SOCIETY: Jurnal Pengabdian Masyarakat,
Vol. 5, No. 2 (2026): Maret, pp. 250-263
E-ISSN:2827-878X (Online -Elektronik)

From Zero to AI: Educational Initiatives Through Webinars and Workshops on Developing Machine Learning Models Using TensorFlow

Hafizh Umar Haq[1], Miftahul Jannah[2], Anggi Rahmadillah[3], Muhammad Imam Najib[4], Kevin Arya Dandy[5], Jumail[6], Nurvelly Rosanti[7], Yana Adharani[8], Popy Meilina[9], Mirza Sutrisno[10], Rully Mujiastuti[11]

[1,2,3,4,5,6,7,8,9,10,11] Teknik Informatika, Teknik, Universitas Muhammadiyah Jakarta, Jakarta Pusat, 10510

23040700013@student.umj.ac.id

ARTICLE INFO

Article history

Received : 20-1-2026

Revised : 26-1-2026

Accepted : 26-1-2026

Keywords

Artificial Intelligence, Machine Learning, TensorFlow, model development, participant understanding, pre-test, post-test, digital literacy, technology education.

ABSTRACT

The development of Artificial Intelligence (AI) and Machine Learning (ML) requires improved technological literacy and a basic understanding of practical applications. This study aims to introduce the concepts of AI and ML through the implementation of simple machine learning models using TensorFlow. The methods used include material delivery, model implementation practice, and evaluation through pre-tests, post-tests, and feedback questionnaires. The evaluation results show an increase in participants' understanding, marked by an increase in the average score from 76.76 on the pre-test to 80.91 on the post-test, or an increase of 5.41%. In addition, the feedback results showed a very high level of satisfaction, with 96% of participants giving positive ratings. This shows that the TensorFlow-based learning approach is effective in improving basic understanding and skills related to AI and ML.

Perkembangan Artificial Intelligence (AI) dan Machine Learning (ML) menuntut peningkatan literasi teknologi dan pemahaman dasar yang aplikatif. Penelitian ini bertujuan mengenalkan konsep AI dan ML melalui implementasi pembuatan model machine learning sederhana menggunakan TensorFlow. Metode yang digunakan meliputi penyampaian materi, praktik implementasi model, serta evaluasi melalui pre-test, post-test, dan kuesioner feedback. Hasil evaluasi menunjukkan peningkatan pemahaman peserta, ditandai dengan kenaikan nilai rata-rata dari 76,76 pada pre-test menjadi 80,91 pada post-test atau meningkat sebesar 5,41%. Selain itu, hasil feedback menunjukkan tingkat kepuasan yang sangat tinggi, dengan 96% peserta memberikan penilaian positif. Hal ini menunjukkan bahwa pendekatan pembelajaran berbasis TensorFlow efektif dalam meningkatkan pemahaman dan keterampilan dasar terkait AI dan ML.

SOCIETY: Jurnal Pengabdian Masyarakat,
Vol. 5, No. 2 (2026): Maret, pp. 250-263
E-ISSN:2827-878X (Online -Elektronik)

A. INTRODUCTION

The development of information and communication technology in recent years has shown significant acceleration, particularly in the fields of Artificial Intelligence (AI) and Machine Learning (ML). AI has evolved into a strategic technology that plays an important role in various sectors, including education, industry, health, and digital services. The use of AI enables computer systems to perform cognitive processes that resemble human capabilities, such as analyzing data, recognizing patterns, making predictions, and supporting automatic and adaptive decision-making. The use of AI enables computer systems to perform cognitive processes that resemble human capabilities, such as analyzing data, recognizing patterns, making predictions, and supporting automated and adaptive decision-making (Forero-Corba & Bennasar, 2024).

Machine Learning is an integral part of Artificial Intelligence that focuses on developing algorithms and models capable of learning from data independently without explicit instructions. With the increasing volume and complexity of data, the Machine Learning approach has become increasingly relevant because it can produce more efficient, accurate, and scalable solutions. In practice, the application of Machine Learning requires the support of a reliable framework to facilitate the data processing, model training, performance evaluation, and model implementation into real systems. One of the most widely used frameworks is TensorFlow, which is known for its flexibility, computational efficiency, and support for the development of Machine Learning and Deep Learning models on various platforms (Santoso et al., 2025).

In the context of education, understanding Artificial Intelligence and Machine Learning is becoming an increasingly urgent need as digital transformation continues. AI literacy is not only related to technical skills, but also includes a conceptual understanding of how algorithms work, the use of data, and the impact of technology on the learning process and everyday life. Research shows that integrating AI concepts into education can enhance students' knowledge, critical thinking skills, and readiness to face the challenges of the digital age (Sihaloho & Napitupulu, 2024).

