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Enhancing Primary School Teachers' Competence in Developing Deep Learning Instructional Materials through AI-Based Prompt Engineering Training

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Abstrak

The ability of teachers to compose effective prompts for AI systems is a critical prerequisite that has not yet been fully met among elementary school teachers, despite its determining role in the quality of Deep Learning instructional materials produced. This community service activity aimed to strengthen elementary school teacher competence in AI-based prompt engineering for designing high-quality Deep Learning instructional materials. A practice based participatory workshop method was employed, comprising five consecutive stages: material delivery (30 minutes), interactive discussion (20 minutes), demonstration (30 minutes), collaborative group practice (90 minutes), and reflection (30 minutes). The activity was conducted on May 25, 2026 at SDN 17 Limboto, Gorontalo Regency, involving 15 teachers as primary participants and 28 fourth-semester PGSD students from Universitas Negeri Gorontalo as facilitators, divided into two working groups. Results indicated that all groups successfully produced AI-assisted Deep Learning Lesson Plans (RPM) in accordance with the guidelines, with 100% attendance, active participation from all participants, improved understanding of prompt engineering, and effective group collaboration. Conclusion : AI based prompt engineering training proved effective in strengthening elementary school teacher competence in designing Deep Learning instructional materials and is recommended for sustainable replication to other schools.

Keywords: Prompt Engineering; Artificial Intelligence; Deep Learning; Teacher Competence; Elementary School

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INTRODUCTION

The rapid advancement of generative artificial intelligence (AI) technologies in recent years has created strategic opportunities for transforming instructional planning in primary education (Kasneci et al., 2023). AI-powered platforms such as ChatGPT, Gemini, and similar systems are now capable of generating comprehensive and well-structured instructional materials within minutes, provided that users are able to formulate precise and effective prompts (Mollick & Mollick, 2023). This ability to construct effective prompts has evolved into a distinct competency known as prompt engineering, which refers to the skill of designing optimal instructions that enable AI systems to generate outputs aligned with users' specific objectives (UNESCO, 2022).

The role of AI in education continues to evolve rapidly. In a comprehensive review of emerging trends in AI for education, Yusuf et al., (2024) argued that the integration of

generative AI into instructional design represents one of the most significant developments reshaping the global educational landscape. Teachers who are capable of leveraging AI effectively are expected to gain a competitive advantage in designing more personalized and adaptive learning experiences (Holmes et al., 2019). Likewise, Selwyn, (2022) emphasized that digital transformation in education cannot be achieved merely by providing access to technological tools; rather, its success depends primarily on educators' capacity to integrate these technologies meaningfully into pedagogical practice. Within this context, AI-based prompt engineering should be regarded not only as a technical digital competency but also as a pedagogical one, as it requires teachers to understand learning objectives, students' characteristics, and curriculum contexts before generating high-quality instructional resources through AI.

In the context of primary education, integrating AI-based prompt engineering with the Deep Learning instructional approach presents highly relevant opportunities. Deep Learning, as conceptualized by Fullan et al., (2018) and subsequently adapted into the policy framework of the Kementerian Pendidikan Riset, dan Teknologi, (2024), is founded upon three core principles: mindful, meaningful, and joyful learning. This approach requires teachers to design learning experiences that are considerably richer, more contextualized, and more meaningful than those offered by conventional instructional models. Furthermore, the Kementerian Pendidikan Riset, dan Teknologi, (2024), through the Merdeka Curriculum Learning and Assessment Guidelines, emphasizes the importance of teachers developing innovative, student-centered instructional planning competencies. These expectations can now be more effectively fulfilled through AI-assisted instructional design. Consequently, the ability to utilize AI through prompt engineering has become an increasingly essential competency for primary school teachers.

Numerous studies and community engagement initiatives focusing on AI training for primary school teachers have reported promising outcomes. Yurianantа & Asteria, (2024), in a professional development program on AI-based instructional media development, found that teachers who participated in structured, practice-oriented training were able to independently create AI-assisted instructional media despite having no prior experience with AI technologies. Similarly, Fadli et al., (2025), in a study examining AI literacy training for primary school teachers, demonstrated that practice-based workshops significantly improved teachers' digital competencies and their ability to understand and apply AI for instructional purposes. Moreover, participatory workshop formats were found to be substantially more effective than conventional lecture-based training approaches. These findings provide a strong empirical foundation for the community engagement program reported in the present study.

