

Integrating Artificial Intelligence into Adaptive Learning Worksheets: a Community Service Initiative to Support Urban Food Security

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Abstract. The rapid development of artificial intelligence (AI) requires teachers to adapt in designing more innovative and contextual learning. However, most partner school teachers still face challenges in utilizing AI-based technology to develop effective teaching materials. This community service program aimed to enhance teachers' capacity in developing adaptive AI-based student worksheets (LKPD) that support differentiated learning. The implementation consisted of socialization, training, practical mentoring, and feedback evaluation, involving 25 elementary school teachers. The results showed a significant improvement in teachers' ability to use AI tools such as ChatGPT, Canva AI, and Quizizz AI to design interactive and contextual LKPD. Participant satisfaction surveys indicated that 72% rated the activity as very good and 28% as good. This program effectively improved teachers' digital literacy and fostered creative integration of technology into classroom learning.

Abstrak. Perkembangan kecerdasan buatan (AI) menuntut guru untuk beradaptasi dalam merancang pembelajaran yang lebih inovatif dan kontekstual. Namun, sebagian besar guru di sekolah mitra masih mengalami kesulitan dalam memanfaatkan teknologi berbasis AI untuk pengembangan perangkat ajar yang efektif. Kegiatan pengabdian kepada masyarakat ini bertujuan untuk meningkatkan kapasitas guru dalam menyusun LKPD adaptif berbasis AI yang mendukung pembelajaran berdiferensiasi. Metode pelaksanaan meliputi tahap sosialisasi, pelatihan, pendampingan praktik, dan evaluasi umpan balik dengan melibatkan 25 guru sekolah dasar. Hasil kegiatan menunjukkan peningkatan signifikan pada kemampuan guru dalam menggunakan alat AI seperti ChatGPT, Canva AI, dan Quizizz AI untuk menyusun LKPD interaktif dan kontekstual. Survei kepuasan peserta memperlihatkan 72% kategori sangat baik dan 28% kategori baik terhadap manfaat kegiatan. Kegiatan ini berhasil meningkatkan literasi digital guru serta mendorong penerapan teknologi secara kreatif dalam pembelajaran.



INTRODUCTION

Food security is a strategic national issue with broad implications for the sustainability of life and community welfare (Vågsholm et al., 2020). This issue is not limited to the availability of food supplies but also concerns the quality of human resources who understand and are capable of managing the agricultural sector effectively, efficiently, and sustainably (Pawlak & Kołodziejczak, 2020). In this context, education plays a crucial role in fostering early understanding, skills, and awareness of the importance of managing food resources wisely (Fathurohman et al., 2023; Kurdiati et al., 2024; Susiloningsih et al., 2024). One of the modern approaches relevant to be introduced in education is precision agriculture (Bournaris et al., 2022), which refers to an information and data-based agricultural system that enables the optimal use of resources to enhance land productivity and operational efficiency.

However, integrating the concept of precision agriculture into elementary education still faces various challenges in practice. The main obstacles include low technological literacy among teachers and students, a lack of contextual and interactive learning media, and limited access to digital-based educational resources (Susiloningsih et al., 2024). These problems are clearly reflected in SD Negeri 27 Palembang, an urban elementary school that has yet to fully utilize its educational technology potential. Based on classroom observations and discussions with teachers, it was found that although the school possesses Chromebook devices and adequate internet connectivity, their use in teaching and learning activities remains very limited. Most teachers are not yet familiar with using digital tools or designing technology-based learning media, including developing AI-based teaching aids or adaptive student worksheets (LKPD).

These limitations directly affect students' active engagement, especially in subjects related to science, technology, and the environment. In fact, topics such as precision agriculture have strong potential to be integrated into science and social studies lessons as a form of contextual learning that connects scientific knowledge with local

realities while cultivating students' technological and food literacy. The situation is further compounded by the limited opportunities for teachers to participate in professional development programs relevant to 21st-century learning, particularly those that combine educational technology with local food security issues.

Based on these conditions, the program titled "Training on the Development of Precision Agriculture Teaching Aids and AI-Based Adaptive Worksheets to Support Food Security in Palembang" was designed as a strategic initiative to enhance teachers' and students' capacity in utilizing educational technology. Through this program, teachers were trained to create simple technology-based teaching aids that facilitate the understanding of precision agriculture concepts and to develop AI-based adaptive LKPD that adjust material difficulty levels according to students' learning abilities.

