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Development of HOTS-Based Questions as an Implementation of the Deep Learning Approach in the Merdeka Curriculum

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Abstract
The Merdeka Curriculum is designed to develop students who are adaptive, creative, critical, and reflective in facing 21st-century challenges. However, many teachers still experience difficulties in designing assessment instruments based on Higher Order Thinking Skills (HOTS), causing learning activities to focus predominantly on Lower Order Thinking Skills (LOTS). To address this issue, a community service program was implemented to enhance teachers' understanding of HOTS and deep learning concepts, strengthen their skills in developing HOTS-based assessment questions aligned with Merdeka Curriculum learning outcomes, and encourage their integration into instructional planning. The program was conducted through socialization, counseling, interactive workshops, mentoring, and reflective evaluation, involving teachers from SMK IPTEK, South Tangerang City. The results demonstrated a significant improvement in teachers' comprehension of HOTS and their ability to design assessment items targeting analytical, evaluative, and creative thinking skills (C4–C6). Teachers also successfully integrated digital tools such as Google Forms and Quizizz for interactive assessments. Overall, the program positively impacted learning quality and supported the realization of the Pancasila Student Profile.
Keywords: HOTS Questions, Deep Learning, Merdeka Curriculum, Teachers, Meaningful Learning

INTRODUCTION

The Merdeka Curriculum is a national education policy developed by the Ministry of Education, Culture, Research, and Technology (Kemendikbudristek) as part of the *Merdeka Belajar* program. This curriculum was introduced as an improvement upon the 2013 Curriculum, emphasizing flexibility, student-centered learning, and the strengthening of the Pancasila Student Profile**.** Juridically, the implementation of the Merdeka Curriculum is grounded in several legal regulations. First, Law Number 20 of 2003 on the National Education System (Sisdiknas) serves as the primary legal foundation for education in Indonesia. Article 3 states that national education functions to develop learners' abilities and to shape dignified national character and civilization in order to educate the life of the nation, aiming to develop learners into individuals who are faithful, pious, morally upright, healthy, knowledgeable, creative, independent, and responsible (Law No. 20 of 2003). This spirit aligns with the direction of the Merdeka Curriculum, which emphasizes holistic and contextual learning.

Second, Government Regulation (PP) Number 57 of 2021 on National Education Standards, later revised by PP Number 4 of 2022, emphasizes flexibility in curriculum development at the school level. This revision grants greater autonomy to schools to adapt learning to students' characteristics, local contexts, and contemporary needs (Government of the Republic of Indonesia, 2022). This serves as the philosophical foundation for the Merdeka Curriculum, which prioritizes differentiation and learner autonomy. Third, Regulation of the Minister of Education, Culture, Research, and Technology: Number 5 of 2022 on Graduate Competency Standards, Number 7 of 2022 on Content Standards, Number 16 of 2022 on Process Standards, and Number 21 of 2022 on Educational Assessment Standards constitute the technical regulations supporting the operational implementation of the Merdeka

Curriculum. These regulations govern learning outcomes, curriculum structure, project-based learning processes, and authentic assessment systems that foster higher-order thinking skills (Kemendikbudristek, 2022a).

Fourth, the Decree of the Head of the Agency for Standards, Curriculum, and Educational Assessment (BSKAP) Number 033/H/KR/2022 on Learning Outcomes establishes the minimum competencies students must achieve at each educational phase (BSKAP, 2022). This document replaces the Basic Competencies (KD) of the 2013 Curriculum and provides teachers with greater flexibility to innovate in adaptive instructional planning. With these foundations, the Merdeka Curriculum emphasizes a paradigm shift from teacher-centered to student-centered learning. It is designed to equip students with 21st-century competencies such as critical thinking, creativity, collaboration, and communication, while fostering character values embodied in the Pancasila Student Profile. The Merdeka Curriculum emphasizes differentiated, project-based, and contextual learning with assessments focused on Higher Order Thinking Skills (HOTS) to prepare students for the challenges of the 21st century.

