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Strengthening teachers' digital competencies through AI-based Learning Design training in remote areas

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ABSTRACT

Limited digital literacy and restricted access to technology training remain major challenges for teachers in disadvantaged, remote, and outermost (3T) areas, particularly in supporting the implementation of the Merdeka Curriculum. At SD Negeri Gudang Garam, Keerom Regency, most teachers had limited experience using Artificial Intelligence (AI) tools for administrative and instructional purposes. This community service program aimed to strengthen teachers' digital competencies through practical training and mentoring in the use of AI-based applications for learning design and educational administration. The program involved 12 teachers and was implemented through needs identification, intensive hands-on training, mentoring, and evaluation activities. Teachers were introduced to AI tools such as ChatGPT and Canva AI to develop digital lesson plans, interactive visual media, and AI-assisted learning videos adapted to local classroom contexts. The results showed improvements in teachers' understanding and practical skills in utilizing AI for instructional purposes. Teachers successfully produced adaptive digital lesson plans, visual learning materials, and instructional videos directly applicable in classroom activities. The program also increased teachers' confidence and creativity in integrating digital technology into teaching despite limited infrastructure and unstable internet access. To support sustainability, offline learning modules and local teacher learning communities were strengthened to encourage continuous collaboration and independent learning after program completion.

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1. INTRODUCTION

The implementation of Merdeka Curriculum encourages teachers to design adaptive and interactive learning processes, yet the readiness of educators in Indonesia's disadvantaged, remote, and outermost (3T) regions remain limited. Demonstrated by SD Negeri Gudang Garam conditions, exposure towards artificial intelligence tools such as ChatGPT, Canva AI, and Quillionz remains limited among teachers. Limited familiarity towards AI tools causes hefty workloads for teachers, as they have to give extensive efforts undertaking administrative tasks, consequently minimizing their time in developing innovative

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teaching methods. Located in Skanto District, Keerom Regency, this remote region faces additional challenges due to limited access to structured training and infrastructural constraints, particularly unstable internet connectivity. Data from Kemendikbudristek (2022) highlight that limited digital literacy remains a major challenge to achieving equality in education quality, especially in Indonesia's remote regions.

Over the last three years, various studies and community service initiatives suggested that the use of technology, particularly AI, can significantly support the development of teachers' competencies. A report by UNESCO (2023) stated that the usage of generative AI for educational purposes can improve teaching efficiency and enable more customized learning approaches. Research by Zawacki-Richter et al. (2019) shows that the integration of AI in education enabling teachers to enhance learning quality and improve the efficiency of teachers' work through the automation of administrative tasks. More recent work by Holmes et al. (2019) suggests that AI has considerable potential to assist teachers in designing adaptive and interactive learning experiences, particularly in primary education. This view is further supported by Luckin (2022), who argues that the practical use of AI can minimize teachers' administrative workload, allowing them to focus more on pedagogical activities.

To address competencies and infrastructure gap, the community service team provided intensive training and mentoring on designing context-based AI-supported learning. The training was conducted face-to-face using a hands-on approach to guide teachers in integrating AI into the development of lesson plans (RPP), digital visual learning materials, and assessment instruments. The solution offered was not solely focused on introducing the technology, but also adopted a sustained approach through equipping teachers with offline learning modules and utilizing applications that require little to no internet connections. In order to ensure the effective implementation of the program, despite connectivity constraints, the team also strengthened local learning communities as a platform for teachers to independently share knowledge and experiences after the training.

The relevance of this solution is supported by a growing body of literature indicating that AI can enhance both the efficiency and customization of teaching and learning processes. The practical use of AI tools has been shown to strengthen primary school teachers' competencies in designing interactive learning experiences while also automating administrative tasks. Although infrastructural challenges remain, improving teachers' foundational understanding of AI can still facilitate classroom implementation when accompanied by appropriate mentoring and support. This is consistent with the view that the successful integration of technology in education depends largely on strengthening educators' capacity as the primary agents of digital transformation.

This community service program aims to enhance the digital competence and self-sustenance of teachers at SD Negeri Gudang Garam in designing learning materials and resources. Through a series of training activities, teachers are expected to use technology more effectively and creatively streamline administrative tasks while improving learning quality in the classroom. The program represents a strategic effort to strengthen the capacity of educators in remote regions, enabling them to contribute more effectively to educational innovation in line with the objectives of the Merdeka Belajar initiative.

