

Training on AI- and Computer-Based Hybrid Mathematics Learning Media with the Integration of Local Cultural Values at Training and Education Institutions

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Abstract

The development of Artificial Intelligence (AI) technology and computer-based learning media requires educators to possess adaptive and innovative digital competencies. However, the utilization of AI technology in mathematics learning at Course and Training Institutions remains suboptimal due to educators' limited ability to develop technology-based learning media and the lack of integration of local cultural values into the learning process. This community service activity was conducted at LKP KARYA PRIMA KURSUS, Medan, Indonesia, with the aim of improving educators' competencies in designing AI- and computer-based mathematics learning media integrated with local cultural values through a hybrid training model. The implementation method employed a participatory approach consisting of needs analysis, training preparation, hybrid training implementation, mentoring, and program evaluation stages. The participants involved 25 educators from LKP KARYA PRIMA KURSUS. Data collection instruments included observation sheets, questionnaires, and competency tests. The results showed that participant attendance reached 96%, AI application usage skills reached 84%, learning media development skills reached 80%, and participant satisfaction reached 92%. In addition, post-test results increased by 78% compared to pre-training conditions. These findings indicate that the hybrid training implemented at LKP KARYA PRIMA KURSUS effectively enhanced educators' digital competencies and supported the development of innovative mathematics learning integrated with local cultural values. The program also strengthened educators' readiness to integrate AI technology into mathematics instruction, thereby contributing to the improvement of learning quality and digital transformation in non-formal education institutions.

Keywords: Artificial Intelligence, Mathematics Learning Media, Hybrid Learning, Local Culture, Community Service.

1. INTRODUCTION

The development of digital technology and Artificial Intelligence (AI) has brought significant changes to the field of education, including mathematics learning in course and training institutions. The utilization of AI in education can support the visualization of mathematical concepts, personalize learning experiences, and enhance student engagement with abstract materials (Hardianti et al., 2025). However, the implementation of learning technologies in various non-formal educational institutions still faces several challenges, such as limited interactive learning media, low integration of local culture, and minimal utilization of AI-based technologies in the learning process. These conditions cause mathematics learning to remain predominantly conventional and less contextualized to students' daily lives. In fact, learning approaches that incorporate elements of local culture have been proven to improve conceptual understanding and student participation in mathematics learning. Furthermore, the integration of ethnomathematics

and local culture can strengthen character development while preserving cultural values amidst the rapid digitalization of education (Herak, 2025). On the other hand, digital transformation in non-formal education requires course and training institutions to adapt to advancements in computer- and AI-based learning technologies in order to improve the effectiveness and competitiveness of educational quality (Siregar et al., 2025). Therefore, the development of AI-based mathematics learning media integrated with local culture represents a strategic solution for enhancing the quality of learning in course and training institutions (Hasanuiddin et al., 2025).

Empirical evidence from various studies indicates that the use of local culture-based learning media has a positive impact on students' mathematical thinking abilities. Research has shown that interactive learning media based on local culture significantly improve students' mathematical communication skills (Zuliana et al., 2025). In addition, ethnomathematics-based learning is considered effective in fostering conceptual understanding because the learning materials are closely related to students' social and cultural environments. The use of local culture as a context for mathematics learning functions not only as an educational tool but also as a means of preserving regional cultures that are increasingly threatened by globalization (Koos, 2022). Moreover, the integration of local wisdom into vocational mathematics learning enhances the relevance of education to the needs of learners in the modern era. In the context of course and training institutions, this approach is particularly important because the characteristics of non-formal education demand learning processes that are more practical, flexible, and contextual. Nevertheless, most course institutions still rely on simple learning media without the support of AI technology or the systematic integration of local culture. As a result, mathematics learning has not yet fully optimized students' creativity, motivation, and digital skills (Oumelaid et al., 2025).

