



SIGAP AI: Empowering Primary School Teachers Through Artificial Intelligence to Overcome Educator Shortages

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Abstract:

This study aimed to address human resource limitations in elementary schools by integrating Generative Artificial Intelligence (AI) into the preparation of learning materials aligned with the Merdeka Curriculum. Limited availability of homeroom teachers often results in vacant teaching positions, increased administrative responsibilities, and teacher fatigue, which may negatively affect learning quality. This community service program used a participatory approach with three stages: needs analysis, implementation, and evaluation. Implementation included workshops and ongoing coaching to strengthen teachers' competencies in structured prompt engineering, using the Sigap AI handbook as a practical guide for generating, adapting, and refining instructional materials and administrative documents. The results showed that the program effectively reduced teachers' time in preparing learning resources and supported more efficient completion of administrative tasks. Evaluation and reflection activities revealed that 100% of participants felt assisted by the program, experienced increased confidence, and demonstrated improved digital independence in utilizing AI technology. The program also reinforced the importance of responsible AI adoption by ensuring that teachers remained the primary decision-makers in instructional processes. These findings suggest that structured Generative AI integration can support teachers and maintain learning quality despite limited human resources in elementary schools.

INTRODUCTION

Artificial Intelligence (AI) has developed rapidly and created new opportunities for improving the effectiveness of education and the efficiency of teachers' professional work. AI integration is increasingly relevant because teachers must manage instructional planning, learning materials, assessment, and administrative responsibilities simultaneously. Evidence from previous studies demonstrates that AI integration in Situational Interactive Teaching can improve students' learning outcomes across cognitive, psychomotor, and affective domains, as well as flow experience (Shi et al., 2024). AI has also been shown to improve teacher performance, particularly in student-centered learning, instructional material development, and teaching practices (Mulyani et al., 2025). AI can also help teachers complete various professional and administrative tasks (Goldman et al., 2024). These developments suggest that responsible AI adoption can deliver broader educational benefits by reducing unnecessary workload and enabling

teachers to focus more attention on students. Therefore, AI integration is increasingly important as a strategic educational innovation to strengthen teacher capacity and sustain learning quality.

Despite these opportunities, educational communities still face challenges in using AI effectively, particularly when teachers have limited human resources and increasing professional demands. In many elementary schools, teachers must perform multiple roles because the number of available educators does not always match the number of classes and responsibilities to manage. These conditions can make it difficult to allocate time, manage responsibilities, and maintain instructional quality. Previous studies indicate that teachers facing multiple responsibilities may experience difficulties in dividing time and responsibilities (Torrino & Naparan, 2024), while other research identifies challenges in balancing different responsibilities (Wallin et al., 2025), increased workloads (Chauhan et al., 2024; Craig et al., 2023), and role conflict and fatigue (Mellor et al., 2021). These problems demonstrate that human resource limitations are not merely organizational issues but can directly influence teachers' professional sustainability. Consequently, practical strategies are needed to help teachers manage workload efficiently without compromising their autonomy, pedagogical responsibilities, or the quality of learning provided to students.

This issue is particularly relevant in elementary schools where limited personnel can affect the continuity of classroom management and instructional preparation. Field observations identified a similar situation at the partner school, where the available workforce consists of nine personnel: one principal, one Islamic Religious Education teacher, one administrative staff member, one gardener who also teaches physical education, and five homeroom teachers. The most significant challenge occurs in Grade IV, which does not have a dedicated homeroom teacher. Consequently, several teachers and administrative personnel conduct learning activities and must accommodate additional responsibilities. Ideally, the number of classroom teachers in an elementary school should correspond to the number of learning groups or classes organized by the school (Waspodo et al., 2020). This imbalance creates additional demands on existing personnel and increases the need for efficient approaches to instructional preparation. Addressing this condition is socially significant because strengthening teachers' capacity to manage professional tasks can support learning continuity, reduce unnecessary workload, and contribute to more sustainable educational services within resource-constrained school communities.