At SMK IPTEK South Tangerang City, the Merdeka Curriculum aims to develop students who are adaptive, critical, creative, and character-driven in accordance with the Pancasila Student Profile. As a vocational institution, SMK IPTEK faces dual challenges: producing graduates who are competent in vocational skills while simultaneously developing soft skills, critical thinking abilities, and global competitiveness. One instructional approach relevant to these needs is deep learning**,** which encourages students to develop profound conceptual understanding, connect knowledge to real-world contexts, and solve complex problems aligned with 21st-century challenges. Deep learning has become a foundational concept across various fields, including facial recognition, medical image analysis, natural language processing, and autonomous vehicles (Goodfellow, Bengio, & Courville, 2016). Schmidhuber (2015) defines deep learning as a machine learning model that employs multiple layers of nonlinear processing to transform data progressively. Each layer learns to represent different aspects of the data, enabling more accurate and contextual decision-making. Thus, deep learning can be understood as an automated learning process based on multilayer neural networks aimed at discovering complex patterns, features, and relationships through intensive training using optimization algorithms and backpropagation.

The objectives of deep learning include developing sustained conceptual mastery, strengthening critical thinking, collaboration, creativity, and communication skills—equipping learners to apply knowledge in real-world contexts and confront global challenges of the 21st century. In the framework proposed by Fullan, Quinn, and McEachen (2017), deep learning is described as "*quality learning that sticks*," requiring partnerships between learners and teachers, authentic learning experiences, and the development of global competencies known as the 6C**s**: critical thinking, creativity, collaboration, communication, citizenship, and character. The deep learning approach in education is supported by three core pillars: mindful learning**,** meaningful learning, and joyful learning**.** Mindful learning focuses on activating awareness and critical thinking through contextual problem stimulation that encourages learners to reflect on their thinking processes (Langer, 2023). Meaningful learning emphasizes conceptual connections that allow students to build deep understanding rather than mere memorization (Ausubel, 2021). Joyful learning fosters a positive and engaging learning environment in which students are emotionally involved and motivated to learn independently (Fullan, 2019). Together, these pillars create a synergy that promotes deep learning oriented not only toward outcomes but also toward the development of critical, creative, and reflective thinking in line with the spirit of *Merdeka Belajar*.

According to Anderson and Krathwohl (2001), HOTS encompass the abilities to analyze, evaluate, and create (C4–C6). Meanwhile, Fullan (2019) emphasizes that deep learning focuses on conceptual mastery, critical thinking, collaboration, creativity, and communication to develop reflective and innovative learners. Contemporary research in Indonesia by Endang Fauziati (2025) further asserts that deep learning is designed to be enduring rather than superficial, with pedagogical frameworks emphasizing understanding, application, and reflection as core components of learning experiences. At SMK IPTEK South Tangerang City, learning practices have attempted to align with the Merdeka Curriculum's emphasis on developing students' competencies, particularly critical, creative, collaborative, and communicative skills. However, challenges remain, especially in assessment practices. One major issue is the suboptimal implementation of HOTS-based assessments that should encourage higher-level thinking and contextual learning.

Not all teachers at SMK IPTEK are able to construct HOTS-based questions effectively in accordance with deep learning principles. Assessments remain dominated by items measuring factual knowledge and basic understanding (LOTS), leading students to rely on memorization rather than analysis, evaluation, or problem-solving. This limitation is influenced by insufficient training, lack of mentoring, and limited access to contextual HOTS assessment examples suitable for vocational students. These conditions negatively impact students' achievement of critical thinking and problem-solving competencies. Students often struggle when faced with real-world situations requiring deep analysis and sound decision-making. Therefore, strengthening teachers' capacity in designing deep learning-based HOTS assessments through training, workshops, and professional collaboration is essential. Such efforts will enable teachers to produce relevant assessment instruments, promote meaningful learning, and support the objectives of the Merdeka Curriculum and the realization of the Pancasila Student Profile.

