Deep Learning-Based Training for Junior High School Teachers in Mempawah

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ARTICLE INFO	ABSTRACT
	Background: The implementation of deep learning-based instruction not only offers a more adaptive and personalized approach to student needs, but also requires teacher readiness and increased competency to implement it effectively in the classroom. Therefore, the goal of this community service activity is to improve the professional competence of junior high school teachers in Mempawah. so that they are able to design and implement learning processes that are more meaningful, creative, and oriented towards developing students' high-level thinking skills. **Contribution:** This training provides a real contribution in improving teachers' professional competence while helping teachers understand the concepts, implementation strategies, and evaluation techniques of *deep learning- based learning*, so that they can be applied in teaching and learning activities. **Method**: This community service activity was implemented using a descriptive qualitative approach through lectures, discussions, and training. The material presented by lecturers and students included an introduction to the basic concepts of *deep learning*, their application in learning, and relevant implementation strategies. **Results:** The training results demonstrated improved teacher competency in implementing *deep learning- based instruction*. Eighty-five percent of participants were able to design meaningful learning activities. This indicates the training's positive impact on improving teachers' pedagogical skills. **Conclusion:** This training shows that teachers need systematic planning, the role of a facilitator in implementation, and authentic evaluation of the Solo Taxonomy.

1. Introduction

The need for a comprehensive training program that empowers educators for utilize technology latest, like *deep learning*, is becoming increasingly important. In line with this, teachers have an essential role in the educational realm [1], [2]. To increase the effectiveness of the learning process, teachers are required to be creative, innovative, and have adequate competencies [3]. However, the main challenges faced include limited infrastructure, the readiness of teaching staff, suboptimal policies, and the difficulty of integrating *deep learning* into the education curriculum [4].

The integration of deep learning for teachers has significant potential to transform the teaching and learning process. It's not simply about technology or artificial neural networks, but rather, in a pedagogical context, emphasizing mindful, meaningful, and joyful learning processes [5]. This aligns closely with the direction of the Independent Curriculum.

Wrong One approach Which promising for increase teacher competency is through the integration of *deep learning* into professional development programs that show significant potential in increase quality and effectiveness Education [6], [7]. Various previous studies of 20 elementary school teachers in Surakarta showed an increase in pedagogical skills by 45% in designing and implementing deep learning strategies that focus on critical thinking, creativity, and *joyful learning*. With the implementation of *joyful learning in particular* , teachers are able to create a dynamic and meaningful learning atmosphere for students [8]. Subsequent research shows that a deep learning mindset can be built through the development of a concept-based curriculum, intensive teacher training, and the implementation of interactive learning strategies.

Building this mindset in elementary school teachers is a process that requires commitment, dedication, and a structured strategy. Constructive disorientation, critical reflection, and art are three important elements that need to be integrated into teacher professional development programs [9]–[11]. Thus, elementary school teachers can become more effective learning facilitators and empower students to become lifelong learners who are ready to face the challenges of the 21st century [12]. Then, local wisdom can improve the score and character of national identity, therefore, " *deep learning* " that integrates technology in it can also increase effectiveness in learning. Linking with Ki Hadjar Dewantara's vision of education can be a solution to improve the quality of education in Indonesia [7]. In addition, this approach significantly improves students' conceptual understanding, long-term retention, and critical thinking and problem-solving skills. *Deep learning* has also been shown to increase student engagement in the learning process, encourage collaboration, and facilitate more adaptive and data-driven learning. However, several challenges identified include a lack of educator preparedness in managing this technology, limited infrastructure in some educational institutions, and ethical issues in managing student data [8] .