Previous studies show that AI can support educational activities and improve teacher effectiveness. Still, much of the literature emphasizes AI's potential rather than practical strategies for integrating it into teachers' daily professional workloads. AI has been associated with improvements in student learning through Situational Interactive Teaching (Shi et al., 2024), enhanced teacher performance in student-centered learning and instructional material development (James & Wyckoff, 2020; Mulyani et al., 2025), and assistance with professional and administrative tasks (Goldman et al., 2024; Kuryani & Timan, 2024). However, the availability of AI tools does not automatically guarantee effective implementation. Teachers still require appropriate competencies to formulate instructions, evaluate generated outputs, and adapt AI-produced materials according to curricular and pedagogical needs. Professional training is therefore essential because it can strengthen teacher competence (Triwiyanto et al., 2018; Rind & Qureshi, 2026). Recent evidence also shows that training can improve teachers' competence in

developing instructional modules and assessments (Yang et al., 2024). Nevertheless, previous studies have paid limited attention to structured AI-assisted interventions designed to mitigate teacher workload arising from uneven human resource distribution in elementary schools.

The gap becomes more evident when considering the importance of human agency and responsible technology use in education. Generative AI should not be positioned as a replacement for teachers but as a strategic partner that supports professional tasks while leaving pedagogical judgment under human control. The Guidance for Generative AI in Education and Research emphasizes the importance of maintaining human agency in using Generative AI (2023). In the partner school, teachers already possess basic familiarity with platforms such as ChatGPT and Google Gemini, as well as access to laptops and internet connectivity. However, the central challenge is turning this initial familiarity into systematic, independent practice. Existing research has demonstrated the benefits of AI and teacher training separately. Yet, a practical gap remains in community-based programs that combine structured prompt engineering, coaching, and contextual learning-material development to address human resource constraints. Resolving this gap matters because teachers need not only access to AI but also practical guidance to use it efficiently, critically, ethically, and sustainably in their everyday responsibilities.

Based on the conditions described above, this community service program addresses the imbalance between available human resources and the professional workload elementary school teachers must manage. The absence of a dedicated Grade IV homeroom teacher requires other teachers and administrative personnel to take on additional instructional and administrative responsibilities. At the same time, teachers must prepare teaching modules, assessment instruments, learning media, and other administrative documents required under the Merdeka Curriculum. Without an efficient strategy, these overlapping responsibilities may increase workload, fatigue, and the risk of reduced instructional effectiveness. Although the school has adequate basic digital infrastructure and teachers are familiar with several Generative AI platforms, they have not yet optimized their use through structured prompt engineering and systematic coaching. Therefore, the central problem is not simply the lack of technology but the limited capacity to integrate Generative AI strategically into professional tasks. This condition highlights the need for an applicable intervention that helps teachers reduce preparation time while preserving professional judgment and responsibility.

The SIGAP AI program was developed to address these challenges by integrating Generative AI into learning-material preparation and professional administrative tasks through structured training and coaching. The program aims to mitigate the effects of limited human resources by strengthening teachers' ability to use AI independently, responsibly, and effectively while maintaining full human control over instructional decisions. Specifically, this community service initiative seeks to analyze how human resource limitations affect the implementation of teaching and learning processes, examine Generative AI's potential to improve the efficiency of teachers' professional tasks, and develop an implementation strategy through SIGAP AI that supports sustainable teacher empowerment. The program focuses on practical competencies in structured prompt engineering, supported by the SIGAP AI handbook, and emphasizes generating, adapting, and refining instructional materials. Through this approach, the program is expected to reduce teachers' workload while sustaining learning quality,

strengthening digital independence, and supporting the broader educational goal of building resilient, adaptive school communities amid resource limitations.

RESEARCH METHODS

This community service program employed a participatory training and coaching design to address the partner's actual needs related to limited human resources, multiple teacher responsibilities, and administrative workload. The design was selected because community service activities require an intervention that not only provides knowledge but also facilitates the direct application of acquired competencies in the partner's professional context. The program combined a workshop and coaching approach. The workshop provided participants with practical competencies and skills in structured prompt engineering for Generative AI, while coaching served as a collaborative, individualized, and continuous mentoring process. The program followed three main stages: preparation, implementation, and evaluation. During the preparation stage, the team conducted observations and in-depth interviews with the school principal and teachers to identify the partner's actual conditions, problems, and required support. Based on these findings, the team developed the SIGAP AI training handbook as a practical intervention to support teachers in using Generative AI to prepare learning materials.

