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Development of a Deep Learning-based Instructional Module for Enhancing Critical Thinking in Pancasila Learning

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Abstract: This study aims to develop a deep learning-based instructional module for enhancing critical thinking in Pancasila education at the elementary level. This research used a Research and Development (R&D) method with the ADDIE development model, which consists of five main stages: analysis, design, development, implementation, and evaluation. The data acquisition encompassed interviews, observations, document analysis, and surveys, with a particular emphasis on the dimensions of validity, practicality, and effectiveness as the core framework for the data analysis technique. The results reveal that the module possesses a very high level of validity, with expert evaluations covering content, visual design, and language use all rated "very valid." Validator input significantly improved the module's alignment with student characteristics. In terms of practicality, teachers reported ease of implementation, compatibility with classroom conditions, and responsiveness to learners' needs, with an average score of 93.3%. Effectiveness was evident in the enhancement of students' critical thinking: the proportion of students scoring in the 90-100 range increased from 0% to 63.16%, and the overall effectiveness score reached 82.2%. These findings highlight the potential of deep learning to foster not only knowledge acquisition but also conceptual understanding, practical skills, and active learner engagement. The developed module thus constitutes a strategic innovation aligned with the Merdeka Curriculum and responsive to the challenges of 21st-century education.

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Introduction

The Minister of Education and Culture envisions improving the quality of Indonesian education through the implementation of national policies, including curriculum innovations and modern teaching practices (Ratnasari & Nugraheni, 2024). Indonesian education has the potential to progress further by aligning with scientific and technological advancements, as well as evolving workforce demands, and be able to produce wise generations who have critical thinking in solving problems if they always make breakthrough curriculum updates (Rosmana et al., 2022) (Wiwik Okta Susilawati, Sonia Yulia Friska, 2023). However, the response of teachers to hearing this curriculum update immediately resulted in wild thoughts of "New Minister New Curriculum" which gave rise to the term "deep learning"(Raup et al., 2022). Though this opinion is less precise, the reason is that there are changes in science, technology, and culture (Saifudin, 2021) so it is necessary to make changes (Momo et al., 2024).

Deep learning is a breakthrough learning approach in Indonesian education (R. Putri, 2024) that focuses on deep understanding and application of complex concepts (not just mastery of superficial facts and rote learning (Yulianto, 2024) but helping students think

critically, analyse, solve problems and correlate knowledge with real-world situations) (Biringan et al., 2025) (R. Putri et al., 2024). This is certainly relevant to the current curriculum, which is the independent curriculum (kurmer) (Saputra & Hadi, 2024) (Zebua, 2025). It can be concluded that deep learning is not a new curriculum, but a more philosophical approach that supports the success of Kurmer (Zuhro, 2024) (Saylendra et al., 2023). So, teachers who are directly involved in education must be able to implement learning (Fitri et al., 2023) (Wiwik Okta Susilawati, Sonia Yulia Friska, 2023) using the deep learning approach (Boenga Jenny Hendrianty, Aldi Ibrahim, Sofyan Iskandar, 2024).

However, it turns out that elementary school teachers have not implemented it. The reason is that many types of subjects must be taught with the nature of the material that is diverse, too theoretical, complex, abstract, and boring, so it hinders student mastery. Pancasila learning tools in elementary schools have not met the needs of students and the development of science and technology (Taufik & Rindaningsih, 2024). It appears that the teaching modules developed by teachers have not facilitated various student characteristics and have not implemented deep learning (Putra & Rizqi, 2024).

Based on the findings of a needs assessment conducted among upper-grade classes at SDN 09 Sitiung, corroborated by relevant scholarly research, it was revealed that a considerable proportion of students have yet to attain a meaningful understanding of the material they have studied. Consequently, they have not fully developed their comprehension and competencies, and they exhibit low levels of motivation in the learning process. This condition is attributable to two fundamental factors. First, teachers tend to conduct initial assessments merely as a formal procedure, resulting in outcomes that fail to address the actual needs of students. Originating from this critical shortcoming, the instructional modules developed by the teachers are consequently unable to effectively facilitate student learning.