Despite adequate digital facilities, the utilization of technology in assessment at SMK IPTEK remains limited. Teachers tend to rely on conventional methods, resulting in assessments that lack variation and engagement. Digital platforms such as Quizizz and Google Forms offer strategic opportunities to design contextual HOTS assessments and analyze student performance efficiently. However, limited digital competence, insufficient training, and perceptions of complexity hinder their adoption. As a result, the potential of technology to support HOTS-based and deep learning-oriented assessment has not been fully realized. Continuous training and the cultivation of a digital culture within schools are therefore necessary to optimize existing facilities and enhance assessment quality. Ultimately, these challenges affect the achievement of the Merdeka Curriculum's goals at SMK IPTEK South Tangerang City. Students are insufficiently trained in critical thinking, problem analysis, solution evaluation, and innovation—skills essential for the workforce and higher education. Consequently, there is an urgent need to strengthen teachers' competencies through systematic training, workshops, and mentoring in HOTS-based assessment as an implementation of deep learning. This capacity-building effort will ensure that assessments align with the Merdeka Curriculum and prepare vocational students not only academically and technically but also with essential higher-order thinking skills required in the global era.

Implementation of Activities

This community service activity was conducted at SMK IPTEK South Tangerang, located on Jl. Puspitek Raya, Serpong, South Tangerang City, Banten. The selection of this site was based on preliminary observations indicating that teachers at the school still face challenges in designing Higher Order Thinking Skills (HOTS)-based assessment instruments in accordance

with the demands of the Merdeka Curriculum. The activity was carried out over two days, October 3–4, 2025, in a face-to-face format, involving a total of 20 teachers. The participants came from diverse teaching backgrounds in terms of experience and prior understanding of HOTS concepts. Although most teachers were familiar with the Merdeka Curriculum, they had not yet developed sufficient skills in implementing the deep learning approach or constructing HOTS-based assessment items that require critical, analytical, and creative thinking. Therefore, this program was designed to enhance teachers' pedagogical capacity to develop assessment instruments aligned with the principles of meaningful learning.

Implementation Methods

The activity employed an andragogical and participatory approach, in which participants were not only provided with theoretical material but also actively engaged in hands-on practice, discussions, and reflection. The program began with socialization and counseling sessions aimed at strengthening participants' understanding of HOTS concepts and the deep learning approach within the Merdeka Curriculum.

Stages of Activities

In the initial session, participants were introduced to the nature, principles, and urgency of implementing HOTS to support the realization of the Pancasila Student Profile. After gaining a foundational understanding, the activity continued with an applied workshop on HOTS-based question development. During this stage, teachers practiced designing assessment items based on learning outcomes and instructional objectives, while considering cognitive levels in the Revised Bloom's Taxonomy (C4–C6). Participants were also guided in developing contextual stimuli, formulating assessment indicators, and constructing scoring rubrics tailored to the characteristics of vocational school students. The next stage involved discussion and reflection, where participants presented their assessment products to receive feedback from facilitators and peers. This process enabled teachers to refine and improve their questions to better reflect authentic learning contexts. Subsequently, implementation mentoring was provided through direct guidance in integrating HOTS-based questions into assessment tools such as lesson plans, teaching modules, and student worksheets. The mentoring also included simulations of classroom implementation and evaluation of assessment outcomes. The materials delivered throughout the program covered key aspects, including fundamental HOTS concepts, deep learning principles, application of the Revised Bloom's Taxonomy (C4–C6), techniques for developing high-quality HOTS questions, and strategies for their implementation within the Merdeka Curriculum. Overall, the activity was designed to provide participants with both conceptual understanding and practical experience, enabling the sustainable application of HOTS-based assessment in classroom practice. Consequently, this community service program not only enhanced teachers' assessment skills but also strengthened the quality of teaching and learning processes oriented toward the development of students' higher-order thinking skills.

RESEARCH RESULTS AND DISCUSSION

Research Result

The Community Service Program (*Pengabdian kepada Masyarakat/PkM*) conducted by the lecturer team of the Pancasila and Civic Education (PPKn) Study Program, Universitas Pamulang, entitled *"Development of HOTS-Based Questions as an Implementation of the Deep Learning Approach in the Merdeka Curriculum"* at SMK IPTEK South Tangerang City, produced several outcomes that serve as indicators of the program's success. These outcomes include measurable improvements in teachers' competencies as evidenced through evaluation

instruments (questionnaires and observations), tangible products in the form of HOTS-based question sets, and positive changes in teachers' professional behavior in designing learning activities oriented toward deep learning.