METHODS

This community service program was carried out at SD Negeri 27 Palembang, one of the partner schools actively involved in innovation-based learning development. The method used in this program was a participatory empowerment approach that emphasized collaboration between the university team, teachers, and the school management. This method aimed to ensure that all activities were relevant to the real needs of the school community and that the outcomes could be implemented sustainably after the program ended. Through this participatory method, teachers were not only positioned as training participants but also as co-designers of adaptive learning innovations.

The implementation combined elements of training, mentoring, and reflective practice, allowing teachers to explore AI-based tools, design adaptive worksheets, and reflect on their classroom applications. This approach encouraged mutual learning, where the facilitators contributed knowledge about artificial intelligence and adaptive pedagogy, while teachers shared contextual insights from classroom experiences. The community-based learning orientation also ensured that every product developed was connected to local food security themes in Palembang City.

Therefore, the program was not limited to producing learning materials but also built the capacity of teachers to sustain educational innovations independently and apply them meaningfully within the local community context.

Activity Plan

The overall implementation of this program at SD Negeri 27 Palembang was

organized in several sequential stages, beginning with preparation, socialization, training, mentoring, and ending with evaluation. Each stage was designed to strengthen the teachers' competence in integrating AI technology into adaptive learning worksheet (LKPD) development. The activity plan is summarized in Table 1 below.

Table 1. Stages of Activity

Stages	Schedule	Activity	Equipment
Preparation	Week 1	Coordination with the school principal and teachers, assessment of participant needs, and preparation of training materials	Laptop, internet access, AI applications, and printed materials
Socialization	Week 2	Introduction of the program's goals, explanation of AI integration into education, and discussion on food security context	Presentation slides, brochures, and digital media
Training	Week 3–4	Workshop on adaptive LKPD design using AI tools and hands-on practice for content contextualization	Laptop, projector, internet access
Mentoring	Week 5–6	Individual mentoring, group discussion, and peer review of participants' LKPD designs	Online collaboration tools, Google Workspace
Evaluation	Week 7	Final product presentation, post-test, and reflective discussion on outcomes and challenges	Evaluation rubrics, feedback forms, documentation tools

The training and mentoring stages were attended by teachers from SD Negeri 27 Palembang, representing various grade levels and teaching backgrounds. Participants were selected based on their motivation, teaching experience, and willingness to integrate technology into their classroom practice. The group was diverse, consisting of both early-career and experienced teachers, allowing rich

Evaluation Plan

The evaluation of this community service program was conducted using a quantitative approach to measure the effectiveness and impact of the training activities. Two types of instruments were employed: a pre-test and post-test, and a participant feedback survey. The pre-test and post-test were designed to quantitatively assess the improvement in participants' knowledge and skills in designing AI-based

collaboration and exchange of ideas throughout the sessions. Before engaging in the training, participants were introduced to the concept of AI-assisted adaptive learning and its relevance to sustainable food security education in urban settings. In total, 25 teachers actively participated in the program. Their demographic characteristics are shown in Table 2 below.

adaptive learning worksheets that integrate food security concepts.

Meanwhile, the feedback survey measured participants' satisfaction levels with various aspects of the training, including the content relevance, trainer performance, clarity of materials, and usefulness of the produced outputs. All data were analyzed descriptively using frequency, percentage, mean, and N-Gain scores to determine the degree of learning improvement and participant satisfaction toward the training program.

Table 2. Participant Demographic Information

	Frequency	Percentage (%)
Gender		
Man	6	24
Woman	19	76
Age of Participants		
20-30 years old	4	16
31-40 years old	9	36
41-50 years old	8	32
>50 years old	4	16
Teaching Periods		
2-4 years	3	12
2-6 years	6	24
6-8 years	7	28
>8 years	9	36
Grade Levels Taught		
Grade 7	6	24
Grade 8	10	40
Grade 9	9	36
Last Educational Experience		
Degree	17	68
Teacher Professional Education	6	24
Magister	2	8

RESULT AND DISCUSSION

Preparation Stage

The preparation stage focused on designing and organizing all essential components of the community service activity. This included conducting initial coordination meetings with the school principal and science teachers of SMP Negeri 17 Palembang, preparing the training modules, pre-test and post-test instruments, and feedback questionnaires. In addition, all digital materials such as the AI-assisted LKPD templates, manual book drafts, and demonstration videos were compiled and reviewed by the implementing team. Technical arrangements including scheduling, venue preparation, and equipment setup such as laptops, LCD projector, and internet connectivity were also finalized to ensure smooth implementation of the next stages.

