



Deep Learning Based Adaptive Strategy Assistance in Supporting Learning Quality at Muhammadiyah University of Palembang

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History Article	Abstract
Received: 5 March 2026 Revised: 28 March 2026 Accepted: 29 April 2026	The development of educational technology requires universities to adopt an adaptive and student-centered learning approach. However, the implementation of a deep learning approach in the learning process still faces various obstacles, such as limited lecturer understanding, a lack of implementation strategies, and suboptimal technology integration in teaching and learning activities. This community service activity aims to improve lecturers' competency in designing and implementing deep learning-based adaptive strategies to support the quality of learning at Muhammadiyah University of Palembang. The methods used include socialization, training, intensive mentoring, and evaluation. The training focused on understanding the concept of deep learning, designing adaptive learning, and utilizing supporting technology. Next, mentoring was provided in the development of learning tools and their implementation in the classroom. Evaluation was carried out through observation, questionnaires, and analysis of learning quality improvements. The results of the activity showed an increase in lecturers' understanding and skills in developing deep learning-based learning strategies. In addition, there was an increase in active student participation, critical thinking skills, and the quality of learning interactions. Lecturers were also able to integrate technology more effectively into the learning process. The conclusion of this activity is that mentoring with deep learning-based adaptive strategies is effective in improving the quality of learning in higher education. This program is recommended to be implemented sustainably with the support of institutional policies to achieve more optimal improvements in the quality of education.
Keyword Mentoring, Adaptive Strategy, Deep Learning, Learning Quality;	

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INTRODUCTION

Higher education institutions play a strategic role in producing superior, adaptive, and competitive human resources in the global era. Improving academic quality remains a major challenge for higher education institutions in the face of globalization. Therefore, consistent and ongoing efforts are needed to improve the quality of higher education to meet job market needs and keep pace with the ever-changing developments in science (Bambang Yulianto, Anas Ahmadi, Harmanto Harmanto, Binar Kurnia Prahani, Hasan Subekti, Sueb Sueb, Fajar Arianto, Wasilatul Murtafiah, 2025). Muhammadiyah University of Palembang, as one of the higher education institutions in Indonesia, continues to strive to improve the quality of learning through innovative learning strategies. From a constructivist perspective, effective learning emphasizes the active involvement of students in constructing knowledge independently through meaningful learning experiences. In line with this, the development of digital technology is driving the transformation of learning towards a more adaptive and technology-based approach. Recent research shows

that deep learning can be a transformational approach relevant to the demands of 21st-century competencies, especially in increasing in-depth understanding and meaningfulness of learning. Deep learning has been successfully implemented in various learning contexts, demonstrating significant improvements in the quality of student understanding and engagement. Through this approach, students are not only able to retain information but also able to analyze, evaluate, and apply knowledge in real-life situations (Hendrik A E Lao, Umar Ali, Anita A Hege Udju, 2025).

The object of this community service is the lecturers and the learning process at Muhammadiyah University of Palembang. Based on the situation analysis, conventional learning methods are still dominant, pedagogical innovation is limited, and technology utilization in learning is not optimal. In modern learning theory, this condition indicates a gap between learning practices and the needs of 21st-century learning that demands critical, creative, and collaborative thinking skills. Research shows that a deep learning approach can increase student engagement and encourage pedagogical transformation towards more interactive and meaningful learning. Therefore, an intervention strategy is needed that is not only training, but also continuous mentoring.

Field conditions indicate that some lecturers have utilized technology such as Learning Management Systems (LMS), but their use is still limited to distributing materials and assignments. Learning interactions that are reflective, analytical, and problem-solving based are still suboptimal. From the perspective of adaptive learning theory, learning should be able to adapt to students' needs, characteristics, and abilities. Research reveals that deep learning technology can support adaptive learning through personalized learning, student needs analysis, and data-driven automated evaluation systems. Deep learning refers not only to in-depth cognitive processes but also to the development of strong conceptual understanding, the ability to connect concepts across subjects, and problem-solving in real-world contexts (Dini Ramadhani, Hanif Harahap, Muhammad Febri Rafli, Ary Kiswanto Kenedi, Tengku Muhammad Sahudra, Asna Mardin, Yuna Yuliyanti, 2025). This shows that proper technology integration can be a solution to improving the quality of learning in higher education.