In addition, mastery of the basics of Machine Learning and the use of frameworks such as TensorFlow contribute to building practical competencies that are relevant to the needs of industry and the world of work today. A study conducted by Santoso, Aji, and Franskusuma (2025) shows that TensorFlow-based learning can help participants understand AI and Machine Learning concepts in a more practical way, from data processing to simple model creation. This confirms that TensorFlow acts as a bridge between theory and practice in AI learning.

On the other hand, AI-based educational transformation also presents challenges, such as human resource readiness, digital literacy, and ethical understanding in the use of smart technology. Therefore, the introduction of AI and Machine Learning needs to be designed systematically in order to provide comprehensive understanding, not only from a technical aspect, but also from the perspective of responsible use. Rakuasa, Faris, and Hidayatullah (2024) emphasize that the development of AI competencies in education must consider the balance between technological innovation and user readiness so that its implementation can run optimally.

Based on the background described above, this study aims to introduce the basic concepts of Artificial Intelligence and Machine Learning through educational activities in the form of webinars and workshops. The program focuses on providing participants with practical

experience in developing simple machine learning models using TensorFlow. In addition, this study seeks to evaluate the effectiveness of these educational activities in improving participants understanding of AI and Machine Learning concepts through pre-test, post-test, and participant feedback analysis.

B. METHODS

When carrying out planned community service activities, the implementation team developed several stages to be carried out gradually. The program consisted of two main activities, namely education through webinars and practical training through workshops. The following are some of the stages that were carried out:

1. **Stage 1 – Activity Socialization**
   In the initial stage, the team disseminated information about the activity through various social media platforms. Digital posters and registration (https://tinyurl.com/54xmndy3) were shared via Instagram and WhatsApp groups to reach a wider audience of potential participants.
2. **Stage 2 – Material Preparation**
   In the second stage, the team compiled learning modules as internal guidelines for the implementation team. These modules were then used as the basis for preparing webinar and workshop materials in the form of PowerPoint slides presented by key speakers during the activities.
3. **Stage 3 – Participant Pre-Test**
   Before the activity begins, participants are asked to complete a pre-test via the link (https://tinyurl.com/yc5e84fw). The pre-test contains a number of questions relevant to the material that will be presented and is used to determine the participants' initial level of understanding.
4. **Stage 4 – Webinar**
   The webinar session was held as an initial stage to introduce the basic concepts of machine learning with a focus on model development using TensorFlow. The material presented included an introduction to artificial intelligence, the basics of machine learning, the functions of TensorFlow as a framework, and an overview of the stages of machine learning model development.
5. **Stage 5 – Workshop**
   During the workshop session, participants were guided through hands-on practice in developing machine learning models using Google Colab. Activities included installing and using the necessary libraries, loading and processing data, designing and training models with TensorFlow, and evaluating and inferring to obtain predictions from the developed models.
6. **Stage 6 – *Post-Test for Participants***
   After the entire series of activities was completed, participants were asked to take a post-test via a link (https://tinyurl.com/4udrcbdm). The post-test contained a number of questions to measure the participants' increased understanding of the material that had been presented.
7. **Stage 7 – *Participant Feedback***
   As a form of evaluation of the activity, participants are asked to fill out a feedback questionnaire via the link (https://tinyurl.com/yckeaysf). The questionnaire contains assessments of the implementation of the activity, the quality and clarity of the material,

the method of delivery by the speakers, and suggestions for improvements to future activities.

8. **Stage 8 – Data Analysis Methods**
   The data obtained from the pre-test, post-test, and participant feedback questionnaires were analyzed using descriptive statistical methods. The pre-test results were used to identify the participants' initial level of understanding of Artificial Intelligence and Machine Learning concepts before the webinar and workshop activities were conducted.
   After the completion of the learning sessions, the post-test results were analyzed to measure the improvement in participants' understanding of the material presented during the activities. The analysis was carried out by calculating the percentage of correct answers obtained by participants and comparing the results between the pre-test and post-test.
   In addition, participant feedback collected through questionnaires was analyzed using a five-point Likert scale ranging from 1 (very dissatisfied) to 5 (very satisfied). The responses were then summarized in the form of percentages to describe the level of participant satisfaction regarding several aspects of the activity, including the clarity of the material, the relevance of the topics, the speakers' delivery, and the overall implementation of the webinar and workshop. The results of this analysis are presented in the Results and Discussion section in the form of descriptive explanations and graphical visualizations.