Socialization Stage

The socialization stage aimed to introduce the objectives, expected outcomes, and workflow of the community service program to the partner school. The team conducted an opening session attended by

teachers and school representatives to explain the importance of integrating artificial intelligence into adaptive learning worksheets to enhance digital literacy and food security awareness in science learning. Participants were informed about the program phases, assessment methods, and expected deliverables. This session also served to align expectations and gather initial feedback from the participants to adjust the training content to their needs.

Training Stage

The training stage served as the core activity of the program by emphasizing practical learning and hands-on experience. Participants were guided through the conceptual understanding of adaptive learning design, followed by demonstrations on how to use AI tools such as ChatGPT, Canva AI, and Quizizz AI to generate context-based questions, visual learning aids, and adaptive instructions. The training was conducted using a blended approach that combined short lectures, live demonstrations, and collaborative workshops in which participants created their own AI-assisted LKPD drafts.



Figure 1. Delivery of materials

After the presentation session, participants were encouraged to engage in collaborative discussions and peer reviews to refine their initial LKPD drafts. Each group exchanged ideas on how AI features could be optimized to enhance interactivity, contextual relevance, and alignment with science learning objectives related to urban food security. The facilitators provided direct assistance to ensure that every participant could independently operate the AI tools and integrate adaptive elements effectively. This interactive atmosphere not only strengthened participants' digital literacy but also fostered creativity and innovation in designing adaptive learning resources suitable for real classroom application.

Mentoring Stage

The mentoring stage was designed as a follow-up process to strengthen participants' ability to apply the knowledge and skills acquired during the training. In this phase, the team provided continuous support through direct mentoring sessions and online follow-ups. Teachers were guided in improving the structure, visual design, and adaptability of their AI-based LKPD products to ensure that they were practical and relevant for classroom implementation.



Figure 2. Participant Assistance

Through the mentoring activities, teachers received constructive feedback related to content accuracy, contextual integration with urban food security themes, and the effective use of AI tools. As a result, participants demonstrated improved confidence and competence in developing and applying adaptive LKPDs in their teaching practice, showing clear progress from the initial drafts prepared during the training stage.

Evaluation Stage

The evaluation stage was conducted to measure the effectiveness of the training activities and to identify the extent of knowledge and skill improvement among participants. The evaluation process was carried out using two quantitative approaches: (1) pre-test and post-test analysis to assess participants' conceptual understanding and practical skills, and (2) feedback and satisfaction survey analysis to evaluate participants' perceptions of the training's relevance, benefits, and implementation quality.

Pre-Test and Post-Test Analysis

The pre-test and post-test were designed to assess the participants' level of understanding regarding the development of AI-based adaptive LKPDs before and after the training session. The results of the quantitative analysis can be seen in Table 3 below

Table 3. Average Achievement of Understanding Before and After Training

Average Score of Understanding		Average Score Increase		N-Gain	
Pre-Test	Post-Test	Score	Percentage (%)	Score	Category
45.97	85.10	39.13	85.10	0.745	High

The data show a substantial increase in participants' understanding, with the average

score rising from 45.97 to 85.10 after the training. The N-Gain score of 0.745 indicates

a high level of learning improvement. These results suggest that the training successfully enhanced teachers' comprehension of adaptive learning design and their ability to utilize AI tools effectively. A visual representation of this improvement can be seen in Figure 3 below.

