

Empirical Paper

Curriculum Management Based on Deep Learning: The Role of Teacher and Student Participation in Elementary Schools under the Merdeka Curriculum

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Abstract

Purpose: This study analyses deep learning-based curriculum management and the influence of teacher and student participation on deep learning implementation within the Merdeka Curriculum in public elementary schools in Grobogan Regency, Indonesia.

Methodology: A convergent mixed-method design combined quantitative and qualitative data from 144 teachers and 144 fifth-grade students across 18 schools, using questionnaires, interviews, observations, and document analysis. Data were analysed through regression and thematic analysis.

Results: Teacher and student participation significantly influence deep learning implementation ($R^2 = 0.48$ and 0.42 , respectively, $p < 0.05$). Curriculum management significantly strengthens this relationship, with overall implementation effectiveness at 76% (moderately effective).

Novelty and Contribution: The study positions curriculum management as an intervening mechanism linking participation with deep learning implementation, offering mixed-method evidence of its systemic role in integrating planning, implementation, and evaluation

Practical and Social Implications: Schools should strengthen curriculum management through collaborative planning, teacher capacity-building, and active student engagement, supporting meaningful, student-centred education aligned with 21st-century competencies.

Keywords: Curriculum Management, Deep Learning, Student Participation, Elementary Education, Merdeka Curriculum

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1 Introduction

The transformation of elementary education in Indonesia requires a paradigm shift from rote-oriented instruction toward meaningful learning that emphasises conceptual understanding, critical thinking, collaboration, and problem-solving skills. The implementation of the Merdeka Curriculum since 2022 highlights the importance of student-centred learning and the development of 21st-century competencies through deep learning approaches (Kemendikbudristek, 2022). However, empirical evidence indicates that the implementation of deep learning-based instruction in elementary schools has not yet been optimal, particularly in relation to curriculum management practices and the active involvement of key educational stakeholders at the school level.

Several studies have reported that learning processes in elementary schools remain dominated by conventional instructional practices focusing on content delivery and test-oriented outcomes. Retnawati (2014) found that more than 70% of students were unable to identify authentic problems due to learning activities that lacked contextual relevance. More recent studies have confirmed that limited meaningful learning is closely associated with weak curriculum planning and insufficient pedagogical innovation among teachers (Hattie, 2021; Darling-Hammond, 2021). These findings demonstrate a substantial gap between the principles of the Merdeka Curriculum and the realities of classroom practice in elementary education.

Curriculum management plays a critical role in addressing this gap. Beyond its administrative function, curriculum management serves as a strategic system that integrates curriculum planning, instructional implementation, supervision, and continuous evaluation to support high-quality learning (Ornstein & Hunkins, 2020). Fullan et al. (2020) emphasise that deep learning can only be effectively realised when supported by flexible, collaborative, and competency-oriented curriculum management. Without a coherent management framework, instructional innovations tend to be fragmented and unsustainable.

In addition to curriculum management, teacher and student participation are essential determinants of successful deep learning implementation. Teachers are expected to act as instructional designers and facilitators who create reflective and contextual learning experiences, while students are required to engage actively, autonomously, and collaboratively in the learning process (Ryan & Deci, 2020; Harper & Milman, 2022). Zhou and Zhang (2021) demonstrated that higher levels of student participation are significantly associated with deeper conceptual understanding and the development of higher-order thinking skills. Nevertheless, existing studies often examine these factors separately and rarely position curriculum management as an intervening variable that mediates the relationship between participation and deep learning implementation.

Based on these considerations, there is an urgent need for an empirical study that comprehensively analyses the relationships among teacher participation, student participation, and curriculum management in supporting deep learning-based instruction in elementary schools. The alternative solution proposed in this study is the strengthening of curriculum management as a systemic strategy to integrate instructional innovation with active stakeholder participation. Accordingly, this study aims to examine the effects of teacher and student participation on the implementation of deep learning-based instruction, with curriculum management positioned as an intervening variable within the context of the Merdeka Curriculum in elementary education. The findings of this study are expected to contribute theoretically to the field of curriculum management and elementary education research, as well as practically inform schools and policymakers in improving the quality of meaningful learning.

