

Digitalization of Instructional Materials; Guidance on Creating E-LKPDs Using AI Technology to Support the Implementation of Deep Learning in Secondary Schools

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Abstract: The Indonesian government continues to update the Merdeka Curriculum to create an education system that is responsive and relevant to the times, by adopting a deep learning approach supported by Artificial Intelligence (AI). However, this implementation faces challenges such as infrastructure limitations, teacher competence, a lack of digital literacy, and the digital divide in remote areas. This community service program aims to equip educators at TNS Christian High School and Taniwel State Junior High School No. 8 with technical AI skills to produce E-LKPDs to support the implementation of deep learning in schools. Activities are carried out through training, mentoring, and direct practice in applying AI to the creation of deep learning-based E-LKPD teaching materials. The workshop topics included: 1) Deep learning; 2) AI-based platforms (Diffit AI and TeachShare) to assist teachers in creating worksheets; 3) AI-based platforms (Wizer and TopWorksheets) to assist in creating digital worksheets; and 4) the use of the Teachy LMS application. After presenting the material, the team shared the response instruments completed by teachers regarding the workshop/training delivered at the partner schools (TNS Christian High School and Taniwel State Junior High School No. 8); the results indicated a positive response, as shown in the results of the questionnaire on teachers' implementation of PKM at the partner schools, where over 66% strongly agreed; and in the questionnaire on perceptions and difficulties in creating e-worksheets for in-depth learning, whilst some teachers were already able to integrate AI, a few were not yet able to design worksheets that looked engaging.

Keywords: Artificial Intelligence, Teacher Training, Deep Learning.

Introduction

As technology advances, the conventional role of the teacher as the primary source of information is shifting to becoming a learning facilitator capable of utilizing digital tools strategically to create a more adaptive learning experience (Anggraini et al, 2025). The implementation of artificial intelligence (AI) technology offers great potential for delivering tailored and efficient learning experiences; however, its effectiveness in enriching instructional practice depends heavily on the precise alignment of digital tools with pedagogical principles (Efendi et al, 2025). Meanwhile, education

with substantial meaning originates from the implementation of deep learning, which focuses on conceptual mastery, cross-curricular integration, and the development of higher-order cognitive skills through critical and reflective thinking (Fullan et al; Quinn et al; Wibowo et al, 2025). Furthermore, the relevance of teachers' digital literacy today is determined by their ability to integrate AI into deep learning approaches. Mastery of digital tools alone is considered insufficient without a deep understanding of the mechanisms by which technology constructs conceptual understanding and meaningful learning experiences for learners (Bauer et al, 2025). In the context of Indonesia, a number of

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studies and reports indicate a gap between policies on the adoption of educational technology and the readiness of infrastructure and teachers' competences; consequently, the adoption of AI remains sporadic and has not yet been able to drive a comprehensive transformation of learning (Rahma et al, 2025).

Based on the initial needs analysis at TNS Christian High School and Taniwel State Junior High School No. 8, several issues were identified at the partner schools which formed the primary rationale for conducting this community service programme. Firstly, levels of digital literacy at the partner schools varied, and in many subjects, teachers had not yet demonstrated the ability to integrate AI-based tools to support meaningful learning (initial survey and partner interviews, 2026). Secondly, although some teachers have been using basic digital platforms for administration and teaching materials, pedagogical understanding of deep learning and how to design digital worksheets (E-LKPD), which require in-depth understanding and critical thinking, was found to be low; consequently, technology often serves merely as a substitute rather than enriching the learning process. Thirdly, infrastructure limitations (connectivity and devices), as well as ethical and data security concerns, act as barriers to the consistency of AI solution implementation in day-to-day learning practices at partner schools. Fourthly, collaborative practices and teacher learning communities focused on developing TPACK (Technological, Pedagogical, and Content Knowledge), particularly for the use of AI in designing teaching materials that support deep learning, have yet to be established.

Several previous studies have examined the application of AI in education. The findings of earlier research include the following: Firstly, they demonstrate that AI can enhance the effectiveness of online learning by providing more accurate analysis of learning data (Zawacki et al, 2019). Secondly, AI-based technology can help pupils grasp subject materials more effectively (Chen et al, 2020). Thirdly, the use of AI-based systems can boost students' motivation to learn through tailored automated feedback (Lu et al, 2021). Among the relevant studies analysed, including those on teachers' readiness for AI, only a few authors have currently examined the use of AI within a deep learning framework that emphasises pedagogical transformation. Therefore, there is a methodological need for community service activities that not only provide technical training but also design teaching materials (E-LKPD) capable of capturing the dimensions of deep learning and the impact of AI on teachers' pedagogical practices in a valid and reliable manner.

