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IMPROVING MADRASAH TEACHERS' COMPETENCIES IN ARTIFICIAL INTELLIGENCE-BASED LEARNING DATA PROCESSING IN BATU CITY

Syaiful Anam[1*], Hilmi Aziz Bukhori[1], Avin Maulana[1], Indah Yanti[1], Anggi Gustiningsih Hapsani[1]

[1] Department of Mathematics, Faculty of Mathematics and Natural Sciences, Universitas Brawijaya, Malang, Indonesia

* Correspondence
Syaiful Anam
Department of Mathematics, Faculty of Mathematics and Natural Sciences, Universitas Brawijaya
Jl. Veteran, Malang, Indonesia
Email: syaiful@ub.ac.id

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ABSTRACT

Teacher competence is a crucial factor in improving the quality of education..This community service program aimed to enhance the professional competence of madrasah teachers in processing learning data using artificial intelligence (AI)-based tools. Conducted through a one-day intensive workshop in Batu City, the program involved 18 teachers from five madrasahs at the Madrasah Aliyah and Madrasah Tsanawiyah levels. The training adopted the ADDIE instructional design model, covering needs analysis, AI-assisted data processing with Google Sheets and ChatGPT/OpenAI, reinforcement of AI ethics, and infographic creation. Quantitative evaluation showed a significant improvement in participants' competencies, with average scores increasing from 60.3 (pre-test) to 86.3 (post-test). The most notable progress was observed in logical operations (IF function mastery) and ethical awareness in AI use, while 88% of participants reported high satisfaction with the training content and delivery. The program effectively integrated digital literacy, ethical reflection, and practical application to foster teacher professionalism. Beyond individual competence, this initiative contributed to building a sustainable collaborative network through the Subject Teachers' Working Group (MGMP) and provided a replicable model for technology-based professional development in Islamic education.

Keywords: Artificial Intelligence, Batu City, Learning Data, Madrasah, Teacher Competency

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INTRODUCTION

Teacher competence is a crucial factor in improving the quality of education. Ministerial Regulation No. 16 of 2007 emphasizes four competency domains that must be mastered: pedagogical, professional, personality, and social. In the professional domain, the ability to process and interpret learning outcome data is essential because it enables teachers to assess student progress, evaluate learning effectiveness, and design evidence-based improvements (Shopia et al., 2022; Hendriani et al., 2022). One frequently used approach is Classroom Action Research (CAR), which involves a cycle of planning, implementation, observation, and reflection (Nunggalina et al., 2018; Kunlasomboon et al., 2015; Handoyono et al., 2019; Zulkifli, 2023).

Despite this, many madrasah teachers still experience challenges in managing learning data. Frequently encountered obstacles include limitations in instrument design, difficulties conducting systematic analysis, and a lack of skills in utilizing digital tools (Daud & Kaleka, 2020; Susanti et al., 2022; Fitria et al., 2019; Harjito et al., 2022). Limited training and weak institutional support further hamper the optimal utilization of learning outcome data (Chandra et al., 2022).

Technological advancements present new opportunities, particularly through Artificial Intelligence (AI). AI can accelerate data processing, provide qualitative and quantitative analysis, and visualize learning outcomes for easier understanding (Onesi-Ozigagun et al., 2024; Wang et al., 2024; Aggarwal et al., 2023; Tapalova & Zhiyenbayeva, 2022). However, the implementation of AI must be accompanied by ethical awareness to safeguard student privacy and avoid bias, so that its use remains aligned with educational values (Shaik et al., 2022; Modran et al., 2024; Alkan, 2024; Sallu et al., 2024).

The urgency of integrating AI and computing into education is growing. AI not only functions to personalize learning and expand access, but can also automate administrative tasks, allowing teachers to focus more on teaching. Visionary and adaptive leadership is also needed to ensure optimal AI adoption and contribute to the transformation of technology-based learning.

Based on these conditions, this community service program was designed to improve the competency of madrasah teachers in Batu City in managing AI-based learning outcome data. The Analysis, Design, Development, Implementation, Evaluation (ADDIE) learning model was chosen to ensure systematic training. The focus of activities includes practicing the use of Google Sheets, implementing AI applications for data analysis, strengthening understanding of AI ethics, and creating infographics. This effort is expected to not only address teachers' real-world needs but also support the development of students' 21st-century skills for the digital era.

OBJECTIVES

The objectives of this community service program are divided into general and specific purposes to ensure clarity, measurability, and alignment with the needs of madrasah teachers in the digital era.