The community service program was conducted at an elementary school on Saturday, July 5, 2026, with nine participants, including teachers and administrative personnel. The location was selected purposively based on the partner's identified needs and the program's relevance to the school's existing conditions. The school faced limited human resources, overlapping professional responsibilities, and substantial administrative demands, while its personnel already had basic access to digital facilities and familiarity with Generative AI platforms. These conditions made the school an appropriate setting for implementing a structured intervention focused on optimizing existing resources rather than introducing technology without contextual preparation. Data were collected through direct observation, in-depth interviews, documentation, participant reflections, and evaluation of learning-material outputs produced during the program. Observation assessed participant discipline, active participation, engagement, and the ability to follow and apply instructions provided during the workshop. Interviews and reflections explored participants' experiences, perceived benefits, challenges, confidence, and independence in using Generative AI. Documentation included training activities and learning materials produced using the SIGAP AI handbook, while participant satisfaction was assessed through program evaluation.

Data were analyzed qualitatively through data condensation, data display, and conclusion drawing and verification, following the analytical principles of Miles, Huberman, and Saldaña. Data condensation involved selecting, focusing, simplifying, and organizing information from observations, interviews, reflections, documentation, and evaluation results according to the program's objectives. The condensed data were then displayed systematically to identify patterns related to participant engagement, the effectiveness of prompt engineering training, perceived workload reduction, digital independence, and the quality of learning-material outputs. The final stage involved drawing and verifying conclusions by comparing information across different data sources to strengthen the credibility of the findings. Triangulation involved comparing observation results, interview responses, participant reflections, documentation, and

program evaluation results. The evaluation therefore covered both process and outcomes: process evaluation examined participation, discipline, engagement, and training implementation, whereas outcome evaluation focused on participants' independence, the learning materials produced through Generative AI, perceived usefulness, and satisfaction with the SIGAP AI program.

RESULTS AND DISCUSSION

Results

Field observations showed that the partner school faced a significant shortage of teaching personnel, particularly in Grade IV, which lacked a dedicated homeroom teacher. This affected the organization of teaching and learning activities because several teachers and educational personnel had to teach classes on a rotating basis. The school adjusted teaching schedules to ensure learning activities could continue and students' learning rights were upheld. However, these adjustments created additional demands for teachers because they had to manage their regular teaching responsibilities while also covering Grade IV. The situation also reduced the time available for lesson preparation, administrative work, and rest between teaching sessions. Based on the observation, the shortage of human resources was therefore not only related to the absence of a homeroom teacher but also affected the distribution of professional responsibilities throughout the school. This condition became an important consideration in designing the SIGAP AI program, particularly because the intervention was expected to help teachers manage their professional tasks more efficiently without reducing their involvement in instructional decision-making.



Figure 1. Field Observation at school

Figure 1 presents the field observation that the community service team conducted before implementing the SIGAP AI program. The observation identified the actual distribution of personnel, teaching arrangements, and the professional challenges teachers and educational staff experienced. The results confirmed that the personnel shortage created additional responsibilities for the available staff. These findings formed the basis for the intervention's focus, particularly the need to improve efficiency in preparing learning materials and administrative documents.

In addition to adjusting teaching schedules, the school assigned additional responsibilities to several educational personnel. Administrative staff supported learning activities in Grade IV, while other personnel were also required to assist with teaching activities outside their primary responsibilities. At the same time, teachers had to manage additional duties such as school administration, financial management, team coordination, and other managerial responsibilities. These overlapping tasks increased

teachers' workload and reduced the time available to prepare instructional materials. The condition also required teachers to use their break periods to complete additional teaching and administrative tasks. The findings indicate that the human resource shortage created a chain of problems involving workload distribution, limited preparation time, and teacher fatigue. Therefore, the intervention was designed not to replace teachers or reduce their professional responsibilities, but to provide technological support that could make routine preparation tasks more efficient. Generative AI was introduced as a support tool to help teachers complete repetitive, time-consuming tasks while allowing them to retain responsibility for final instructional decisions.

