

STRATEGIC ANALYSIS OF DEEP LEARNING IMPLEMENTATION IN HIGH SCHOOL GEOGRAPHY EDUCATION: A CASE STUDY FROM SURAKARTA, INDONESIA

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ABSTRACT

The implementation of the Deep Learning Approach in Indonesia's Merdeka Curriculum marks a significant shift toward competency-based and student-centered learning. However, its implementation in geography education remains uneven and context-dependent. This study aims to analyze the strategic implementation of the Deep Learning Approach in high school geography education through a SWOT-based approach in Surakarta, Indonesia. This study employs a qualitative design with a strategic analysis framework. Data were collected from nine public high schools using observation, in-depth interviews, open-ended questionnaires, and document analysis. Informants included school administrators, geography teachers, and students selected through purposive sampling. Data were analyzed through coding, categorization, and SWOT matrix mapping to formulate strategic directions. Findings indicate that while most schools have established a conceptual foundation for deep learning reflected in curriculum alignment, teacher competencies, and emerging reflective practices its implementation remains inconsistent and largely in a transitional phase. Strengths relate to an adaptive curriculum and pedagogical readiness, while weaknesses include uneven implementation and limited resources. Opportunities arise from strong policy support and professional networks, while threats stem from administrative burdens and exam-oriented pressures. This study also identifies varying implementation trajectories, ranging from basic to advanced levels across different schools. The study concludes that the implementation of the Deep Learning Approach is a complex and multi-layered process, shaped by the interaction between institutional capacity and systemic pressures. Therefore, context-sensitive and differentiated strategies are essential to ensure sustainable and systemic transformation in geography education.

Keywords: *deep learning approach; educational strategy ;
geography education; Merdeka Curriculum; SWOT analysis*

INTRODUCTION

The “Merdeka Belajar” Curriculum Reform in Indonesia marks a paradigm shift from content-based learning toward

the development of competencies, independent learning, and pedagogical flexibility at the school level. This shift



aligns with global trends that promote a transformation toward competency-based learning and the integration of the Deep Learning Approach to enhance the quality of conceptual understanding and knowledge transfer (Fullan et al., 2017; Gregersen-Hermans, 2021). Recent studies indicate that the implementation of this curriculum has led to improved learning outcomes. However, its effectiveness depends heavily on the capacity of schools and teachers to translate policy principles into meaningful and context-appropriate classroom practices (Darling-Hammond et al., 2019). Recent research using bibliometric analysis indicates that the implementation of the current geography curriculum is evolving in tandem with GIS education to maximize concrete learning outcomes (Nugroho et al., 2025a). Thus, curriculum transformation requires not only structural adaptation but also systemic and sustained pedagogical changes.

Conceptually, the Deep Learning Approach is understood as an approach that promotes the integration of meaning-making, reflective awareness, and students' active engagement in the learning process (Fullan et al., 2017; Nafi'ah & Faruq, 2025). From a

constructivist perspective, this approach reinforces the process of conceptual internalization through active, dialogic interaction between students and the learning environment (Hasanah & Pujiati, 2025; Muhammad hifdhul Islam Qur'aniy Zidna et al., 2025; Rochmah & Alifiani, 2026). The implementation of deep learning is also closely linked to the principles of meaningful, mindful, and joyful learning, which contribute to improving the quality of the learning experience (Mu'ti et al., 2025). This orientation aligns with the policy direction of the Merdeka Curriculum, which emphasizes differentiation, exploration, and the development of 21st-century skills (Baharuddin, 2025).

Empirically, various interdisciplinary studies have shown that the Deep Learning Approach has transformative potential in improving the quality of learning. Studies in mathematics and science education indicate that this approach can foster deeper conceptual understanding and higher-order thinking skills (Mulyaningrum et al., 2025; Siregar et al., 2025). In other fields, the integration of affective and reflective aspects into learning has been shown to increase student engagement significantly (Mawardi et al., 2025). This



finding is supported by Ricita et al. (2025), which indicates that integrating meaningful, mindful, and joyful learning into a deep learning approach can enhance student participation and learning experiences in a holistic manner. Furthermore, in the context of implementing the Merdeka Curriculum in Indonesia, this approach is also viewed as an innovative strategy for bridging the demands of 21st-century learning with students' contextual needs, although it still faces challenges regarding teacher readiness and support systems (Syaifulloh, 2025). However, the implementation of this approach is not without its challenges, including teacher readiness, pedagogical literacy, technological proficiency, and conceptual ambiguities in today's education system (Darling-Hammond et al., 2019; Fitrah et al., 2025; Paramita et al., 2025). This situation indicates a gap between the conceptual framework of deep learning and its practical implementation in the field.

In addition to pedagogical factors, the successful implementation of learning innovations is also significantly influenced by institutional factors, such as curriculum management and school governance. Adaptive curriculum

management innovations have been shown to contribute to improved learning quality at the secondary school level (Najah & Febriyanti, 2023). Meanwhile, organizational capacity and instructional leadership play a crucial role in ensuring the sustainability of pedagogical innovation (Kamaludin, 2023). At the policy level, an evaluation of the Merdeka Curriculum indicates a need to strengthen scientific literacy and ensure consistent implementation across educational institutions (Wijaya et al., 2025). Variations in local school contexts result in varying levels of implementation, making context-based analysis crucial for understanding how policies are translated into actual practice (Supriani et al., 2022).