The deep learning approach in education is not only interpreted as artificial intelligence technology, but also as a pedagogical approach that emphasizes deep conceptual understanding, active engagement, and the application of knowledge in real contexts. Deep Learning is learning that emphasizes in-depth understanding and mastery of comprehensive competencies in a subject matter, with a framework: Pedagogical Practices, Learning Partnerships, Learning Environments, Leveraging Digital (Use of technology to enrich the learning experience) (Rahmad Bustanul Anwar, Dwi Rahmawati, Mustika Mustika, Maulfi Alvansuri, Suci Kumala Dewi, Muhammad Rafly, 2026). In theory, this approach is rooted in constructivism and meaningful learning, which emphasize the importance of relevant and contextual learning experiences. Recent research shows that deep learning can improve students' critical thinking, creativity, and problem-solving skills through more personalized and interactive learning. Furthermore, this approach also supports the development of adaptive learning, which can tailor the learning process to students' individual needs.

Research studies over the past five years have shown that deep learning is a key trend in educational innovation. The result of this Community Service Program (PKM) is the implementation of Community Service, which provides training and understanding to teachers on the importance of implementing a deep learning approach in the Merdeka curriculum (Hendrik A E Lao, Umar Ali, Anita A Hege Udju, 2025). The results of the activity showed an increase in teachers' knowledge of digital literacy in deep learning, skills in producing and using digital learning resources. Furthermore, mentoring helped teachers gain confidence in applying digital technology creatively and productively (Rahmad Bustanul Anwar, Dwi Rahmawati, Mustika Mustika, Maulfi Alvansuri, Suci Kumala Dewi, Muhammad Rafly, 2026). The results show an average increase in teacher competency of 69.5%, especially in designing thematic lesson plans that integrate STEAM elements and higher-order thinking (Dini Ramadhani, Hanif Harahap, Muhammad Febri Rafli, Ary Kiswanto Kenedi, Tengku Muhammad Sahudra, Asna Mardin, Yuna Yuliyanti, 2025). Literature studies have shown that this approach significantly improves the quality of learning through technology integration, increased student engagement, and enhanced 21st-century competencies. Other research also confirms that implementing deep learning can enhance learning motivation, critical thinking skills, and the quality of learning interactions.

The novelty of this community service activity lies in its comprehensive and sustainable approach to mentoring adaptive strategies based on deep learning. Unlike previous activities, which tended to focus on one-way training, this community service program emphasizes direct mentoring in designing, implementing, and evaluating deep learning-based learning. Furthermore, this community service program

simultaneously integrates pedagogical and technological aspects, resulting in a contextual and applicable adaptive learning model. This approach is expected to significantly contribute to improving the quality of learning at Muhammadiyah University of Palembang and can be replicated at other universities.

METHOD

This community service activity uses a participatory and mentoring-based approach, emphasizing the active involvement of participants in every stage of the activity. This approach aligns with Knowles' andragogy theory, which emphasizes that adults learn effectively through direct experience, reflection, and active involvement in the learning process. In this context, lecturers as participants not only receive material but also engage in hands-on practice implementing deep learning-based adaptive strategies. Research over the past five years has shown that a participatory approach to lecturer training can significantly increase the effectiveness of knowledge and skills transfer (Ambarita et al., 2025).

The first stage is a needs assessment, which aims to identify the initial conditions, challenges, and needs of lecturers in implementing deep learning-based instruction. This activity is conducted through observation, interviews, and questionnaires. This stage refers to the ADDIE (Analysis, Design, Development, Implementation, Evaluation) instructional design model theory, which emphasizes the importance of needs analysis as a foundation for designing effective learning programs. Recent studies have shown that systematic needs analysis can increase the relevance and success of technology-based training programs in higher education (Hastuti et al., 2024).

The second stage is program design, which includes the development of training modules, learning tools, and implementation scenarios for deep learning-based adaptive strategies. This design is based on constructivist theory, which emphasizes the importance of learner-centered and experience-based learning. In this stage, the material focuses on the concepts of deep learning, adaptive learning, and technology integration in learning. Research shows that technology-supported, constructivist-based learning design can significantly increase participant engagement and understanding (Akmal et al., 2025).

The third stage is implementation through workshops and practical sessions. These activities involve material delivery, interactive discussions, case studies, and hands-on practice in designing deep learning-based instruction. This approach draws on Kolb's experiential learning theory, which emphasizes that effective learning occurs through a cycle of concrete experience, reflection, conceptualization, and active experimentation. Recent research shows that hands-on training is more effective in improving lecturers' competency in integrating learning technology (Syukur et al., 2024).

The fourth stage is intensive and ongoing mentoring. At this stage, lecturers are assisted in developing learning tools, implementing deep learning-based adaptive strategies in the classroom, and reflecting on the learning process. This mentoring is based on Vygotsky's scaffolding theory, which emphasizes the importance of gradual support in helping individuals achieve higher levels of competence. Research shows that ongoing mentoring can significantly increase the success of implementing learning innovations (Dewi et al., 2025).