Secondly, the formulation of learning objectives remains overly general, failing to incorporate the advancements in science and technology as well as the evolving demands of the labor market. In fact, it is at the elementary school level that the foundational competencies should be firmly established (Melianti et al., 2023) (Sanjaya et al., 2016) (Hery Noer Aly, Dayun Riadi, Firdaus, Dina Agustina, 2024) (Rindayati et al., 2022). The contemporary workforce necessitates individuals who possess critical thinking abilities (Susongko et al., 2024) and are adept at solving complex problems (Rifa Hanifa Mardhiyah, Sekar Nurul Fajriyah Aldriani, Febyana Chitta, 2021). This pressing need has driven the integration of deep learning into the curriculum. In practice, deep learning operates synergistically with technology and emphasizes the interconnection of knowledge, the transformation of understanding, authentic application, and collaborative engagement (M. Elbashbishy, 2024).

Oakley (Barbara Oakley, Terry Sejnowski, 2023), in the book Learning How to Learn, describes that deep learning strengthens the skill of transferring knowledge to different contexts. In addition, deep learning involves a thorough understanding of the concept (not just short-term memory). Refining Oakley's opinion, Fullan(Michael Fullan, Joanne Quinn, 2017) in his book Deep Learning: Engage the World, Change the World also explains that deep learning encourages students to become active learners and aims to create a positive impact in the real world by emphasising the development of the 6Cs, better known as the deep learner profile (Montessori et al., 2023) (S. Bousalem, 2025) (Chen et al., 2018). From this analysis, a recommendation is obtained that innovation and reform are needed in the learning process and the development of teaching modules (Indriani et al., 2024) that are relevant to the development of science and technology and the demands of the world of work..

The concrete solution and problem-solving approach in this research is to develop learning tools that can be applied directly by teachers (I. H. Putri et al., 2025) and have a direct impact on students' lives. This is a learning tool in the form of an elementary Pancasila Education teaching module developed to improve 6C skills, especially critical thinking (Manurung & Pappachan, 2025) by considering the long-term needs of students (Widia Wati, 2023) (Mustapha et al., 2023)(S. Bousalem, 2025). This deep learning-based teaching module will continue to exist. It is proven that this deep learning first appeared in 1943 by Warren McCulloch & Walter Pitts (Chen et al., 2018) and until now, it still exists because human life will always be side by side with technology (Linggu & Tasir, 2022) (Valencia & Shodiq, 2024) (artificial intelligence / AI) (Cathrin et al., 2024).

Another advantage of this research is that the learning process will be more meaningful, in-depth, and directed. The use of deep learning is a trigger for students to become critical individuals who are always friendly with science and technology(Hidayati et al., 2023) (technology/artificial intelligence) (Nguyen et al., 2023) instead of becoming individuals who only memorise formulas. Not only that, this deep learning strengthens the view that "education is not a diploma factory but a garden of growth of reason and conscience as seen from the increasing skills of the 6C/deep learner profile. In previous studies (Susilawati et al., 2024) (Susilawati et al., 2025), learning tools in SD only focus on the application of technology without correlating with deep learning to improve 6C skills (critical thinking), integrating a deep learner profile in accordance with the development of science and technology and the world of work. This research seeks to design a Pancasila Education module integrating a deep learning framework and Edcafe AI, aimed at fostering critical thinking among upper elementary students.

Research Method

The research uses the development research method with the ADDIE Model, which consists of five phases: analyze, design, develop, implement, and evaluation (Branch, 2009). This study was conducted among upper-grade students at SDN 09 in Sitiung Subdistrict, Dharmasraya Regency, West Sumatra, Indonesia, involving a total of 19 participants selected through purposive sampling. Data were gathered through observations, interviews, documentation, and questionnaires, then evaluated for the validity, practicality, and effectiveness of the instructional materials developed in the form of teaching modules for elementary Pancasila Education using Edcafe AI based on a deep learning approach to improve 6C skills, especially critical thinking.

The research procedure followed the ADDIE development model, encompassing five integrated stages: (1) the *Analysis* phase involved identifying the needs of both teachers and students, mapping essential student competencies, and examining student characteristics; (2) the *Design* stage focused on formulating research instruments and constructing the initial product framework; (3) the *Development* phase entailed producing the teaching module, which was then subjected to expert validation covering content, graphical design, and linguistic clarity; (4) the *Implementation* phase consisted of pilot testing the product, collecting data through teacher response questionnaires to evaluate its practicality and classroom applicability; and (5) the *Evaluation* phase employed an effectiveness assessment sheet to measure the extent to which the deep learning-based module enhanced students' critical thinking as part of the 6C/Deep Learner Profile.

After all the data has been collected, the next step is to process the data by referring to the principles of the Likert scale as described in Table 1 (Widodo et al., 2023).