General Purpose

The general purpose of this program is to enhance the professional competence of madrasah teachers in processing and

analyzing learning data using AI-based tools, thereby fostering digital literacy, ethical awareness, and evidence-based teaching practices.

Special Purpose

The specific purposes of this community service program are:

1. To train madrasah teachers in the use of AI-integrated applications such as Google Sheets and ChatGPT/OpenAI for efficient learning data management and interpretation.
2. To strengthen teachers' understanding of AI ethics, emphasizing data privacy, fairness, and responsible technology use in educational contexts.
3. To develop teachers' ability to design informative and communicative infographics based on processed data for Classroom Action Research and lesson reflection.
4. To implement the ADDIE instructional design model as a structured framework for training, from needs analysis to evaluation.
5. To evaluate the effectiveness of the program through pre-test and post-test analysis and participant satisfaction surveys.
6. To establish a sustainable mentoring and collaboration system through the Subject Teachers' Working Group so that the acquired skills can continue to be applied and expanded in schools.
7. To produce measurable outcomes including enhanced digital competence, ethical AI literacy, and improved classroom data analysis skills among teachers.

PLAN OF ACTION

Strategy Plan

Before the implementation, the authors designed a systematic training strategy using the ADDIE instructional design model. The planning stages included:

1. Needs Analysis
   Conducted through interviews, surveys, and discussions with Subject Teachers' Working Group to identify teachers' challenges in managing learning data and classroom action research.
2. Program Design
   Developed a structured training module covering topics such as AI introduction, use of Google Sheets, application of AI tools (Google AI add-on and ChatGPT/OpenAI API) for data analysis, AI ethics, and infographic design techniques.
3. Learning Materials Development
   Prepared teaching media including printed modules and presentation slides to ensure conceptual understanding and practical engagement.
4. Scheduling and Coordination
   Established collaboration with Subject Teachers' Working Group and participating schools for participant recruitment, venue preparation, and technical setup to ensure smooth execution.

This strategy ensured that the activity could run efficiently, with clear objectives, measurable outputs, and a focus on hands-on learning experiences for teachers.

Implementation

The program was implemented in the form of a one-day workshop involving 18 teachers from five madrasahs in Batu City. Activities included:

1. Pre-test administration to assess initial competence.
2. Lectures and demonstrations on AI concepts and tools.

3. Hands-on practice using Google Sheets and AI-based applications for analyzing student learning data.
4. Group discussions and collaboration sessions for experience sharing among participants.
5. Post-test and satisfaction surveys to assess knowledge gains and participant responses.
6. Each session was designed to last 60–90 minutes, ensuring sufficient time for conceptual understanding and practical exercises. The implementation adopted an andragogical approach, emphasizing experience sharing, collaboration, and reflection.

Setting

The training took place at the Subject Teachers' Working Group coordination hall in Batu City, which provided adequate facilities for computer-based workshops. All required equipment, including laptops, internet connectivity, and projection tools, was supplied by the organizing team. The setting enabled real-time collaboration between participants and facilitators, fostering a conducive environment for active learning and experimentation.

Target

The primary target participants were madrasah teachers from both public and private institutions within Batu City. A total of 18 teachers (11 from Madrasah Aliyah and 7 from Madrasah Tsanawiyah) took part in the program. The selection prioritized teachers responsible for managing student performance data and conducting classroom research. This diverse participant composition encouraged cross-school knowledge exchange and collaborative learning.

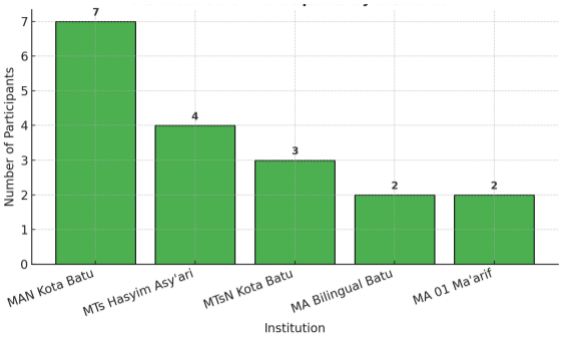
The long-term target is to establish a sustainable mentoring system through Subject Teachers' Working Group, ensuring that AI-based data literacy and ethical awareness continue to develop beyond the initial workshop.

This structured plan ensured efficient implementation, measurable improvements in AI-based data literacy, and the strengthening of teacher collaboration networks across madrasahs in Batu City.