The final stage is evaluation, which aims to measure the effectiveness of community service activities. Evaluation is conducted through observation, questionnaires, interviews, and analysis of learning implementation results. This evaluation refers to Kirkpatrick's evaluation model, which includes four components: reaction, learning, behavior, and outcomes. Evaluation results are used as a basis for further program improvement and development. Research shows that comprehensive evaluation of educational training programs can provide an accurate picture of the program's impact on improving the quality of learning (Handayani et al., 2025). With a systematic and theory-based approach, this community service activity is expected to be able to improve lecturers' competence in implementing deep learning-based adaptive strategies, thereby having an impact on improving the quality of learning at Muhammadiyah University of Palembang.

RESULTS AND DISCUSSION

RESULTS

1. Overview of Activities

This community service activity was carried out as an effort to improve the quality of learning through the implementation of adaptive strategies based on a deep learning approach. The target group is lecturers and educational staff at Muhammadiyah University of Palembang, who are expected to be able to integrate technology and deep learning approaches into the teaching and learning process. The mentoring

program is carried out through several stages: concept socialization, technical training, implementation practice, and evaluation and reflection.

2. Results of Activity Implementation

a. Improving Understanding of Deep Learning Concepts

After participating in the activity, participants experienced a significant increase in understanding regarding the concept of deep learning in the context of education. Schwartz et al. (Dini Ramadhani, Hanif Harahap, Muhammad Febri Rafli, Ary Kiswanto Kenedi, Tengku Muhammad Sahudra, Asna Mardin, Yuna Yulianti, 2025), deep learning contributes significantly to building transformative and sustainable learning in elementary schools. However, its implementation requires teachers to be prepared to design cross-disciplinary learning and manage classes dynamically. This improvement includes an understanding of learning that emphasizes in-depth mastery of concepts, not just memorization, but also encourages critical thinking and problem-solving skills. Furthermore, participants also increasingly understand the importance of technology integration in supporting adaptive learning that suits student needs. This is evidenced by the results of the pre-test and post-test, which showed a significant increase in participants' level of understanding after participating in the activity.



Figure 1. Presentation of the award certificate for the resource person to Prof. Dr. Houtman, M.Pd.

b. Ability to Design Adaptive Learning Strategies

Participants were able to develop more adaptive learning tools after participating in the mentoring activities. Deep learning, a crucial branch of artificial intelligence, enables computers to learn patterns from large amounts of data through multilevel neural network architectures, thus recognizing behavioral tendencies, emotions, and risks with a high degree of accuracy (Ellya Rakhmawati, Dini Rakhmawati, Desi Maulia, 2025). This was demonstrated through their ability to design deep learning-based Semester Learning Plans (RPS), implement active learning methods such as project-based and case-based learning, and adapt learning materials to student needs and characteristics. Most participants also successfully produced innovative and contextual learning tool designs, making them more relevant to the demands of modern learning.

c. Implementation of Technology in Learning

During the mentoring activities, participants were introduced to various digital platforms that support adaptive learning. The results of these activities indicate that lecturers are beginning to utilize Learning Management Systems (LMS) more optimally in the learning process. Alammary, (Ellya Rakhmawati, Dini Rakhmawati, Desi Maulia, 2025) emphasized that training that combines theory with hands-on practice has proven more effective in building teacher confidence and readiness to use technology in the classroom. Furthermore, the use of interactive learning media has increased, such as the use of instructional videos, digital quizzes, and online discussion forums. Furthermore, participants have begun integrating simple data analysis to understand student learning needs, enabling a more effective and targeted learning process.

d. Peningkatan Kualitas Interaksi Pembelajaran

The implementation of adaptive strategies based on deep learning has a positive impact on the learning process. Maulina, (Dina Maulina, Abdurrahman, Gamilla Nuri Utami, Ismah Fathimah, Fadil Firdian, 2026) The concept of deep learning in education leads to meaningful, in-depth learning that equips students with the skills to understand, apply, and critically analyze information. This approach emphasizes

the importance of active student involvement in the learning process and the integration of various relevant learning resources, including technology. This is evident in the increasing active participation of students in learning activities, as well as the establishment of more intense two-way interactions between lecturers and students. Furthermore, students become more involved in the process of exploring and reflecting on the material, so that learning is not only about receiving information but also encourages active involvement in understanding and developing knowledge more deeply.