Thus, the implementation of in-depth learning-based training programs for teachers Indonesia can become strategy Which valuable for increase teaching and learning practices. In addition, teachers must be qualified or competent as learning supports that can facilitate students in understanding the subject matter [15]. Previous research has highlighted the efficacy of deep learning-based strategies in improving primary and secondary school teaching, which underscores the potential for similar approaches to be applied in a wider range of academic subjects [16]. However, the adoption of *deep learning* -based learning in teacher training programs is still limited. Then, limited training, facilities, and school policy support cause the

implementation of *deep learning* to not run optimally, so that the learning objectives of forming independent, creative, and competitive students have not been fully achieved. Further research is needed to understand the specific needs and perceptions of teachers regarding the integration of these advanced techniques [17]. By considering the various challenges and opportunities that exist, this study aims to explore the effectiveness of deep learning-based teacher training in improving pedagogical competence and reflective teaching practices. The focus of this research includes the planning, implementation, and evaluation of training in supporting the implementation of *deep learning* at SMP Mempawah.

Therefore, it is crucial to conduct this research. Without it, teachers will continue to struggle with implementing *deep learning- based instruction*. This leads to a more conventional learning process that fails to foster critical and creative thinking skills in students. Consequently, learning quality declines, student engagement is low, and the goal of the independent curriculum, which aims to develop independent and reflective learners, cannot be optimally achieved. The research results are expected to provide recommendation strategic for stakeholders' interest in designing programs training Which optimal and contribute to development learning innovation. One way in which *deep learning can be implemented* is by maximizing its benefits in improving the quality of learning and teacher preparedness in facing digital transformation in the world of education.

2. Method

This In this study, the design used was a qualitative approach with a descriptive type to achieve the goal of improving the quality of *deep learning -based learning* through Community Service (PKM) activities. Implemented using participatory education using lecture, discussion and training methods for educators. as well as power education in school. As seen in Figure 1, activity This aim to equip teachers with a deeper understanding of the concept of *deep learning* and its application in the classroom learning process. The stages of this community service activity include: 1) preparation, initial coordination with partner schools, determining the schedule and collecting participant data; 2) delivery of materials, regarding *deep learning*. 3) participants follow the teaching module in groups, presenting and practicing learning scenarios through teaching simulations; 4) evaluation and reflection, providing *a post-test* to determine the increase in participants' understanding after the training; 5) the implementation team will monitor in an effort to provide feedback.
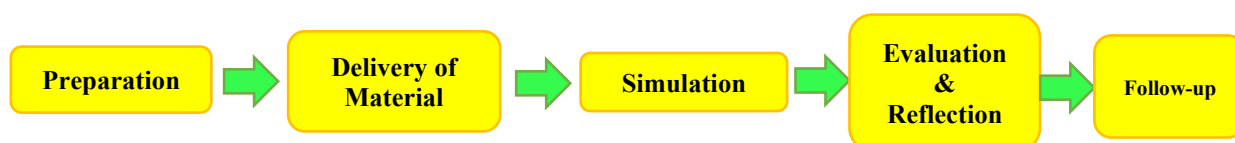

Figure 1. Stages of the *Deep Learning Training Program*

This research was conducted at SMP Negeri 1 Anjongan, Mempawah Regency, West Kalimantan. On June 3, 2025, one full day starting at 09:00 to 16:30 WIB. The location was chosen for several reasons, one of which is because this school has a high commitment to educational innovation and improving the quality of learning in the Mempawah Regency area. SMP Negeri 1 Anjongan is considered strategic and representative to become a training center. In addition,

its easily accessible location from various sub-districts makes it an ideal place to accommodate the participation of junior high school teachers from around the area, thereby strengthening synergy between levels. Data was collected using interview, observation and document study techniques accompanied by data analysis based on data collection, data presentation and drawing conclusions (verification). Data was triangulated using techniques, time and sources, accompanied by a member check being carried out first.

3. Results and Discussion

3.1. Deep Learning-Based Learning Planning for Teachers

Through presentations by lecturers, teachers from various fields of study at SMP Negeri 1 Anjongan gained new insights into the essence of *deep learning* as an approach that emphasizes the full involvement of students' cognitive, affective, and psychomotor skills in the learning process. As seen in Figure 2, during the training session, teachers were also trained to develop components of the Lesson Implementation Plan (RPP) that are in accordance with *deep learning principles*, such as the integration of 21st-century skills, an emphasis on contextual learning, and the use of authentic assessments. This activity encouraged teachers to be more reflective in developing learning strategies that not only pursue material targets, but also shape students' character and essential competencies.