Table 1. Skala Likert

Score	Category
5	SS = Strongly Agree
4	S = Agree
3	RG = Undecided
2	TS = Disagree
1	STS = Strongly Disagree

The scores obtained from the assessment results were then converted into a percentage using the formula V = (f/n) × 100%, where V represents the level of validity, practicality, and effectiveness of the teaching module (Susilawati et al., 2022). f indicates the number of scores achieved by students. While n refers to the maximum score that can be obtained. The classification of teaching modules in the valid, practical, or effective category is determined based on the final score obtained by students, which is expressed in a scale range of 0 to 100, as shown in Table 2 (Creswell & Clark, 2011).

Table 2. Categories of Teaching Modules for Pancasila in Elementary School

Interval	Category
V/P/E ≤ 20	Not Very Valid/ Practical/ Effective
20 < V/P/E ≤ 40	Not Valid/ Practical/ Effective
40 < V/P/E ≤ 60	Less Valid/ Practical/ Effective
60 < V/P/E ≤ 80	Valid/ Practical/ Effective
V/P/E > 80	Very Valid/ Practical/ Effective

So that it can be concluded that the product of the Teaching Module of Pancasila Elementary School, based on deep learning, is valid/practical/effective if the percentage is V> 60%.

Results and Discussion

Validity of Deep Learning-based Elementary Pancasila Teaching Tools

The validity of the product that has been developed through several stages of ADDIE (Branch, 2009) (Maxnun et al., 2024), which starts from analysis, design, and develop.

Analysis

Mapping and Interpretation of Learning Needs from Teacher and Student Perspectives

With reference to the Ministry of Education and Culture's academic framework on inclusive quality education (Kementerian Pendidikan Dasar dan Menengah Republik Indonesia, 2025), at the primary school level, the development of students' knowledge, skills, and attitudes is the main focus. To achieve maximum growth in all three domains, a deep learning approach is designed in line with students' ability to learn (Fullan et al., 2017). This approach aims for students to have a strong foundation in critical thinking and be able to face and solve various problems they encounter. However, in reality, many students have not been able to make meaning of what they have learnt, so that they have not been able to develop their understanding and competence, and are not motivated in the learning process. This happens because of two things. Firstly, teachers only formally conduct initial assessments so that the results of the initial assessment do not answer student needs. Starting from this fatal mistake, the teaching module developed by the teacher cannot facilitate students (Suratmi & Sopandi, 2022). Secondly, the learning objectives are stated too broadly, lacking alignment with advancements in science and technology as well as current workforce demands. Whereas in elementary school, this is where the initial foundation should be strengthened. The world of work requires a person to be able to think critically in solving problems. That's why deep learning emerged in Curriculum. Deep learning is technology-led and oriented towards knowledge connection, understanding transformation, real-world application, and collaboration/engagement.

Then, data from the preliminary study were also obtained, which provided an overview of the lack of optimal implementation of Kurmer in elementary schools, which was seen in the development of teaching modules with a deep learning approach as an effort to improve students' critical thinking skills. These initial findings become an important foothold in the process of designing and compiling products (Yulianti & Herpratiwi, 2024) in the form of deep learning-based teaching modules that are relevant to the needs in the field.

Before the teaching module was further developed, a needs assessment was conducted involving teachers and students as the main users of the product. This step aims to make the module truly able to answer the real learning needs at SDN 09 Sitiung. Needs analysis itself is a systematic technique to identify gaps between the ideal conditions expected and the reality that occurs in the learning environment. (Suprihatiningsih et al., 2025). Data regarding the needs of teachers and students were obtained through distributing questionnaires to teachers and students of high-grade classes at SDN 09 Sitiung.

The questionnaire instrument addressed to teachers was used to identify aspects of their needs for the development of teaching modules. Respondents in this case were high-grade class teachers at SDN 09 Sitiung. The questionnaire was designed to explore teachers' views on the development of teaching modules based on deep learning applied to high-grade students at SDN 09 Sitiung, especially in the context of implementing the Merdeka Curriculum.

Examination of Key Competencies that Students Must Master

This section presents a description of the findings obtained from the preliminary study related to the implementation of Kurmer at the primary school level. Data were collected through interviews and direct observations conducted with teachers and students in the high grades at SDN 09 Sitiung. Based on the results of interviews with the respondent teachers, it is known that the school has just started implementing Kurmer in the 2022/2023 school year. In developing teaching modules, teachers download teaching modules from the internet and then adapt them to the context and needs of the school. However, because teaching modules are relatively new, not all teachers have the skills to compile them independently, let alone based on a deep learning approach. In addition, in determining learning materials, teachers still tend to rely on the main textbooks available at school. The assessment carried out is still limited to the cognitive aspect, especially knowledge.