In the era of Society 5.0, the application of AI in mathematics learning has become an essential requirement for improving the effectiveness of the learning process. AI technology enables students to experience more adaptive, interactive, and personalized learning according to their individual abilities (Anoir et al., 2023). The use of computer- and AI-based applications also facilitates the visualization of complex mathematical concepts through simulations and interactive animations. However, the implementation of AI in education must be accompanied by humanistic and cultural approaches to ensure that students' local identities are not diminished (Anisyah et al., 2025). The integration of local culture into mathematics learning media can serve as a bridge between technological advancement and the values of local wisdom within society. Mathematics learning tools based on local wisdom can improve educational quality while simultaneously preserving regional cultural heritage. In addition, community service activities have demonstrated that incorporating local culture into mathematics learning can enhance teachers' creativity in developing more contextual learning media. Therefore, the development of AI- and computer-based mathematics learning media integrated with local culture is highly relevant for implementation in course and training institutions as an innovative form of technology- and culture-based non-formal education (Santika et al., 2024).

Problems identified among community service partners indicate that most tutors and learners still experience difficulties in optimally utilizing digital technology in mathematics learning (Polydoros et al., 2025). The learning media currently used are generally limited to printed books, whiteboards, and lecture-based methods, making learning less engaging and more difficult for students to understand. Furthermore, the instructional materials have not yet integrated local cultural elements as part of a contextual approach to mathematics education (Kurniawan et al., 2024). These conditions contribute to low levels of learning interest, creativity, and critical thinking skills among learners in understanding mathematical concepts. Preliminary observations reveal that most learners show greater interest in interactive digital media than in conventional teaching methods. Therefore, this community service activity focuses on the development of AI- and computer-based mathematics learning media that combine elements of local culture as an innovative learning approach (Bulkani et al., 2022). The development of such media is expected to assist tutors in delivering learning materials in a more engaging, interactive, and comprehensible manner. In addition, the integration of local culture is expected to foster students' appreciation of regional culture while strengthening local identity amidst the rapid advancement of digital technology.

Based on the foregoing discussion, this community service program aims to develop AI- and computer-based mathematics learning media integrated with local cultural values in course and training institutions (Arif et al., 2023). This activity is expected to enhance tutors' competencies in utilizing digital technology as an innovative learning medium. Furthermore, learners are expected to gain more engaging, interactive, and contextual mathematics learning experiences through the integration of local culture into AI-based learning media. The development of these learning media also represents an implementation of digital transformation in non-formal education while maintaining a commitment to preserving regional cultural heritage (Wayan Suardana et al., 2024). Through training and mentoring activities, course and training institutions are expected to be able to independently develop learning media according to learners' needs and advancements in educational technology. Ultimately, this community service initiative is expected to improve learners' digital skills, creativity, and understanding of mathematical concepts more effectively. In addition to enhancing the quality of learning, this activity also contributes to supporting educational innovation based on technology and local culture in Indonesia. Therefore, the development of AI- and computer-based mathematics learning media integrated with local culture constitutes a strategic step toward creating adaptive, innovative, and sustainable learning in the digital era.

2. RESEARCH METHODOLOGY

2.1 Approach and Type of Activity

This community service program employed a participatory and quantitative descriptive approach using a hybrid training model, which combines face-to-face and online training methods. This approach was selected to enhance participants' flexibility in attending training sessions while expanding access to technology-based learning. The program focused on improving educators' competencies in designing AI- and computer-based mathematics learning media integrated with local cultural values. The implementation was carried out systematically, beginning with needs identification, followed by training, media development practice, mentoring, and evaluation stages. This method was designed based on empirical and measurable principles, ensuring that each stage had clear indicators of success. Furthermore, evaluation was conducted quantitatively using assessment instruments and participant response questionnaires. The evaluation results were then analyzed to determine the effectiveness of the training in improving participants' competencies. Therefore, the selected methodology supports the implementation of a systematic, measurable, and community service-oriented program in accordance with the characteristics of community service journals.

2.2 Participants and Activity Location

The participants in this community service program consisted of 25 educators and instructors from a Course and Training Institution (Lembaga Kursus dan Pelatihan/LKP). Participants were selected based on the institution's need to improve digital competencies in technology-based mathematics instruction. The program was conducted within the Course and Training Institution environment using a hybrid system, involving both offline sessions in a computer laboratory and online sessions through video conferencing platforms. Participants were selected purposively by considering their involvement in mathematics learning activities. Since the participants had diverse educational backgrounds, the training was designed using a practical and application-oriented approach. The program was conducted over three days of intensive training covering both theoretical and practical components. The primary focus of the activity was the utilization of AI applications and computer-based media in the development of mathematics learning integrated with local cultural values. Consequently, participants were expected to implement the training outcomes directly within their respective educational institutions.