In the context of geography education, the implementation of the Deep Learning Approach is of high urgency because the nature of this discipline requires spatial analysis skills, an understanding of complex systems, and the integration of the physical and social aspects of the environment. The literature indicates that this approach has the potential to strengthen students' spatial literacy and environmental awareness, which are key competencies for addressing global challenges such as climate change and



disaster risks (Meadows, 2020; Nugroho et al., 2026). However, its implementation in Indonesia still faces various challenges, including pedagogical adaptation and alignment with teaching materials (Sholehah & Mushoddik, 2024). An empirical study in Surakarta shows that teachers' levels of understanding of the concept of deep learning still vary, with 64% of teachers falling into the moderate understanding category, 24% into the high understanding category, and 12% into the low understanding category (Tjahjono et al., 2026). Surakarta provides a relevant context for examining deep learning implementation because all public senior high schools have adopted the Merdeka Curriculum and are expected to integrate deep learning principles into classroom practices. However, evidence suggests that readiness for implementation remains uneven. Tjahjono et al. (2026), found that while most schools demonstrated moderate readiness for deep learning implementation, substantial variations persisted across institutions. These findings indicate that schools may differ in their capacity to translate curriculum reforms into consistent pedagogical practices. Such

variation highlights the need for a strategic analysis capable of identifying the internal and external factors that facilitate or constrain the implementation of deep learning in geography education. This indicates that the implementation of deep learning has not yet been fully and uniformly integrated into teaching practices.

To date, most previous studies have focused on evaluating the effectiveness of deep learning or teachers' perceptions of this approach, whether in the context of biology, religious education, or other disciplines (Oka & Sudiana, 2025; Rahmawati et al., 2025; Ricita et al., 2025). Although it makes an important contribution, this approach has not yet been able to explain how internal and external factors simultaneously shape the dynamics of implementation. On the other hand, research on the Merdeka Curriculum generally focuses on its impact or adoption rate (Eryanto & Prasetyono, 2025). This is done without incorporating a strategic analysis perspective capable of systematically mapping the interactions between strengths, weaknesses, opportunities, and threats. Although SWOT analysis has been used in the context of evaluating teacher competencies (Pratiwi et al.,



2025), this approach has not yet been specifically designed to analyze strategies for implementing the Deep Learning Approach in geography education. Consequently, there is a significant research gap at the analytical level regarding the integration of curriculum policy, pedagogical practices, and institutional dynamics within a coherent strategic framework.

Based on the conceptual and empirical gaps identified, this study is framed around one main research question: How can an implementation strategy for the Deep Learning Approach in high school geography education be effectively formulated through a SWOT analysis within the context of the Merdeka Curriculum in Surakarta? This question focuses on efforts to integrate the identification of internal and external factors into a strategic analysis framework to produce a contextual, structured, and sustainable implementation direction.

Although several frameworks have been employed to examine educational innovations and organizational change, each serves a distinct analytical purpose. The Context, Input, Process, Product (CIPP) model is primarily designed to evaluate program effectiveness across

implementation stages and assess whether educational interventions achieve their intended outcomes (Muqorobin et al., 2022). Likewise, strategic frameworks such as TOWS and SOAR are commonly used to formulate future-oriented strategies, yet they generally rely on a prior identification of organizational conditions and strategic factors (Cole & Stavros, 2019; Maity et al., 2023). In contrast, SWOT analysis provides a comprehensive framework for simultaneously examining internal strengths and weaknesses alongside external opportunities and threats, enabling researchers to capture the interaction between institutional capacity and environmental influences (Puyt et al., 2023). Since the present study aims not only to understand the implementation of deep learning but also to identify strategic directions for its development across schools with diverse contexts, SWOT offers a more appropriate analytical lens for mapping the multidimensional factors shaping implementation and informing context-based improvement strategies.

This gap is critical because without a comprehensive strategic understanding, the implementation of pedagogical innovations risks remaining at a



normative level and failing to be sustainable. Therefore, this study aims to strategically analyze the implementation of deep learning in high school Geography education in Surakarta City using a SWOT framework, in order to identify internal and external factors and formulate contextual and practical strategic directions for strengthening the program.

Theoretically, this study expands the discourse on the Deep Learning Approach by integrating it into a strategic analysis framework grounded in the context of upper secondary education, thereby yielding a multi-level perspective that links policy, practice, and institutions. Methodologically, this study demonstrates how SWOT analysis can be used as an analytical tool to examine the dynamics of educational policy implementation systematically. Practically, the findings provide a decision-making foundation for schools and policymakers in designing more adaptive, structured, and sustainable deep learning implementation strategies, not only within the Indonesian context but also within the global landscape of educational reform.

MATERIALS AND METHODS

Theoretically, this study expands the discourse on the Deep Learning Approach by integrating it into a strategic analysis framework grounded in the context of upper secondary education, thereby yielding a multi-level perspective that links policy, practice, and institutions. Methodologically, this study demonstrates how SWOT analysis can be used as an analytical tool to examine the dynamics of educational policy implementation systematically. Practically, the findings provide a decision-making foundation for schools and policymakers in designing more adaptive, structured, and sustainable deep learning implementation strategies, not only within the Indonesian context but also within the global landscape of educational reform (Abdussamad, 2021; Lichtman, 2023). In educational research, this approach is often used to understand the dynamics of teaching and learning practices, social interactions, and the institutional contexts that influence the educational process (Coe et al., 2025; Pilcher & Cortazzi, 2024).