C. RESULTS AND DISCUSSION

This webinar and workshop was organized by students of the Information Technology Study Program, Faculty of Engineering, Muhammadiyah University Jakarta as an educational activity in the field of information technology. The activity aimed to introduce the basic concepts of Artificial Intelligence and Machine Learning and to provide participants with practical experience in developing simple machine learning models using TensorFlow. The event was conducted online using the Zoom Meeting Conference platform via the link https://s.umj.ac.id/FTUMJ-02 on Wednesday, January 7, 2026, from 1:00 PM to 3:30 PM.

The event was attended by 40 participants from various backgrounds, including students from various universities, teachers, the general public, and students from Muhammadiyah University Jakarta. During the event, the program ran smoothly and interactively. In addition to the presentation session by the speakers, the event also included a question-and-answer session, providing participants with the opportunity to interact directly, ask questions, and deepen their understanding of the presented material. The following is the agenda for the webinar and workshop that was conducted.

Tabel 1. Webinar and Workshop Agenda

Time	**Activity**	**PIC**
12.30 – 13.00 WIB	Preparation	All Committe
13.00 – 13.10 WIB	Opening by MC	Miftahul Jannah
13.10 – 13.20 WIB	National and Muhammadiyah Anthem	Anggi Rahmadillah
13.20 – 13.30 WIB	Remarks by KKN Chair	Hafizh Umar Haq
13.30 – 13.40 WIB	Pre-Test	Miftahul Jannah

SOCIETY: Jurnal Pengabdian Masyarakat,
Vol. 5, No. 2 (2026): Maret, pp. 250-263
E-ISSN:2827-878X (Online -Elektronik)

13.40 – 14.30 WIB	Webinar	Kevin Arya Dandi
14.30 – 14.40 WIB	Question and Answer Session	Hafizh Umar Haq
14.40 – 14.50 WIB	Break	Hafizh Umar Haq
14.50 – 15.50 WIB	Workshop	M. Imam Najib
15.50 – 16.00 WIB	Question and Answer Session	Hafizh Umar Haq
16.00 – 16.10 WIB	Post-Test	Hafizh Umar Haq
16.10 – 16.20 WIB	Group Photo and Closing	Miftahul Jannah

The community service activities were then carried out according to the stages described in the table above.

Stage 1 – Activity Socialization

At this stage, the author and the implementation team disseminated information to the general public with the aim of informing and attracting potential participants. The socialization process was carried out through various social media by sharing digital flyers that had been prepared and designed in advance so that the activity information could be conveyed clearly and attractively. The flyers contained important information about the Webinar and Workshop activities, such as the theme of the activity, the time of implementation, the media used, and the target participants. This promotional media was used as the main means of reaching potential participants from various backgrounds in a broad and efficient manner. Documentation of the activity flyers can be seen in the image below:

Figure 1. Activity Flyer

SOCIETY: Jurnal Pengabdian Masyarakat,
Vol. 5, No. 2 (2026): Maret, pp. 250-263
E-ISSN:2827-878X (Online -Elektronik)

Stage 2 - Activity Material Preparation

At this stage, the presenter prepares and compiles presentation materials in the form of PowerPoint (PPT) slides as a medium for delivering the material. The material is compiled in a structured and systematic manner so that the flow of discussion is easy for participants to understand, especially for those who are still in the early stages of learning about Artificial Intelligence and Machine Learning.

The material presented covers several main topics, including an introduction to Artificial Intelligence, the basic concepts of Machine Learning, and the role of TensorFlow as a framework in the development of machine learning models. The webinar begins with an explanation of the concept of AI and its application in everyday life, followed by a discussion of how machine learning works, the types of learning algorithms, and examples of their implementation.

Stage 3 – Pre-Test Completion by Participants

At the initial stage of the activity, participants were asked to complete a Pre-Test prepared by the author and the implementation team. This Pre-Test was used as an initial instrument to determine the participants' level of knowledge before receiving the material in the Webinar and Workshop.

Based on the Pre-Test results, 34 participants were recorded as having participated in filling out the Google form. In general, the Pre-Test results showed that participants already had a fairly good basic understanding of the concepts of AI and machine learning. These findings indicate that while participants are familiar with the conceptual aspects of AI, practical knowledge regarding model development still needs to be strengthened. This finding is consistent with the study conducted by Sihaloho and Napitupulu (2024), which reported that learners often possess basic knowledge of artificial intelligence but require practical learning activities to deepen their understanding of AI implementation.