2 Methodology

This study employed a mixed-method approach using a convergent parallel design to obtain comprehensive findings. Quantitative and qualitative data were collected simultaneously, analysed separately, and then integrated to provide an in-depth interpretation of deep learning-based curriculum implementation.

Research Design

The quantitative component examined the influence of teacher and student participation on the implementation of deep learning-based curriculum. The qualitative component explored curriculum management practices at the school level to support and explain statistical findings.

Participants

The participants consisted of 144 fifth-grade teachers and 144 fifth-grade students from 18 public elementary schools in Grobogan Regency, Indonesia. A two-stage cluster sampling technique was used. First, 18 schools were randomly selected as clusters. Second, eight teachers and eight students from each school were selected as respondents.

Data Collection

Quantitative data were collected through Likert-scale questionnaires measuring four variables: student participation, teacher participation, curriculum management, and deep learning-based curriculum implementation. Qualitative data were obtained through semi-structured interviews with school principals and teachers, classroom observations, and document analysis of lesson plans and curriculum documents.

Data Analysis

Quantitative data were analysed using regression analysis and significance testing ($p < 0.05$) to determine the contribution of independent variables. The coefficient of determination (R^2) was used to measure effect size. Qualitative data were analysed using data reduction, data display, and conclusion drawing techniques following Miles, Huberman, and Saldaña's interactive model. The integration of quantitative and qualitative findings was conducted at the interpretation stage to strengthen validity and provide a comprehensive explanation of curriculum management and deep learning implementation.

Observation

Classroom observations were conducted to examine the actual implementation of deep learning-based instruction and curriculum management practices in elementary schools. The observations aimed to capture authentic teaching–learning interactions, student engagement, instructional strategies, and the integration of deep learning principles aligned with the Kurikulum Merdeka framework. A structured observation checklist was used to assess several indicators, including: (1) student active participation in discussions and collaborative activities, (2) teacher facilitation of project-based or problem-based learning, (3) integration of 21st-century competencies (critical thinking, collaboration, communication, and creativity), (4) use of learning media and technology, and (5) formative and authentic assessment practices.

Observations were conducted in selected Grade V classrooms across 18 public elementary schools. Each session focused on identifying the consistency between lesson planning documents and classroom implementation. Field notes were recorded systematically to support data triangulation and to provide contextual explanations for the quantitative findings.

Needs Analysis

A needs analysis was conducted to identify gaps between the expected principles of deep learning implementation and the actual practices in elementary schools under the Kurikulum Merdeka. The analysis aimed to determine the level of readiness in terms of curriculum management, teacher competence, and student engagement.

Data for the needs analysis were collected through questionnaires, interviews, classroom observations, and document reviews. The focus was on identifying challenges related to lesson planning, instructional strategies, assessment practices, and the integration of 21st-century competencies. Particular attention was given to teacher participation in curriculum design and student involvement in project-based and collaborative learning activities.

The results of the needs analysis provided the foundation for interpreting the extent to which curriculum management supports deep learning practices. It also helped clarify areas requiring improvement, particularly in strengthening teacher facilitation skills, enhancing student active participation, and aligning classroom implementation with curriculum objectives.

Training and Mentoring Stage

The training and mentoring stage was conducted to strengthen teachers' understanding and implementation of deep learning-based instruction aligned with the Kurikulum Merdeka. This stage aimed to enhance teachers' pedagogical capacity, particularly in designing project-based learning, facilitating collaborative activities, and applying authentic assessment. The training sessions focused on three main components:

- i. conceptual understanding of deep learning principles and 21st-century competencies,
- ii. development of innovative teaching modules based on problem-based and project-based learning, and
- iii. formative and reflective assessment strategies. Following the training, mentoring activities were conducted through classroom assistance, lesson plan review, and reflective discussions.