A strategic analysis design using the SWOT framework was chosen to map the internal and external conditions that influence the implementation of deep



learning in Geography education. The SWOT analysis enables the identification of strengths, weaknesses, opportunities, and threats, which can serve as the basis for the systematic formulation of educational development strategies (Benzaghta et al., 2021; Gurel, 2017). This approach has also been used in various strategic studies to evaluate policies, education systems, and learning innovations because it effectively integrates situational analysis with strategy formulation (Rus, 2023; Tahmasbi et al., 2025). In addition, SWOT analysis has pedagogical potential in fostering critical analysis of

teaching practices and the development of educational strategies that are adaptable to change (AlMarwani, 2020; Rosiah et al., 2019).

The research location was selected at a public high school in Surakarta that has implemented the Merdeka Belajar Curriculum. The location was chosen through purposive sampling, taking into account the school's readiness to implement the curriculum and its relevance as a representative context of high schools in an urban area with active educational policy dynamics. **Figure 1**, shows the geographical distribution of this study's research locations.

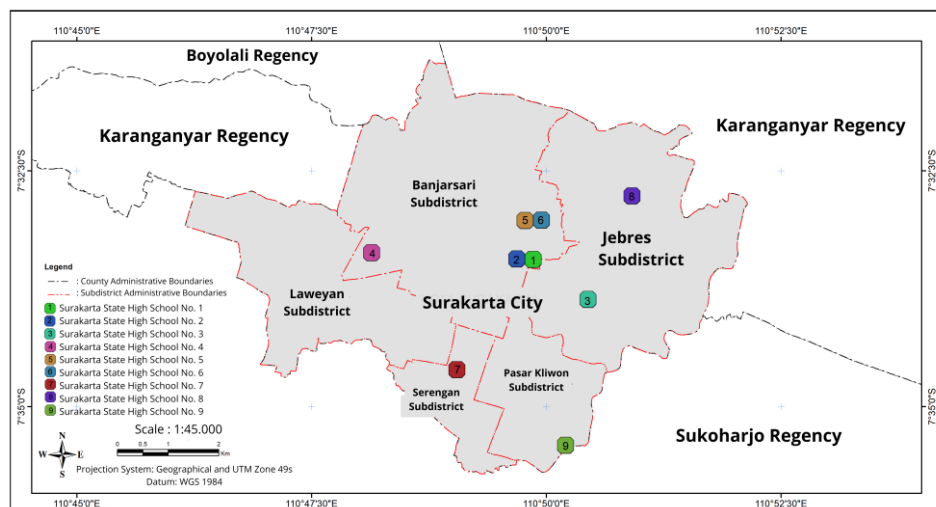


Figure 1. Map of Research Location Distribution

Source: Authors' GIS analysis based on field survey data (2026)

The population of this study comprised all public senior high schools in Surakarta City, totalling nine schools that had implemented the Merdeka Curriculum. Because the number of

public senior high schools was manageable and all schools met the inclusion criteria, this study involved all nine schools. A total of 243 key informants participated in the study,

consisting of 9 school principals or vice principals in charge of curriculum, 9 geography teachers, and 25 students from each school, who were purposively selected to represent a variety of implementation experiences.

Data collection methods included observation, in-depth interviews, open-ended questionnaires, and document analysis. Observation was used to directly observe the Geography learning process, including pedagogical approaches, classroom interactions, the use of teaching materials, and student learning experiences. In-depth interviews were conducted with the school principal, the vice principal for curriculum, and Geography teachers to explore perceptions, internal policies, institutional readiness, and challenges in implementing deep learning. Open-ended questionnaires were administered to students to gather perspectives on their learning experiences, engagement, and understanding of Geography instruction. A documentary study was conducted on the School Operational Curriculum (KOSP) documents, teaching materials, learning objective sequences, and other supporting documents relevant to the implementation of the Merdeka

Curriculum. The use of these various data collection techniques aimed to enhance the comprehensiveness of information and the quality of data through methodological triangulation (Miles et al., 2014; Salmia, 2023). In addition, the quality of the data collection process is also a key factor in producing credible and reliable research findings (Whang et al., 2023).

The research instruments were developed based on subcomponents that reflect the dimensions of deep learning implementation, including: curriculum implementation (KOSP documents), learning frameworks, school environment conditions, school readiness, geography teachers' competencies, learning approaches, student characteristics, internal and external support, learning objective sequences, leadership, the learning process, learning media, extracurricular activities, learning experiences, graduate profiles, learning outcomes, and achievements (Mu'ti et al., 2025; Wahyudin et al., 2024). These subcomponents are based on the deep learning framework outlined in the academic paper on deep learning and serve as the foundation for developing observation guidelines, interview



guidelines, and open-ended questionnaires (Mu'ti et al., 2025). To clarify the structure of the instrument, **Table 1**, presents an instrument matrix that maps the indicators and data sources.