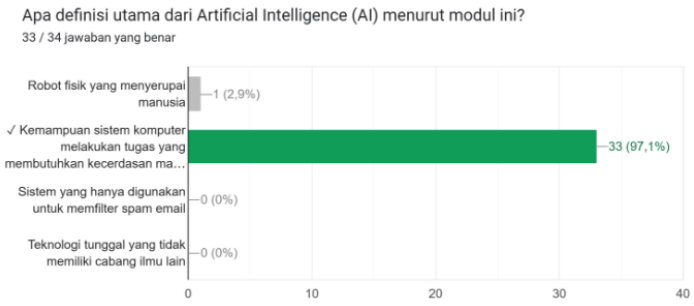

Figure 2. AI Recognition Pre-Test

Based on Figure 2, the results of the Pre-Test on questions regarding the main definition of Artificial Intelligence (AI) can be seen. A total of 33 participants (97.1%) were able to answer the questions correctly.

SOCIETY: Jurnal Pengabdian Masyarakat,
Vol. 5, No. 2 (2026): Maret, pp. 250-263
E-ISSN:2827-878X (Online -Elektronik)

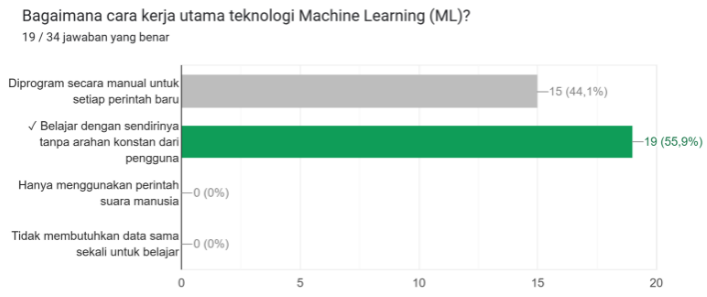

Figure 3. Pre-Test on How Machine Learning Works

Based on Figure 3, the results of the pre-test on questions about how Machine Learning technology works can be seen. A total of 19 participants (55.9%) were able to answer the questions correctly.

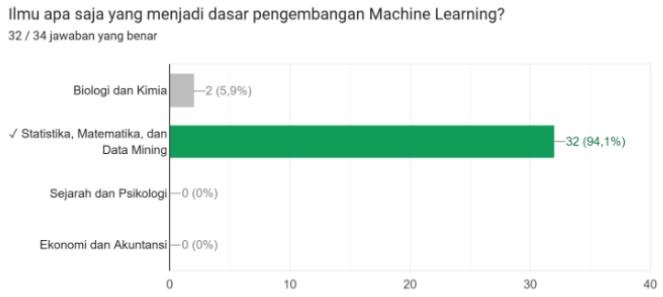

Figure 4. Fundamentals of ML Development

Based on Figure 4, the results of the pre-test on questions regarding the fundamentals of ML development can be seen. A total of 32 participants (94.1%) were able to answer the questions correctly.

Stage 4 – Community Education Through Webinars

At this stage, the material was presented by webinar speaker Kevin Arya Dandi. The topics discussed in the webinar session included an introduction to Artificial Intelligence, the basic concepts of Machine Learning, and an introduction to TensorFlow as a framework for developing machine learning models. The presentation began with an explanation of the concept of AI and its role in the development of digital technology, followed by a discussion of how machine learning works, the types of learning algorithms, and an overview of the use of TensorFlow.

In addition to the material presentation session, the webinar also included interactive sessions, both through questions asked by the presenter and questions from participants submitted via the chat feature on Zoom Meeting Conference. This interaction aimed to increase active participant participation and deepen their understanding of the material presented. The webinar session served as an important introductory stage to build participants conceptual understanding before entering the practical workshop session.

SOCIETY: Jurnal Pengabdian Masyarakat,
Vol. 5, No. 2 (2026): Maret, pp. 250-263
E-ISSN:2827-878X (Online -Elektronik)