Saleh, Khairunissa Podungge, et al., (2025) further reported that implementing AI-based digital media in SDN 17 Limboto enhanced teachers' professionalism by promoting more interactive,personalized, and efficient instructional practices. Their study also identified AI literacy-including prompt engineering skills-as a critical determinant of successful technology integration into teachers' professional practice. These findings were reinforced bySaleh, Kudus, et al., (2025), who demonstrated that AI-assisted instructional models utilizing digital platforms significantly improved students' engagement and learning quality in primary schools. Nevertheless, both studies highlighted that teachers' prompt engineering competencies remain underdeveloped and require more systematic professional development.

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The challenges associated with the use of artificial intelligence (AI) are also relevant to the context of teachers at SDN 17 Limboto, Gorontalo Regency, particularly in supporting instructional planning within the framework of the Merdeka Curriculum. In the context of the partner institution, the need to strengthen teachers' competencies extends beyond familiarity with AI technologies to include the ability to use AI appropriately to generate outputs aligned with pedagogical objectives, including through the formulation of effective prompts. This is consistent with Syahrir et al., (2024), who reported that although AI has substantial potential to support instructional design, most primary school teachers continue to face challenges arising from limited technical knowledge and insufficient practical experience in using AI productively to support pedagogical objectives. Similarly, Yulisetiani et al., (2025), in their systematic review of digital competency development among primary school teachers, concluded that professional development programs emphasizing application-oriented learning, authentic learning experiences, and hands-on practice are more effective in enhancing teachers' digital competencies than training that is primarily theoretical or informational. In light of these conditions, this community engagement program is designed to strengthen teachers' practical skills through an AI-based prompt engineering workshop focused on developing Deep Learning Lesson Plans (Rencana Pembelajaran Mendalam; RPM). This approach is expected to enable teachers to use AI in a more purposeful and pedagogically appropriate manner, in accordance with the instructional planning needs of teachers at SDN 17 Limboto.

Accordingly, this program aims to: (1) strengthen teachers' understanding of AI-based prompt engineering concepts and techniques; (2) train teachers to develop high-quality AI-assisted Deep Learning Lesson Plans (RPM); and (3) enhance the quality of teachers' instructional planning through the effective and contextually appropriate integration of AI in accordance with the current national curriculum.

METHODS

1. Program Design and Approach

This community engagement program employed a practice-based participatory workshop approach that integrated theoretical instruction, live demonstrations, collaborative group practice, and guided reflection into a continuous learning process. This approach was selected based on the principles of adult learning (andragogy) proposed by (Knowles et al., 2020), which emphasize that adult professional development is most effective when it is problem-centered and involves authentic, hands-on learning experiences. Likewise, (Mandailina et al., 2024), in their case study of an AI-assisted instructional material development workshop, confirmed that practice-oriented workshop formats, in which participants produce tangible outputs during training, are more effective in enhancing teachers' competencies sustainably than demonstration-based training alone. Furthermore, the collaborative group format was adopted based on the findings of Saleh, Riana, et al., (2025), who reported that AI training programs incorporating teamwork and active discussion produce greater improvements in teachers' competencies than individually conducted training.

2. Waktu, Lokasi, dan Peserta

The workshop was conducted on Monday, May 25, 2026, at SDN 17 Limboto, Gorontalo Regency, Indonesia. The participants consisted of 15 primary school teachers from SDN 17 Limboto as the primary beneficiaries and 28 fourth-semester students from the Primary School Teacher Education Program (PGSD), Universitas Negeri Gorontalo (UNG), who served as

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workshop facilitators, resulting in a total of 43 participants (5 males and 38 females) aged between 25 and 45 years. Participants were selected using a total sampling technique, whereby all active teachers at the school were included.

The demographic characteristics of the participants are presented in Table 1.