Initial observations have also been conducted using an instrument in the form of an observation sheet designed to measure the dimensions of critical thinking skills of high-grade students at SDN 09 Sitiung with 19 students as respondents. The results of the observation showed that the level of students' critical thinking skills was low. This is because the learning methods used by teachers are still traditional and have not been able to encourage the development of critical thinking skills optimally (Abidah et al., 2024). From the data obtained, students' critical thinking skills only reached a percentage of 15.78%, which was categorised in the “very less” level. This finding shows that in the learning process, students have not shown adequate indicators of critical thinking skills.

The preliminary findings indicate that teachers have yet to effectively foster students' critical thinking skills. This shortcoming is largely due to the limited integration of deep learning principles in choosing instructional models and strategies. To address this gap, it is essential to design teaching modules grounded in a deep learning approach to enhance teachers’ ability to facilitate learning that promotes critical thinking (Fahruddin et al., 2025) more effectively.

Examination of Student Characteristics

To understand the characteristics of students, the author collected data through distributing questionnaires to students at the high grade level (Wiwik Okta Susilawati et al., 2023). The results of the questionnaire revealed that high grade students have good social interaction skills. This is evidenced by the 19 students who showed a preference for learning activities both in groups and independently. Based on these findings, the researcher then designed a teaching module tailored to the characteristics of high-grade students at SDN 09 Sitiung. The module was designed to support group and individual learning, and was equipped with a variety of learning media to suit the variety of learning styles possessed by the students (Dewi & Primayana, 2019).

Design

In this stage, researchers began to design products that would be further developed. In addition, researchers also compiled the instruments needed to assess the validity, practicality, and effectiveness of the product. The validity instrument was designed to cover three main aspects, namely content suitability, visual appearance or graphics, and language use (Nababan et al., 2023). Meanwhile, to assess the level of practicality, researchers compiled a number of statements in the form of a questionnaire addressed to teachers as direct users of the developed product (Maxnun et al., 2024). The effectiveness of the product is measured through observation of students' critical thinking skills as the main indicator of the success of the application of the product.

Develop

The activities carried out include the process of developing a product, which is then submitted to experts (validators) to obtain input and evaluation of the development results (Nurdyansyah et al., 2024). The validation instrument used assesses the feasibility of the product based on three main aspects, namely content suitability, visual appearance (grammar), and accuracy of language use. The following are the results.

Table 3. Validity Test Results

Number	Aspects Assessed	Score V1	Score V2	Average Score (%)
1	Content Suitability	95%	92%	93.5%
2	Visual Appearance (Grammar)	92.5%	90.83%	91.67%
3	Accuracy of Language use	88%	92%	90%
	Final Score		**91.72%**	

Table 3 presents the validity test results based on expert evaluations across three primary aspects: content suitability, visual appearance, including grammar, and accuracy of language use. Two validators independently scored the teaching module, and their scores were averaged to obtain the final percentage values. Content suitability received the highest average score of 93.5%, indicating a strong alignment of the material with the established learning objectives (Widodo et al., 2023) (Creswell & Clark, 2011). The visual appearance aspect, which encompasses both design and grammatical accuracy, achieved an average score of 91.67%, reflecting a well-structured and visually coherent presentation. Accuracy of language use, assessing the correctness and appropriateness of the language employed, attained an average score of 90% (Wiwik Okta Susilawati et al., 2023). Overall, the final validity score of 91.72% demonstrates that the developed product meets expert quality standards and is highly suitable for educational use.

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Practicality of Deep Learning-Based Pancasila Teaching Materials for Elementary Schools

During the fourth phase, the researcher conducted a practicality test on the teaching module that had been previously developed and validated. This evaluation was carried out using a practicality instrument completed by upper-grade teachers at SDN 09 Sitiung. Based on the teachers' assessments, an average score of 93.3% was obtained, indicating that the developed module falls into the "highly practical" category (Kurniawan & Sanoto, 2024). This confirms that the deep learning-based Pancasila teaching module for elementary school is both feasible and practical for implementation, particularly within the learning context at SDN 09 Sitiung.