Figure 2. Preparation for *Deep Learning* Planning Training

As seen in Figure 3, In planning *deep learning,* itself, there are several approaches used, such as *mindful learning, joyful learning* and *meaningful learning*. The three complement each other in building a learning atmosphere that not only emphasizes academic achievement, but also emotional involvement, self-awareness, and understanding of the subject matter being studied.
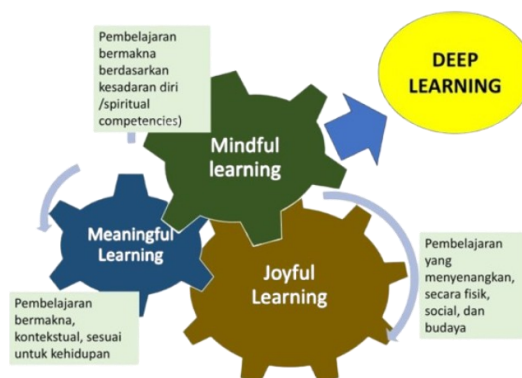

Figure 3. *Deep Learning* Approach

As seen in Table 1, Evaluation results of teacher competencies before and after the training showed significant improvements, particularly in designing lesson plans that emphasize meaningful and collaborative learning. The training data are presented in the following table:

Table 1. Training Result Data

Rated aspect	Before Training (%)	After Training (%)	Increase (%)
Understanding the Concept of Deep Learning	52	88	36
Ability to Design Deep Learning-Based Lesson Plans	48	84	36
Use of Mindful, Joyful, and Meaningful Learning Strategies	46	80	34
Ability to Integrate Technology in Learning	40	78	38
Learning Reflection and Evaluation Skills	50	82	32

This finding is also consistent with the results of research [18] which concluded that deep learning-based teacher training can improve teachers' pedagogical abilities and creativity in designing 21st-century learning. Subsequent research [19] *Deep learning* encourages students to understand the meaning and relationships between concepts, rather than simply memorizing information. In addition, research [20] in China found that teacher training in *deep learning classroom design* had an impact on increasing teachers' reflective awareness and the effectiveness of contextual learning. Furthermore, research [21] on the application of *deep learning pedagogy* Project-based learning in secondary schools has resulted in improved critical thinking and collaboration skills among students. Therefore, the results of this PKM training strengthen empirical evidence that developing teacher capacity through deep learning outreach and training is a strategic step in improving the quality of learning in schools. In *deep learning- based learning planning*, there are several important aspects that need to be considered to ensure the learning process runs optimally, namely as follows:

a) Identification
   1. Identifying student readiness
   2. Understanding the characteristics of the subject matter
   3. Determining the dimensions of the graduate profile
b) Learning Design
   1. Determining learning outcomes
   2. Determine contextual and relevant learning topics
   3. Integrating across disciplines relevant to the topic
   4. Determining learning objectives
   5. Determine the learning framework (pedagogical practices, learning partnerships, learning environments, digital utilization)
c) Learning Experience
   1. Designing learning with the principles of awareness, meaning and joy.
   2. Designing learning stages with initial, core and closing activity steps.
   3. Describe the learning experience of understanding, applying, and reflecting.

d) Assessment
1. Assessment at the beginning of learning
2. Assessment in the learning process
3. Assessment at the end of learning [5].

From this planning activity, group discussions and learning planning simulations became effective media in internalizing the concepts presented by the resource person. Teachers showed high enthusiasm in trying to design project-based learning, problem solving, and the use of digital technology as supporting media.