Table 1. Characteristics of Participants in the Prompt Engineering Workshop at SDN 17 Limboto

Characteristic	Description
Workshop venue	SDN 17 Limboto, Gorontalo Regency, Gorontalo Province, Indonesia
Date of implementation	Monday, May 25, 2026
Primary participants	Teachers of SDN 17 Limboto
Total participants	43 participants (15 teachers and 28 fourth-semester PGSD students, UNG)
Gender	5 males and 38 females
Age range	25–45 years
Sampling technique	Total sampling (all active teachers at SDN 17 Limboto)
Group organization	Two teacher working groups (7–8 participants per group)
Academic supervisor	One lecturer from the Primary School Teacher Education Program, Universitas Negeri Gorontalo
Facilitators	Fourth-semester PGSD students, Universitas Negeri Gorontalo
Roles of facilitators	Providing technical guidance on prompt engineering, facilitating discussions, mentoring practical activities, and observing participant engagement

Source: Primary data from the Community Engagement Program (2026)

3. Workshop Procedures and Duration

The workshop was implemented through five sequential stages with a total duration of 200 minutes, as summarized in Table 2.

Table 2. Stages and Duration of the Prompt Engineering Workshop

No.	Workshop Stage	Duration	Activity Description
1	Theoretical Instruction	30 minutes	Introduction to the fundamental concepts of generative AI, the principles of prompt engineering (context, objectives, format, and constraints), and the three pillars of the Deep Learning approach (mindful, meaningful, and joyful learning).
2	Discussion and Question-and-Answer Session	20 minutes	Clarification of participants' understanding of the presented materials, sharing of initial experiences with educational technologies, and identification of participants' professional development needs.
3	Live Demonstration	30 minutes	Real-time demonstration of prompt development using AI platforms, followed by the presentation of sample AI-generated Deep Learning Lesson Plans (Rencana Pembelajaran Mendalam [RPM]).

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4	Collaborative Group Practice	90 minutes	Participants worked collaboratively to develop prompts, submit them to AI platforms, evaluate the generated outputs, and adapt the resulting Deep Learning Lesson Plans (RPM) to the instructional needs of their respective classrooms.
5	Reflection, Presentation, and Evaluation	30 minutes	Group presentations of the developed lesson plans, evaluative feedback provided by the supervising lecturer, and guided reflection on participants' learning experiences throughout the workshop.

Source: Primary data from the Community Engagement Program (2026)

4. Evaluation Instruments

The effectiveness of the workshop was evaluated using three complementary instruments. First, a participant engagement observation checklist was completed by the student facilitators throughout the practical sessions to document participants' levels of involvement and participation. Second, a Deep Learning Lesson Plan (RPM) assessment rubric was employed by the supervising lecturer to evaluate the quality of the instructional plans produced by each group. Third, participants completed a self-reflection questionnaire at the end of the workshop to assess their perceived improvement in understanding prompt engineering concepts and their ability to integrate artificial intelligence into instructional planning.

RESULTS AND DISCUSSION

1. Achievement of Program Success Indicators

The effectiveness of the workshop was evaluated based on six predetermined success indicators established prior to program implementation. Overall, all indicators met or exceeded their respective performance targets, demonstrating the successful implementation of the workshop. The results are summarized in Table 3.

Table 3. Achievement of Success Indicators for the Prompt Engineering Workshop

No.	Achievement Indicator	Target	Measurement Criteria	Achieved Outcome
1	Participant attendance	≥ 95% of participants	Participant attendance and engagement throughout all stages of the activity	100% of participants attended and participated in all stages of the activity.
2	Active participant engagement	≥ 80% of participants	Participants actively asked questions, engaged in discussions, provided responses, and participated in practical activities, as observed throughout the program	Based on observations, ≥ 80% of participants demonstrated active engagement throughout the activity, particularly during the demonstration and practical sessions on *prompt engineering*.