The implementation of the SIGAP AI program showed that Generative AI could provide practical assistance in completing teachers' professional tasks. Based on the post-training evaluation and participant reflections, teachers used Generative AI to prepare various components of learning materials more efficiently. These included teaching modules, learning objectives, learning activity sequences, triggering questions, differentiated learning activities, student worksheets, formative assessments, and assessment rubrics. Teachers reported that several tasks that previously required substantial preparation time could be completed more quickly after they learned how to formulate structured prompts. The efficiency gains were particularly relevant to the school's limited human resources because teachers could use the time saved from routine preparation for other professional responsibilities and instructional activities. The findings show that SIGAP AI's main contribution was not simply introducing teachers to Generative AI, but helping them turn the technology into a practical tool for solving specific problems in their daily work.

The participant reflection results further demonstrated the SIGAP AI program's usefulness. All participating teachers (100% of participants) stated that the training helped them complete their professional tasks. Participants also expressed greater confidence in using Generative AI to develop learning materials and explore new instructional ideas. However, the participants did not directly adopt AI-generated outputs without further consideration. They reviewed, modified, and adjusted the generated materials to match their students' characteristics, learning objectives, subject requirements, and school context. This process shows that teachers remained actively involved in developing learning materials. Generative AI functioned primarily as a brainstorming partner, an initial content generator, and a tool for improving work efficiency. Teachers made the final decisions about the materials' suitability and quality. This finding matters because the program showed that AI integration can support teacher productivity without eliminating teachers' professional autonomy. The technology supported the process, while the teacher retained full control of pedagogical judgment.



Figure 2. Implementation of the SIGAP AI Program

Figure 2 illustrates the implementation of the SIGAP AI program through direct training and practical activities with teachers and educational personnel. The activities focused on authentic professional tasks that participants encountered in their daily work. Teachers practiced developing structured prompts, generating learning materials, reviewing AI outputs, and adapting the results to their instructional needs. The activity's practical orientation enabled participants to connect the training material to their professional responsibilities immediately. The figure therefore represents the program's direct implementation as an intervention designed to address the actual conditions identified during the initial observation.

The SIGAP AI program focused particularly on Grade IV because this class experienced the most direct impact of the shortage of teaching personnel. The class did not have a dedicated homeroom teacher and therefore required support from several teachers and educational personnel. This condition made Grade IV an appropriate initial context for applying the program. The training emphasized structured prompt engineering by teaching participants how to formulate clear, specific, contextual, and systematic instructions for Generative AI. Participants were guided to include important elements in their prompts, such as subject matter, grade level, learning objectives, student characteristics, learning activities, assessment requirements, and expected output format. Through this approach, teachers obtained AI-generated materials more closely aligned with their instructional needs. The training therefore moved beyond simply demonstrating how to access AI platforms and focused on developing teachers' ability to communicate effectively with AI. This competency enabled participants to use Generative AI more purposefully and independently.

The post-training evaluation also showed positive changes in teachers' confidence and digital independence. Participants reported feeling more capable of using Generative AI after completing the training and coaching sessions. They not only followed the examples provided during the workshop but also began identifying their own professional tasks that AI could support. Their action plans included developing mathematics student worksheets, accelerating the preparation of PAI and IPAS teaching modules for the upcoming semester, and exploring the development of learning objectives and instructional sequences for Grade III. These plans indicate that participants had begun transferring the skills acquired during the program into other professional contexts. The results also show that the program's impact extended beyond workshop completion. Participants showed an intention to continue experimenting with Generative AI independently according to their respective teaching needs. This emerging independence is an important outcome because the sustainability of a community service program depends not only on immediate participant satisfaction but also on participants' ability to continue applying the acquired competencies after the intervention ends.

Overall, the findings indicate that the SIGAP AI program provided a practical response to the partner school's human resource limitations. The program helped teachers reduce the time required to prepare instructional materials, strengthened their confidence in using Generative AI, and encouraged greater digital independence. More importantly, the program showed that technology can optimize existing human resources without shifting pedagogical responsibility from teachers to AI. The teachers remained responsible for reviewing, validating, adapting, and deciding whether AI-generated materials were appropriate for their students and learning objectives. The combination of workshop activities, practical exercises, coaching, reflection, and the continued use of

the SIGAP AI handbook also created a foundation for sustainable implementation. The participants' intention to apply the skills to other subjects and classes further indicates the potential for program expansion within the school. Thus, SIGAP AI can serve as a practical, community-based intervention to help elementary schools manage professional workloads amid limited human resources while maintaining teacher autonomy and the quality of learning preparation.