Teachers received feedback on instructional design, student engagement strategies, and assessment practices. This continuous mentoring approach was intended to ensure consistency between curriculum planning and classroom implementation. The training and mentoring stage also functioned as an intervention mechanism to support curriculum management improvement and to optimise the active participation of both teachers and students in the learning process.

Activity Evaluation Stage

The activity evaluation stage was conducted to assess the effectiveness of the training, mentoring, and classroom implementation of deep learning-based instruction aligned with the Kurikulum Merdeka. The evaluation aimed to measure changes in teacher participation, student engagement, and the overall quality of curriculum implementation.

Evaluation data were collected through post-activity questionnaires, follow-up classroom observations, reflective interviews, and analysis of revised teaching modules. The focus of evaluation included: (1) improvement in teachers' ability to design project-based and problem-based learning, (2) enhancement of student active and collaborative participation, (3) consistency between lesson planning and implementation, and (4) application of formative and authentic assessment practices.

Quantitative findings were analysed using descriptive statistics and regression results to determine the contribution of teacher and student participation. Qualitative feedback from teachers and school leaders was used to identify strengths, challenges, and areas for further improvement. This evaluation stage ensured that the intervention process was systematically reviewed and provided evidence-based recommendations for strengthening deep learning-based curriculum management in elementary education.

Technology and Innovation Products

The technology and innovation products developed in this study were designed to support the implementation of deep learning-based curriculum aligned with the Kurikulum Merdeka. These products aimed to enhance instructional quality, strengthen curriculum management practices, and increase teacher and student participation in meaningful learning.

The primary innovation product was a set of deep learning-based teaching modules integrating project-based learning (PjBL), problem-based learning (PBL), and authentic assessment strategies. The modules were structured to promote 21st-century competencies, including critical thinking, collaboration, communication, and creativity.

In addition, digital learning media and technology-supported instructional tools were introduced to facilitate interactive learning activities. These included presentation templates, collaborative worksheets, and reflective assessment instruments designed to encourage active student engagement.

The development of these products emphasised alignment between curriculum planning, classroom implementation, and evaluation processes. As a result, the technology and innovation products functioned not only as instructional tools but also as practical instruments to strengthen sustainable curriculum management in elementary education.

This study adopts a descriptive correlational survey design to examine the relationships among educational cost, teacher professional competence, and learning outcomes in private junior secondary schools in Lagos State. The design was considered appropriate because it allowed the variables to be examined as they naturally occur without

manipulation, and enabled the determination of the magnitude, direction, and predictive strength of their associations. The population will consist of all private junior secondary schools across the six education districts of

3 Discussion and Implications

The results of this study are presented through descriptive statistics, inferential analysis, and qualitative findings obtained from interviews, observations, and document analysis. Before discussion, quantitative data were analysed to identify patterns, relationships, and the strength of influence among teacher participation, student participation, curriculum management, and the implementation of deep learning–based instruction in elementary schools.

Quantitative analysis revealed that teacher participation demonstrated a positive and significant effect on the implementation of deep learning–based instruction. Teachers who actively engaged in curriculum planning, instructional design, and reflective evaluation tended to implement learning activities that emphasised critical thinking, problem-solving, and contextual understanding. These findings indicate that teacher involvement is a crucial factor in transforming curriculum objectives into meaningful classroom practices. The descriptive results of teacher participation are summarised in Table 1, which presents the mean scores and standard deviations across all measured indicators.

Table 1 Descriptive Statistics of Teacher Participation, Student Participation, Curriculum Management, and Deep Learning Implementation

Variable	N	Mean	Std. Deviation	Category
Teacher Participation	45	4.12	0.48	High
Student Participation	120	4.05	0.52	High
Curriculum Management	45	4.18	0.46	High
Deep Learning Implementation	45	4.09	0.50	High

The analysis also showed that student participation significantly influenced the effectiveness of deep learning–based instruction. Students who actively participated in discussions, collaborative tasks, and inquiry-based activities demonstrated higher engagement and deeper conceptual understanding. These findings support the notion that deep learning requires students to function not merely as recipients of information but as active constructors of knowledge. The distribution of student participation levels is illustrated in Figure 1, which depicts the overall trend of student engagement during classroom learning activities.

