ABDI MASYARAKAT
Vol. x, No. x, Bulan Tahun
***P-ISSN**: 2715-8799;**E-ISSN**: 2715-9108*
Link : *https://ejournal.mandalanursa.org/index.php/PB/issue/archive*

Strengthening Elementary School Teacher Competence in the Development of Artificial Intelligence-Based Teaching Modules at the Kalisongo Elementary School Cluster

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Article Info
Article history:
Accepted: 15 Juni 2026
Publish: 29 Juni 2026

Keywords:
artificial intelligence;
teacher competence;
teaching module;
professional development;
elementary school

Abstract

Strengthening Elementary School Teachers' Competence in Developing Artificial Intelligence-Based Teaching Modules in the Kalisongo Elementary School Cluster. The rapid diffusion of generative artificial intelligence requires elementary school teachers to use digital tools not only as content generators, but also as pedagogical supports that must be critically verified and aligned with students' needs. This community service program aimed to strengthen teachers' competence in developing AI-based teaching modules in the Kalisongo Elementary School Cluster, Dau District, Malang Regency. The program was implemented through training, guided practice, mentoring, and reflective evaluation. Evaluation data were collected using participant questionnaires, observation, documentation, and product-oriented reflection. The questionnaire generated 24 responses. The results showed that 79.2% of respondents considered the training materials very useful, 70.8% considered them very relevant to teachers' needs, 91.6% rated the training methods as effective or very effective, and 66.7% reported being highly motivated to develop AI-based teaching modules after the training. The overall benefit of the program was rated very useful by 83.3% of respondents. These findings indicate that contextual, practice-oriented AI training can strengthen teachers' readiness to design teaching modules while maintaining pedagogical control over AI-generated outputs. Follow-up mentoring is needed to validate the modules and examine their classroom impact.

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1. INTRODUCTION

The development of *artificial intelligence*(AI), especially generative AI based on *large language models*, has changed the way educators design materials, provide feedback, develop assessments, and personalize learning experiences.[1], [2]In the context of primary education, this change cannot be understood simply as the adoption of digital tools, but rather as a shift in the way teachers interpret students' learning needs and translate them into more adaptive learning designs. Recent studies confirm that AI has the potential to help teachers generate learning ideas and diversify learning activities.[3], formulating questions, providing early feedback, and providing more personalized learning support, but its use still requires pedagogical and ethical verification from teachers.[4], [5].

The presence of generative AI also strengthens the need for AI *literacy*, *prompt engineering*, and teachers' critical thinking skills. Teachers don't just need to know how to use the application; they need to understand how commands or prompts are formulated, how AI output is checked.[6], [7], how bias and inaccuracies are anticipated, and how AI-generated results are tailored to the curriculum, student characteristics, classroom context, and learning objectives.[8], [9], [10]. Thus,

AI training for teachers needs to shift from simply demonstrating tools to mentoring that emphasizes pedagogical decisions, quality control of materials, data protection, and sustainability of professional practice.

At the elementary school level, this need becomes even more critical because teachers interact directly with students in their early developmental phase. Learning modules that lack context can lead to procedural learning, while appropriately designed learning modules can help teachers manage the flow of learning objectives, activity differentiation, media use, and formative assessment.[11], [12], [13]Recent research shows that AI can support adaptive learning, material development, assessment development, and learning reflection, but these benefits are only meaningful if teachers have AI literacy and the ability to evaluate the validity of the resulting content.[14], [15].

The situation of partners in the Kalisongo Elementary School Cluster area demonstrates a concrete need for assistance in developing AI-based teaching modules. Teachers already have a basic understanding of teaching modules, and school facilities are relatively supportive of technology-based learning. However, they still face difficulties in initiating AI-based teaching module development because the process requires detailed prompts, an understanding of the module's structure, and the ability to assess the suitability of AI output to learning needs. This situation demonstrates a gap between the potential of AI as a tool for developing teaching materials and teachers' practical readiness to use it safely, effectively, and relevantly.