Figure 1. Providing an understanding of the deep learning approach in the Merdeka Curriculum

Figure 1. Providing an understanding of deep learning in the Merdeka Curriculum. In this initial session, participating teachers were introduced to the deep learning approach within the Merdeka Curriculum by the resource person Dr. Yatti Rosmiati, M.Pd.

Figure 2. Development of HOTS-Based Questions

Figure 2 illustrates teachers' activities in developing HOTS-based questions as an implementation of the deep learning approach in the Merdeka Curriculum, facilitated by Dr. Dra. Neng Nurhemah, M.Pd., with assistance from Mas Fierna Janvierna Lusie Putri, S.Pd., M.Pd., and other resource persons. Based on the evaluation conducted through questionnaires, the results indicate a significant improvement in teachers' understanding of HOTS concepts and their application in learning assessment. Prior to the program, approximately 70% of teachers perceived HOTS questions as merely difficult and technically complex. However, after participating in the training, 85% of participants stated that they understood HOTS as assessments that promote higher-order thinking processes, including analysis, evaluation, and creation. This finding demonstrates a substantial increase in conceptual understanding of deep learning as the philosophical foundation of the Merdeka Curriculum.

In addition to conceptual gains, the program generated concrete products. Each group of teachers successfully developed a minimum of five HOTS-based assessment items relevant to their respective subjects, incorporating contextual stimuli, higher cognitive levels (C4–C6), and authentic assessment rubrics. These products were compiled into a cross-subject HOTS

question bank and a concise module on developing HOTS-based questions using the deep learning approach, which were subsequently provided to the school as professional development resources. The module includes practical guidelines, sample stimuli, and step-by-step procedures aligned with the learning outcomes of the Merdeka Curriculum. These outputs demonstrate that the program's success extends beyond improved understanding to the production of sustainable and applicable instructional resources. Another indicator of success was the positive response from participants during and after the activity. Based on final evaluation forms, most teachers stated that the program was highly relevant to their needs, particularly in addressing the assessment demands of the Merdeka Curriculum. Approximately 90% of participants expressed positive feedback regarding the interactive, reflective, and application-oriented training methods. Participants also appreciated the *learning by doing* approach employed during the workshops, as it allowed them to directly practice question development while receiving technical guidance from the facilitators.

Field observations further revealed improvements in participants' analytical skills in constructing assessment items that require deep reasoning. During workshop sessions, teachers demonstrated the ability to identify competency indicators aligned with higher cognitive levels in the Revised Bloom's Taxonomy. They were also able to design contextual stimuli relevant to vocational students' real-life experiences, such as workplace scenarios, entrepreneurship projects, and industry-based case studies. Facilitators' observations indicated that approximately 80% of participants produced HOTS items that met quality criteria in both content and structure, reflecting mastery of deep learning principles. Beyond technical competence, the program also contributed to a shift in teachers' instructional paradigms. Through final reflection sessions, teachers recognized that deep learning-based instruction requires educators to act as facilitators who encourage students to think critically, collaboratively, and reflectively. Teachers began proposing more contextual learning designs, including the integration of digital literacy, project-based assessment, and the use of HOTS questions to assess students' problem-solving and creativity. This transformation represents a significant achievement, as it indicates a shift from outcome-oriented instruction toward sustained deep cognitive processes.

Overall, the outcomes of this program can be categorized into two main forms: products and services (partner competencies). The products include a deep learning-based HOTS assessment module and a cross-subject HOTS question bank, while the service outcomes consist of enhanced teacher competencies in independently designing, implementing, and evaluating HOTS-based assessments. Both outcomes serve as tangible indicators of the program's success, as they are practical, sustainable, and directly applicable in the partner school's instructional practices. Several factors contributed to the success of this activity, including strong support from the school administration, active participant engagement throughout the workshops, and training approaches tailored to teachers' needs. Conversely, a limiting factor was the relatively short duration of the program, indicating the need for follow-up mentoring to ensure optimal classroom implementation of HOTS-based assessments. Therefore, it is recommended that this initiative be continued through long-term collaborative programs between Universitas Pamulang and SMK IPTEK South Tangerang City to sustain research-based and innovative teacher professional development.