Further analysis indicated that curriculum management played a significant intervening role in strengthening the relationship between teacher participation, student participation, and deep learning implementation. Schools with well-structured curriculum management characterised by coherent planning, flexible implementation, and continuous evaluation were more successful in facilitating deep learning–based instruction. The mediation analysis results, presented in Table 2, demonstrate that the indirect effect of teacher and student participation on learning implementation increased when curriculum management was included as an intervening variable. This finding suggests that curriculum management serves as a systemic mechanism that aligns instructional practices with curriculum goals.

The qualitative findings reinforce the quantitative results by providing contextual explanations for the observed patterns. Interviews with teachers and school principals revealed that effective curriculum management enabled teachers to collaborate, adapt learning materials, and design authentic learning tasks aligned with students' real-life contexts. Classroom observations further indicated that schools with strong curriculum coordination were more likely to implement inquiry-based and collaborative learning strategies. These qualitative insights help explain why similar levels of teacher or student participation may result in different learning outcomes depending on the quality of curriculum management.

Table 2 Results of Mediation Analysis on the Role of Curriculum Management

Path Relationship	Direct Effect (β)	Indirect Effect (β)	p-value	Conclusion
Teacher Participation → Deep Learning	0.42	0.18	<0.05	Significant
Student Participation → Deep Learning	0.39	0.16	<0.05	Significant
Curriculum Management → Deep Learning	0.47	–	<0.01	Significant

From a theoretical perspective, these findings align with the deep learning framework proposed by Fullan et al. (2020), which emphasises the integration of pedagogy, curriculum, and learner engagement. The results also support previous studies highlighting the importance of participatory learning environments and strategic curriculum leadership in fostering meaningful learning experiences (Hattie, 2021; Darling-Hammond, 2021). The integration of quantitative and qualitative findings confirms that deep learning-based instruction in elementary schools cannot be achieved through isolated efforts but requires a comprehensive curriculum management approach that actively involves teachers and students.

Overall, the results and discussion demonstrate that teacher participation and student participation significantly influence the implementation of deep learning-based instruction, with curriculum management functioning as a critical intervening variable. These findings provide empirical evidence that strengthening curriculum management practices is essential for ensuring the successful implementation of the Merdeka Curriculum and for promoting meaningful, sustainable learning in elementary education.

Community Service Implementation Stage Method

The community service implementation stage was carried out as a structured intervention to strengthen deep learning-based curriculum practices in elementary schools aligned with the Kurikulum Merdeka. This stage aimed to bridge research findings with practical application by directly assisting schools in improving curriculum management and instructional strategies.

The implementation method consisted of four main phases:

- i. preliminary assessment and coordination with school stakeholders;
- ii. training workshops on deep learning principles and innovative instructional design;
- iii. classroom mentoring and assisted implementation of project-based and problem-based learning; and
- iv. monitoring and evaluation of instructional practices.

Training sessions emphasised the development of teaching modules integrating 21st-century competencies, authentic assessment, and collaborative learning strategies. During the mentoring phase, teachers received direct feedback on lesson planning, student engagement techniques, and reflective assessment practices. This approach ensured alignment between curriculum planning documents and actual classroom practices.

The community service method applied a participatory and collaborative approach, involving school principals, teachers, and students to foster shared responsibility in curriculum improvement. Through this structured implementation stage, schools were expected to enhance instructional quality, strengthen teacher agency, and increase student active participation in meaningful learning processes.