This community service program is designed to address this gap through training and mentoring in the development of AI-based teaching modules for elementary school teachers in the Kalisongo Elementary School Cluster area, Dau District, Malang Regency. The objectives of this activity are to introduce basic AI concepts in learning, equip teachers with the technical skills to develop AI-based teaching modules, strengthen teachers' pedagogical abilities in integrating AI output into learning designs, and encourage the formation of a culture of sharing good practices among teachers. The practical novelty of this activity lies in the use of generative AI not as a substitute for the role of teachers, but as a tool controlled by teachers' pedagogical decisions and evaluated based on students' learning needs.[16], [17].

2. IMPLEMENTATION METHOD

This community service activity uses a participatory training approach based on practice, mentoring, and reflective evaluation. This approach was chosen because the partners' needs relate not only to introducing AI concepts but also to the ability to translate the structure of the teaching module into prompts, examine the AI output, and edit the results to suit the context of elementary school learning. The activity was implemented in the Kalisongo Elementary School Cluster area, Dau District, Malang Regency.

The program targets elementary school teachers within the Kalisongo Elementary School Cluster. The program evaluation is based on 24 participant questionnaire responses, observations during the program, documentation, and reflections on the learning module development process. Therefore, the results are not considered an experimental test, but rather a descriptive evaluation of the program's usefulness, material relevance, method effectiveness, participant motivation, material adequacy, instructor support, facilities and infrastructure, and the overall benefits of the program.

The activity consists of three main phases. The first phase is training and professional development. In this phase, participants receive reinforcement on basic AI concepts, the potential of AI in learning, the components of teaching modules, the principles of developing prompts, and how to use generative AI to help develop learning objectives, materials, student activities, and assessments. The second phase is guidance and mentoring. Participants are directed to identify the structure of the teaching module, formulate learning needs, develop prompts step by step, read AI output, and make edits to ensure the module remains relevant to student needs. The third phase is ongoing evaluation and feedback. In this phase, participants reflect on the results of the training,

while the community service team collects participant responses and notes aspects that need follow-up.

The materials and devices used include a laptop, internet connection, multimedia, documentation tools, and a generative AI platform to assist with module framework creation, material writing, example development, practice question creation, presentation development, and language adaptation. The AI platform is positioned as a tool, not a substitute for teachers. Each output produced still needs to be checked for conceptual accuracy, curriculum suitability, language accuracy, activity feasibility, and assessment alignment. This principle aligns with literature emphasizing the need for literacy-based AI integration, human control, and risk management in educational practices.[18], [19], [20], [21].

Table 1. Stages of community service implementation

Level	Focus of activities	Main activities	Evidence/output
Training	Strengthening AI concepts and teaching modules	Explanation of AI concepts, teaching module components, prompt principles, and examples of the use of generative AI.	Initial understanding and readiness of participants to participate in practice
Mentoring	Practice of preparing teaching modules	Identifying module structure, composing prompts, reading AI output, editing materials, and assessments	Draft/framework of AI-based teaching module
Implementation of the exercise	Simulation of the use of AI for learning needs	Participants use AI to organize objectives, materials, activities, and assessments according to class/subject.	Practice products and process reflections
Evaluation-reflection	Response measurement and follow-up	Filling out questionnaires, observing, discussing obstacles, and preparing recommendations	Data from 24 questionnaire responses and follow-up support plans

3. RESULTS AND DISCUSSION

Program Implementation and Partner Needs

The community service activities were implemented as a form of collaboration between universities and elementary school teachers to address the need for developing teaching materials in the digital era. The focus of the activities went beyond introducing AI as a new application, but also focused on teachers' ability to use AI to develop teaching modules that remained oriented towards learning objectives, student needs, and the school context. In practice, participants were encouraged to analyze the components of the teaching modules, write detailed prompts, read the AI-generated output, and then edit it to ensure that the output was not used raw.

The main challenge for partners lies in the early stages of developing AI-based learning modules. Teachers generally understand the minimal structure of a learning module, but still need concrete examples of how to transform learning needs into AI-processable prompts. This difficulty is understandable because utilizing generative AI requires new capabilities: explicitly communicating pedagogical intent, verifying output consistency, and tailoring generated results to student characteristics. This finding aligns with recent studies that suggest AI can accelerate instructional work, but its effectiveness is highly dependent on user literacy, verification skills, and clarity of learning objectives.[1], [8], [21], [22].

