore the material independently and then discuss what they found with the teacher." This statement demonstrates that GenAI provided an intermediate space for students who were previously reluctant to communicate directly in class. The researcher interprets this finding as evidence that AI-supported learning can reduce psychological barriers to participation by providing students with an accessible environment for preliminary exploration. Students could formulate questions privately, obtain initial explanations, and subsequently participate more confidently in classroom discussions. Therefore, GenAI contributed to behavioral engagement by encouraging students to move from passive reception toward more active questioning and interaction.

A student provided a complementary perspective, stating, "I become more

interested in learning when I can ask AI questions directly. If the first answer is not clear, I can ask again, and sometimes I look for another example or related information." This statement indicates that GenAI encouraged continuous cognitive engagement through iterative questioning and information exploration. The researcher interprets the finding as evidence that engagement was strengthened through the interactive characteristics of GenAI rather than through content delivery alone. Students were able to determine the direction of their learning by asking follow-up questions, requesting clarification, and exploring related topics. This process transformed learning from a one-directional activity into an interactive dialogue. The repeated interaction also suggests that GenAI supported students' curiosity and persistence, particularly when they encountered difficult concepts or wished to understand learning materials more deeply.

Classroom observations showed that students demonstrated different forms of engagement while interacting with GenAI. Some students actively formulated questions related to the learning material, others compared AI-generated explanations with teacher explanations, and several students used AI to explore additional examples before completing assignments. Students also demonstrated greater persistence when encountering difficult learning tasks because they could obtain immediate assistance rather than discontinue the activity. The researcher interprets these observations as evidence of multidimensional engagement. Behavioral engagement was reflected in active participation and task completion, cognitive engagement appeared through questioning, comparison, and exploration, while emotional engagement was indicated by students' curiosity and sustained interest. Nevertheless, teacher monitoring remained necessary because active interaction with AI did not automatically guarantee meaningful learning. Engagement became educationally valuable when students critically processed AI-generated information and connected it with learning objectives.

The research findings can be restated as showing that GenAI strengthened student engagement by creating opportunities for continuous interaction, independent exploration, and immediate learning assistance. Across interviews and observations, three recurring forms of engagement emerged: active participation, cognitive exploration, and sustained learning interest. Students became more willing to formulate questions, investigate additional information, and continue working when they encountered difficulties. The availability of immediate responses reduced waiting time and enabled students to maintain their learning momentum. At the same time, students' engagement increasingly extended beyond classroom boundaries because GenAI could be accessed during independent study. These findings demonstrate that GenAI expanded the temporal and interactive dimensions of student engagement. However, meaningful engagement remained dependent on students' ability to evaluate information critically and on teachers' capacity to provide appropriate pedagogical direction.

The pattern emerging from the findings demonstrates a relationship between AI accessibility → interactive questioning → exploration → sustained participation → deeper learning engagement. The data indicate that immediate access to AI-supported assistance encouraged students to initiate questions, while conversational interaction encouraged them to continue exploring information. This repeated interaction subsequently supported persistence in completing learning activities and strengthened students' cognitive involvement. The pattern also demonstrates that GenAI influenced different dimensions of engagement simultaneously rather than affecting participation alone. Nevertheless, the findings suggest that technology functions as an enabling factor

rather than an independent determinant of engagement. Students became more engaged when GenAI was integrated into meaningful learning tasks, supported by teacher guidance, and accompanied by opportunities for discussion and critical reflection. Therefore, GenAI can strengthen student engagement when positioned as an interactive pedagogical mediator rather than merely an automated answer-generating tool.

Discussion

The findings show that human-centered AI integration at MA Nurul Jadid strengthened critical thinking by requiring students to question, verify, compare, and evaluate AI-generated information before accepting conclusions. This finding is consistent with recent scholarship emphasizing that generative AI can support higher-order thinking when learners engage critically with generated content rather than simply reproduce it. However, the present finding differs from technology-centered approaches that primarily evaluate AI through efficiency, accessibility, or task completion. In this study, AI became educationally meaningful only when teachers explicitly required verification and justification. Theoretically, this supports a human-centered digital pedagogy perspective in which technological capability is mediated by pedagogical intention and learner agency. Practically, teachers should design AI-supported tasks requiring evidence checking, explanation, argumentation, and reflection. Thus, this finding demonstrates that critical thinking emerges through structured interaction surrounding AI, rather than through AI exposure alone.