Limited digital literacy among teachers at SD Negeri Gudang Garam poses a significant challenge to educational modernization, particularly in the adoption of artificial intelligence (AI). Initial observations indicated that approximately 80 percent of teachers were neither familiar with nor capable of using AI tools such as ChatGPT, Canva AI, and Quillionz. This condition directly limits innovation in the development of learning materials, with nearly 90 percent of the materials remaining conventional and lacking interactivity. As a result, a gap persists between the potential of available technologies and actual classroom practices. This highlights the need for strategic interventions to equip educators with practical skills that support the effective implementation of the Merdeka Curriculum.

AI tools have considerable potential to simplify lesson planning and support the implementation of the Merdeka Curriculum. However, teachers currently lack access to structured training programs that provide practical skills in AI-based learning design. The school's location in a border region further restricts access to online professional development opportunities. In addition, limited internet connectivity poses a challenge to the effective use of technology in educational activities. Consequently, a comprehensive approach is needed that extends beyond technical training and addresses the practical conditions under which technology is implemented.

Such approach may include the provision of offline learning modules and low-bandwidth applications that remain accessible under constrained connectivity conditions. Strengthening local teacher learning communities can also play an important role in facilitating continuous peer support and knowledge sharing. Furthermore, government agencies and relevant institutions should provide face-to-face training that is practical and tailored to local needs. Finally, mentoring activities may be delivered through a flexible hybrid model that accommodates the connectivity limitations commonly encountered in border regions. To address the challenges, the solution framework is provided in Figure 1.

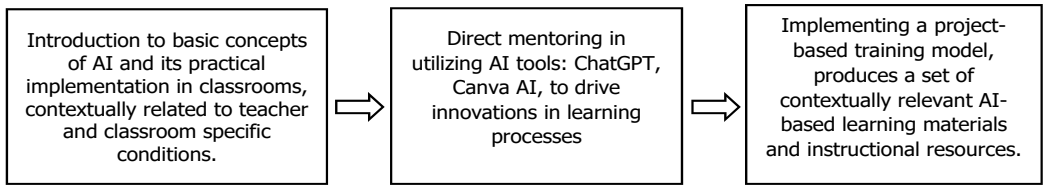

Figure 1. Solution framework

2. METHODS

Partners' Profile and Location

This community service program was conducted in partnership with teachers from SD Negeri Gudang Garam, located in Skanto District, Keerom Regency, Papua Province. The school was selected because it is situated in a disadvantaged, remote, and outermost (3T) area with limited access to information and technology. The participants consisted of 12 teachers, including homeroom teachers from Grades 1 to 6 as well as subject teachers. The implementation team consisted of three academics with expertise in educational technology and learning design

AI Basic Concept on Learning

The program adopted an adaptive and practical AI-based learning approach. Its primary objective was to equip teachers with the skills needed to use AI tools to improve administrative efficiency and enhance creativity in learning design. The technologies introduced included ChatGPT for the development of lesson plans (RPPs), Canva AI for designing visual learning materials, and AI-based video editing applications. These technologies were selected and implemented to ensure accessibility not only through laptops, but also through Android smartphones, which are the primary digital devices available to most teachers at the partner school.

Implementation

Based on coordination with stakeholders and needs identification, the program was implemented through the systematically structured stages described in Table 1.

Table 1. Implementation stages

Stages	Description	Participants
Planning and Preparation	Initial coordination for creating materials, preparing equipment (internet modems, projectors, laptops), and developing offline training materials to anticipate internet issues.	Community Service Team
Coordination and Arranging Permits	Sending official letters and discussions with the principal regarding technical implementation and appointing an internal coordinator from the school.	Community Service Team and School Partners
Needs Identification	Mapping teachers' initial skills through questionnaires and informal interviews to adjust the depth of the AI material to be presented.	Community Service Team
Day 1 Implementation	Socialization of AI concepts, practical use of ChatGPT for learning plans, and visual media design with Canva AI in the Teachers' Room at SD Negeri Gudang Garam.	Community Service Team and Teachers
(Intensive Training and Practice)	Practical creation of learning videos, teaching simulations using AI, and evaluation through digital/printed attendance and feedback forms.	Community Service Team and Teachers