3.2. Implementation of Deep Learning-Based Learning for Teachers

Good teaching skills and professional skills require adequate and efficient pedagogy in the teaching and learning process [22]. Several subject teacher participants indicated that the material presented during the training, such as the basic concepts of deep learning, implementation strategies in the classroom, and examples of independent curriculum-based applications, had been well understood by the participants. As seen in Figure 4, this training was designed to provide teachers with a comprehensive understanding of the importance of shifting the learning paradigm from merely transferring information to a process of forming meaningful and contextual knowledge. Thus, teachers are not only required to master the teaching material, but also to be able to design a learning process that stimulates students' critical, reflective, and creative thinking.


Figure 4. Implementation of *Deep Learning* -Based Learning Training

Through this activity, teachers were challenged to develop lesson plans, select learning activities that stimulate critical thinking, and implement authentic assessments. Observations showed that 80% of participants were able to develop teaching materials that met in-depth learning indicators, such as integration between disciplines, relevance to real-life contexts, and development of higher-order thinking skills. Group discussions and reflections during the training also generated critical thinking from teachers regarding implementation challenges. Some teachers stated that time constraints and the dominance of exam-oriented learning were the main obstacles. However, this training succeeded in opening teachers' insights to change their learning approach from simply delivering material to learning that encourages exploration, collaboration, and the creation of meaning by students. They expressed motivation to begin implementing a deep learning approach gradually in the classroom.

In addition, effective teaching must be able to adapt learning methods to the characteristics of individual students, so that they feel valued and involved in learning [23]. Students apply concepts in real-world contexts and teachers provide formative feedback throughout the learning process. As seen in Figure 5, the importance of active student

involvement in the learning process is also a major focus in this approach. In it, students are encouraged to think more deeply about the material being studied and relate it to personal experiences or everyday situations [24].
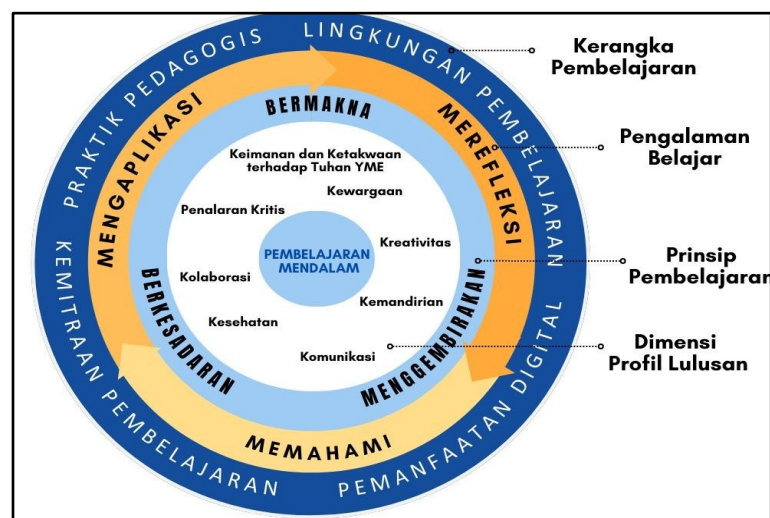
Figure 5. Four Learning Frameworks adapted from *Four Elements of Learning Design*

Deep learning as a learning approach aims to train students' critical thinking skills. Information received by students is digested critically. Students analyze a problem and find a solution based on data and facts [25]. In addition, the *deep learning approach* significantly improves students' conceptual understanding, long-term retention, and critical thinking and problem-solving skills [26]. This is in line with the constructivist theory developed by Piaget and Vygotsky, which emphasizes that knowledge is built through social interaction and direct experience [27]. There are several stages in implementing deep learning as follows:

1) Delivery of material according to the students' thinking stages to support the achievement of students' deep understanding of concepts.
2) Existing learning models or strategies can be used with the principles of conscious, meaningful and enjoyable learning.
3) Implementation of meaningful learning by utilizing the surrounding environment, such as utilizing the school environment, the surrounding natural environment, the social environment, and so on.
4) The principles of conscious, meaningful and enjoyable learning can be found in several learning activities, they do not have to be sequential and/or simultaneous.
5) The learning experience of understanding, applying, and reflecting is carried out using learning steps that are appropriate to the context and conditions of learning, as well as teacher innovation.
6) The syntax/learning steps in existing learning models or strategies can be adapted according to the learning experience of understanding, applying and reflecting.
7) The learning experience of understanding, applying and reflecting is carried out in several learning steps, the implementation of which is adapted to the context and conditions of learning.