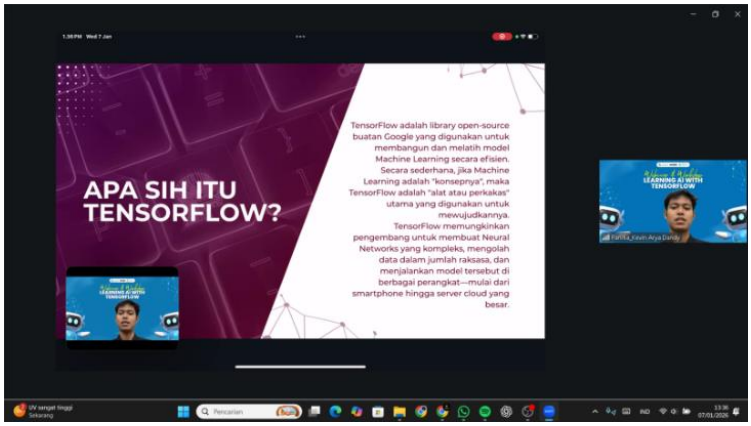

Figure 5. Webinar Material Presentation

Stage 5 – Training Through Workshops

At this stage, workshop presenter Muhammad Imam Najib provided direct application of the material presented in the previous webinar session. The workshop focused on the practical creation and development of machine learning models using TensorFlow, so that participants could understand the workflow in practice, not just in theory.

During the workshop, the presenter uses Google Colaboratory (Google Colab) as a practice medium. Participants are directed to open the notebook provided, then the presenter explains the initial steps of importing the necessary libraries and packages, such as TensorFlow, NumPy, Pandas, and other supporting libraries. This stage aims to help participants understand the functions of each library used in the data processing and machine learning model development processes.

Through this practice session, participants gained firsthand experience in implementing machine learning models, while also understanding the TensorFlow workflow from the initial stage to the model testing stage. With this workshop, participants are expected to be able to apply the knowledge gained from the webinar session into simple practices independently. The hands-on practice provided during the workshop allowed participants to directly experience the process of developing machine learning models using TensorFlow, which can enhance conceptual understanding through practical application.

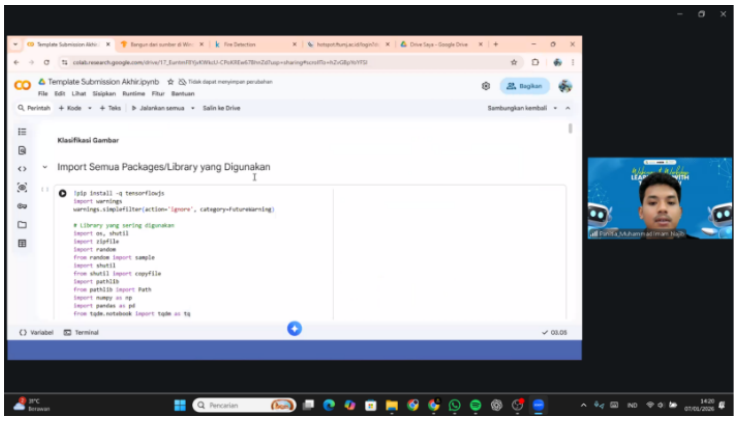

Figure 6. Workshop Material Presentation

SOCIETY: Jurnal Pengabdian Masyarakat,
Vol. 5, No. 2 (2026): Maret, pp. 250-263
E-ISSN:2827-878X (Online -Elektronik)

Stage 6 – Feedback and Post-Test Completion by Participants

At the end of the activity, participants are directed to fill out an attendance sheet, feedback questionnaire, and post-test distributed via Google Form. The purpose of this is to document participant attendance and evaluate their understanding after participating in the entire series of webinar and workshop activities. In collecting feedback, a linear scale is used as a tool to measure the level of participants assessment of the implementation of the activity. The scale used is adjusted to be easily understood and filled out by participants. This questionnaire applies a five-point rating scale, with the following criteria: (5) Very Satisfied, (4) Satisfied, (3) Fair, (2) Dissatisfied, (1) Very Dissatisfied. The questions asked in the feedback questionnaire are as follows:

1. How clear and easy to understand was the material presented to participants?
2. To what extent was the material presented relevant to the theme of the webinar and workshop?
3. How well did the speakers demonstrate their mastery of the material?
4. How good was the interaction between the speakers and participants during the event?
5. In your opinion, how well organized was the webinar and workshop?
6. To what extent did this activity increase your insight and knowledge?
7. How did the facilitator assist participants during the activity?
8. How comfortable and accessible was the online platform used in this activity?
9. How satisfied were you overall with the implementation of this event?
10. Would you be willing to participate in a similar event in the future?
11. Suggestions or criticism.

Based on the questionnaire results, it can be seen that most participants gave positive assessments of the material delivery, in terms of clarity, relevance to the theme, and interaction during the activity. In general, the answers provided by participants fell into the categories of satisfied to very satisfied, indicating that the material and implementation of the activity met participants' expectations. This can be seen from the graph presented in the image below, which illustrates participants' assessments of the material presented during the activity.