Detailed Description of Stages

Stage 1: Activity planning (including internet connectivity mitigation)

The implementation team conducted an initial coordination phase to develop training materials tailored to the context of disadvantaged, remote, and outermost (3T) regions. The program focused on the application of AI technologies to support thematic learning at the primary school level. Given the limited and unstable internet connectivity at the partner site, the team provided a dedicated modem and internet data package, as well as offline versions of the training materials as a contingency measure. These efforts were intended to ensure the effective implementation of the program by enabling teachers to access learning resources even under limited connectivity conditions. This approach is consistent with UNESCO's (2023) recommendation that technology-based learning initiatives should be designed to accommodate infrastructural constraints in remote areas.

Stage 2: Coordination and arranging permits

The initial step involved preparing a formal request letter for permission to conduct the program, addressed to the principal of SD Negeri Gudang Garam. The letter contained key information regarding the program title, objectives, implementation schedule, and the proposed collaboration between the community service team and the school. It was submitted through official channels as part of maintaining academic ethics and professionalism in establishing partnerships with educational institutions. Through direct coordination, it was agreed that the training would involve 12 teachers and be scheduled in a manner that would not interfere with the ongoing mid-semester examinations. The importance of institutional collaboration in community service activities is also highlighted by Wahyuni et al. (2022), who found that the success of such programs is strongly influenced by effective communication and cooperation between the implementation team and partner schools.

Stage 3: Teachers' readiness identification

This step aimed to understand the background, readiness, and actual needs of teachers prior to the technology-based training. Such identification was essential to ensure that the training approach

is well-adapted to the specific school context and participants' initial competencies. In order to gather proper results, the implementation team distributed questionnaires and conducted brief interviews on the characteristics of teachers in the Keerom area. The collected data were then used to develop an effective training strategy, ensuring that the AI technologies introduced is suitable with the devices and resources available to the teachers. This needs-based approach is supported by the work of Zawacki-Richter et al. (2019), who argue that the implementation of educational technologies, including artificial intelligence (AI), is more effective when aligned with the readiness, needs, and context of end users, particularly teachers as the primary agents of learning.

Stage 4: Implementation of intensive training

The first day of the program focused on providing a theoretical foundation combined with hands-on practice in the Teachers' Room of SD Negeri Gudang Garam. The training was conducted from 08:00 to 16:00 WIT and covered key topics related to the AI ecosystem and the development of instructional materials. Teachers received intensive guidance on transforming conventional lesson plans (RPP) into more dynamic digital lesson plans using ChatGPT. In the afternoon session, participants explored Canva AI to create engaging visual learning materials for primary school students. This approach is consistent with the findings of Holmes et al. (2019), who reported that hands-on training is particularly effective in enhancing teachers' ability to integrate AI into teaching and learning practices.

Stage 5: Mentoring and evaluation

On the second day, the implementation team adopted a more flexible mentoring approach to minimize disruption to regular school activities. The session focused on completing the AI-based instructional videos that participants had begun developing on the previous day. In addition to using laptops, teachers were guided in operating AI applications through their own smartphones to ensure that the technologies could be applied using the devices most readily available to them. The program concluded with the completion of both digital and paper-based evaluation instruments to assess the effectiveness of the training and participants' satisfaction with the program. This approach is consistent with the findings of Holmes et al. (2019), who emphasize that hands-on training is particularly effective in strengthening teachers' competencies in integrating AI into educational practice.

3. RESULTS AND DISCUSSION

Results

The community service program at SD Negeri Gudang Garam was implemented in accordance with the planned stages. The outcomes of the program are presented below based on each stage of implementation.

Planning and mitigation results

During the initial stage, the community service team successfully established collective understanding with the partner school regarding the objectives and implementation of the program. As a result of the coordination process, 12 teachers were selected as the core participants. The team also addressed potential infrastructural challenges by preparing offline training materials and providing a modem with dedicated internet access to ensure that knowledge transfer activities would not be disrupted by the unstable connectivity commonly experienced in Skanto District. To promote transparency and public

accessibility, all presentation materials and training modules were made available through the following link: https://drive.google.com/drive/folders/18kXTlzq4_tOoabqutf8-AbPBsuxjPkmc?usp=sharing

Identification on teachers' needs and characteristics

Based on the results of the initial questionnaire (pre-test), 80 percent of the teachers were found to own Android devices; however, only 15 percent had previously used AI tools to support administrative tasks. These findings were used to tailor the training activities, with greater emphasis placed on user-friendly AI applications that are compatible with mobile devices.