8) Learning experiences through mental, emotional, emotional, and physical training are holistic and integrative self-development encompassing intellectual, socio-emotional, spiritual, and physical aspects. Thus, learning produces individuals with complete and balanced competencies in accordance with their natural disposition.

9) Learning topics are linked to cross-disciplinary (multi/interdisciplinary) or related to the fields of science or subjects studied by students.

10) The application of in-depth learning is adapted to the characteristics of each subject.

11) Partnerships involving various parties, both within the school environment, outside the school, and the community, to support in-depth learning.

12) The learning environment created is an integration of physical space, virtual space and learning culture to support in-depth learning.

13) The use of digital technology will strengthen in-depth learning in planning, implementing, and assessing learning.

14) Assessment uses *assessment as learning*, *assessment for learning*, *assessment of learning*. PM emphasizes the importance of feedback and authentic assessment [5].

This training not only enhances theoretical understanding but also develops teachers' practical competencies in implementing deep learning-based instruction. Another important aspect of this training is developing teachers' practical skills in implementing deep learning concepts.

3.3. Evaluation of Deep Learning-Based Learning for Teachers

One important focus of this training is understanding evaluation in the context of *deep learning*, which emphasizes the development of students' higher-order thinking skills through an evaluation model that focuses on the depth of conceptual understanding, one of which is the SOLO Taxonomy. This taxonomy provides a systematic approach to evaluating students' learning processes from beginning to advanced levels, which is highly relevant to learning objectives.

Figure 6. *Deep Learning* -Based Learning Training Focus of Learning Evaluation

In the training session, participants were introduced to various approaches known as the Solo Taxonomy. Teachers were encouraged to view evaluation not only as a tool for measuring knowledge, but also as a means to explore the depth of students' understanding and their potential to apply that knowledge to real-world contexts. As seen in Figure 7, the SOLO Taxonomy (Structure *of Observed Learning Outcomes)* is an evaluation framework developed by John Biggs and Collis to classify students' level of understanding of a subject. This taxonomy is used to assess the extent to which students not only remember information, but are able to connect, analyze, and apply concepts in depth. The main purpose of using the SOLO taxonomy in *Deep Learning* is to help teachers evaluate and map the development of students' understanding systematically and gradually. This evaluation not only functions as a tool for assessing learning outcomes, but also as a guide for teachers in designing learning interventions that are appropriate to students' level of understanding.
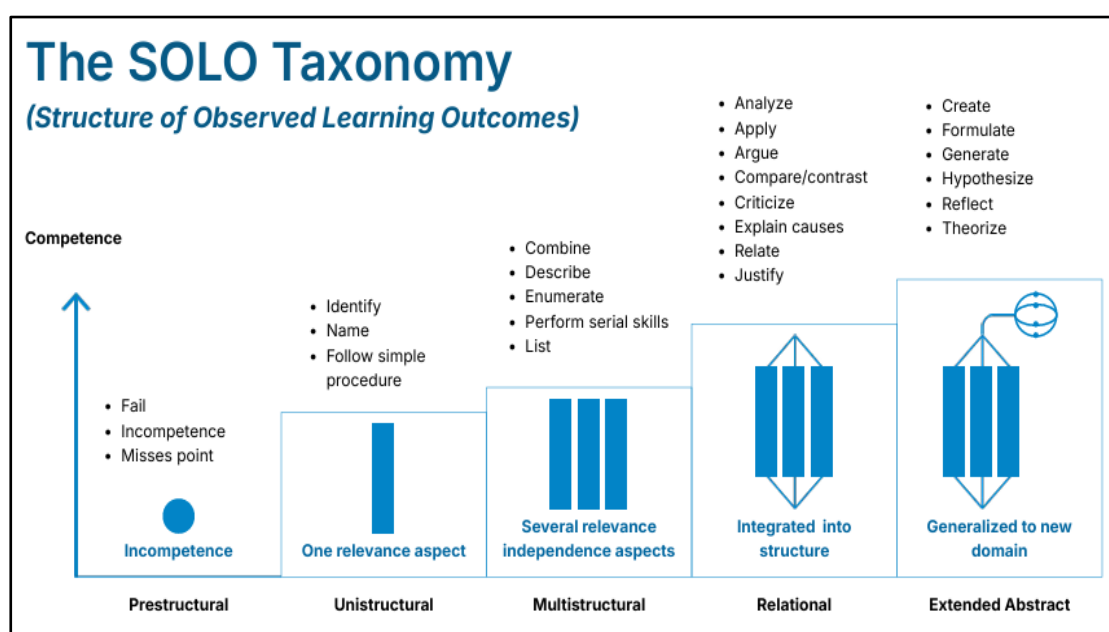