Results of Activity Implementation

The results of the activity implementation indicate a measurable improvement in the application of deep learning-based instruction aligned with the Kurikulum Merdeka. Following the training and mentoring stages, teachers demonstrated increased competence in designing project-based and problem-based learning modules, integrating 21st-century competencies, and applying authentic assessment strategies.

Quantitative findings reveal that teacher participation significantly influenced the implementation of deep learning-based curriculum ($R^2 = 0.48$, $p < 0.05$), while student participation also showed a substantial contribution ($R^2 =$

0.42, $p < 0.05$). These results suggest that strengthening teacher engagement has a direct impact on improving student involvement and overall instructional quality.

Classroom observations further confirmed improved student engagement, particularly in collaborative activities, critical discussions, and reflective learning tasks. The alignment between lesson planning documents and classroom practices became more consistent after mentoring activities. Additionally, curriculum management practices were categorised as moderately effective, with an overall implementation rate of 76%, indicating structural readiness to sustain deep learning initiatives. Overall, the implementation activities successfully enhanced instructional practices, teacher agency, and student active participation, contributing to a more meaningful and transformative learning environment in elementary schools.

4 Conclusion

This study concludes that teacher participation and student participation have a significant influence on the successful implementation of deep learning-based instruction in elementary schools, with curriculum management functioning as a critical intervening variable. Effective curriculum management strengthens the alignment between instructional planning, classroom practices, and evaluation processes, thereby enhancing the impact of teacher and student engagement on meaningful learning outcomes. These findings logically demonstrate that deep learning-based instruction cannot be implemented optimally through individual efforts alone but requires a coherent and systematic curriculum management framework. As an implication, schools are encouraged to strengthen collaborative curriculum planning, promote active participation of teachers and students, and continuously evaluate learning practices to ensure alignment with the principles of the Merdeka Curriculum. Future research may further explore the role of school leadership or digital learning environments in supporting curriculum management and deep learning implementation in elementary education.

Study Limitations

This study has several limitations. First, the research was conducted only in 18 public elementary schools in Grobogan Regency, Indonesia, which may limit the generalisability of the findings to other educational contexts or regions. Second, the cross-sectional design captures curriculum management and participation at a single point in time and does not assess changes in deep learning implementation over time. Third, the study focused primarily on teacher participation, student participation, and curriculum management, while other influential factors such as school leadership, parental involvement, digital infrastructure, and teacher professional development were not examined. Finally, the reliance on questionnaire data may introduce self-report bias despite the use of qualitative data to support and validate the findings.

Future Research Considerations

Future studies should employ longitudinal research designs to examine how deep learning-based curriculum implementation evolves and its long-term effects on student learning outcomes. Expanding the study to include schools from different provinces, private institutions, and diverse educational settings would improve the generalizability of the findings. Future research could also investigate the roles of school leadership, digital learning environments, teacher professional development, parental engagement, and organisational culture as mediating or moderating variables influencing curriculum implementation. Comparative studies across countries implementing competency-based curricula would further enrich understanding of effective curriculum management practices.

Practical and Social Implications

The findings provide practical guidance for school leaders, teachers, and educational policymakers seeking to strengthen the implementation of the Merdeka Curriculum. Schools should prioritise systematic curriculum management through collaborative planning, continuous monitoring, and regular evaluation of instructional practices. Professional development programs should equip teachers with competencies in deep learning pedagogy, project-based learning, authentic assessment, and student-centred instructional strategies. Policymakers should also provide

institutional support, adequate learning resources, and ongoing mentoring to ensure sustainable implementation of deep learning across elementary schools. The study contributes to broader educational improvement by demonstrating that effective curriculum management and active participation from teachers and students can foster meaningful learning experiences and strengthen the development of 21st-century competencies, including critical thinking, collaboration, communication, and creativity.

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Conflict of Interest

The authors declare no conflicts of interest.

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Declaration of Use of Generative AI

Generative Artificial Intelligence (AI) tools were used solely to improve language quality, grammar, and manuscript formatting. All intellectual content, analyses, and conclusions are the responsibility of the authors.

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