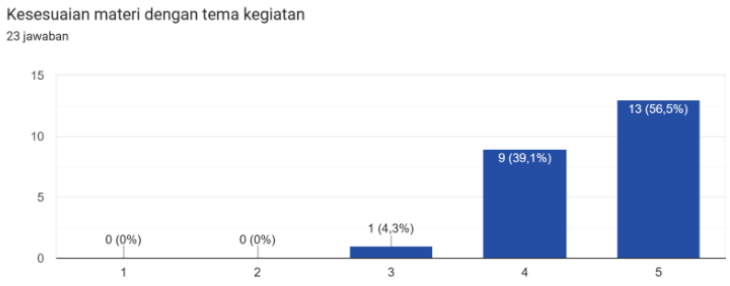

Figure 7. Level of Material Relevance

Based on Figure 7, it can be seen that the participants' feedback regarding the relevance of the material to the theme of the activity shows a very positive assessment. A total of 13 participants (56.5%) gave a rating of very satisfied, while 9 participants (39.1%) stated that they were satisfied.

SOCIETY: Jurnal Pengabdian Masyarakat,
Vol. 5, No. 2 (2026): Maret, pp. 250-263
E-ISSN:2827-878X (Online -Elektronik)

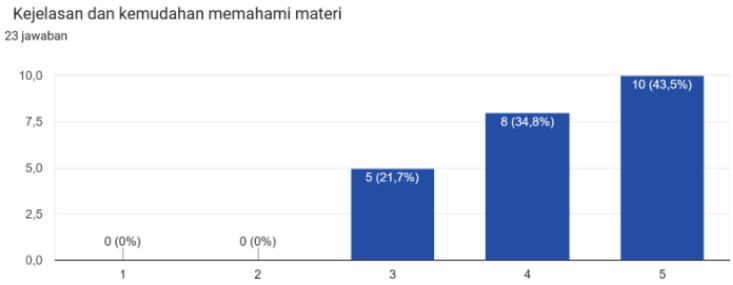

Figure 8. Level of Clarity in Understanding the Material

Based on Figure 8, it can be seen that the participants' feedback regarding the clarity of understanding the material shows positive results. A total of 10 participants (43.5%) gave a rating of very satisfied, 8 participants (34.8%) stated they were satisfied, while 5 participants (21.7%) stated they were fairly satisfied.

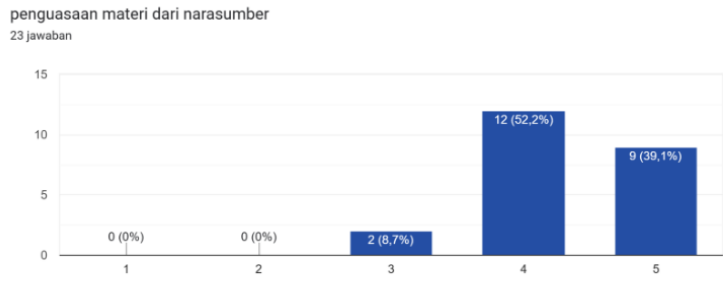

Figure 9. Level of Mastery of Material by Resource Persons

Based on Figure 9, it can be seen that the participants' feedback regarding the resource persons' mastery of the material shows positive assessments. A total of 9 participants (39.1%) gave a rating of very satisfied, 12 participants (52.2%) stated that they were satisfied, while 2 participants (8.7%) stated that they were fairly satisfied.

Based on the questions asked to the participants and their responses to the questionnaire, it appears that the participants gained an understanding of the new material in line with the theme of the activity. The participants responses indicating satisfaction with the material presented show that the presentation of the material by the speaker was quite good and easy to understand, enabling them to learn and comprehend new knowledge. In other words, the activity was successfully implemented and the material was well understood by the participants. The positive responses indicate that the delivery of the material and the interaction between the speakers and participants were effective in supporting the learning process. Similar findings were reported by Hakimi et al. (2024), who emphasized that interactive technology-based learning activities can significantly improve participant engagement and understanding of artificial intelligence-related topics.

SOCIETY: Jurnal Pengabdian Masyarakat,
Vol. 5, No. 2 (2026): Maret, pp. 250-263
E-ISSN:2827-878X (Online -Elektronik)

In addition to the feedback questionnaire, participants were also asked to complete a post-test to measure their level of understanding after participating in the activity. Of the total number of participants present, 33 respondents participated with very satisfactory results.