2.3 Stages of Program Implementation

The implementation of the community service program was carried out through several systematically arranged stages to ensure that the training objectives were achieved optimally. The first stage was a needs analysis conducted through observations and interviews with representatives of the course and training institution regarding the need for AI-based learning media. The second stage involved training preparation, including the development of modules, instructional materials, evaluation instruments, and supporting facilities for hybrid learning. The third stage was the implementation of training sessions covering topics such as the application of AI in mathematics education, the integration of local cultural values, and practical training on the use of computer-based applications. The fourth stage consisted of mentoring participants in designing AI- and local culture-based mathematics learning media, either individually or collaboratively in groups. The final stage was program evaluation, conducted through competency tests, skills observations, and participant satisfaction questionnaires. The evaluation aimed to measure participants' competency improvements after completing the training. Each stage included specific success indicators to ensure that the program outcomes could be measured objectively and systematically.

2.4 Flowchart of the Implementation Method

The following flowchart illustrates the implementation process of the community service program:

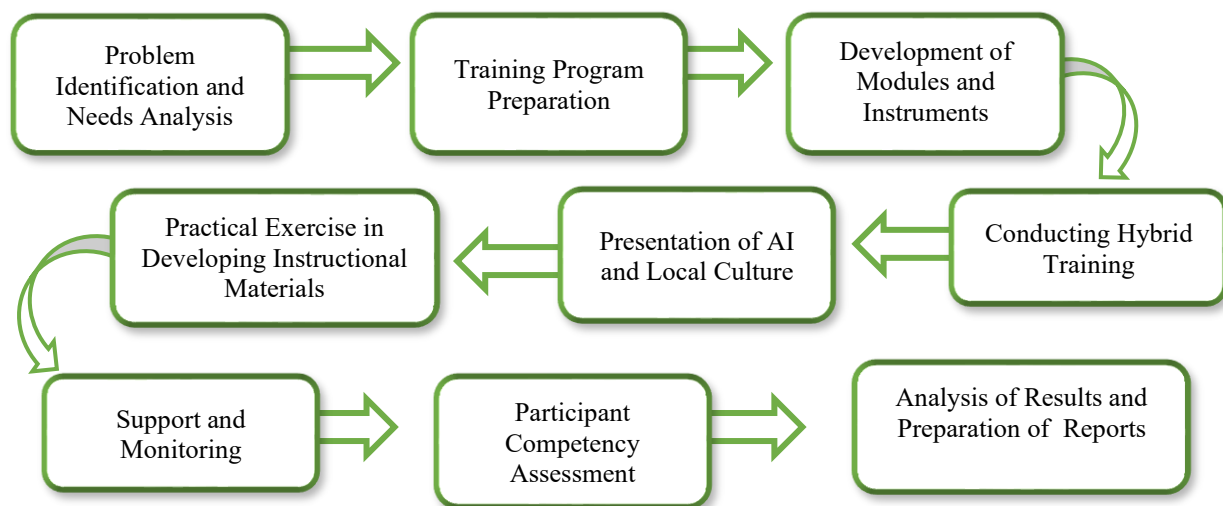


Figure 1. Systematic Flowchart for the Implementation of Community Service Activities

The diagram above illustrates the systematic process of implementing community service activities, starting from problem identification through to the preparation of a final report. The initial phase was conducted to identify participants' needs regarding AI- and computer-based mathematics learning materials. Next, program preparation is carried out, including the development of training modules, evaluation instruments, and hybrid learning tools. Following this, the activities proceed with the implementation of training, which includes the delivery of course material and hands-on practice in using AI technology for mathematics education. Participants then receive guidance to develop learning materials based on local culture. The final stage involves evaluating participants' competencies and analyzing the activity results to assess the effectiveness of the community service implementation.