Participant Response Evaluation Results

The activity was evaluated using a 24-item questionnaire. The data showed that participants had diverse levels of AI knowledge. Before the training, 50% of respondents stated their understanding was adequate, 29.2% high, 12.5% low, and 4.2% very low and very high, respectively. This composition suggests that the training needs to be designed in a layered manner: simple enough for beginners, but still challenging for those with a basic understanding of AI.

Table 2. Questionnaire results of training participants (n = 24 responses)

Evaluation indicators	Dominant category	Percentage of dominant categories	Supporting categories	Interpretation
Understanding AI before training	Enough	50%	High 29.2%; low 12.5%; very low 4.2%; very high 4.2%	Participants have heterogeneous starting points of knowledge.
Usefulness of the material	Very helpful	79,2%	Useful 16.7%; quite useful 4.2%	The material is considered strong in increasing understanding and practical needs.
Relevance of material to teacher needs	Very relevant	70,8%	Relevant 20.8%; quite relevant 8.3%	The material answers practical problems in developing AI-based teaching modules.
Effectiveness of training methods	Very effective	58,3%	Effective 33.3%; quite effective 8.3%	The practical and mentoring methods are considered capable of facilitating participant learning.
Motivation to develop AI teaching modules	Highly motivated	66,7%	Motivated 25%; moderately motivated 8.3%	The training sparked continued interest in independent exploration and practice.
Adequacy of training materials	Very adequate	50%	Adequate 41.7%; quite adequate 8.3%	The material is sufficient, but further study is still needed.
Ease of understanding and applying the material	Easy	41,7%	Very easy 37.5%; quite easy 20.8%	Some participants still need more gradual and contextual examples.
Instructor and team support	Very supportive	66,7%	Support 29.2%; somewhat support 4.2%	Facilitator support is a strengthening factor for the success of the practice.
Benefits of facilities and infrastructure	Very helpful	79,2%	Useful 12.5%; quite useful 8.3%	The facilities support practice-based training processes.
Overall benefits of training	Very helpful	83,3%	Useful 12.5%; quite useful 4.2%	The program was deemed successful in providing knowledge, skills, and motivation.

The data in Table 2 shows that participant responses were generally positive. Indicators of material usefulness, relevance, method effectiveness, facilitator support, and overall usefulness received high ratings. This indicates that the training design met teachers' needs for hands-on experience using AI in developing teaching modules. These findings also suggest that practice-based training is more appropriate for elementary school teachers than training that only presents theoretical concepts.

However, the survey results also revealed room for improvement. 20.8% of respondents rated the material as only moderately easy to understand and apply, while 8.3% rated it as adequate. This data is important because it indicates that some teachers still require more intensive support, particularly in formulating specific prompts, editing AI output, and ensuring the module aligns with learning objectives. In the literature, these challenges are often associated

with the need for ongoing teacher professional development, rather than one-time training.[6], [17], [19], [23].

Strengthening Teacher Competence in Developing AI-Based Teaching Modules

The improvement in teacher competency in this activity is evident in three main aspects. First, teachers gain a conceptual understanding of AI as a learning tool. This understanding is crucial to prevent the mechanical use of AI. Teachers are not directed to copy AI output, but rather to use it as starting material that needs to be selected, edited, and adapted. Second, teachers acquire technical skills in composing prompts. This skill is crucial because the quality of AI output is greatly influenced by the clarity of instructions, classroom context, learning objectives, and user-defined constraints. Third, teachers gain pedagogical experience in assessing whether AI output aligns with the material, student characteristics, learning activities, and assessments.

Participants' responses demonstrated that the training successfully fostered continued motivation. Sixty-six-seven percent of respondents stated they were highly motivated, and 25% expressed a desire to develop AI-based teaching modules after the training. This motivation is crucial for the program's sustainability, as AI utilization cannot be mastered through a single demonstration.[2], [3]Teachers need to experiment with different forms of prompts, compare outputs, test the accuracy of the materials, and reflect on their impact on learning. Recent studies on generative AI in education also emphasize that productive use of AI arises from repeated interactions between users, pedagogical goals, and critical evaluation of the resulting outcomes.[11], [24].