Discussion

The SIGAP AI program's findings indicate that Generative AI can provide practical support for teachers working with limited human resources and increased professional responsibilities. The program showed that teachers could use Generative AI to speed up the preparation of teaching modules, learning objectives, instructional activities, student worksheets, formative assessments, and assessment rubrics. This finding aligns with previous research showing that Generative AI can reduce the time required for lesson and resource preparation and may help reduce teachers' workload (Gui et al., 2026). It also aligns with research indicating that teachers tend to use Generative AI extensively for lesson preparation, assessment, and administrative tasks rather than replacing direct classroom interaction (Dennison et al., 2026). However, this program's findings extend these observations by showing its application in a school facing an shortage of teaching personnel. In this context, AI was not introduced merely as a technological innovation but as a practical mechanism for optimizing existing human resources. The program therefore shows that Generative AI can support workloads when its implementation is directly connected to real organizational problems.

The program's effectiveness was strongly associated with structured prompt engineering. Participating teachers were not simply introduced to AI platforms; they were trained to formulate prompts that included instructional objectives, student characteristics, subject content, learning activities, and expected outputs. The teachers' ability to produce more relevant and usable instructional materials after the training indicates that the quality of AI outputs is closely related to the quality of human instructions provided to the system. This finding aligns with previous research showing that prompt engineering can improve the relevance and alignment of Generative AI outputs in lesson planning and that teachers need iterative refinement to obtain outputs that match specific classroom requirements (Mahoklory & Hoda, 2021; Zeng et al., 2025). The similarity is particularly evident in the finding that AI-generated materials still require teacher review and modification. Therefore, the present program reinforces the view that AI literacy should not be limited to operating an AI platform but should include the ability to communicate with AI, evaluate its outputs, and adapt them pedagogically. Theoretically, this finding strengthens a human-centered view of AI integration in which technological effectiveness depends on the interaction between technological capability and teachers' professional expertise.

Another important finding concerns Generative AI's role in reducing teachers' workload without transferring professional authority to technology. All participating teachers reported that the SIGAP AI program helped them complete professional tasks, and their reflections showed increased confidence and digital independence. At the same time, teachers continued to validate and modify AI-generated outputs according to student characteristics, learning objectives, and school context. This finding is important because the benefits of AI-assisted workload reduction should not be interpreted as

complete automation of teachers' work. Previous research has similarly shown that although Generative AI can reduce preparation time, teachers still need to review, correct, and refine AI-generated outputs because these outputs may not always be fully appropriate for specific instructional contexts (Alrumayh et al., 2025; Nasruddin, 2026). The findings therefore support a complementary relationship between teachers and AI rather than a substitution relationship. From a theoretical perspective, this reinforces the principle of human agency in integrating educational technology. From a practical perspective, schools should design AI training that explicitly emphasizes verification, contextual adaptation, ethical use, and teacher accountability rather than focusing solely on speed or productivity.

The findings also have important implications for teacher professional development. The increased confidence and independence demonstrated by participants suggest that short-term training can serve as a starting point for developing sustainable digital competencies when combined with practical exercises, contextual coaching, and opportunities for independent application. This finding aligns with studies emphasizing that teachers need continuous professional development and targeted support to integrate Generative AI effectively into their professional practice (Hasna Uzzakiyah & Galang Lufityanto, 2025; Vicci, 2024). The action plans developed by participants after the training, including the preparation of mathematics worksheets, PAI and IPAS teaching modules, and instructional planning for other grades, indicate that the acquired competencies were beginning to transfer beyond the original training context. This transfer matters because professional development becomes meaningful when teachers translate training knowledge into workplace practice. Practically, the SIGAP AI model suggests designing teacher training around authentic professional problems rather than generic technology demonstrations. Schools with limited personnel can prioritize repetitive and time-consuming preparation tasks for AI assistance while maintaining teachers' responsibility for pedagogical decisions.