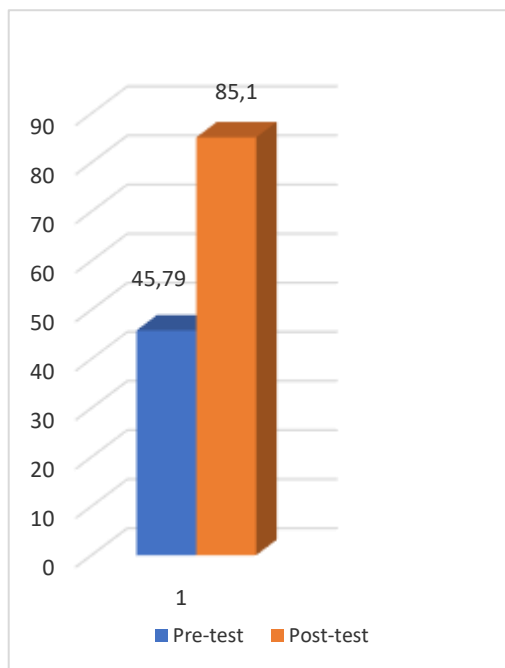


Figure 3. Comparison Result Graph of Pre-test and Post-test

Feedback and Satisfaction Survey Analysis

To complement the quantitative learning outcome data, a feedback and satisfaction survey was administered to assess participants' perceptions of the activity's quality and usefulness. The detailed results of this survey are shown in Table 4 below.

The data from Table 4, indicate that participants responded positively to all aspects of the activity, particularly regarding the relevance of the training content and the usability of the Canvas LMS platform. The majority of respondents rated the activity as "Very Good," demonstrating high satisfaction with both the materials and delivery. The distribution of participant responses can be visually observed in Figure 5 below.

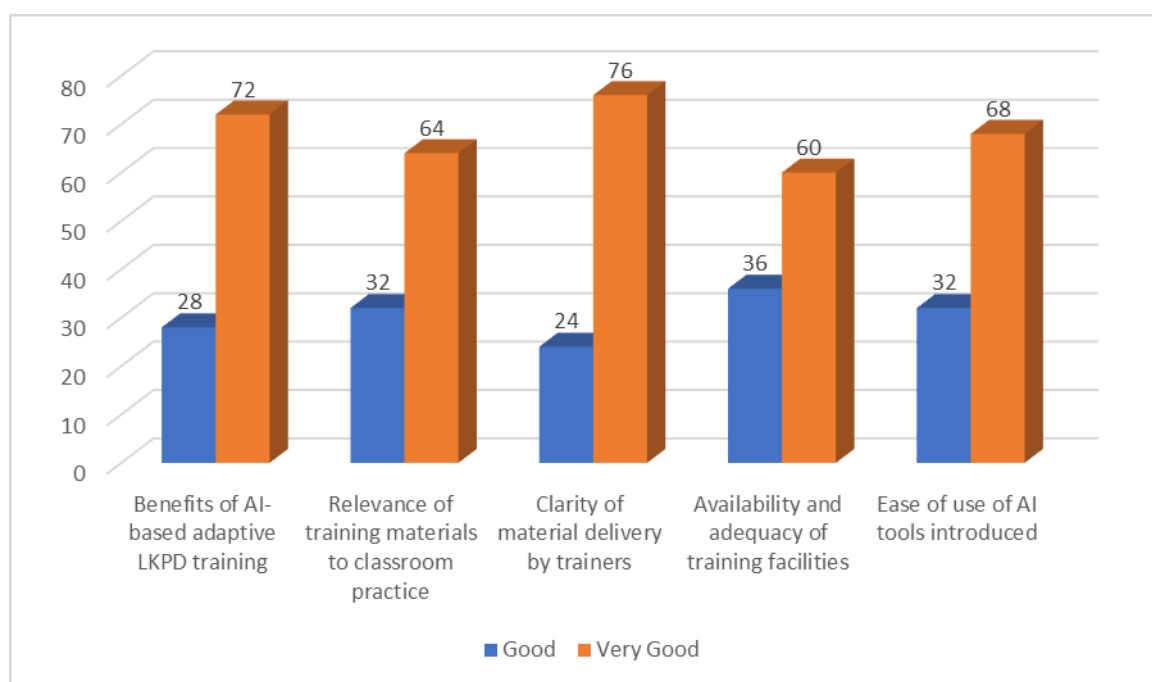


Figure 5. Participant Response Graph to Feedback and Satisfaction Survey

Table 4. Participant Responses to Feedback and Satisfaction Surveys

Indicators	Percentage of Training Participant Responses (%)			
	Very Poor	Poor	Good	Very Good
Benefits of AI-based adaptive LKPD training	0	0	28	72
Relevance of training materials to classroom practice	0	4	32	64
Clarity of material delivery by trainers	0	0	24	76
Availability and adequacy of training facilities	0	4	36	60
Ease of use of AI tools introduced	0	0	32	68