From a pedagogical perspective, the program's primary contribution lies in changing the way teachers view AI. AI is positioned not as a technology that replaces teacher creativity, but as a tool that can expand alternative learning designs.[7], [12]Teachers remain the primary decision-makers in setting objectives, selecting activities, developing assessments, and ensuring the appropriateness of materials to students' needs. This position is crucial because recent literature consistently demonstrates that AI in education carries both potential and risks: it can accelerate material development and diversify activities, but it can also produce erroneous, biased, or out-of-context information if used without verification.[12], [15], [20].

Activity Output and Program Sustainability

This activity produced several initial outcomes that support teacher competency strengthening and program dissemination. The most substantive outcome for partners was the experience of developing AI-based teaching modules through training and mentoring. However, the effectiveness of the developed teaching modules on student learning processes and outcomes has not been tested in classroom settings, necessitating follow-up.

The program's sustainability needs to be focused on three agendas. First, continued mentoring to refine the teaching modules developed by teachers, particularly in terms of conceptual accuracy, curriculum suitability, learning differentiation, and assessment quality. Second, validation of the teaching modules through expert review or peer review among teachers to ensure the products used in the classroom have adequate pedagogical quality. Third, limited classroom implementation to assess the modules' impact on student engagement, the quality of learning activities, and learning outcomes. This agenda is crucial to ensure that the use of AI does not remain a technical innovation but truly contributes to improving learning practices.

Figure 1. Documentation of AI-based teaching module development training activities

Critical Analysis: Program Opportunities and Limitations

Overall, this activity demonstrated that AI training for elementary school teachers is more effective when it is based on their daily work needs. Teaching modules represent both an administrative and pedagogical need, closely related to teacher practice. Therefore, the use of AI in the context of developing teaching modules was relatively easily accepted by participants. High ratings of the training's usefulness and overall benefits indicate that participants see a direct connection between the training materials and their work as teachers.

The program's limitations lie in the scope of the evaluation. The available data are still participant responses after the activity, not pretest-posttest measurements, rubric analysis of module quality, or assessment of impact on student learning. Therefore, claims of program success must be placed in perspective: the program is strong in improving teachers' readiness, motivation, and initial experience in using AI to develop teaching modules, but it cannot yet conclude the modules' effectiveness on student learning outcomes.

Theoretically, this activity supports the view that teacher professional development in the field of AI needs to be carried out in a contextual, collaborative, and practice-oriented manner.[4], [9]. Generative AI can help teachers accelerate initial work, but the final quality still depends on teachers' professional competence in assessing, adapting, and integrating AI results.[13], [14]. Thus, AI training for elementary school teachers needs to integrate technological literacy, ethical use, prompt design skills, curriculum understanding, and pedagogical reflection. This combination is a prerequisite for AI to be used responsibly and not degrade the quality of learning decisions.[14], [16].

4. CONCLUSIONS

The community service program in the Kalisongo Elementary School Cluster area has succeeded in strengthening the readiness of elementary school teachers in developing learning-based modules in *artificial intelligence*. The evaluation results of 24 questionnaire responses showed that the training material was considered very useful by 79.2% of respondents, very relevant by 70.8% of respondents, the training method was considered effective or very effective by 91.6% of respondents, and the overall benefits of the training were considered very useful by 83.3% of respondents. These findings indicate that training that combines concept reinforcement, practice in developing prompts, mentoring, and reflection can help teachers understand AI as a pedagogical tool, not as a substitute for the role of teachers. The main impact of the activity was seen in increasing teacher motivation, readiness, and initial experience in developing AI-based teaching modules. Recommended follow-up actions include mentoring to improve the modules, validating the quality of the teaching modules, establishing a community of practice among

teachers, and testing implementation in the classroom to assess its impact on student learning processes and outcomes.

5. ACKNOWLEDGMENTS

The author would like to thank Malang State University, through its Faculty of Education's Decentralization funding scheme, for supporting this community service program. He also expresses his appreciation to the teachers in the Kalisongo Elementary School Cluster in Dau District, Malang Regency, who actively participated in the training and mentoring for the development of artificial intelligence-based teaching modules.

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