The findings indicate that AI supported collaborative learning by expanding access to explanations while maintaining peer discussion as the central mechanism for knowledge construction. Students used AI to obtain information, compared responses, discussed differences, and negotiated conclusions. This agrees with research showing that digital technologies can facilitate collaborative inquiry when learners exchange perspectives and construct meaning. It extends previous work by demonstrating that AI can function as an informational catalyst without becoming a decision maker. Collaboration remained dependent on communication, negotiation, and judgment among students. This suggests that AI-supported collaboration should be conceptualized as a sociotechnical process in which technological resources and human interaction operate together. Practically, teachers should organize group tasks requiring students to compare AI outputs, defend interpretations, resolve disagreements, and produce collective solutions. This design transforms AI from an individual productivity tool into a resource for shared learning.

A contribution of the study is the identification of a connected mechanism linking AI-supported inquiry, critical evaluation, and collaborative knowledge construction. Previous studies examine critical thinking, collaboration, and AI adoption as separate educational outcomes, whereas the findings show that these processes can reinforce. Students used AI to explore information, evaluated its relevance and reliability, discussed interpretations with peers, and revised conclusions collectively. This sequence suggests that critical thinking can improve the quality of collaboration, while collaborative dialogue can stimulate critical reflection. Theoretically, the finding extends human-centered digital pedagogy by positioning AI as a mediator between individual inquiry and collective knowledge construction. Practically, the model offers teachers a pathway for AI-supported learning: generate possibilities, verify evidence, discuss perspectives, revise

reasoning, and communicate shared conclusions. The study therefore contributes a pedagogical mechanism connecting technological assistance with higher-order cognitive and social learning processes.

The findings further demonstrate that teacher facilitation remains essential despite the sophistication of AI systems. Teachers at MA Nurul Jadid established boundaries by instructing students not to accept AI responses and requiring comparison with learning materials. This finding aligns with human-centered approaches emphasizing teacher oversight, ethical responsibility, and learner agency in AI. At the same time, it challenges assumptions that effective AI integration depends primarily on technological functionality. The observed learning process suggests that pedagogical structure, rather than technological sophistication alone, determines whether AI supports learning. Theoretically, this reinforces the teacher's role as a mediator who organizes interaction between students, AI, content, and peers. Practically, schools should strengthen teacher competencies in AI literacy, source verification, and collaborative learning design practices. Institutional guidelines should also clarify responsible AI use, ensuring that technological adoption remains aligned with academic integrity, critical inquiry, and educational objectives.

Overall, the study contributes to understanding AI integration as a human-centered pedagogical transformation rather than technological substitution. The findings indicate that meaningful learning emerged when AI provided informational possibilities, students exercised intellectual agency, peers negotiated interpretations, and teachers guided verification and reflection. This pattern is consistent with literature emphasizing responsible and purposeful AI use, while extending it through an integrated account of critical thinking and collaboration within one learning process. The principal theoretical implication is that human-centered digital pedagogy can mediate between AI capabilities and higher-order cognitive and social learning outcomes. The practical implication is that institutions should prioritize pedagogical redesign over simple technology adoption. AI-supported activities should explicitly include inquiry, verification, discussion, argumentation, and collective problem solving. The study consequently offers evidence that educational transformation depends less on possessing AI tools than on organizing human relationships around their purposeful use.

CONCLUSION

This study concludes that the most important lesson from human-centered AI integration at MA Nurul Jadid is that Artificial Intelligence becomes educationally valuable when positioned as a supporting resource within teacher-guided inquiry and collaborative learning, rather than as an autonomous provider of knowledge. The findings demonstrate that AI can strengthen critical thinking through questioning, verification, comparison, argumentation, and reflection, while simultaneously supporting collaborative learning through peer discussion, negotiation, and collective problem solving. The principal scholarly contribution lies in proposing an integrated understanding of AI-supported learning in which technological assistance, learner agency, teacher facilitation, critical thinking, and collaboration operate as interconnected elements of human-centered digital pedagogy. Nevertheless, the study is limited by its qualitative case study design and focus on a single institution, which limits broader generalization. Future research should examine multiple educational contexts using longitudinal, mixed-method, or experimental designs to assess sustained effects on critical thinking,

collaboration, AI literacy, learning outcomes, and responsible AI use.

ACKNOWLEDGEMENT

The author expresses his deep appreciation and gratitude to the supervisor for all the knowledge, direction, and patience in guiding the author during this research process. The guidance and input provided greatly contributed to the improvement of this work so that it could be completed properly.

REFERENCES

Albadarin, Y., Saqr, M., Pope, N., & Tukiainen, M. (2024). A systematic literature review of empirical research on ChatGPT in education. Discover Education, 3, 60. https://doi.org/10.1007/s44217-024-00138-2

Alfredo, R., Echeverria, V., Jin, Y., Yan, L., Swiecki, Z., Gašević, D., & Martinez-Maldonado, R. (2023). Human-centred learning analytics and AI in education: A systematic literature review. arXiv. https://arxiv.org/abs/2312.12751

Chen, L., Chen, P., & Lin, Z. (2020). Artificial intelligence in education: A review. IEEE Access, 8, 75264–75278. https://doi.org/10.1109/ACCESS.2020.2988510

Holmes, W., Bialik, M., & Fadel, C. (2019). Artificial intelligence in education: Promises and implications for teaching and learning. Center for Curriculum Redesign.