This community service program contributes a contextual intervention model that connects Generative AI, prompt engineering, teacher professional development, and human resource limitations in an elementary school setting. Existing research has largely discussed the potential of Generative AI for lesson planning, administrative support, and teacher productivity, while studies on prompt engineering have emphasized the importance of improving the quality and relevance of AI-generated instructional outputs (Aisyah & Utamimah, 2025; N et al., 2023). The SIGAP AI program contributes by translating these insights into a practical community-based intervention consisting of needs analysis, structured workshop activities, coaching, practical application, reflection, and continued use of a SIGAP AI handbook. This approach positions AI not simply as an instructional technology but as a strategic resource for mitigating organizational challenges caused by limited personnel. The contribution is therefore both conceptual and practical: conceptually, it demonstrates how human-centered AI integration can support teacher work without replacing professional judgment; practically, it provides a replicable approach for schools facing similar workload and human resource constraints. The program also demonstrates that digital transformation can begin by optimizing existing resources rather than requiring substantial additional infrastructure.

Overall, the findings suggest that SIGAP AI can serve as a sustainable strategy for supporting teacher productivity and maintaining instructional preparation quality under conditions of limited human resources. The program's success depended not only on the

availability of Generative AI but on the combination of teachers' existing digital readiness, structured prompt engineering, contextual training, coaching, and continuous human validation of AI-generated outputs. This finding is consistent with broader evidence that effective Generative AI integration requires teacher preparedness, professional support, contextual adaptation, and clear attention to ethical and pedagogical considerations (Kusumawati, 2025; Ma'arif, 2025). Practically, schools should develop simple, sustainable mechanisms to sustain AI-supported work after training, such as maintaining the SIGAP AI handbook, sharing effective prompts among teachers, conducting periodic peer reflection, and continuously evaluating the quality of AI-assisted instructional materials. Theoretically, the findings support the understanding of Generative AI as an augmentation tool that strengthens rather than replaces teacher capacity. Thus, SIGAP AI's principal contribution is demonstrating that responsible, teacher-controlled Generative AI integration can mitigate workload pressures, strengthen teachers' digital independence, and sustain the quality of educational services.

CONCLUSION

This study concludes that the SIGAP AI program effectively addressed challenges stemming from limited human resources and heavy professional workloads in elementary schools. Based on field observations, post-test results, and teacher reflections, the program enabled educators to develop learning objectives, instructional activities, assessments, and other educational components more efficiently through structured Generative AI training and coaching, while preserving their pedagogical creativity and professional autonomy. The implementation also enhanced teachers' digital independence and encouraged knowledge sharing among educators and schools experiencing similar constraints. These findings highlight SIGAP AI's potential as a sustainable professional development model for strengthening technology-based teaching competencies. However, AI integration should serve as a supportive tool rather than a substitute for broader efforts to achieve adequate and equitable teacher distribution. The implications of this study suggest that education authorities and stakeholders can adopt structured AI-based capacity-building programs to optimize teacher productivity, improve instructional preparation, and support improvements in learning quality in resource-limited educational settings. Future research should further investigate the long-term impacts of such interventions through broader quantitative or experimental studies involving diverse school contexts.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

AI was used solely to assist with language translation and copyediting for readability. All research content, analytical findings, and conclusions remain the exclusive responsibility of the authors.