Table 1. Research Instrument Grid

SWOT Dimension	Component	Key Indicator	Data Collection Techniques
Strengths	Curriculum Implementation (KOSP Documents)	Alignment of curriculum documents with deep learning pedagogy principles	Interview, Observation
	Learning Framework	Clarity of instructional structure supporting conceptual and inquiry-based learning	Interview
	Geography Teacher Competence	Teachers' pedagogical, technological, and subject-matter competence	Interview, Questionnaire
	Learning Approach	Application of student-centered learning strategies	Observation
	Deep Learning Approach	Use of higher-order thinking, inquiry, and problem-solving activities	Interview
	Holistic Learning Approach	Integration of cognitive, affective, and experiential learning processes	Observation
	Learning Objective Flow	Coherence and sequencing of learning objectives	Interview
	Learning Process	Quality of classroom interaction and active learning engagement	Observation
	Learning Media	Availability and utilization of learning resources and instructional media	Observation, Interview
Weaknesses	Learning Experience	Students' meaningful engagement in learning activities	Observation, Questionnaire
	School Readiness for Implementing Deep Learning	Institutional readiness including infrastructure and pedagogical preparedness	Interview, Observation
	Student Characteristics	Variability in motivation, learning independence, and prior knowledge	Interview, Questionnaire
	Internal Support	Institutional support from school management and internal collaboration	Interview
	Leadership	Effectiveness of school leadership in promoting pedagogical innovation	Interview
Opportunities	External Stakeholder Support	Support from government agencies, academic institutions, and professional networks	Interview
	Extracurricular Implementation	Opportunities to extend deep learning through projects, clubs, or field activities	Observation, Interview
	Graduate Profile	Alignment with national competency standards and future skill orientation	Interview
Threats	Learning Outcomes	Pressure to meet measurable learning outcomes and curriculum standards	Interview
	Academic Achievement Orientation	Dominance of exam-oriented culture that may constrain deep learning implementation	Interview, Questionnaire

Source: (Fullan et al., 2017; Gurel, 2017; Mu'ti et al., 2025), with modification



Table 1, presents the framework of the research instrument used to identify internal and external factors influencing the implementation of deep learning pedagogy in upper-secondary geography education. Each component was operationalized through key indicators and evaluated using various qualitative data collection techniques, including in-depth interviews, classroom observations, and open-ended questionnaires.

Instrument validation was conducted through expert judgment involving experts in geography education, the Chair of the Surakarta City Geography Teachers' Working Group (MGMP), and the head of the Central Java Provincial Education Office's Regional Education Office VII, to assess the construct

validity, clarity of indicators, and relevance of the instrument items to the research objectives. The expert judgment approach is a commonly used method to ensure the conceptual validity of research instruments through evaluation by experts competent in the relevant field. (Mach et al., 2017). The research findings were also validated through triangulation of sources and methods, as well as confirmation of the findings with key informants, to enhance the credibility and consistency of the data. Based on the results in **Table 2**, the validation of the test instrument conducted by subject matter experts revealed that the instrument is highly valid, as indicated by a score of $4 \leq 4.75 \leq 5$, making it suitable for use in this study.

Table 2. Results of Questionnaire and Interview Instrument Validity

Interval	Validity Criteria
$4 \leq RV \leq 5$	Highly Valid
$3 \leq RV \leq 4$	Valid
$2 \leq RV \leq 3$	Invalid
$1 \leq RV \leq 2$	Not Valid

Source: SPSS Results

The data analysis process was conducted in stages. Data from observations, interviews, questionnaires, and documentation were first reduced, coded, and categorized according to the study's subcomponents. This analysis

process followed the stages of qualitative data analysis, which include data reduction, data presentation, and drawing conclusions (Miles et al., 2014). Next, the identified factors were grouped into internal dimensions (strengths and



weaknesses) and external dimensions (opportunities and threats). The results of this mapping were analyzed using a SWOT matrix to formulate strategic alternatives in the SO, WO, ST, and WT quadrants. This analysis enables the development of strategies that take into account both the institution’s internal conditions and the dynamics of the external educational environment (Benzaghta et al., 2021; Gurel, 2017). The categorization of schools into basic, intermediate, and advanced levels is based on a cross-case analysis of SWOT findings and key indicators of deep

learning implementation, including curriculum alignment, teacher competencies, the quality of the learning process, and institutional support. These levels (elementary, middle, and high school) reflect differences in complexity, consistency, and institutional support for implementation, in accordance with the general principle that educational levels can be distinguished based on the stages of the learning process and competencies. **Table 3**, presents the grouping of schools based on the SWOT findings of this study.

Table 3. Classification Criteria of Implementation Level

Level	Criteria
Basic	The implementation of deep learning remains limited; KOSP has not yet been fully integrated; teaching practices are not yet consistent; and support for facilities and systems remains limited.
Intermediate	Implementation is beginning to take shape; KOSP has already incorporated the principles of deep learning; learning practices are fairly consistent but not yet uniform; institutional support is beginning to take shape.
Advanced	Implementation is systematic; KOSP is strongly integrated; learning practices are consistent and reflective; leadership support and school culture are strong.