Intensive training and hands-on practice

The two-day training program resulted in substantial improvements in participants' competencies. Some documentation illustrates the technical activities carried out by participants throughout the training sessions.

Creating Digital Lesson Plan (RPP)

The mentoring session on the development of digital lesson plans demonstrated teachers' strong interest in utilizing generative artificial intelligence, particularly ChatGPT, as a tool for designing thematic learning activities aligned with the Merdeka Curriculum. During this session, participants were trained to formulate prompts systematically by incorporating key elements such as learning themes, learning outcomes, instructional objectives, student characteristics, and differentiation strategies relevant to the context of SD Negeri Gudang Garam. This process was intended to ensure that the outputs generated by ChatGPT could support the development of learning plans that were more structured, contextualized, and responsive to the needs of primary school students.

Figure 2. Teachers formulated prompts in ChatGPT
to develop thematic learning procedures aligned with instructional objectives

Based on observations conducted during the mentoring sessions, the use of ChatGPT had a positive impact on teachers' work efficiency, particularly by reducing the administrative burden associated with the initial stages of developing instructional materials. Rather than creating lesson plans (RPPs) or teaching modules from scratch, teachers were able to use AI to generate preliminary drafts, which were subsequently refined and adapted to meet the specific needs of their classrooms. This finding is consistent with the Technological Pedagogical Content Knowledge (TPACK) framework, which emphasizes that the integration of digital technologies into instructional design can enhance teachers' pedagogical capabilities and creativity in developing meaningful learning experiences.

In addition to improving time efficiency, ChatGPT provided teachers with a wider range of instructional ideas, differentiation strategies, and innovative assessment alternatives. Following AI-generated recommendations, teachers demonstrated greater engagement in exploring project-based learning, collaborative learning, and contextual teaching approaches. These observations suggest that AI functions not only as a tool for administrative automation, but also as a digital teaching assistant that supports teachers' professional development in the context of educational digital transformation. This result is consistent with the findings of Hanis & Wahyudin (2024), who reported that AI can help primary school teachers develop assessment plans and instructional materials more effectively and flexibly.

In the context of primary education, teachers' ability to formulate effective prompts is a critical factor in generating AI outputs that are relevant to instructional needs. Accordingly, the mentoring sessions focused not only on the use of technology itself, but also on strengthening teachers' digital literacy and pedagogical competencies. The training highlighted the importance of integrating pedagogy, subject matter content, and technology, as emphasized in the Technological Pedagogical Content Knowledge (TPACK) framework.

Another notable finding was that several teachers revised and refined ChatGPT-generated outputs to better align with students' characteristics and the local school context. This suggests that the use of AI in education continues to require pedagogical oversight from teachers as the primary facilitators of learning. AI should therefore be viewed as a support system rather than a substitute for the teacher's role in the instructional process. Similarly, Romadhoni & Zuhdi (2024) found that the use of ChatGPT in developing teaching modules can enhance the variety and quality of learning materials, although teacher validation and contextual adaptation remain essential.

Overall, the mentoring activities demonstrated that integrating AI into the development of digital lesson plans can serve as an innovative strategy for strengthening the professional competencies of primary school teachers in the digital era. The use of AI enables teachers to devote greater attention to designing creative learning experiences, fostering meaningful interactions with students, and promoting student-centered learning.

Visual media Canva AI: Designing infographics for teaching materials using the Magic Media feature on Canva

The Canva AI visual media training session focused on enhancing teachers' ability to design visual learning materials using Canva's Magic Media feature. During this session, participants received technical guidance on utilizing generative artificial intelligence to transform text prompts into educational images, instructional illustrations, and infographics aligned with primary school learning content. This approach provided a practical solution for teachers to create engaging visual learning materials without requiring advanced graphic design skills.