REFERENCES

- Aisyah, E. N., & Utamimah, S. (2025). Implementing project-based learning with loose parts in early childhood education: A qualitative descriptive study. *Golden Age: Jurnal Ilmiah Tumbuh Kembang Anak Usia Dini*, 10(1), 71–84. <https://doi.org/10.14421/jga.2025.101-06>
- Alrumayh, S., & Kasheem, M. (2025). Perceptions of Islamic studies, Sharia, and law students towards the use of artificial intelligence in English learning. *Action Research Journal Indonesia (ARJI)*, 7(3). <https://doi.org/10.61227/arji.v7i3.504>
- Chauhan, R., Nurhamidah, U., Pariyanti, E., Sulastri, S., & Desastra, Y. Z. (2024). Performance Challenges for Female Teachers: Dissecting Workload and Dual Role Conflict. *Mabsya: Jurnal Manajemen Bisnis Syariah*, 6(2), 171–184. <https://doi.org/10.24090/mabsya.v6i2.10912>
- Craig, C. J., Hill-Jackson, V., & Kwok, A. (2023). Teacher Shortages: What Are We Short Of? *Journal of Teacher Education*, 74(3), 209–213. <https://doi.org/10.1177/00224871231166244>
- Dennison, D. V., Ahtisham, B., Chourasia, K., Arora, N., Singh, R., Kizilcec, R. F., Nambi, A., Ganu, T., & Vashistha, A. (2025). *Shiksha Copilot: Teacher-AI Collaboration for Curating and Customizing Lesson Plans in Low-Resource Schools* (Version 3). arXiv. <https://doi.org/10.48550/ARXIV.2507.00456>
- Goldman, S. R., Taylor, J., Carreon, A., & Smith, S. J. (2024). Using AI to Support Special Education Teacher Workload. *Journal of Special Education Technology*, 39(3), 434–447. <https://doi.org/10.1177/01626434241257240>
- Gui, Q., Omar, M. K., & Harithuddin, A. S. M. (2026). Teachers' professional development on self-efficacy, attitudes, and digital competencies in the digital era. *Acta Psychologica*, 265, 106683. <https://doi.org/10.1016/j.actpsy.2026.106683>
- Hasna Uzzakiyah, & Galang Lufityanto. (2025). Workforce agility in startup employees: The role of psychological empowerment, emotional intelligence and job autonomy. *Humanitas: Indonesian Psychological Journal*, 22(1), 1–12. <https://doi.org/10.26555/humanitas.v22i1.755>
- James, J., & Wyckoff, J. H. (2020). Teacher Evaluation and Teacher Turnover in Equilibrium: Evidence From DC Public Schools. *AERA Open*, 6(2), 2332858420932235. <https://doi.org/10.1177/2332858420932235>
- Kuryani, T., & Timan, A. (2024). *The Development of Teacher Professionalism in Implementing Curriculum and Learning Management Towards Education 5.0*.
- Kusumawati, I. (2025). AI-based human capital as a catalyst for increasing the strategic agility of educational organizations. *International Journal of Multidisciplinary Research*, 1(5), 239–245.
- Lee, D., & Palmer, E. (2025). Prompt engineering in higher education: A systematic review to help inform curricula. *International Journal of Educational Technology in Higher Education*, 22(1), 7. <https://doi.org/10.1186/s41239-025-00503-7>
- Ma'arif, M. A. (2025). Smart school branding: Leveraging AI-driven digital marketing to enhance institutional reputation and student enrollment. *Journal of Educational Management Research*, 4(6), 3406–3418.
- Mahoklory, S. S., & Hoda, F. S. (2021). The effect of self-evacuation drill on the preparedness level of children with disabilities in facing tornado disaster. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 6(3), 1658–1666. <https://doi.org/10.31004/obsesi.v6i3.1636>