Source: (Borgstede & Rau, 2023), with modification

This study has received ethical approval from the Ethics Committee of Kusuma Husada University, Surakarta, under approval number No. 3438/UKH.L02/EC/IV/2026. All procedures performed in this research involving human participants were conducted in accordance with established ethical standards and

institutional guidelines. Prior to data collection, informed consent was obtained from all participants, ensuring that their participation was voluntary. Participants were also informed about the purpose of the study, the procedures involved, and their right to withdraw at any time without any consequences. Confidentiality and anonymity of the



participants were strictly maintained throughout the research process. All data were securely stored and used solely for academic purposes.

The research procedure was carried out in several stages, namely: (1) preliminary study and instrument development; (2) instrument validation through expert judgment; (3) field data collection; (4) SWOT analysis and

mapping; (5) formulation of strategic directions; and (6) preparation of the research report. All stages were carried out systematically to ensure the traceability of the research process and to maintain methodological consistency in producing scientifically accountable findings. **Figure 2**, presents the entire research process in detail.

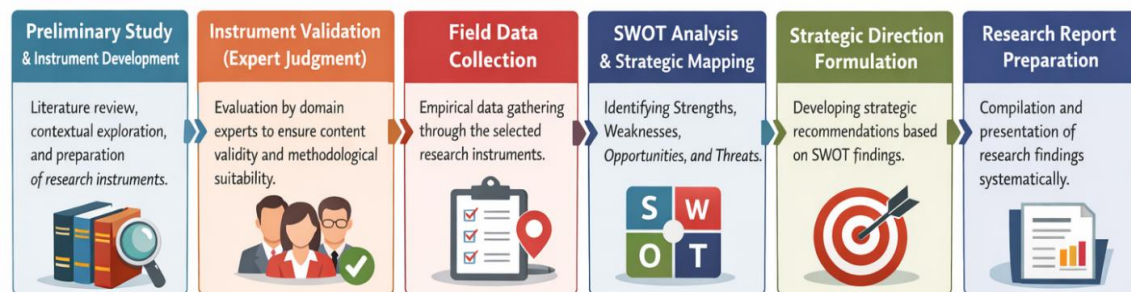


Figure 2. Research Procedure Framework

Source: (Benzaghta et al., 2021; Miles et al., 2014), with modification.

RESULTS AND DISCUSSION

1. SWOT Analysis of Deep Learning Implementation in Each School

The results of the SWOT analysis at nine public high schools in Surakarta reveal a mixed picture regarding the implementation of deep learning pedagogy in geography education. Overall, the findings indicate that most schools have begun integrating deep learning principles, primarily through curriculum alignment and the implementation of student-centered learning practices. However, the depth,

consistency, and institutional support for this implementation vary significantly across cases.

Internally, strengths are primarily linked to curriculum flexibility, teacher competencies, and an emerging culture of reflective learning. At the same time, weaknesses are largely associated with uneven implementation, limited learning resources, and variations in student readiness. Externally, implementation is supported by national curriculum policies, professional networks, and increasingly widespread access to digital

learning resources. However, schools also face systemic challenges, including administrative workload, policy dynamics, and constraints in sustaining pedagogical innovation. These variations indicate that the implementation of deep learning is not

uniform but context-dependent, shaped by the interaction between institutional capacity, teacher readiness, and external educational pressures. **Table 4** presents a comprehensive breakdown of the strengths, weaknesses, opportunities, and threats for each school.

Table 4. SWOT Analysis of All Public High Schools in Surakarta

School	Strengths (S)	Weaknesses (W)	Opportunities (O)	Threats (T)
State High School 1	Adaptive and collaborative KOSP; high teacher competence; strong leadership; reflective and consistent learning; emphasis on meaningful learning experiences	The equity of learning outcomes is not yet optimal; reliance on teachers remains a key factor in learning; fieldwork opportunities are limited	Support for the Merdeka Curriculum; subject-specific teacher working groups (MGMP) and external partnerships; access to technology and digital learning resources	Policy dynamics continue to evolve and adapt; administrative burden; innovation fatigue
State High School 2	The KOSP is systematically organized; teachers possess adequate competencies; resource management is supportive; and the learning environment is conducive	The implementation of deep learning has not been uniform; teachers' reflection remains limited; technology has not been fully utilized	Policy support through the curriculum; support from the MGMP; and access to digital learning resources	Teachers' administrative workload is increasing; policy dynamics are constantly evolving; innovation is stagnating
State High School 3	Leading schools; strong KOSP; competent teachers; visionary leadership; a culture of deep reflection	Expectations for the implementation of instruction are very high; consistency across classes must be maintained for heterogeneous classes	National support through lead teachers and lead schools; support from subject-specific teacher working groups; becoming a model school	Policy changes; organizational structures that have not yet been adjusted; high performance expectations for optimal results
State High School 4	Linear and active teaching within the GTK platform; participatory leadership; a growing culture of reflection	Technology remains limited; infrastructure constraints; the implementation of deep learning has not been uniformly adopted across all subjects	Support from the MGMP and the Central Java Provincial Education Office; opportunities to improve performance at the National Science Olympiad	Facility dependency; variations in teacher readiness
State	Adaptive KOSP;	Limited digital lab	Support from the	Facility