Based on observations made during the training, participants actively explored a variety of visual materials generated through Canva AI features. Teachers experimented with keywords related to locally relevant learning themes, such as the school environment, Papuan culture, ecosystems, and students' everyday activities. Canva's AI system then automatically generated illustrations and infographic designs that could be further modified to suit specific instructional needs. These observations suggest that AI technology can assist teachers in producing visual learning materials more efficiently while ensuring that the content remains engaging and relevant to the primary school context.

The use of Canva AI in this program also had a positive impact on teachers' creativity in designing instructional media. In addition to simplifying the technical aspects of creating illustrations, the platform

encouraged teachers to adopt more communicative and visually oriented approaches to instruction. This finding is consistent with previous studies showing that Canva can improve the quality of instructional materials, enhance student motivation, and increase learner engagement in digital learning environments. Sanjaya et al. (2026), for example, reported that Canva AI helps teachers develop more interactive and efficient learning media, particularly in support of reformed teaching and learning practices.

Figure 3. The teacher designs infographics for teaching materials using the Magic Media feature on Canva

The use of Canva AI in this program had a positive impact on teachers' creativity in designing instructional media. Beyond providing technical support for creating illustrations and visual materials, the platform encouraged teachers to adopt more communicative and visually engaging instructional approaches. This finding is consistent with previous studies reporting that the use of Canva can improve the quality of teaching materials, enhance student motivation, and increase learner engagement in digital learning environments. Sanjaya et al. (2026) further found that Canva AI enables teachers to develop more interactive and efficient instructional media, particularly in support of twenty-first-century learning.

From a pedagogical perspective, AI-generated visual media also aligns with multimodal learning theory, which emphasizes the integration of visual, textual, and auditory elements to enhance students' understanding. The infographics developed by teachers using Canva AI helped transform abstract concepts into visual representations that were more accessible to primary school students. Recent studies have shown that AI-supported learning visualizations can increase learner engagement, improve information retention, and foster creative thinking among young learners. These findings are reinforced by Febriana et al. (2024), who reported that AI-assisted infographic design through Canva enhances teachers' visual literacy skills and their ability to create interactive learning experiences.

During the mentoring process, teachers were also introduced to the importance of evaluating and refining AI-generated visual content. This step was essential to ensure that instructional materials remained aligned with learning objectives, student characteristics, and the local cultural context. Accordingly, AI was positioned as a creative support tool that enhances teachers' capabilities rather than replacing their role in determining the quality and educational value of learning experiences.

The Canva AI training session demonstrated that the integration of generative AI into the development of instructional media can serve as a strategic innovation for strengthening the digital competencies of primary school teachers. Beyond improving teachers' technological skills, the program expanded their capacity to design learning experiences that are more engaging, contextualized, and student-centered in the era of educational digital transformation.

Intensive training and hands-on practice outcomes

The training and hands-on practice sessions were conducted over two days, from 16–17 May 2025, using a hands-on training approach that emphasized the development of practical skills in applying artificial intelligence (AI) technologies in primary education. The program focused not only on introducing theoretical concepts related to AI in education, but also on producing a range of digital learning resources that teachers could directly implement in classroom instruction.

Throughout the program, teachers received step-by-step guidance, beginning with an introduction to AI platforms, followed by practical application exercises and the development of AI-supported digital learning materials. This hands-on approach proved effective in fostering participant engagement, as teachers were able to immediately test, evaluate, and refine the instructional products they created during the training. Such a training model is particularly valuable for strengthening teachers' digital literacy, especially in primary schools located in disadvantaged, remote, and outermost (3T) regions where access to educational technology training remains limited.

Table 2. AI-based outputs

Types	Description	Documentation
Adaptive Digital Lesson Plans (RPP Digital)	Thematic lesson plans optimized with AI-generated differentiation strategies.	Link to Modules
Interactive Visual Media	Presentation slides and posters (e.g., the Water Cycle, National Emblems) designed by Canva AI.	Link to Visual Media
AI-Generated Learning Videos	Short explanatory videos with natural voiceovers from text-to-speech conversion.	Link to Video

Based on the outcomes of the program, the main outputs produced by participants included adaptive digital lesson plans, interactive visual learning materials, and AI-assisted instructional videos. In developing digital lesson plans, teachers were able to create more systematic thematic teaching modules by utilizing ChatGPT to generate learning activities, differentiation strategies, and assessment components. These outputs demonstrate that AI can help reduce the administrative burden associated with instructional planning while simultaneously enhancing the quality of lesson design.