Based on the issues above, the team decided to adopt the title: "Digitisation of Teaching Materials:

Guidance on the Creation of E-LKPD Using AI Technologies (Diffit, TeachShare, Wizer, & TopWorksheets) to Support the Implementation of the Deep Learning Approach in Secondary Schools". The primary objective of this community service activity is to equip teachers at TNS Christian Senior High School and Taniwel State Junior High School No. 8 with technical AI skills to produce E-LKPDs that can support the implementation of deep learning in schools. The expected benefits are that teachers will be able to utilise AI technology to create teaching materials (E-LKPD) that support deep learning, thereby making the learning process more conscious, meaningful and enjoyable; improving the quality of E-LKPD; and fostering a school ecosystem that supports digital innovation and the sustainability of new learning practices.

Method

Community service activities are carried out based on the results of a situational analysis, the issues identified at the partner organization, and the solutions agreed upon by the Community Service (PKM) implementation team and the partner. The stages of implementing these community service activities can be summarized as follows:

1. Socialization
 - a. Started with presenting the purposes of the Community Service Programme (PkM) and the benefits of the activities to teachers at TNS Christian Senior High School and Taniwel State Junior High School No. 8.
 - b. Provided materials on Deep Learning, AI-based platforms (Diffit AI and TeachShare) to assist teachers in creating worksheets, AI-based platforms (Wizer and TopWorkSheets) to assist in creating digital worksheets, and the use of the Teachy LMS application.
2. Training
 - a. Provided teachers with the opportunity to create Deep Learning-based digital worksheets.
 - b. Assistance for teachers in creating Deep Learning-based E-LKPDs. The team will split into small groups to observe and assist with the creation of E-LKPDs.
3. Technology Implementation

The team worked to develop teachers' proficiency in the use of technology; therefore, in addition to delivering the course content, the team also worked in small groups to stimulate further understanding of AI technology.
4. Mentoring and Evaluation

Provided teachers with response instruments regarding the workshops and training delivered so that the team could gauge teachers' feedback on the

workshops and use this as evaluation material for future Community Service (PkM) programmes.

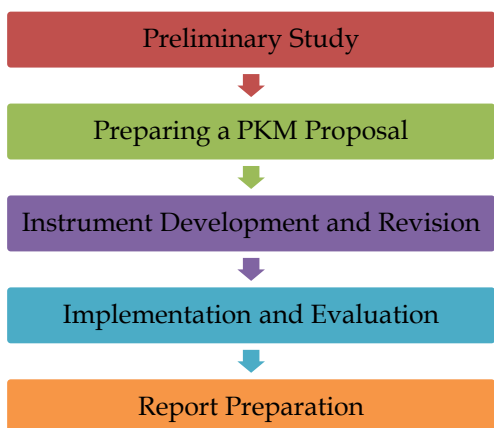


Figure 1. Community Service Program Workflow

Result and Discussion

The Community Service (PkM) activities began in January 2026 with a preliminary study and coordination facilitated by a teacher from TNS Christian High School and Taniwel Public Junior High School No. 8. During the preliminary study phase, the team identified the challenges faced by the partner institutions, which ultimately led to focusing the activities on deep learning and the development of digital worksheets (E-LKPD) using AI technology. The next steps involved drafting a proposal and obtaining activity permission from SMAS Kristen TNS and SMP Negeri 8 Taniwel, which were submitted to the school principal. The activities were then scheduled by the principal at SMAS Kristen TNS for Tuesday and Wednesday, July 14 and 15, 2026, at 9:00 a.m. WIT, while at SMP Negeri 8 Taniwel, the activities were scheduled by the principal for Thursday and Friday, July 16 and 17, 2026, at 9:00 a.m. WIT. Further steps included the development of instruments and materials, as well as the assignment of tasks to each team member.