2.5 Data Collection Instruments

The instruments used in this community service activity consist of observation sheets, participant feedback questionnaires, and training competency tests. The observation sheets were used to monitor participant engagement throughout the activity. The participant feedback questionnaires were used to assess participants' satisfaction with the training content, methods, and implementation. Competency tests are used to measure improvements in participants'

abilities before and after the training. All instruments are designed based on competency indicators for AI-based learning media and the integration of local culture. The evaluation instruments use a Likert scale with a score range of 1–5. Additionally, activity documentation is also used as supporting data for the implementation of the community service program. The data obtained is then analyzed using quantitative descriptive methods to determine the effectiveness of the training.

2.6 Table of Program Success Indicators

Table 1. Table of Success Indicators

No	Success Indicator	Target
1	Participant attendance during training	$\geq 90\%$
2	Participants are able to use AI applications	$\geq 80\%$
3	Participants are able to create learning materials	$\geq 75\%$
4	Participant satisfaction level	$\geq 85\%$
5	Improvement in competency test results	$\geq 70\%$

The success indicator table shows the evaluation parameters used to measure the effectiveness of community service activities. Participant attendance serves as an initial indicator of successful participation in the hybrid training. The ability to use AI applications and create learning media is used to assess the practical improvement in participants' competencies. Participant satisfaction levels are measured through an evaluation questionnaire on the implementation of the activity. Additionally, improvements in competency test results are used to determine the training's impact on participants' understanding of AI-based mathematics learning materials and local culture. All these indicators serve as the basis for an empirical and measurable evaluation of the community service program's success.

2.7 Data Analysis Techniques

Data from the activities were analyzed using quantitative descriptive techniques. Observation and questionnaire data were calculated as percentages to determine the degree to which the program's success indicators were achieved. The analysis of participants' competency improvement was conducted by comparing the results of the pre-test and post-test. Furthermore, the evaluation results were categorized into the criteria of excellent, good, fair, and poor based on the percentage of achievement. The analysis results were used to determine the effectiveness of the hybrid training program using AI- and computer-based mathematics learning media with the integration of local culture. This analysis technique was chosen because it provides an empirical picture of the impact of community service activities on participants' competency improvement. Additionally, the analysis results serve as the basis for formulating recommendations for the development of future training programs.

3. RESULTS AND DISCUSSION

3.1. Implementation of a Hybrid Training Program on AI- and Computer-Based Mathematics Learning Media

The community service activity was conducted through a hybrid training model that combined in-person learning with computer-based practice. The program began with instruction on the concepts of AI-based mathematics learning media, the use of computer applications to support learning, and the integration of local cultural values into the mathematics learning process. The training participants consisted of educators and instructors from Training and Education Institutions who needed to enhance their digital competencies. In the initial phase, participants were provided with an understanding of the importance of digital transformation in mathematics education in the modern era. Subsequently, participants were guided to familiarize themselves with various AI-based applications that can be

utilized in the development of interactive learning media. The training activities were conducted in stages, ranging from an introduction to concepts, demonstrations of application use, to independent practice. Throughout the training process, participants showed high enthusiasm in following each stage of the activities. This was evident from the participants' active involvement in discussions as well as in the practical use of computer-based learning technologies.



(a)



(b)

Figure 2. Figure (a) shows guidance on the use of computer-based media, and Figure (b) shows AI-based hybrid training practice in the computer lab

Figure (a) illustrates the process of guiding participants in understanding the use of computer-based learning media on an individual basis. Meanwhile, Figure (b) depicts the atmosphere of the hybrid training session as participants engage in practical exercises using AI-based learning applications in the computer lab. Both figures demonstrate participants' active engagement in the training process and the use of computers as the primary medium for the activities.

The implementation of hybrid training provides a more flexible and interactive learning experience for participants. The hybrid model allows participants to receive instructional content directly while simultaneously practicing the use of AI-based learning applications independently. Additionally, the use of computers in the training process helps participants understand technical steps more effectively. Based on the observation results, most participants were able to follow the training well despite having varying levels of technological proficiency. Mentoring activities also assisted participants who encountered technical difficulties during the practical sessions. Thus, the hybrid training model has proven effective in increasing participant participation and engagement in this community service activity.