- Mellor, C., Gaudreault, K. L., & Jenkins, J. (2021). Preparing Physical Educators to Manage Teacher/Coach Role Conflict. *Journal of Physical Education, Recreation & Dance*, 92(7), 39–43. <https://doi.org/10.1080/07303084.2021.1948462>
- Mohamad, S. K., & Dharam Singh, H. K. (2025). Prompt Engineering Frameworks and Their Educational Value in Higher Education. *Innovative Teaching and Learning Journal*, 9(2), 495–505. <https://doi.org/10.11113/itlj.v9.204>
- Mulyani, H., Istiaq, M. A., Shauki, E. R., Kurniati, F., & Arlinda, H. (2025). Transforming education: Exploring the influence of generative AI on teaching performance. *Cogent Education*, 12(1), 2448066. <https://doi.org/10.1080/2331186X.2024.2448066>
- N, Y., Susanti, N., Nofiyah, W., & Ainy, E. N. (2023). The rotating roles method as a determinant of the social development of early age students. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, 7(3), 3809–3818. <https://doi.org/10.31004/obsesi.v7i3.4090>
- Napier, J. B., Luft, J. A., & Singh, H. (2020). In the Classrooms of Newly Hired Secondary Science Teachers: The Consequences of Teaching In-field or Out-of-field. *Journal of Science Teacher Education*, 31(7), 802–820. <https://doi.org/10.1080/1046560X.2020.1800195>
- Nasruddin, M. F. (2026). Realize Islamic education values through behavioral approach to students of Islamic boarding school. *Applied Social Psychology Studies*. <https://letiges.or.id/index.php/asps/article/view/56>
- O’Rafferty, G., Eryilmaz, N., Kennedy, A., & Strietholt, R. (2026). Trends in reading teacher shortage: Using 20 years of evidence from PIRLS. *Teaching and Teacher Education*, 174, 105415. <https://doi.org/10.1016/j.tate.2026.105415>
- OECD. (2025). *Results from TALIS 2024: The State of Teaching*. OECD Publishing. <https://doi.org/10.1787/90df6235-en>
- Pangestu, F. N. N., Hamidah, I., Widaningsih, L., Abdullah, A. G., & Saputra, N. A. (2026). A scoping literature review of prompt engineering for bridging students AI literacy in higher education. *Computers and Education: Artificial Intelligence*, 10, 100581. <https://doi.org/10.1016/j.caeai.2026.100581>
- Park, J., & Choo, S. (2025). Generative AI Prompt Engineering for Educators: Practical Strategies. *Journal of Special Education Technology*, 40(3), 411–417. <https://doi.org/10.1177/01626434241298954>
- Qian, Y. (2025). Prompt Engineering in Education: A Systematic Review of Approaches and Educational Applications. *Journal of Educational Computing Research*, 63(7–8), 1782–1818. <https://doi.org/10.1177/07356331251365189>
- Rind, I. A., & Qureshi, M. A. (2026). AI-mediated teaching in K–12 classrooms. *Computers in Human Behavior: Artificial Humans*, 8, 100321. <https://doi.org/10.1016/j.chbah.2026.100321>
- Sheppard, K., Padwa, L., Kelly, A. M., & Krakehl, R. (2020). Out-of-Field Teaching in Chemistry and Physics: An Empirical Census Study. *Journal of Science Teacher Education*, 31(7), 746–767. <https://doi.org/10.1080/1046560X.2019.1702268>
- Shi, S. J., Li, J. W., & Zhang, R. (2024). A study on the impact of Generative Artificial Intelligence supported Situational Interactive Teaching on students’ ‘flow’ experience and learning effectiveness—A case study of legal education in China. *Asia Pacific Journal of Education*, 44(1), 112–138. <https://doi.org/10.1080/02188791.2024.2305161>

- Sorensen, L. C., & Ladd, H. F. (2020). The Hidden Costs of Teacher Turnover. *AERA Open*, 6(1), 2332858420905812. <https://doi.org/10.1177/2332858420905812>
- Torrino, J. A., & Naparan, G. B. (2024). Experiences of teachers in managing dual roles: As a school head and class adviser. *Eureka: Journal of Educational Research*, 3(1), 17–27. <https://doi.org/10.56773/ejer.v3i1.34>
- Triwiyanto, T., Wiyono, B. B., & Kusumaningrum, D. (2018). *Peningkatan Kompetensi Penelitian Pengembangan Dan Penulisan Karya Ilmiah Guru*.
- Vicci, D. H. (2024). Emotional intelligence in artificial intelligence: A review and evaluation study. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.4818285>
- Wallin, D., Newton, P., & Jutras, M. (2025). Teaching Principals in Rural, Remote, and Northern Schools in Canada: An Empirical Analysis of Workload, Roles, and Instructional Leadership. *Theory & Practice in Rural Education*, 15(1), 182–213. <https://doi.org/10.3776/tpre.2025.v15n1p182-213>
- Waspodo, M., Agus Amin Sulistiono, Budi Kadaryanto, Lucia Hermien Winingsih, Sri Rahayu, & Tatik Soroeida. (2020). *Studi Guru Tidak Tetap Pada Jenjang Pendidikan Dasar*.
- Yang, Y.-F., Tseng, C. C., & Lai, S.-C. (2024). Enhancing teachers' self-efficacy beliefs in AI-based technology integration into English speaking teaching through a professional development program. *Teaching and Teacher Education*, 144, 104582. <https://doi.org/10.1016/j.tate.2024.104582>
- Zeng, M., Cheah, K. S. L., & Abdullah, Z. (2025). The influence of school principals' digital leadership on teachers' competency in integrating artificial intelligence: A systematic thematic review. *Frontiers in Education*. <https://doi.org/10.3389/educ.2025.1655967>