The developed instrument consisted of a questionnaire gauging teachers' responses to the Community Service Program (PkM). The materials covered included: (1) Deep learning, (2) AI-based platforms (Diffit AI and TeachShare) which can assist teachers in creating worksheets, (3) AI-based platforms (Wizer and TopWorksheets) which can assist in creating digital worksheets, and (4) the use of the Teachy LMS application. These four topics were presented by lecturers from the Physics Education Program at Pattimura University in Ambon. This community service activity was opened by the principal of TNS Christian High School on July 14 and by the principal of Taniwel Public Junior High School No. 8 on July 16. The

sessions were then led by moderators, who were teaching assistants from the Physics Education Program at Pattimura University. Documentation of the activities is shown in Figures 2 and 3 below.



Figure 2. (a) Group Photo with the Principal of TNS Christian High School and the Teachers, (b) Training on Creating E-LPKD: In-Depth Learning Using AI Technology.



Figure 3. (a) Group Photo with the Principal of SMPN 8 Taniwel and the Teachers, (b) Training on Creating E-LPKD: In-Depth Learning Using AI Technology.

The principal and teachers at the partner schools were fully supportive of this community service activity, as shown by the principal's welcoming remarks, the teachers' appreciation for participating in the activity, and the results of the teacher response questionnaire regarding the community service initiative. The main points of the material presented to both partner schools included:

1. The first topic was deep learning (First Session).
The first speaker provided an introduction and presented material on the nature of deep learning, including its definition, benefits, objectives, characteristics, types, and examples, as well as its application in the deep learning lesson plan (RPM) and assessment.
2. The second session covered AI-based platforms (Diffit AI and TeachShare) which can assist teachers in creating worksheets.
The second speaker presented and guided the teachers on how to use Diffit AI and TeachShare to assist them in creating digital worksheets (E-LKPD). Diffit AI can convert any content or text into reading material adjusted to students' reading levels, while TeachShare integrates the creation of lesson plans

(RPM), worksheets (LKPD), presentations, and concept-based assessments.

After the first and second presentations, a question-and-answer session (discussion) was held for approximately 30 minutes.

1. The third topic was AI-based platforms (Wizer and TopWorksheets) which can assist in creating digital worksheets (second session). The second speaker guided the teachers on how to use the Wizer and TopWorksheets platforms; on the Wizer platform, teachers can provide immediate feedback, and students can submit answers in the form of audio recordings, resulting in modern, interactive digital worksheets. The TopWorksheets platform can quickly support various file formats and provides a wide selection of interactive question types.
2. The fourth topic was the use of the Teachy LMS application (second session). The second speaker guided the teachers on how to use the Teachy application, which can help them with automated content creation, question banks and assessments, interactive activities, and classroom management.

Following this, a survey was shared with teachers regarding their feedback on the Community Service Program (PKM) activities at both partner schools. The first partner school was SMAS Kristen TNS, with 16 participants, while the second partner school was SMP Negeri 8 Taniwel, with 20 participants. The questionnaire consists of: 1) the implementation of community service activities related to the digitization of teaching materials to support a deep learning approach, and 2) teachers' perceptions and difficulties in creating e-LKPDs for deep learning.

1. Survey on the Implementation of the PKM Program Regarding the Digitization of Teaching Materials to Support a Deep Learning Approach.

The results of the teacher response survey regarding the implementation of PKM at TNS Christian High School are presented in Figure 4, and the results of the teacher response survey at Taniwel Public Junior High School No. 8 are presented in Figure 5 below.

In general, the implementation of this program is designed to address the main challenges faced by partner schools, such as teachers' limited ability to integrate digital technology and AI into the creation of in-depth E-LKPDs. Based on the results of observations and interviews, most teachers still view the use of technology merely as a presentation tool or administrative aid, rather than as a resource capable of deepening students' learning processes. These findings indicate that teachers already have experience using basic technologies such as PowerPoint, Microsoft Word, Canva, and

educational social media; however, they have not yet fully leveraged digital technology to support creative and collaborative learning processes. This community service program successfully addressed this situation through a series of "learning by doing"-based training and mentoring sessions that emphasized the concept of deep learning.