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3	Ability to develop AI-assisted lesson plans (RPM)	≥ 90% of groups produce an RPM that meets the established criteria	Each group develops an AI-assisted RPM containing the required components in accordance with the guidelines and presents or applies the product during the activity	Both groups developed AI-assisted RPMs in accordance with the activity guidelines. This outcome was based on direct observation of the resulting products and is not intended to serve as evidence for generalizing the overall effectiveness of the training program.
4	Participants' understanding of *prompt engineering*	≥ 80% of participants demonstrate adequate understanding	Participants are able to answer questions, explain key concepts, and apply basic *prompt engineering* principles during question-and-answer sessions, practical activities, and reflection, based on observations	Based on observations and question-and-answer sessions, ≥ 80% of participants were able to explain the basic principles of *prompt engineering* and demonstrate their application in developing AI-assisted RPMs.
5	Group collaboration	≥ 80% of groups achieve a good rating	Evidence of task distribution, communication, coordination, and member involvement throughout the activity, based on observations	Based on observations, both groups demonstrated good collaboration, as indicated by effective task distribution, active communication, coordination, and member involvement during the practical activities.
6	Environmental awareness	≥ 80% of participants	Participants properly dispose of and sort waste and maintain environmental cleanliness, based on observations	Based on observations, ≥ 80% of participants demonstrated environmental awareness by properly disposing of and sorting waste and maintaining cleanliness

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	throughout the activity.

Source: Primary data from the Community Engagement Program (2026)

2. Workshop Implementation Dynamics

The theoretical instruction session was conducted in a highly conducive learning environment and successfully stimulated active participant engagement from the outset. The prompt engineering concepts were introduced using a structured framework consisting of context, objective, format, and constraints, which proved readily understandable even for teachers with no previous experience using artificial intelligence technologies. Participants demonstrated strong interest in the topic, as reflected by the large number of questions raised even before the formal discussion session began. This early engagement indicated the high relevance of the workshop content to their professional needs.

The live demonstration represented the most transformative stage of the workshop. When the facilitators illustrated, in real time, how a carefully designed prompt based on prompt engineering principles could generate a comprehensive Deep Learning Lesson Plan (RPM) within minutes, participants responded with considerable enthusiasm. Teachers who had initially expressed skepticism regarding the practical value of AI in supporting instructional planning became noticeably more receptive and interested in integrating the technology into their professional practice. These observations are consistent with the findings of(Saleh, Maharani, et al., 2025), who reported that live demonstrations of AI applications constitute one of the most effective strategies for reshaping teachers' perceptions and strengthening their confidence in adopting emerging educational technologies.

During the 90-minute collaborative practice session, both teacher groups demonstrated a high level of engagement and productivity. Each group independently identified instructional objectives, constructed prompts using the framework introduced during the workshop, submitted the prompts to an AI platform, critically evaluated the generated outputs, and adapted the resulting Deep Learning Lesson Plans (RPM) to the specific instructional needs of their respective classrooms. This iterative process indicates that participants did not merely accept AI-generated outputs uncritically; instead, they engaged in reflective evaluation and creative adaptation to ensure pedagogical relevance. Such practices have been identified by (Mollick & Mollick, 2023) as essential for the successful integration of AI into educators' professional practice.

The reflection and presentation session served as a meaningful opportunity for consolidating participants' learning experiences. Both groups presented their completed Deep Learning Lesson Plans (RPM) and explained the prompt engineering strategies they had employed throughout the development process. The supervising lecturer provided constructive feedback that further deepened participants' conceptual understanding and practical competence. Compared with their initial level of confidence before the workshop, participants demonstrated a noticeable increase in self-confidence regarding the use of AI for instructional planning and lesson design.

DISCUSSION

The successful completion of AI-assisted Deep Learning Lesson Plans (RPM) by all participant groups within the 90-minute collaborative practice session represents a noteworthy achievement, particularly considering that none of the participants had prior experience with

prompt engineering. This finding reinforces the study by Saleh, Kudus, et al., (2025), which demonstrated that contextually designed AI integration in primary school instructional planning, supported by skilled facilitators, can substantially improve the quality of instructional materials within a relatively short period. Similarly, (Kasneci et al., 2023), in their systematic review of artificial intelligence in education, reported that teachers are more motivated to engage in technology-related professional development when they can directly observe its practical benefits for their daily instructional responsibilities.