Discussion

The results of this community service activity demonstrate a significant enhancement in teachers' understanding and practical skills in developing AI-based adaptive learning worksheets. The increase in pre- and post-test scores reflects the effectiveness of the training structure that combined conceptual delivery, demonstrations, and mentoring sessions. This improvement indicates that teachers were able to grasp the use of artificial intelligence not only as a digital tool but also as an enabler for differentiated instruction that responds to students' diverse learning needs. Similar findings were reported by Wang et al. (2024), who noted that AI-assisted learning materials improve teacher creativity and reduce the gap between technology and pedagogy in primary schools.

In terms of content relevance, the integration of urban food security themes into the adaptive worksheets strengthened the contextual value of the program. Teachers were encouraged to design problem-based learning tasks that connect science concepts to real issues in Palembang, such as food waste management, urban farming, and sustainable consumption. This aligns with the findings of Pertiwi & Oetomo (2022), who emphasized that contextualized STEM-based learning promotes environmental literacy and critical thinking in young learners. Thus, the implementation of AI in developing adaptive LKPDs not only enhanced technological literacy but also embedded sustainability values in the learning process.

Feedback and satisfaction survey results further confirm the success of the program, as participants rated the training highly in terms of benefits, material delivery, and platform usability. The blended mentoring approach,

which combined on-site guidance with online consultation, allowed participants to receive continuous support in the process of designing and revising their adaptive worksheets. This finding resonates with Melton et al. (2019), who argue that hybrid mentoring promotes greater teacher confidence in adopting innovative digital practices. The interactive nature of the mentoring also created a collaborative learning community among teachers, a crucial factor for sustaining educational innovation in schools.

One of the most important impacts of the program is the emergence of teacher-led initiatives to continue integrating AI tools into their classroom practices beyond the project period. Several participants reported that they began experimenting with ChatGPT for generating learning prompts and using Canva AI to produce localized visual materials. This self-initiated continuation indicates a shift from technology as a novelty to technology as a habit of practice. As Statti & Torres (2020) highlight, the sustainability of digital literacy among teachers depends on continuous engagement and institutional support, both of which were strengthened through this community service project.

Despite the positive outcomes, several challenges emerged during implementation. Differences in digital literacy levels among participants initially caused disparities in task completion speed and confidence. However, peer-assisted mentoring successfully mitigated this issue, as more digitally skilled teachers provided direct help to their peers. This collaborative culture reflects the principle of participatory empowerment that underpinned the entire program. Moving forward, it is recommended that future community service initiatives adopt a longer mentoring phase to deepen classroom integration and expand the

thematic focus beyond food security to other aspects of sustainable development education.

CONCLUSION AND SUGGESTION

The implementation of this community service program at SD Negeri 27 Palembang successfully strengthened teachers' capacity in utilizing artificial intelligence to create adaptive learning worksheets aligned with the theme of urban food security. The participatory empowerment approach enabled active collaboration among the university team, teachers, and school management, ensuring that the training addressed real classroom needs. Improvements shown in pre- and post-test results, supported by high participant satisfaction, confirmed that the combination of structured workshops and mentoring effectively enhanced both technological and pedagogical competencies. The integration of local sustainability issues into adaptive worksheets also demonstrated how AI tools can be meaningfully applied to contextualize learning while promoting environmental awareness among students.

It is recommended that future programs extend the duration of mentoring to observe the real classroom implementation of AI-based learning materials and provide continuous technical assistance. Periodic follow-up evaluations and advanced workshops are essential to sustain teacher proficiency and adapt to rapid technological changes. Collaboration with education offices and local policymakers should also be pursued to institutionalize the use of AI-driven adaptive worksheets as part of school innovation programs. Through these steps, the initiative can evolve into a scalable model for promoting sustainable, technology-integrated education in other schools across Palembang and beyond.

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