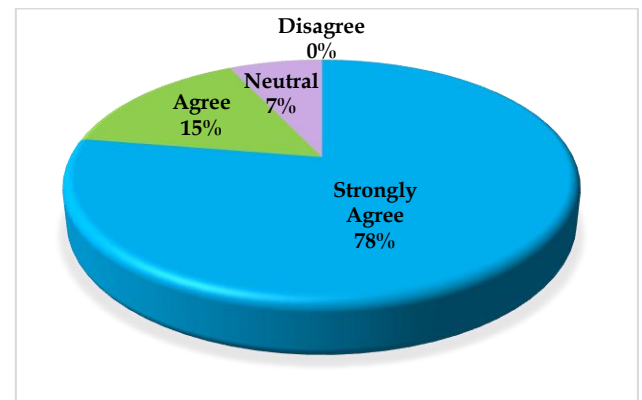


Figure 4. Survey Results on the Implementation of PKM at TNS Christian High School.

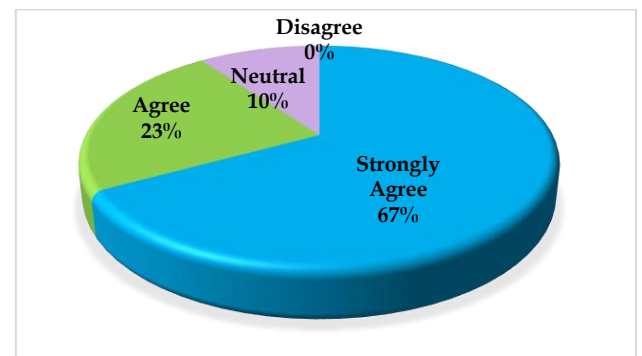


Figure 5. Survey Results on the Implementation of PKM at SMP Negeri 8 Taniwel.

Based on Figures 4 and 5, it was found that teachers at partner schools responded positively to the PKM; this is evident in the results of the PKM implementation at partner schools, where over 66% strongly agreed, over 14% answered "agree," and over 6% answered "somewhat agree." Thus, overall, the implementation of the community service program had a positive impact in the form of an enhanced understanding of deep learning and the integration of digital technology and AI for the creation of E-LKPDs. This occurred as the community service team analyzed the needs of the partner schools prior to implementation, ensuring that the program provided new insights aligned with contemporary developments and curriculum requirements. In addition, the material was presented in an engaging manner using technology to make it easy to understand, and teachers were given the

opportunity to exchange ideas (through group discussions), making the training feel comfortable and interactive. When the training is comfortable and interactive, teachers at partner schools can immediately grasp the concepts and gradually apply them to create E-LKPDs using AI technology (Diffit, TeachShare, Wizer, and TopWorksheets) to support the implementation of the deep learning approach at partner schools.

AI could help students explore subject materials or knowledge and is also capable of visualizing information (Hwang et al., 2020; Maritsa et al., 2021). AI has tremendous potential to enhance student-centered learning (Stefanova & Georgiev, 2024). Thus, the use of AI in education increases not only the effectiveness of learning but also broadens the scope and depth of students' understanding of the subject (Sopani Ahmad, 2024; Rebolledo Font de la Vall & González Araya, 2023), making teachers' roles crucial in delivering more meaningful and effective instruction.

In the context of the teacher's role, deep learning requires teachers to act as designers of HOTS-oriented learning (Kosasih et al., 2022). Teachers' understanding of HOTS influences the quality of instructional materials and assessments that emphasize the processes of analysis and reflection (Nurmawati et al., 2021), while professional development significantly contributes to the effectiveness of active and reflective learning (Rulyansah et al., 2022). The impact of deep learning is reflected in the improvement of conceptual understanding (Jaakkola & Veermans, 2015), critical thinking skills (Nurlailah & Hamdu, 2021), learning motivation, as well as technology-based worksheets and formative assessments (Rini et al., 2023).

2. Teachers' Perceptions and Challenges in Developing E-Worksheets for Deep Learning

The statements in the questionnaire were positive rather than negative. The results of the questionnaire regarding teachers' perceptions and challenges in developing E-worksheets for deep learning at TNS Christian High School are presented in Figure 6, and the results of the questionnaire regarding teachers' responses at Taniwel Public Junior High School No. 8 are presented in Figure 7 below.