The findings further indicate that improving teachers' competencies through AI-based prompt engineering extends beyond technological proficiency alone. Rather, effective prompt engineering requires teachers to formulate clear, systematic, and contextually appropriate instructions that align with pedagogical objectives. This suggests that prompt engineering should be regarded as an advanced form of digital literacy, requiring educators to possess a comprehensive understanding of learning objectives, students' characteristics, and curriculum requirements before generating AI-assisted instructional materials. These findings are consistent with UNESCO, (2023), which emphasizes that the successful adoption of generative AI in education depends largely on educators' ability to formulate effective prompts while maintaining professional responsibility throughout the teaching and learning process. Likewise, Yusuf et al., (2024) argued that AI in education has evolved beyond a simple automation tool into an effective pedagogical partner. However, its educational value ultimately depends on teachers' competence in directing, validating, and integrating AI-generated outputs into meaningful learning contexts.

The high level of participant engagement observed throughout all stages of the workshop reflects both the relevance and the urgency of prompt engineering as an emerging professional competency for teachers. Moreover, the effectiveness of collaborative group work carries important implications for teacher professional development. Balanced task distribution and active communication among participants suggest that collaborative workshop designs constitute an appropriate model for developing teachers' digital competencies. This finding is consistent with Darling-Hammond et al., (2017), who argued that sustainable teacher professional learning is best achieved within collaborative learning communities. Similarly, Yulisetiani et al., (2025), in their systematic review of practice-based digital competency development for primary school teachers, concluded that collaborative training models producing authentic instructional products generate stronger competency retention and greater motivation for classroom implementation than conventional lecture-oriented professional development programs.

The ability of all participant groups to produce AI-assisted Deep Learning Lesson Plans also demonstrates that artificial intelligence can function as a pedagogical support tool that enhances teachers' instructional efficiency without diminishing their professional agency. Teachers remained responsible for determining instructional objectives, verifying the accuracy of learning content, adapting instructional strategies to students' characteristics, and refining AI-generated outputs before classroom implementation. (Kasneci et al., 2023) similarly argued that large language models, such as ChatGPT, possess considerable potential to support instructional material development; nevertheless, the quality of the final products continues to depend on teachers' capacity to guide, critically evaluate, and validate AI-generated information.

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The collaborative learning environment established during the workshop further contributed to the program's effectiveness. Group discussions enabled participants to exchange professional experiences, critically evaluate the quality of their prompts, and collaboratively refine AI-generated outputs. Comparable findings were reported by Yurianantа & Asteria, (2024), who found that collaborative practice during AI-based instructional media training encouraged peer learning and resulted in higher-quality instructional products than individual work. The interactions among participants also facilitated collective reflection, allowing teachers not only to acquire technical skills in using AI but also to strengthen their critical thinking when evaluating AI-generated content. This observation aligns with (Darling-Hammond et al., 2017), who emphasized that sustainable teacher professional development is most effectively achieved through collaboration, authentic practice, reflective learning, and engagement with real-world instructional challenges.

These findings are also consistent with the policy direction of the (Kementerian Pendidikan Riset, dan Teknologi, 2024), which promotes strengthening teachers' AI literacy as an integral component of the national educational digital transformation agenda. Furthermore, the Merdeka Curriculum Learning and Assessment Guidelines Kementerian Pendidikan Riset, dan Teknologi, (2022) emphasize the importance of developing teachers' competencies in innovative and adaptive instructional design to meet diverse student needs. These competencies can now be substantially enhanced through the responsible and pedagogically informed use of AI. Syahrir et al., (2024) likewise identified that generative AI has significant potential to assist teachers in developing more diverse and differentiated lesson plans within the Merdeka Curriculum, provided that teachers possess adequate prompt engineering competencies to guide AI systems in producing outputs consistent with the curriculum's educational philosophy. Consequently, prompt engineering should be understood not merely as a technical skill but as a pedagogical competency that enables teachers to articulate instructional objectives more precisely while producing richer, more diverse, and more adaptive learning resources for students with varying educational needs.