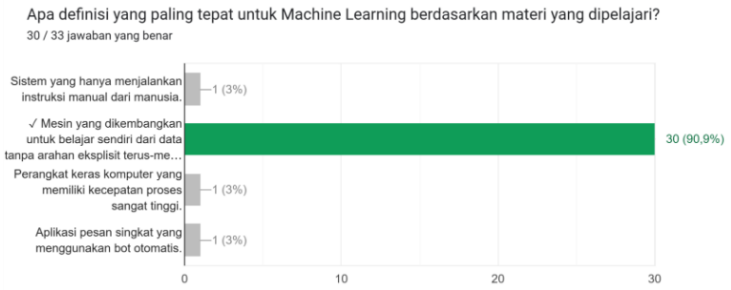

Figure 10. Post-Test Definition of ML

Based on Figure 10, the results of the Post-Test on questions regarding the definition of Machine Learning can be seen. A total of 30 participants (90.9%) were able to answer the questions correctly.

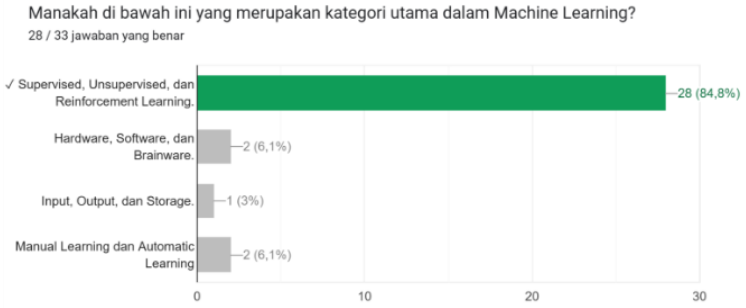

Figure 11. ML Main Category Post-Test

Based on Figure 11, the results of the Post-Test on questions regarding the main categories of Machine Learning can be seen. A total of 28 participants (84.8%) were able to answer the questions correctly.

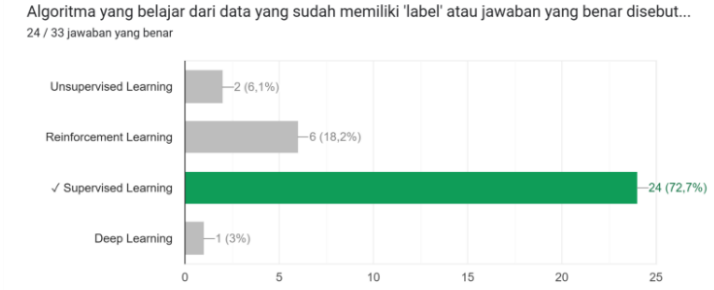

Figure 12. ML Algorithm Post-Test

Based on Figure 12, the results of the Post-Test on questions about Machine Learning Algorithms can be seen. A total of 24 participants (72.7%) were able to answer the questions correctly.

In general, the Post-Test results show an increase in the number of correct answers on several questions, even though the number of respondents was slightly lower than in the Pre-Test. This increase indicates that the participants' understanding of the material improved after participating in the webinar and workshop sessions. The practical training provided during the workshop helped participants better understand the process of developing machine learning models using TensorFlow. This finding supports previous research conducted by Santoso et al. (2025), which demonstrated that hands-on learning using TensorFlow can effectively enhance participants' understanding of machine learning concepts through practical implementation. After all activities were completed, the webinar and workshop participants received participation certificates officially signed by the Head of the Informatics Engineering Study Program at Muhammadiyah University Jakarta.

D. CONCLUSION

Based on the results of the community service activities that have been carried out, it can be concluded that the webinar and workshop programs related to Artificial Intelligence and Machine Learning using TensorFlow ran well and in accordance with the objectives that had been set. The entire series of activities was able to provide participants with conceptual understanding as well as practical experience regarding the basics of AI, Machine Learning, and the stages of developing a simple machine learning model.

The results of the evaluation through pre-tests and post-tests showed an increase in participants' understanding of the material presented. The increase in the number of correct answers on the post-test indicated that participants were able to absorb the material better after attending all sessions of the activity. In addition, the results of the feedback questionnaire showed a high level of participant satisfaction with the clarity of the material, the expertise of the speakers, and the delivery methods used during the activity.

Overall, this activity had a positive impact on improving technological literacy, particularly in the fields of Artificial Intelligence and Machine Learning. The program also served as an effective means of bridging the gap between theoretical understanding and practical application of TensorFlow as a machine learning model development framework. In the future, similar activities are expected to be developed with more advanced material and a wider range of participants in order to optimize the benefits.