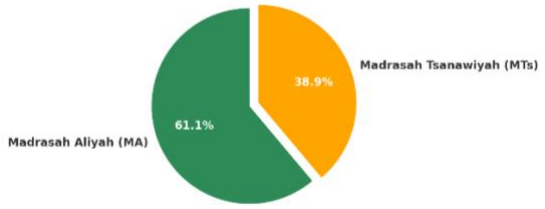
RESULTS AND DISCUSSION

This section presents the various findings obtained during the implementation of the community service program. The presentation begins with a comprehensive description of the program outcomes, followed by an in-depth discussion. The discussion is structured systematically, starting from general aspects and progressing toward more specific analyses aligned with the program's focus. At the beginning, the profile of program participants is presented as a basis for understanding the training context and the characteristics of the madrasah teachers involved.

The program involved 18 teachers from five madrasahs in Batu City: MAN Kota Batu, MTs Hasyim Asy'ari, MTsN Kota Batu, MA Bilingual Batu, and MA 01 Ma'arif. of these, 11 participants were from Madrasah Aliyah (MA) and 7 from Madrasah Tsanawiyah (MTs). This diversity of school backgrounds provided opportunities for teachers from both public and private institutions to exchange experiences, enriching the discussions and practice sessions. Figure 1 (a) shows the distribution of participants by institution, while Figure 1(b) shows the distribution by educational level.



(a)



(b)

Figure 1. (a) Participant distribution by institution; (b) Participant distribution by educational level.

Figure 2. Documentation of the AI-based learning data processing training in Batu City.

The program implementation was carried out through a full-day workshop, including a pre-test, material delivery, hands-on practice using Google Sheets and AI applications, group discussions, and a post-test. During the activities, participants were actively engaged in every session—listening to explanations, experimenting directly with applications, and engaging in problem-solving discussions. The documentation in Figure 3 shows the training atmosphere, where madrasah teachers participated in practice and discussion sessions.

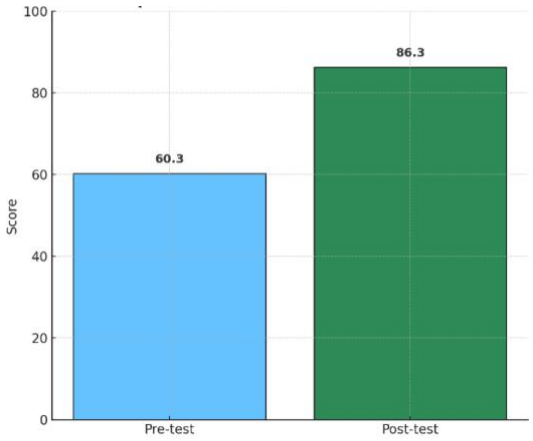


Figure 3. Comparison of pre-test and post-test scores.

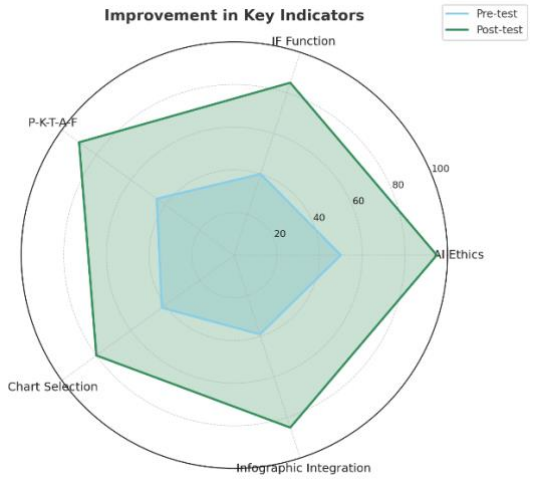


Figure 4. Improvement across significant indicators.

Quantitative evaluation showed an increase in the average score from 60.3 (pre-test) to 86.3 (post-test), as shown in Figure 3. This 26-point (approximately 43%) improvement confirms a significant enhancement in teachers' competence in learning data processing after participating in the training. The success was largely influenced by the hands-on, practice-based training method using Google Sheets and

AI applications, which proved more effective than purely theoretical approaches.

Furthermore, a detailed analysis of the five competency indicators in Figure 4 reveals substantial improvement across all aspects. The analysis of each aspect is as follows:

- **IF Function**
  Teachers' ability to use the IF function increased from around 40 to 85, showing a rapid improvement in their logical understanding of spreadsheet operations.
- **AI Ethics**
  Teachers' understanding of AI ethics increased from 50 to 95, indicating greater awareness of professional responsibility, student privacy protection, and potential bias in AI usage.
- **P-K-T-A-F (Process, Knowledge, Technique, Analysis, Format)**
  Teachers' understanding of the P-K-T-A-F framework rose from 45 to 90, demonstrating stronger conceptual ability in conducting data analysis.
- **Chart Selection**
  The ability to select appropriate charts increased from 42 to 80, reflecting improved skill in choosing suitable and informative data representations.
- **Infographic Integration**
  The ability to integrate infographics increased from 39 to 85, showing greater capability to present data in a more communicative, engaging, and comprehensible way.