In conclusion, this community service activity proved effective in addressing the partner school's challenges related to teachers' limited capacity in developing and implementing HOTS-based assessments aligned with the Merdeka Curriculum. Through the deep learning approach, teachers gained not only conceptual understanding but also practical skills and tangible products that support the improvement of assessment quality. This demonstrates that the PkM

program functions not merely as a technical training initiative but also as a strategic effort to strengthen instructional transformation toward an authentic *Merdeka Belajar* paradigm oriented to the holistic development of learners' potential.

Discussion

The Community Service Program entitled *"Development of HOTS-Based Questions as an Implementation of the Deep Learning Approach in the Merdeka Curriculum"* was successfully implemented and produced a significant positive impact on improving teachers' competencies at SMK IPTEK South Tangerang City**.** Based on the implementation and discussion of the activities, it can be concluded that this program effectively enhanced teachers' conceptual understanding of the importance of Higher Order Thinking Skills (HOTS) and their relationship with the Deep Learning approach within the Merdeka Curriculum. Teachers gained a clearer understanding that deep learning requires critical, reflective, and contextual thinking, enabling students to connect knowledge with real-life situations. In addition, the program successfully developed teachers' analytical skills in constructing HOTS-based assessment items. Through technical guidance and collaborative practice, participants were able to identify higher cognitive levels such as analysis, evaluation, and creation, and to formulate assessment items that challenge students' reasoning and creativity. Furthermore, the activity encouraged teachers' creativity in designing more meaningful learning experiences by integrating literacy, numeracy, and real-life contexts into assessment practices. This aligns with the spirit of *Merdeka Belajar*, which emphasizes flexibility, learner autonomy, and the relevance of learning to students' lives.

Overall, the implementation of the Deep Learning approach proved effective in strengthening the Merdeka Curriculum by supporting a paradigm shift from teacher-centered to student-centered learning, while fostering higher-order thinking skills essential for facing 21st-century challenges. Therefore, this program was not limited to technical training in assessment development but also reinforced teachers' pedagogical capacity to create reflective, analytical, and creative learning processes in line with the demands of the Merdeka Curriculum. Based on the results and field findings, the implementation team offers several recommendations to relevant stakeholders. For the school, particularly SMK IPTEK South Tangerang City, it is recommended that similar activities be institutionalized as sustainable programs to support ongoing teacher professional development, especially in planning, implementation, and assessment based on Higher Order Thinking Skills (HOTS). The school is also encouraged to establish a teacher learning community to facilitate the sharing of best practices and experiences in developing HOTS-based assessments and applying the Deep Learning approach in classroom instruction.

For participating teachers, continuous efforts are needed to deepen the application of the Deep Learning approach not only in assessment practices but also in daily instructional strategies and thematic projects, so that students become more actively engaged in critical and creative thinking. Teachers are also advised to conduct regular reflective evaluations of HOTS-based assessments to obtain constructive feedback for improving learning processes and student learning outcomes. For the Pancasila and Civic Education (PPKn) Study Program, Universitas Pamulang**,** this community service activity may serve as a model for strengthening teacher capacity in partner schools through research-based and innovative learning approaches. Follow-up activities in the form of monitoring and evaluation of classroom implementation are also necessary and may serve as sources for scholarly publications involving both lecturers and partner schools. For researchers and other lecturers, further studies are recommended to examine the effectiveness of the Deep Learning approach in

enhancing students' critical and creative thinking skills across various educational levels. Interdisciplinary collaboration is also encouraged to expand the impact of HOTS-based learning innovations in partner schools of Universitas Pamulang, ensuring that the outcomes of this community service program provide sustainable and meaningful contributions to education.

CONCLUSION

The authors would like to express their sincere gratitude to Yayasan Sasmita Jaya for providing full financial support for this Community Service Program. The support from Yayasan Sasmita Jaya not only enabled the successful and smooth implementation of the activity but also reflected the foundation's strong commitment to advancing the *Tridharma of Higher Education*, particularly in the area of community service. Through this support, the program was able to contribute positively to enhancing teachers' competencies and strengthening collaboration between higher education institutions and partner schools. It is hoped that this valuable cooperation will continue and expand in the future for the advancement of education in Indonesia.

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