School	Strengths (S)	Weaknesses (W)	Opportunities (O)	Threats (T)
High School 5	competent teachers; ongoing supervision; improved performance	resources; limited project time	MGMP team, the Department of Education, and universities	dependency; variations in teacher readiness
State High School 6	KOSP is systematically organized; reflective teachers; democratic leadership; a strong learning community	The depth of learning is not yet consistent; time constraints in studying deep learning	Support from the MGMP team and the university	The demands of a dynamic curriculum; time constraints
State High School 7	A strong culture of tolerance; reflective teachers; evaluation through FAS (<i>Forum Aspirasi Siswa</i>)	Technology is limited; field practices are not yet optimal	Support from the MGMP and lead teachers	Limited funds; academic demands
State High School 8	Consistent KOSP; reflective teachers; leadership supportive	Technology is not yet widely available; practical tools are limited	Support from subject-specific teacher associations and universities	Restrictions on extracurricular activities; academic pressure
State High School 9	Professional teachers; a strong philosophy of deep learning; adaptive leadership	Limited resources; implementation standards are not yet uniform	Support from the MGMP team and universities	Quality requirements; budget constraints

Source: Authors' field data analysis (2026).

Thus, the variation in SWOT results across schools indicates that the direction of deep learning development cannot be standardized but must be tailored to the readiness level and characteristics of each educational institution. Although this study did not employ quantitative SWOT weighting, the recurrence of factors across schools indicates clear strategic priorities. Curriculum alignment, teacher competence, and reflective learning culture emerged as the most prominent strengths, while inconsistent implementation and limited learning

resources were the most recurrent weaknesses. Likewise, support from the Merdeka Curriculum and MGMP networks appeared as dominant opportunities, whereas administrative burden, policy dynamics, and academic pressure represented the most significant threats. To further identify these dominant patterns, a cross-school synthesis is presented in the following section.

The results of the SWOT analysis indicate that the implementation of the Deep Learning Approach in Geography instruction at public high schools



throughout Surakarta City varies widely, both in terms of internal strengths and external pressures. In general, these findings confirm that the implementation of deep learning is not uniform but is significantly influenced by institutional capacity, teacher competence, and the surrounding educational policy context. In terms of strengths, most schools have demonstrated alignment between their operational curriculum documents (KOSP) and the principles of deep learning, particularly in strengthening inquiry-based, reflective, and contextual learning. This indicates that policy transformation through the Merdeka Curriculum is beginning to be internalized at the practical level. These findings are consistent with Prihantoro et al. (2025), who state that the implementation of deep learning in Indonesian secondary schools is supported by the integration of curriculum policies and teachers' pedagogical readiness. In addition, teachers' relatively strong competencies and the emergence of a culture of reflection in some schools indicate the presence of a crucial foundation for fostering meaningful learning. This situation is further reinforced by Andayanie et al. (2025), which

emphasizes that deep learning requires the integration of mindful, meaningful, and joyful learning—an integration that can only be achieved if teachers possess adequate reflective and pedagogical capacities.

However, the identified weaknesses indicate that implementation has not yet been fully consistent or equitable. Variations in the quality of learning across classes, limited resources, and reliance on specific teachers are the main obstacles. This suggests that the implementation of deep learning remains partial and has not yet been systematically institutionalized. These findings are consistent with Hidayani et al. (2025), who found that one of the main challenges in implementing deep learning is the inconsistency in teaching practices due to differences in teacher capacity and institutional support. In addition, limited class time and a lack of hands-on practice also hinder the creation of authentic learning experiences, even though this approach is crucial for strengthening students' conceptual understanding (Pujawati et al., 2025).

In terms of opportunities, policy support for the Merdeka Curriculum, the existence of MGMPs, and access to



digital learning resources are significant external factors in driving the strengthening of implementation. These findings indicate that, structurally, Indonesia's educational ecosystem has provided ample space for the development of deep learning. Nugroho et al. (2025), The scoping review also confirms that the Merdeka Curriculum provides pedagogical flexibility that enables teachers to develop more contextual and competency-based learning. Additionally, professional networks such as MGMP serve as important platforms for sharing best practices and collectively enhancing teachers' capacities.

On the other hand, the identified threats indicate systemic pressures that could potentially hinder the sustainability of implementation. Teachers' administrative burdens, the dynamics of education policy, and the dominance of an academic achievement-oriented approach are factors that can shift the focus of learning from the process to results alone. This situation aligns with the findings Rickles et al. (2019), which states that the implementation of deeper learning is often hindered by the pressures of an evaluation system that remains focused on measuring short-

term outcomes. Furthermore, the risks of innovation burnout and resource constraints also indicate that pedagogical innovation requires sustained systemic support, not merely individual initiatives.

Overall, the results of this analysis confirm that the implementation of deeper learning is a complex and multidimensional transformative process. The success of implementation is determined not only by teacher readiness but also by the alignment between policy, school culture, and the support of the education system. These findings reinforce the argument Rahmawati et al. (2025), that deep learning is part of the transformation of education toward higher quality, which requires changes not only in teaching practices but also in the education system as a whole. Furthermore, in the context of geography education, the implementation of deep learning holds strategic potential for developing students' critical thinking skills and spatial understanding, Nugroho et al. (2026), The implementation of the deep learning approach within the Merdeka Curriculum still requires the strengthening of implementation



strategies grounded in the school context. Thus, the variation in SWOT results across schools indicates that the direction of deep learning development cannot be standardized but must be tailored to the readiness level and characteristics of each educational institution. This underscores the importance of a context-based strategic approach in optimizing the implementation of the Deep Learning Approach in high school geography education.