From the perspective of educational policy implementation, the results of this community engagement program demonstrate that prompt engineering training supports Indonesia's ongoing educational transformation toward the Deep Learning instructional approach. Rather than focusing solely on the completion of administrative teaching documents, this approach encourages teachers to design learning experiences that are meaningful, mindful, and joyful. Through AI-assisted instructional planning, teachers are able to explore alternative teaching strategies, differentiated learning activities, authentic assessment methods, and contextual learning scenarios, which can subsequently be adapted to their students' characteristics and learning needs. Supporting this finding, (Fadli et al., 2025) reported that teachers who had received AI literacy training demonstrated significant improvements in the quality of their instructional planning, particularly regarding the creativity of instructional strategies and the diversity of learning activities designed for students.

Beyond improving instructional planning quality, the workshop also contributed to strengthening teachers' technological self-efficacy. Prior to participating in the program, many teachers perceived AI as a complex and difficult technology to use. However, following direct hands-on experience, participants demonstrated greater confidence in experimenting with AI tools and developing increasingly specific and effective prompts. (Selwyn, 2022) argued that

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meaningful digital transformation in education occurs only when teachers move beyond mere exposure to technology and experience its practical application within authentic professional contexts-a process clearly reflected in the present workshop. Likewise, (Mandailina et al., 2024) confirmed that experiential learning approaches in AI professional development produce stronger and more enduring improvements in teachers' technological self-efficacy than information-based training alone.

Overall, the findings of this community engagement program indicate that AI-based prompt engineering training represents a highly relevant model of teacher professional development for twenty-first-century education. The integration of authentic practice, collaborative learning, reflective activities, and generative AI technologies effectively enhanced teachers' competencies in designing Deep Learning Lesson Plans. Accordingly, this professional development model has considerable potential for replication in other primary schools, provided that its implementation is adapted to participants' levels of digital literacy, the availability of technological infrastructure, and the curricular contexts of individual educational institutions.

CONCLUSION

The AI-based prompt engineering training program designed to strengthen teachers' competencies in developing Deep Learning Lesson Plans at SDN 17 Limboto successfully achieved all predetermined success indicators. All participants attended the workshop and actively engaged throughout every stage of the program. Most importantly, every teacher group successfully developed AI-assisted Deep Learning Lesson Plans *(Rencana Pembelajaran Mendalam, (RPM))* that met the established guidelines within the allocated practice period. These findings demonstrate that a structured workshop integrating conceptual instruction on prompt engineering, live demonstrations, and collaborative hands-on practice constitutes an effective professional development strategy for enhancing primary school teachers' capacity to utilize generative AI in designing high-quality, meaningful, and deep learning experiences.

Based on the findings of this program, three recommendations are proposed. First, AI-based prompt engineering training should be systematically expanded to other primary schools across Gorontalo Regency to strengthen teachers' digital and pedagogical competencies. Second, follow-up coaching programs should be implemented for one to three months after the training to support sustained competency development and facilitate the practical integration of AI into classroom instruction. Third, future research and development initiatives should prioritize the creation of a curated repository of context-specific prompts for different subjects and grade levels within Indonesian primary education, thereby providing teachers with adaptable and pedagogically appropriate AI resources.

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REFERENCES

Darling-Hammond, L., Hyler, M. E., & Gardner, M. (2017). *Effective Teacher Professional Development*. Learning Policy Institute.

Fadli, M. R., Santosa, I., Alfian, A., Syofyan, H., & Fatonah, K. (2025). Optimizing the use of ai in elementary school learning: For teachers in the digital era. *Jurnal Pembelajaran Pemberdayaan Masyarakat (JP2M)*, *6*(1), 260–271. https://doi.org/10.33474/jp2m.v6i1.23358

Fullan, M., Quinn, J., & McEachen, J. (2018). *Deep Learning: Engage the World Change the World*. Corwin Press.

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., Pfeffer, J., 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

Kementerian Pendidikan Riset, dan Teknologi, K. (2022). *Panduan Pembelajaran dan Asesmen Kurikulum Merdeka*. Kemendikbudristek RI.

Kementerian Pendidikan Riset, dan Teknologi, K. (2024). *Panduan Pembelajaran Mendalam (Deep Learning)*. Kemendikbudristek RI.

Knowles, M. S., Holton, E. F., & Swanson, R. A. (2020). *The Adult Learner: The Definitive Classic in Adult Education and Human Resource Development* (9th ed.). Routledge.