Figure 2. Community service activities

e. Evaluation and Reflection

Based on the evaluation results, 83% of participants stated that the activity was highly relevant to current learning needs. Furthermore, 92% of participants felt more confident in implementing innovative learning strategies in the classroom. Furthermore, the evaluation results indicated a need for further in-depth training on technology utilization and strengthening skills in conducting data-based learning evaluations, enabling the implementation of adaptive learning to be more optimal and sustainable. Ghazali (Dina Maulina, Abdurrahman, Gamilla Nuri Utami, Ismah Fathimah, Fadil Firdian, 2026) This lack of training is an obstacle in optimizing technology for sustainable education, even though this is closely related to achieving the Sustainable Development Goals (SDGs) in the field of Quality Education.

3. Impact of Activities

This community service activity has had a significant positive impact on the learning process. One impact is a shift in the teaching paradigm from teacher-centered to student-centered. Furthermore, this activity has also improved the pedagogical competence of lecturers in designing and implementing more innovative learning. Gemici (Rahmawati, QatrunnadaWidhiaNugraha, RinaAgustina, Rini Anjani, Riska, 2024) The public's view of continuing education is crucial for achieving future goals and hopes. This view of the importance of education is a predictor that influences students' aspirations. Another impact is the creation of a more adaptive, interactive, and technology-based learning environment, thus supporting a more effective and modern learning process.

4. Obstacles Faced

During the implementation of the activity, several obstacles were encountered. These obstacles included varying levels of digital literacy among participants, which affected the speed at which they understood and implemented the material presented. Furthermore, limited time for practical implementation hindered the provision of in-depth mentoring. Furthermore, the uneven distribution of technology infrastructure also posed a challenge to supporting the smooth and optimal implementation of technology-based learning.

5. Recommendations

For the sustainability of the program, it is recommended that regular follow-up training be conducted to deepen participants' understanding and skills in implementing deep learning-based learning strategies. Furthermore, institutional support for learning innovation is needed to ensure optimal and sustainable implementation of adaptive learning. Furthermore, developing a community of practice among lecturers is crucial as a platform for sharing experiences, knowledge, and innovations to collaboratively improve the quality of learning. Lecturers are not only required to excel in on-campus learning but must also be able to share their skills with their partners, namely teachers in schools, both at the elementary and secondary levels. This is done to support the implementation of the Tri Dharma of Higher Education and prepare teachers to face the challenges of learning in the era of global technology (Idam Ragil Widiyanto Atmojo*,

Muzzazinah, Elvin Yuslana Ekawati, Rini Triastuti, Fajar Danur Isnantyo, Sukarno, 2025). Quality is an important part of the institution's strategy and is implemented systematically using a strategic planning process (Rahmawati, QatrunnadaWidhiaNugraha, RinaAgustina, Rini Anjani, Riska, 2024).

A deep learning-based adaptive strategy mentoring program at Muhammadiyah University of Palembang has successfully improved lecturers' understanding and skills in designing and implementing higher-quality learning. This program is a strategic step in supporting the transformation of higher education that adapts to technological developments and student needs.

DISCUSSION

This community service activity was carried out as an effort to improve the quality of learning through the application of adaptive strategies based on a deep learning approach. This approach is in line with Biggs and Tang's views (Ellya Rakhmawati, Dini Rakhmawati, Desi Maulia, 2025) which states that meaningful learning occurs when students are able to build deep understanding through active involvement in the learning process. The target of the activity is lecturers and educational staff at the Muhammadiyah University of Palembang who are expected to be able to integrate digital technology and deep learning approaches in the learning process. The program implementation is carried out through systematic stages, namely concept socialization, technical training, implementation practice, and evaluation and reflection. These stages are in line with the five things conveyed by the government that are the target of student character that is inherent in our evaluation system in the national exam and is a 21st-century skill. High Order Thinking Skills (HOTS) are also implemented due to the still low ranking of the Programme for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS) compared to other countries, so the standard of national exam questions is attempted to be improved to catch up (Nina Kurniah, 2023).