2. Cross-School Pattern Analysis of Deep Learning Implementation
A cross-school analysis reveals consistent patterns in the implementation of deep learning in Geography instruction at public high schools throughout Surakarta. The synthesis of SWOT findings presented in **Table 5** indicates that the primary strengths lie in curriculum alignment and teacher competencies, while the main weaknesses relate to the consistency of implementation and limitations in learning resources.

Table 5. Cross-School Pattern Synthesis of SWOT Factors

Dimension	Dominant Pattern	Evidence Across Schools	Interpretation
Strengths	Adaptive KOSP; strong teacher competencies; a culture of reflection is beginning to take shape	Almost all schools demonstrated alignment between the curriculum and teacher capacity (High Schools 1, 2, 3, 5, 6, and 8)	The conceptual foundation for the implementation of deep learning has been established
Weaknesses	Implementation has not been uniform; limited resources; limited field experience	Found in most high schools (High Schools 2, 4, 6, 7, 8, 9)	Implementation remains partial and is not yet systematic
Opportunities	Support for the Merdeka Curriculum; MGMP; digital learning resources	Consistent across all high schools (High Schools 1, 2, 3, 4, 5, 6, 7, 8, and 9)	The external environment is highly conducive to development
Threats	Administrative burden; policy dynamics; academic pressure	Consistent across all high schools (High Schools 1, 2, 3, 4, 5, 6, 7, 8, and 9)	Systemic pressures have the potential to hinder innovation

Source: Authors’ synthesis from SWOT findings (2026).

Furthermore, the distribution of constraints shown in **Table 6**, indicates that implementation barriers are not individual in nature, but rather systemic and experienced by the majority of schools, particularly regarding limited facilities and the uneven adoption of

deep learning practices. On the other hand, opportunity factors show a high degree of consistency across all schools, particularly the support provided by the Kurikulum Merdeka policy and professional teacher networks.



Table 6. Distribution of Key Constraints Across the School

Constraint Type	Schools Affected
Limited resources for geography education	SMA 4, 5, 6, 7, 8, 9
The implementation of deep learning is not consistent across all subjects	SMA 2, 4, 6, 8, 9
Limited learning time	SMA 5, 6, 7
Administrative pressure on teachers	SMA 1, 2, 3
Limited fieldwork	SMA 2, 4, 6, 7, 9

Source: Authors' field data analysis (2026).

The results of the cross-school analysis in **Tables 5** and **Table 6** indicate that the implementation of deep learning in Geography instruction at public high schools throughout Surakarta is in a developing phase, exhibiting a relatively consistent pattern among strengths, weaknesses, opportunities, and threats. These findings confirm that the pedagogical transformation driven by the Merdeka Curriculum has begun to be internalized, but has not yet fully reached a level of systemic and sustainable implementation.

In terms of strengths, the dominance of KOSP alignment and teacher competencies indicates that the conceptual foundation of deep learning has been established in most schools. This suggests that curriculum reform has not merely remained at the policy level but has begun to be translated into teaching practices. These findings align with Khairunnisa et al. (2025), who emphasise that the Merdeka Curriculum promotes more flexible and student-

centered learning. Furthermore, the emergence of a culture of reflection and active learning practices indicates a paradigm shift from traditional learning toward more meaningful learning. In this context, the implementation of deep learning is also closely linked to the strengthening of adaptive and sustainable student learning trajectories (Amiruddin et al., 2023).

However, on the downside, the emerging patterns suggest that implementation remains partial. Inconsistencies in practices across classes, limited resources, and a lack of field-based learning experiences indicate that deep learning has not yet been fully institutionalized. This situation is consistent with Saputra et al. (2025), who found that the implementation of deep learning at the high school level still faces challenges in terms of technical aspects and instructional readiness. In addition, the need for more adaptive differentiated instruction also poses a challenge, given that the diverse



characteristics of students have not yet been fully accommodated in instructional practices. This is consistent with the findings Sugiyanto et al. (2026), which emphasizes the importance of differentiated instruction in supporting inclusive, competency-based learning.

In terms of opportunities, the results indicate strong and relatively uniform external support across all schools, particularly through the Merdeka Curriculum policy, MGMP networks, and access to digital learning resources. This situation reflects that the broader educational ecosystem has provided a conducive environment for the development of deep learning. This support is crucial for strengthening project-based and experiential learning practices, as also demonstrated by Antoro et al. (2026), in the context of project-based learning. In addition, the existence of professional learning communities for teachers is a key factor in collectively enhancing pedagogical capacity. This is supported by Murdjoko et al. (2025), which confirms that professional learning communities play a significant role in fostering sustainable learning innovation.

On the other hand, the threat dimension indicates the presence of considerable

structural pressures, particularly regarding teachers' administrative workload, the dynamics of education policy, and demands for academic achievement. These findings reveal a tension between a deep learning orientation that emphasizes process and an evaluation system that remains outcome-oriented. This situation is further exacerbated by Soedjono et al. (2025), which indicates that administrative demands and shifting policies often shape school principals' perceptions of curriculum reform. Additionally, resource constraints and the potential for organizational burnout pose challenges to sustaining pedagogical innovation.