Teachers also successfully developed interactive visual learning materials, including presentation slides, educational posters, and instructional infographics using Canva AI. These materials were designed with engaging visual elements intended to capture students' attention and enhance their motivation to learn. Recent studies have shown that AI-supported visual learning media can positively influence student engagement and the effectiveness of digital learning. This finding is consistent with the work of Sanjaya et al. (2026), who reported that Canva AI can enhance teachers' creativity in designing interactive and contextually relevant instructional materials.

Evaluation

To evaluate the effectiveness of the community service program, participants' competencies were assessed before and after the training using a structured questionnaire administered as a pre-test and post-test. The evaluation focused on four key indicators: understanding of AI concepts in education, skills in developing ChatGPT-assisted lesson plans, ability to create visual learning materials using Canva AI, and competence in producing AI-assisted instructional videos.

Table 3. Comparison of teacher competencies

Indicators	Before Program (Average)	After Program (Average)	Increase Rate (%)
Understanding AI Basics in Education	35	85	14.2
Lesson Plan Development Skills with ChatGPT	20	90	35.0
Visual Media Creation Skills (Canva AI)	40	82	10.5
AI-Based Learning Video Creation	10	75	65.0

The evaluation results indicate improvements in teachers' competencies across all assessment indicators. The largest increase was observed in the ability to create AI-assisted instructional videos, with a 65.0 percent improvement. This finding suggests that, prior to the training, many teachers perceived video production as a complex task requiring advanced technical skills. Following the training, however, participants recognized that AI technologies could simplify the process through features such as automated voice generation, design templates, and streamlined editing tools.

The improvement in teachers' AI-related competencies also demonstrates that infrastructural limitations in disadvantaged, remote, and outermost (3T) regions do not necessarily constitute a barrier to educational digital transformation. The adaptive AI approach adopted in this program, which emphasized the use of readily available devices such as Android smartphones, proved effective in supporting the implementation of technology-enhanced learning. In addition, the provision of offline training materials served as an important strategy for maintaining continued access to learning resources after the completion of the training program.

These findings support the concept of inclusive digital transformation in education, in which technology functions as a creative tool that enhances rather than replaces the role of teachers. AI strengthens teachers' capacity to design learning experiences that are more innovative, engaging, and student-centered. Similarly, Zhang (2024) argues that the integration of AI in primary education can improve teachers' pedagogical efficiency while expanding opportunities for more personalized and adaptive digital learning. Holmes & Tuomi (2024) further emphasize that the use of AI in education should focus on strengthening teacher competencies and fostering instructional creativity rather than substituting for human interaction in the learning process.

Overall, the results demonstrate that hands-on training based on an adaptive AI approach can significantly enhance the digital competencies of primary school teachers. The program also provides evidence that technology-driven educational transformation can be implemented inclusively in 3T regions through approaches that are practical, contextually appropriate, and responsive to local conditions.

Discussion

The results of this community service program suggest that the integration of artificial intelligence (AI) technologies into teaching and learning can lead to substantial improvements in teachers' competencies, both pedagogical and technological. The observed improvements in teachers' ability to develop digital lesson plans, create visual learning materials, and produce instructional videos suggest that AI functions not only as an administrative support tool, but also as a cognitive partner that facilitates more systematic and creative pedagogical thinking. This transformation reflects a shift in teachers' roles from primarily delivering instruction to designing learning experiences that are adaptive, innovative, and responsive to students' needs.

These findings are consistent with a growing body of research in Indonesia highlighting the effectiveness of digital technologies in enhancing teachers' competencies. Maulida & Puspitasari (2023)

reported that the use of AI-powered features in Canva can improve both teachers' work efficiency and the quality of instructional materials. Similarly, Lismayani et al. (2023) found that hands-on training significantly enhances teachers' ability to develop interactive learning media. Estuhono et al. (2024) further demonstrated that the use of Canva in educational settings can improve students' understanding by presenting learning content in a more visual and contextualized manner. In addition, Chairani et al. (2023) showed that strengthening teachers' digital competencies through Canva-based training directly contributes to their readiness to implement the Merdeka Curriculum. Accordingly, the outcomes of this community service program not only reflect the local context, but also reinforce national empirical evidence regarding the importance of integrating technology into primary education.