Effectiveness of Deep Learning-Based Pancasila Teaching Materials for Elementary Schools

The following description presents the initial condition of students' thinking abilities before the implementation of the learning intervention utilizing a teaching module based on the deep learning approach. This observation was conducted during Pancasila Education lessons in upper-grade classes at SDN 09 Sitiung.

Table 4. Percentage of Critical Thinking Skills Before Product Implementation

Value	Total Students	Percentage	Remarks
90-100	0	0%	Very Critical
80-89	3	15.78%	Critical
65-79	9	47.36%	Fairly Critical
55-64	4	21.05%	Less Critical
Below 50	3	15.78%	Uncritical

The information presented in Table 4 reflects the level of upper-grade students' ability to understand issues related to the Pancasila Education subject before the implementation of the developed product. Based on these findings, it was noted that no student demonstrated a level of thinking that could be categorized as highly critical. Meanwhile, three students fell into the critical category, nine students were identified as having moderately critical thinking skills, and four others showed thinking abilities that were not yet critical. Additionally, three students were found to have very low levels of critical thinking, categorized as not critical at all.

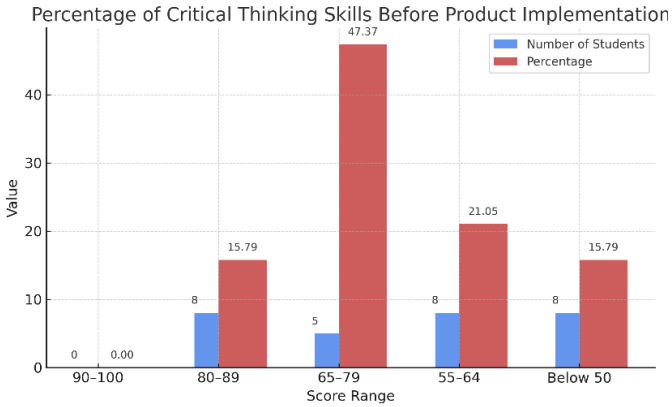

Figure 2. Distribution Chart of Students' Critical Thinking Skills Before Product Implementation

The findings indicate that most students have yet to exhibit sufficient critical thinking abilities. Only about 15.78% of the total students showed the capacity for critical thinking

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during the learning process. This condition served as the foundation for the researcher to develop and produce a teaching module based on a deep learning approach aimed at enhancing critical thinking abilities. Further details regarding the effectiveness of the product after its implementation are presented in the following section.

Table 5. Critical Thinking Skill Percentages Following the Implementation of the Product (Effectiveness Evaluation)

Value	Total Students	Percentage	Remarks
90-100	12	63.15%	Very Critical
80-89	4	21.05%	Critical
65-79	2	10.52%	Fairly Critical
55-64	1	5.26%	Less Critical
Below 50	0	0%	Uncritical

Referring to the data presented in Table 5, the results illustrate the critical thinking abilities of upper-grade students in addressing various issues encountered during the Pancasila education lessons. Based on the collected data, 12 students demonstrated a highly critical level of thinking. Four students were categorized as critical thinkers, while two others fell into the moderately critical category. One student showed a low level of critical thinking, and none were identified as having a very poor level of critical thinking.

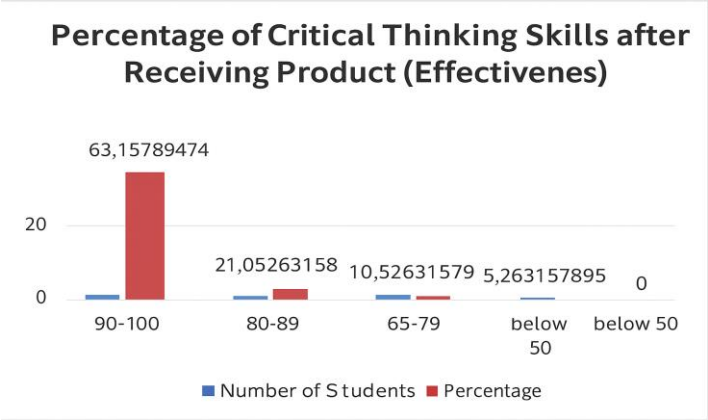

Figure 3. Chart of the Percentage of Critical Thinking Skills After the Implementation of the Product

Through the implementation of the developed product, namely the instructional module based on a deep learning approach, it was found that 82.2% of the students demonstrated critical thinking skills, 10.52% were categorized as moderately critical, and 5.26% were considered to have not yet developed critical thinking abilities.