Mandailina, V., Syaharuddin, S., & Abdillah, A. (2024). Pelatihan Penerapan Teknologi Artificial Intelligence untuk Meningkatkan Kompetensi Guru dalam Menyusun Perangkat Pembelajaran. *Darma Diksani: Jurnal Pengabdian Ilmu Pendidikan, Sosial, Dan Humaniora*, *4*(1), 26–37. https://doi.org/10.29303/darmadiksani.v4i1.4928

Mollick, E., & Mollick, L. (2023). Assigning AI: Seven approaches for students, with prompts. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.4475995

Saleh, M., Khairunissa Podungge, S., Nurul, R., Babuta, H., Yusuf, A., Sid, N. N., Ishak, A., & Pengabdian, A. (2025). Pengembangan Model Pembelajaran Berbasis Lingkungan Dan Media Digital Berbasis AI Di Sekolah Dasar. *Ju Jurnal Kolaboratif Sains*, *8*(8), 5166. https://jurnal.unismuhpalu.ac.id/index.php/JKS/article/view/8461

Saleh, M., Kudus, & Nadine, M. N. (2025). Implementasi Model Pembelajaran Mordiscvein Berbantuan Media Digital Berbasis AI Pada Mata Pelajaran IPAS di Kelas Rendah Sdn 5 Kabila Kabupaten Bone Bolango. *Pendas : Jurnal Ilmiah Pendidikan Dasar*, *10*(04), 496–510. https://journal.unpas.ac.id/index.php/pendas/article/view/39375/20542

Saleh, M., Maharani, M., Puspita, D. E., Sulastri, Y., Suleman, F., Musa, N. A. S., & Najib, A. S. A. (2025). Jurnal Teori dan Pengembangan Pendidikan Jurnal Teori dan Pengembangan Pendidikan. *Jurnal Teori Dan Pengembangan Pendidikan*, *9*(4), 319–336. https://journal.fexaria.com/j/index.php/jtpb/article/view/322

Saleh, M., Riana, L. T., Kamali, S. R., Managhuang, N., Wawointana, S., & Abubakar, Z. (2025). Peran Guru Dalam Menumbuhkan Kesadaran Lingkungan di SDN 14 Paguyaman Kabupaten Boalemo, Provinsi Gorontalo. *Integrative Perspectives of Social and Science Journal (IPSSJ)*, *2*(3), 6963–6974. https://ipssj.com/index.php/ojs/article/view/816

Selwyn, N. (2022). *Digital Education: Learning, Teaching and Schooling in a Digital Age*.

ISSN: 2622-6766 (*online*)

Polity Press.

Syahrir, S., Pujiriyanto, P., As, M., Nur, F. A. M., & Fitri, S. (2024). Primary School STEM Education Innovation through ICT Integration for Teacher Competency Development: A Systematic Literature Review. *Jurnal Pendidikan Dan Kebudayaan*, *9*(1), 47–61. https://doi.org/10.24832/jpnk.v9i1.4896

UNESCO. (2022). *Guidance for generative AI in education and research*. https://unesdoc.unesco.org

Yulisetiani, S., Hatta, P., & Aristyagama, Y. H. (2025). Peningkatan Kompetensi Digital Guru SD melalui Pelatihan Pengembangan Pusat Sumber Belajar Digital Berbasis Cloud Computing. *DEDIKASI: Community Service Reports*, *7*(2), 65. https://doi.org/10.20961/dedikasi.v7i2.94963

Yurianta, R., & Asteria, P. V. (2024). Pelatihan Pembuatan Media Pembelajaran Berbantuan Artificial Intelligence (AI) untuk Guru. *Jurnal Gramaswara*, *4*(3), 274–285. https://doi.org/10.21776/ub.gramaswara.2024.004.03.07

Yusuf, A., Pervin, N., & Román-González, M. (2024). Generative AI and the future of higher education: a threat to academic integrity or reformation? Evidence from multicultural perspectives. *International Journal of Educational Technology in Higher Education*, *21*(1), 21. https://doi.org/10.1186/s41239-024-00453-6