E. ACKNOWLEDGEMENTS

The organizing committee extends its deepest gratitude to the Computer Science Program, Faculty of Engineering, Muhammadiyah University of Jakarta, and the MSIB Coordinator for the support, facilitation, and funding provided. This support played a significant role in ensuring the smooth planning, implementation, and evaluation of this community service activity, allowing it to be carried out successfully in accordance with its intended objectives.

F. AUTHOR CONTRIBUTIONS

During the event, all team members played an active role in accordance with their respective duties and responsibilities. Kevin Arya Dandi served as a resource person for the webinar session and delivered the main material to the participants. Muhammad Imam Najib served as a presenter for the workshop session, providing guidance and hands-on practice in accordance with the material that had been delivered previously. Hafizh Umar Haq was responsible for creating publication media in the form of posters, assisting in the report writing process, and documenting activities during the implementation. Miftahul Jannah was involved in creating participant certificates, designing activity flyers, and writing journals. Anggi Rahmadillah was involved in compiling evaluations in the form of pre-tests, post-tests, and feedback questionnaires, as well as the journal writing process. Jumail, B.Sc., M.Sc. served as the supervisor, providing guidance, input, and academic supervision from the planning stage to the final evaluation of the activity. The contributions and collaboration of all parties were crucial factors in ensuring the smooth implementation of the activity and the successful preparation of the report and journal.

G. REFERENCES

Budiono, H. (2025). *Science and Social Learning Tools based on Artificial Intelligence (AI) in growing Elementary Schools ' Digital Literacy*. *9*(1), 147–157.

Hakimi, M., Zarinkhail, M. S., Ghafory, H., & Hamidi, S. A. (2024). *Revolutionizing Technology Education with Artificial Intelligence and Machine Learning : A Comprehensive Systematic Literature Review*. *5*(2), 94–110.

Jurnal, S., Ilmu, R., Budaya, B., Nadya, R., Amalia, I., & Rachman, I. F. (2025). *Analisis Potensi dan Tantangan dalam Penggunaan AI di Bidang Pendidikan Universitas Siliwangi , Indonesia*. *3*.

Maret, N., Nugroho, G. D., Santoso, I. B., Aji, I. P., & Franskusuma, S. (2025). *SOCIETY : Jurnal Pengabdian Masyarakat , Educating on the Application of Tensorflow in Artificial Intelligence , Machine Learning and Deep Learning SOCIETY : Jurnal Pengabdian Masyarakat ,*. *4*(2), 301–317.

Medan, U. N., Nahdlatul, U., Sumatera, U., Sihaloho, F. A. S., & Napitupulu, Z. (2024). *Penggunaan Kecerdasan Buatan (Artificial Intelligence) Dalam Dunia Pendidikan Di Indonesia : Tinjauan Literatur*. *9*(1), 13–20.

Muslim, U., Medan, N. A., Education, C., Application, D. R., Education, C., & Application, D. R. (N.D.). *Implementasi Teknologi Artificial Intelegence Dalam*. 72–79.

Nurfita, R. D., Ariyanto, G., Learning, D., Network, C. N., & Pendahuluan, I. (2004). *Implementasi Deep Learning Berbasis Tensorflow*.

Oktavianus, A. J. E., Naibaho, L., & Rantung, D. A. (2023). *Pemanfaatan Artificial Intelligence Pada Pembelajaran Dan Asesmen Di Era Digitalisasi*. *05*(2), 473–486.

Rakuasa, H., Faris, D. A., & Hidayatullah, M. (2024). *Transforming Education In The Age Of Artificial Intelligence : Challenges And Opportunities In Indonesia , A Literature Review*. *Knox 2020*, 180–186.

Wiranda, N., Purba, H. S., & Sukmawati, R. A. (2020). *Survei Penggunaan Tensorflow Pada Machine Learning Untuk Identifikasi Ikan Kawasan Lahan Basah*. *10*(2).

Zhang, H., Chen, Y., & Zhuo, H. (2023). Unit middleware for implementation of human – machine interconnection intelligent ecology construction. *Journal of Big Data*. https://doi.org/10.1186/s40537-023-00787-4

(Rakuasa et al., 2024)(Medan et al., 2024)(Maret et al., 2025)(Muslim et al., n.d.)(Budiono, 2025)(Wiranda et al., 2020)(Nurfita et al., 2004)(Hakimi et al., 2024)(Zhang et al., 2023)(Jurnal et al., 2025)(Oktavianus et al., 2023)