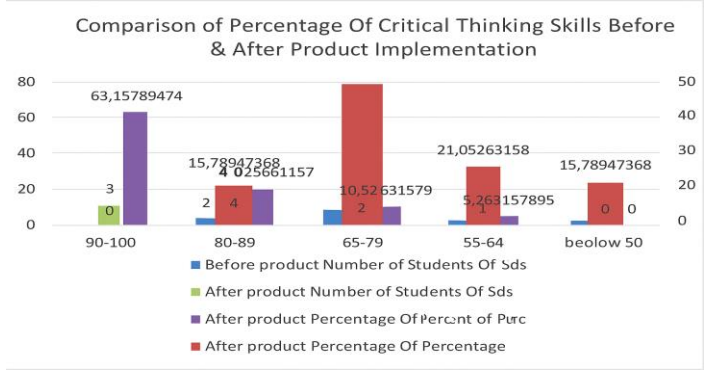

Figure 4. Comparison of Critical Thinking Skill Percentages Before and After the Implementation of the Product

The image above illustrates a comparison of students' critical thinking skills before and after the implementation of a deep learning-based teaching module, analyzed through the distribution of student numbers and achievement percentages across five score ranges.

Before the use of the product, there were no students who reached the highest score category (90-100), indicating that none had yet demonstrated an optimal level of critical thinking. However, following the intervention, a remarkable improvement was observed, with 12 students (equivalent to 63.16%) achieving scores within that range. This shift reflects the strong positive impact of the product on enhancing high-level critical thinking abilities. In the 80-89 score range, the number of students increased slightly from three (around 15.79%) before implementation to four (15.79%) after. Although this increase was modest in absolute terms, the stable percentage suggests a positive transition in competency toward a higher score bracket.

Conversely, the 65-79 category, which initially had the largest group with nine students (47.37%), saw a significant decline to just two students (10.53%) post-intervention. This substantial drop indicates a shift upward into higher score categories, representing an overall enhancement in critical thinking quality. Similarly, in the 55-64 range, the number of students decreased from four (21.05%) to just one (5.26%), further supporting the trend of overall improvement in thinking skills. Notably, in the lowest score category (below 50), no students were recorded either before or after the intervention, indicating no regression in performance to a lower level.

This supports the conclusion that the deep learning approach is “highly effective” in enhancing students’ critical thinking skills, as evidenced by the 82.2% achievement rate (Yusmar et al., 2024) (Mahfudz & Sukarno, 2023). Strengthened by the findings of a systematic literature review (SLR) conducted by Maelasari & Lusiana, (2025) across 13 articles, the deep learning approach has been shown to significantly enhance students’ conceptual understanding, long-term retention, as well as critical thinking and problem-solving skills. Moreover, deep learning has been proven to increase student engagement in the learning process, foster collaboration, and facilitate more adaptive, data-driven learning experiences.

Conclusion

The research results conclude that the Pancasila Education module possesses a very high level of validity, with expert evaluations covering content, visual design, and language use all rated as 'very valid.' Validator input significantly improved the module's alignment with student characteristics. In terms of practicality, teachers reported ease of implementation, compatibility with classroom conditions, and responsiveness to learners' needs, with an average score of 93.3%. Effectiveness was evident in the enhancement of students' critical thinking: the proportion of students scoring in the 90-100 range increased from 0% to 63.16%, and the overall effectiveness score reached 82.2%. These findings highlight the potential of deep learning to foster not only knowledge acquisition but also conceptual understanding, practical skills, and active learner engagement. The developed module thus constitutes a strategic innovation aligned with the Merdeka Curriculum and responsive to the challenges of 21st-century education.

Recommendation

Teachers are advised to consistently utilize the deep learning-based instructional module and to adjust their teaching strategies to optimize the development of students’ critical thinking skills. It is essential for teachers to conduct regular assessments and provide constructive

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feedback to effectively monitor student progress. Moreover, ongoing professional development is necessary to ensure that teachers remain proficient in implementing innovative teaching methods aligned with the Merdeka Curriculum. Collaborative learning should also be encouraged to strengthen students' communication and creativity skills. Teachers are expected to engage in reflective practice and share their experiences with colleagues to improve the module and overall teaching practices. In doing so, teachers can ensure the sustainability and effectiveness of learning in addressing the challenges of 21st-century education.

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