Kasneci, E., Sessler, K., Küchemann, S., Bannert, M., Dementieva, D., Fischer, F., Gasser, U., Groh, G., Günnemann, S., Hüllermeier, E., Krusche, S., Kutyniok, G., Michaeli, T., Nerdel, C., Pfeiffer, F., Poquet, O., Sailer, M., Schmidt, A., Seidel, T., ... Kasneci, G. (2023). ChatGPT for good? On opportunities and challenges of large language models for education. Learning and Individual Differences, 103, 102274. https://doi.org/10.1016/j.lindif.2023.102274

Lo, C. K., Yu, P. L. H., Xu, S., Ng, D. T. K., & Jong, M. S. Y. (2024). Exploring the application of ChatGPT in ESL/EFL education and related research issues: A systematic review of empirical studies. Smart Learning Environments, 11, 50. https://doi.org/10.1186/s40561-024-00342-5

Lu, M. (2023). Challenges and opportunities in education with the integration of ChatGPT. Global Research Review, 2, 247–249. https://doi.org/10.50908/grb.2.0_247

Ogunleye, B., Zakariyyah, K. I., Ajao, O., Olayinka, O., & Sharma, H. (2024). A systematic review of generative AI for teaching and learning practice. arXiv. https://arxiv.org/abs/2406.09520

Tzirides, A. O., Saini, A., Zapata, G., Searsmith, D., Cope, B., Kalantzis, M., Castro, V., Kourkoulou, T. P., Jones, J., Silva, R. A., Whiting, J., & Kastania, N. P. (2023). Generative AI: Implications and applications for education. arXiv. https://arxiv.org/abs/2305.07605

Zhang, P., et al. (2024). A systematic review of ChatGPT use in K–12 education. European Journal of Education. https://doi.org/10.1111/ejed.12599

Liu, H., et al. (2024). The use of ChatGPT in teaching and learning: A systematic review through SWOT analysis approach. Frontiers in Education, 9. https://doi.org/10.3389/feduc.2024.1328769

Ali, H., et al. (2024). ChatGPT in teaching and learning: A systematic review. Education Sciences, 14(6), 643. https://doi.org/10.3390/educsci14060643

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education—Where are the educators? International Journal of Educational Technology in Higher Education, 16, 39. https://doi.org/10.1186/s41239-019-0171-0

Roll, I., & Wylie, R. (2016). Evolution and revolution in artificial intelligence in education. International Journal of Artificial Intelligence in Education, 26, 582–599. https://doi.org/10.1007/s40593-016-0110-3

Holmes, W., Porayska-Pomsta, K., Holstein, K., Sutherland, E., Baker, T., Shum, S. B., Santos, O. C., Rodrigo, M. M. T., Cukurova, M., Bittencourt, I. I., & Koedinger, K. R. (2022). Ethics of AI in education: Towards a community-wide framework. International Journal of Artificial Intelligence in Education, 32, 504–526. https://doi.org/10.1007/s40593-021-00239-1

Ouyang, F., & Jiao, P. (2021). Artificial intelligence in education: The three paradigms. Computers and Education: Artificial Intelligence, 2, 100020. https://doi.org/10.1016/j.caeai.2021.100020

Seo, K., Tang, J., Roll, I., Fels, S., & Yoon, D. (2021). The impact of artificial intelligence on learner–instructor interaction in online learning. International Journal of Educational Technology in Higher Education, 18, 54. https://doi.org/10.1186/s41239-021-00292-9

Luckin, R., Holmes, W., Griffiths, M., & Forcier, L. B. (2016). Intelligence unleashed: An argument for AI in education. Pearson.

Williamson, B., & Eynon, R. (2020). Historical threads, missing links, and future directions in AI in education. Learning, Media and Technology, 45(3), 223–235. https://doi.org/10.1080/17439884.2020.1798995

UNESCO. (2021). AI and education: Guidance for policy-makers. UNESCO. https://unesdoc.unesco.org/

Wang, H., Dang, A., Wu, Z., & Mac, S. (2023). Generative AI in higher education: Seeing ChatGPT through universities' policies, resources, and guidelines. arXiv. https://arxiv.org/abs/2312.05235

Al-Smadi, M. (2023). ChatGPT and beyond: The generative AI revolution in education. arXiv. https://arxiv.org/abs/2311.15198

Tong, R., Li, H., Liang, J., & Wen, Q. (2024). Developing and deploying industry standards for artificial intelligence in education (AIED): Challenges, strategies, and future directions. arXiv. https://arxiv.org/abs/2403.14689