The improvement across these indicators confirms that the training enhanced not only technical skills but also conceptual and ethical dimensions. This aligns with previous research emphasizing the importance of digital literacy and AI ethics in education (Onesi-Ozigagun et al., 2024; Shaik et al., 2022).

The three analysed graphs complement each other in illustrating the program's impact: participant distribution reflects cross-level madrasah representation; the pre- and post-test score comparison shows the overall effectiveness of the training; and the radar chart highlights detailed improvements in technical, ethical, and visual communication skills. Thus, this program proved to be comprehensive and effective in enhancing madrasah teachers' competencies in AI-based learning data processing, with the potential to serve as a replicable professional development model in other regions.

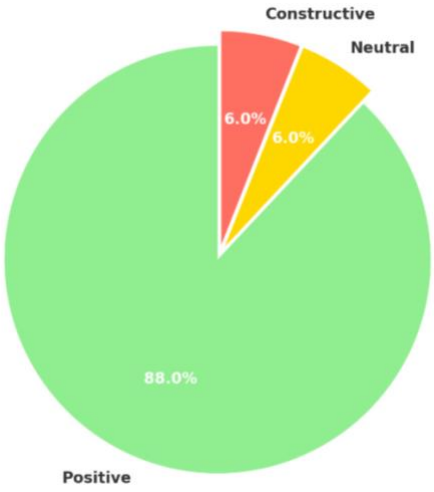


Figure 5. Participant satisfaction toward the training.

Participant satisfaction evaluation results show that most teachers gave positive feedback on the program. Eighty-eight percent (88%) of participants found the training useful and relevant to their needs, 6% responded neutrally, and 6% provided constructive suggestions (Figure 5). This indicates that the training was not only well-received but also encouraged valuable feedback for future improvement.

These findings have important implications for developing madrasah teacher competencies, as improved AI-based data processing skills contribute directly to more transparent, accountable, and evidence-based teaching practices. Moreover, the enhancement of AI ethics demonstrates that teachers are increasingly ready to use technology responsibly, supporting the creation of an education ecosystem adaptive to digital transformation.

Nevertheless, several open problems remain for future community service programs. First, although teachers' technical skills improved, continuous mentoring is needed to ensure that these skills become embedded in daily teaching practice. Second, AI adoption in madrasahs still faces challenges, such as limited digital infrastructure and insufficient school policy support. Third, further research is required to evaluate the effectiveness of AI use in Classroom Action Research to generate best-practice recommendations.

Therefore, future programs are recommended to develop long-term mentoring schemes, enhance madrasah digital capacity, and explore more advanced AI applications in learning analytics. Through this approach, community engagement can be expanded, not only improving individual teachers' competencies but also building institutional capacity for sustainable educational transformation.

These findings affirm that madrasah teachers' need for AI and computational literacy is genuine and that practical, AI-integrated training effectively addresses existing competency gaps.

CONCLUSION

This community service program introduced an innovative approach by integrating AI into the professional development of madrasah teachers, particularly in processing learning outcomes data and conducting Classroom Action Research. As an emerging practice in Indonesian madrasahs, this integration successfully combined technical competence, such as the use of spreadsheet formulas, chart selection, and infographic design, with strengthened ethical awareness through the understanding of AI ethics. The program achieved substantial results, with teachers' average scores improving from 60.3 (pre-test) to 86.3 (post-test), accompanied by significant gains across five competency indicators. Moreover, 88% of participants expressed positive satisfaction, highlighting the program's practical relevance. Collaboration through the Subject Teachers' Working Group further reinforced data-driven teaching practices and established a foundation for continuous professional exchange among educators. From a theoretical perspective, the program validated the ADDIE instructional design model as an effective framework for technology-based training. It also demonstrated how AI integration in teacher capacity-building can bridge the gap between digital literacy and ethical competence. Looking forward, sustained mentoring, digital infrastructure enhancement, and the adoption of advanced AI tools for learning analytics are recommended to ensure long-term impact. Through these efforts, community engagement can evolve beyond individual skill enhancement toward building institutional readiness for sustainable educational transformation. Ultimately, this program not only strengthened teachers' technical and ethical competencies but also underscored the critical role of AI and

computational literacy as foundational skills for educators navigating the digital era.

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