The results of the activity showed a significant increase in participants' understanding of the concept of deep learning in education. This concept emphasizes learning that is not solely oriented towards memorization, but rather on in-depth conceptual understanding, as well as the development of critical thinking and problem-solving. This aligns with Dinni's (Nina Kurniah, 2023) stated that a person is said to be able to solve a problem if they are able to analyze a problem and apply their knowledge to new situations. In accordance with this statement, it can be concluded that possessing higher-order thinking skills can train students to solve problems they face wisely and prudently. Participants demonstrated the ability to design more adaptive learning tools, such as deep learning-based Semester Learning Plans (RPS), as well as the application of project-based and case-based learning methods. Wiyoko (Tri Aminingsih, Asep Saepulrohman, 2025) Education, which is the basic spearhead in improving human resources, must be carried out as early as possible. Education is not only about reading and writing, but also how to ensure that the next generation of the nation can also think critically and be able to compete in today's digital era. Furthermore, the implementation of project-based learning also supports the development of 21st-century skills such as collaboration, creativity, and communication (Trilling & Fadel, 2009). Adapting material to student characteristics also reflects the principle of differentiated instruction developed by Tomlinson (2001), namely learning that is tailored to the individual needs of students.

In this activity, lecturers began to optimize the use of the Learning Management System (LMS) and various interactive learning media such as videos, digital quizzes, and online discussion forums. Mas (Indarini Dwi Pursitasari, Dadang Jaenudin, 2025) The importance of the teacher's role as a planner, implementer, and evaluator of learning means that teachers must possess the professional competence to provide high-quality learning and evaluate overall academic success. The quality of learning depends heavily on the teacher's professional abilities, particularly in facilitating effective and efficient learning for students. The teacher's role as a planner, implementer, and evaluator of learning is crucial, so teachers must possess the professional competence to provide high-quality learning and evaluate overall academic success. The use of this technology supports the concept of adaptive digital learning as explained by Siemens (2005) in connectivism theory, which states that learning occurs through digital networks and broad access to information. Furthermore, the integration of simple data analysis to understand student learning needs reflects the development of learning analytics, which helps improve the effectiveness of data-driven learning (Siemens & Baker, 2012). Thus, technology plays a role as a facilitator in creating more personalized and responsive learning.

The evaluation results showed that the majority of participants (83%) considered this activity relevant to current learning needs, and 92% felt more confident in implementing innovative strategies. This is relevant to the implementation of community service, the success of increasing participants' knowledge about deep learning training for special needs teachers: steps towards assistive technology-based education and adaptive learning have a positive impact on special needs teachers (Muhammad Nurrohman Jauhari, Ana Rafikayati, 2024). However, the need for advanced training related to technology and data-based evaluation demonstrates the importance of continuous professional development in higher education (Guskey, 2002).

This activity had a significant impact in the form of a shift in the learning paradigm from teacher-centered to student-centered. This transformation aligns with modern learning theory that emphasizes the active role of students in the learning process (Schunk, 2012). Furthermore, the improvement in lecturers' pedagogical competence demonstrates success in developing educator professionalism. A more adaptive and technology-based learning environment also supports the concept of a 21st-century learning environment that demands flexibility, collaboration, and technology integration (Partnership for 21st-Century Skills, 2015). Several obstacles identified, such as variations

in digital literacy, time constraints, and uneven technological infrastructure, indicate a gap in digital transformation readiness. This aligns with the findings of (Muhammad Nurrohmah Jauhari, Ana Rafikayati, 2024) Deep learning plays a crucial role in linking assistive technology and adaptive learning to support students with disabilities with diverse characteristics and needs. Therefore, strategies for strengthening capacity and equitable access to technology are needed to support the sustainability of learning innovations. Communities of practice play a crucial role in creating spaces for sharing knowledge and experiences among educators, allowing learning innovations to develop sustainably and contextually. Overall, the deep learning-based adaptive strategy mentoring program has successfully improved lecturers' competency in designing and implementing higher-quality learning. This supports the transformation of higher education toward more adaptive, technology-based, and student-centered learning.

CONCLUSION

Community service activities through mentoring on deep learning-based adaptive strategies at Muhammadiyah University of Palembang have successfully achieved their primary objective: improving the quality of learning by strengthening lecturers' understanding and skills in integrating deep learning approaches and digital technology. Results demonstrate significant improvements in understanding of deep learning concepts, their ability to design adaptive learning tools, and the utilization of technologies such as LMS and interactive media in the learning process. Furthermore, the implementation of this strategy has also resulted in more active, participatory, and meaningful learning interactions, marked by a paradigm shift from teacher-centered to student-centered.

Overall, this program has proven to have a positive impact on improving lecturers' pedagogical competence and the effectiveness of the learning process at the university. Although several obstacles remain, such as variations in digital literacy, time constraints, and uneven technological infrastructure, evaluation results indicate a high level of participant satisfaction and confidence in implementing learning innovations. Therefore, program sustainability through further training, strengthened institutional support, and the development of a community of practice is crucial to ensure that technology-based learning transformation and deep learning can continue to develop sustainably and orientate themselves to the needs of students in the modern education era.

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