Taken together, the success of the program can be examined through four principal dimensions of impact. First, from a pedagogical perspective, teachers demonstrated improved capacity to design learning experiences that are innovative, adaptive, and differentiated, thereby contributing to higher-quality teaching and learning processes. Second, from a technological perspective, teachers' digital literacy improved substantially, enabling them to move beyond the role of technology users and become creators of AI-supported instructional content. Third, from an efficiency perspective, the use of AI reduced teachers' administrative workload, particularly in the preparation of lesson plans and learning materials, allowing more time to be devoted to meaningful instructional activities and student interaction. Finally, from a socio-educational perspective, the program contributed to narrowing the digital divide in disadvantaged, remote, and outermost (3T) regions through an adaptive approach that relied on accessible technologies and commonly available devices.

The advantages of the program extended to multiple stakeholders. Teachers gained enhanced professional competencies, greater creativity, and increased confidence in utilizing educational technologies. Students benefited from more interactive, engaging, and contextually relevant learning experiences through AI-supported instructional media. The school experienced improvements in instructional quality while strengthening its image as an institution that is responsive to technological developments. For the university as the implementing institution, the program provided an opportunity to strengthen the implementation of the Tri Dharma Perguruan Tinggi, particularly through a tangible contribution to improving educational quality in disadvantaged regions.

The program also demonstrates strong potential for further development. The availability of offline training modules enables teachers to continue learning independently without relying on stable internet access. Likewise, the use of mobile-based technologies, particularly Android devices, ensures that the tools introduced remain accessible and practical in areas with limited infrastructure. The establishment of a teacher community of practice further creates opportunities for sustained knowledge sharing, allowing participants to act as change agents within their schools and surrounding communities. Future development may include more intensive mentoring, advanced workshops, and AI-supported classroom action research. In addition, the instructional products developed during the program can serve as a foundation for integrating AI more systematically into school-level teaching and learning policies.

Overall, this community service program generated not only short-term improvements in teachers' competencies, but also laid the groundwork for a more sustainable, inclusive, and contextually responsive digital transformation of education. The combination of hands-on training, adaptation to local conditions, and the use of accessible technologies proved to be an effective strategy for addressing educational challenges in disadvantaged, remote, and outermost (3T) regions. Consequently, this model has strong potential to be replicated and further developed as an AI-based teacher empowerment initiative in other regions with similar characteristics.

4. CONCLUSION AND RECOMMENDATIONS

The community service program conducted at SD Negeri Gudang Garam successfully enhanced teachers' digital literacy and competencies in integrating artificial intelligence (AI) into teaching and learning practices. Evaluation results indicated substantial improvements across all competency areas, with the greatest gains observed in the development of instructional videos (650 percent) and digital lesson plans (350 percent). The success of the program is attributed to its adaptive and flexible training approach, which was designed to accommodate beyond the infrastructural constraints commonly encountered in disadvantaged, remote, and outermost (3T) regions. A key factor underlying the program's effectiveness was the use of technologies readily available to teachers, particularly Android smartphones, combined with the provision of offline learning materials that mitigated the challenges posed by unstable internet connectivity. As a result, AI was no longer perceived as an inaccessible technology, but rather as a practical tool capable of improving administrative efficiency and enhancing the quality of instructional materials in primary education.

Although the program successfully achieved its short-term objectives, several areas remain open for further development. Accordingly, the following recommendations are proposed for future initiatives. First, a school-level teacher working group should be established to facilitate the sharing of new and better AI prompts, digital teaching practices, and implementation experiences, consequently sustaining momentum for digital transformation after the completion of the program. Second, future training activities could focus on the use of AI for developing more diverse assessment items, including higher-order thinking skills (HOTS) questions, as well as AI tools for automated analysis of student learning outcomes. Third, given that internet connectivity remains a major constraint for cloud-based applications such as Canva, collaboration with local government agencies or private-sector partners is recommended to improve digital infrastructure through the provision of signal boosters or more stable satellite-based internet services. Lastly, future programs should extend beyond teachers and include students by providing guidance on the ethical use of AI. Such initiatives would help students use AI responsibly as a learning support tool while maintaining the principles of academic integrity.

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