Based on Figures 6 and 7, the results of the questionnaire on Teachers' Perceptions and Difficulties in Developing E-LKPDs for Deep Learning, based on indicators at partner schools, include: 1) Understanding of the concept of deep learning, with a percentage greater than 74%; 2) Formulation of learning objectives and indicators, with a percentage greater than 76%; 3) Development

of worksheet content, with a percentage greater than 54%; 4) Assessment of deep learning, with a percentage greater than 59%; 5) Support and resources, with a percentage greater than 65%; 6) The appeal of the worksheets, with a percentage greater than 44%; and 7) The use of AI in creating e-worksheets, with a percentage greater than 50%.

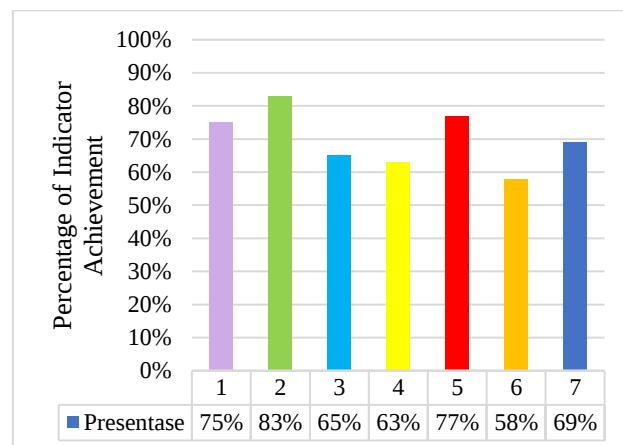


Figure 6. Results of a Survey on Teachers' Perceptions and Challenges in Developing E-LKPDs for In-Depth Learning at TNS Christian High School.

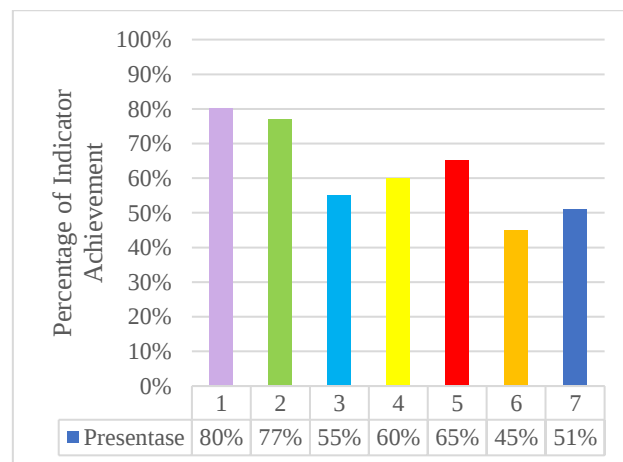


Figure 7. Results of a Survey on Teachers' Perceptions and Challenges in Developing E-LKPDs for In-Depth Learning at Taniwel Public Junior High School No. 8.

The indicator perceived as the most difficult to develop is the appeal of the worksheets, considering that only a limited number of teachers can design them, let alone technology-based (AI) ones, even though triggering student motivation and interest during the learning process depends on worksheet designs that are not monotonous. The use of technology-based media can help students understand the material more easily; in addition, students also feel more engaged and enjoy learning (Alfi et al., 2022). Furthermore, valid learning media can clarify messages and information thereby increasing interest as well as material comprehension.

The results of this indicator align with the seventh indicator, which is the use of AI in the creation of e-worksheets. AI significantly helps teachers in creating content and designing worksheets; however, teachers must be proficient in using technology to effectively integrate AI into the creation of engaging e-worksheets that foster higher-order thinking skills. The integration of AI into the learning experience supports the creation of a more meaningful, context-appropriate, and engaging learning process, which ultimately has a positive impact on educational outcomes and student participation (Ramadan et al., 2025).

Conclusion

The conclusions and recommendations that can be drawn and offered are as follows: The community service program focused on providing guidance in the development of E-LKPDs using AI technology to support the implementation of the deep learning approach at partner schools (SMAS Kristen TNS and SMP Negeri 8 Taniwel) received a positive response; as evidenced by the results of the questionnaire on teachers' responses to the PKM implementation at the partner schools, where over 66% strongly agreed, and by the questionnaire on perceptions and difficulties in creating E-LKPDs for deep learning—while some teachers were already able to integrate AI, others were not yet able to design LKPDs that were visually engaging.

A recommendation given was that it would be beneficial for lecturers to develop specialized training on how teachers can design worksheets using AI, as well as more in-depth training on computer use..

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