Figure 7. Solo Taxonomy in *Deep Learning -Based Learning Evaluation*

At the *prestructural stage* (complete ignorance or misconceptions) training participants are taught how to identify students who do not yet understand a concept. Entering the *unistructural stage* (knowing only one concept), teachers are equipped to evaluate students who are beginning to understand one aspect of the learning material. The *multistructural* stage (knowing several concepts but not yet able to connect one element with another) becomes a more complex evaluation point.

Teachers at SMP Negeri 1 Anjongan were invited to create evaluation questions that measure students' success in answering questions from various material angles, as well as encouraging the use of rubrics to see the breadth of students' understanding holistically. Evaluation at this stage is crucial in *Deep Learning* because it demonstrates students' reflective and integrative thinking skills. The final stage, the *extended abstract,* (deep abstract thinking) teachers are trained to compile evaluations that encourage students to create new ideas, predict, or extrapolate based on existing understanding.

Some principles that need to be considered in this Deep Learning Assessment are:

1) Assessment as Learning*: Assessment for reflection on the learning process and student self-reflection. Examples include reflective journals, self-assessment, peer assessment, learning progress checklists, and others.

2) *Assessment* for Learning: Assessments for improving the learning process serve as feedback to help students understand their learning progress and provide teachers with reflection on their teaching. Examples include concept maps, formative feedback, observations, diagnostic questions, and more.

3) *Assessment of* Learning: Assessments used to measure student learning outcomes at the end of a course. Examples include oral tests, written tests, reports, project assessments, portfolios, and more.

Teachers learn how to develop evaluation instruments that measure students' critical, collaborative, and creative thinking skills. For example, in this training, teachers are trained to create project assessment rubrics that assess the process, not just the final product. In this training, teachers are encouraged to integrate self-evaluation and peer assessment *as* part of the learning process. This approach provides opportunities for students to actively participate in the assessment process and helps them develop metacognitive awareness and responsibility for their own learning.

4. Conclusion

Deep learning -based training for teachers at SMP Negeri 1 Anjongan showed significant results in improving teachers' ability to design, implement, and evaluate meaningful, reflective, and contextual learning. The training results showed a 36% increase in teachers' understanding of the concept of deep learning, a 36% increase in the ability to design deep learning- based lesson plans, and a 38% increase in technology integration skills. Teachers also showed progress in implementing mindful, joyful, and meaningful learning strategies that build an active and collaborative learning atmosphere. These findings confirm the effectiveness of training as a means of developing teachers' pedagogical competencies in the Independent Curriculum era. With the deep learning approach, teachers not only act as material transmitters, but as facilitators who foster students' critical, reflective, and creative thinking skills.

Acknowledgement

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