3.2. Improving Participants' Competence in Developing Learning Materials

After completing the training, participants were able to design AI- and computer-based mathematics learning materials by integrating local cultural elements into the learning content. Participants were given a practical assignment to create interactive learning materials using the computer applications introduced during the training. The results of the practical assignment showed that most participants were able to develop simple learning materials that included visual elements, animations, and local cultural contexts. The integration of local culture was achieved through the use of mathematical examples related to the participants' immediate surroundings. This approach helped participants understand that mathematics learning can be connected to daily life and the cultural values of the local community. In addition, participants also demonstrated improved skills in operating AI-based applications to assist in the development of learning materials. The improvement in participants' competencies was evident in their ability to create more creative and interactive learning materials compared to before the training was conducted. Thus, this community service activity had a positive impact on enhancing the digital competencies of educators at training and course institutions.



Figure 3. Figure (a) shows guidance on the creation of computer-based mathematics learning materials, and Figure (b) shows the independent development of learning materials in the computer lab.

Figure (a) illustrates the process of guiding participants during the practical session on creating computer-based mathematics learning materials. Figure (b) shows participants' activities as they independently develop learning materials using computers in the training lab. Both figures indicate that participants actively engaged in the practical activities and were able to directly apply the training material. To assess the effectiveness of the training, an evaluation was conducted to measure the achievement of the program's success indicators. The evaluation was carried out through observation, participant feedback questionnaires, and pre- and post-training competency test results. The evaluation results demonstrated an improvement in participants' competencies regarding the use of AI- and computer-based learning materials.

3.3 Table of Activity Evaluation Results

Table 2. Summary of Activity Evaluation Results

No	Evaluation Indicator	Result Percentage
1	Participant attendance	96%
2	Ability to use AI applications	84%
3	Ability to create learning materials	80%
4	Participant satisfaction level	92%
5	Post-test score improvement	78%

The table above indicates that the community service activity proceeded successfully based on the established success indicators. Participant attendance reached 96%, demonstrating high enthusiasm among participants in attending the hybrid training. Participants' ability to use AI applications reached 84%, while their ability to create computer-based learning materials reached 80%. Additionally, participant satisfaction with the implementation of the activity reached 92%, indicating that the hybrid training method was deemed effective and relevant to participants' needs. Post-test results also improved by 78% compared to before the training was conducted. Thus, the evaluation results indicate that the training activity successfully enhanced participants' digital competencies in the development of AI- and computer-based mathematics learning media.

3.4 Impact Analysis of the Community Service Program

The hybrid training program on AI- and computer-based mathematics learning materials had a positive impact on participants' ability to utilize learning technologies. Participants not only gained theoretical understanding of AI and digital learning media but also gained hands-on experience in developing computer-based learning media. Additionally, the integration of local culture into mathematics learning helped participants understand the importance of preserving cultural values in modern education. This training also increased participants' motivation to be more creative in designing engaging and interactive mathematics lessons. Based on observations, participants appeared more confident in using learning technologies compared to before participating in the program. This program also contributes to improving the digital literacy of educators at training and course institutions. With the increased digital competencies of the participants, it is hoped that the mathematics learning process at these institutions will become more innovative, effective, and aligned with current developments in educational technology. Therefore, this community service activity can serve as one solution in supporting technology- and local culture-based educational transformation in the digital age.

4. CONCLUSION

The community service activity, which involved hybrid training on AI- and computer-based mathematics learning materials that integrated local cultural values at the Course and Training Institute, was successfully carried out in a systematic and effective manner. The implementation of the activity enhanced participants' competencies in understanding and utilizing AI-based technology as an interactive and innovative medium for mathematics learning. Additionally, participants were able to develop computer-based learning materials by integrating local cultural elements into the curriculum, thereby making the learning process more contextual and engaging. Evaluation results indicate that participant participation and enthusiasm were very high, as evidenced by an attendance rate of 96% and a participant satisfaction rate of 92%. Participants' proficiency in using AI applications reached 84%, while their ability to create learning media reached 80%. A 78% increase in post-test scores also indicates improved understanding and skills among participants following the training. Thus, this community service initiative has a positive impact on enhancing digital literacy and pedagogical competencies among educators at training and course institutions. This hybrid training program is expected to serve as a model for technology- and local culture-based mathematics learning development that can be sustainably implemented to support educational transformation in the digital age.

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