More broadly, variations in implementation patterns across schools indicate that deep learning is a contextual phenomenon that cannot be standardized. Each school exhibits dynamics influenced by the interaction between internal and external factors. From a more contemporary perspective, cross-institutional data-driven educational evaluation approaches, such as those developed by Fang & Xiao (2025), emphasizes the importance of integrated analysis for a more comprehensive understanding of the



complexities of educational implementation. This aligns with the findings of this study, which indicate that cross-school analysis provides a more complete picture than case-by-case analysis.

Thus, the results of this study confirm that the implementation of deep learning in public high schools throughout Surakarta is in a transitional phase with significant potential for development. However, to achieve systemic and sustainable implementation, strengthening is needed in the areas of consistency of practice, resource support, and instructional leadership capable of bridging the gap between policy and classroom practice.

3. Spatial Direction of Deep Learning Implementation

The results of the analysis indicate that the direction of deep learning implementation in Geography education at public high schools throughout Surakarta City follows a spatial and contextual pattern, as illustrated in **Figure 3**. The map shows that each school not only has distinct internal characteristics but also specific areas for strengthening implementation based on

its individual conditions and level of readiness.

In general, the identified implementation directions can be grouped into several main trends, namely: strengthening the foundations of learning, enhancing pedagogical capacity, ensuring consistency in the learning process, adapting resource-based strategies, and accelerating contextual and reflective learning practices. These variations in direction indicate that the implementation of deep learning cannot be carried out uniformly but requires an adaptive approach grounded in the school's specific context.

Schools with relatively strong internal conditions tend to direct implementation toward accelerating learning practices that are more contextual, integrative, and experience-based. Conversely, schools with limited resources and implementation consistency place greater emphasis on strengthening foundational skills and establishing initial learning practices. On the other hand, some schools are in a transitional phase, focusing on enhancing teacher capacity and ensuring consistency in the learning process.



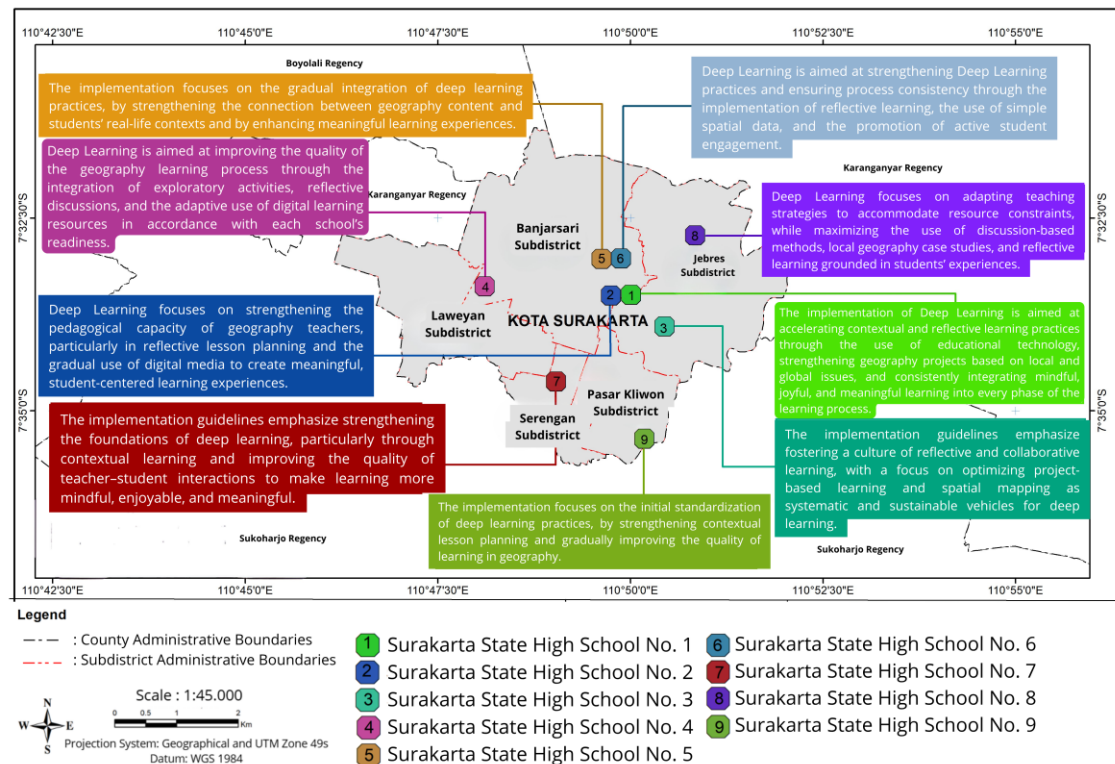


Figure 3. Strategic Roadmap for the Implementation of Deep Learning in the Merdeka Belajar Curriculum for Geography Instruction at Public High Schools in Surakarta
 Source: Developed by the authors based on SWOT analysis results (2026).

The spatial visualization in **Figure 3**, also shows that the distribution of implementation directions does not entirely follow specific geographical patterns but is more influenced by internal school factors such as leadership, learning culture, and pedagogical readiness. This confirms that the spatial approach in this study serves not only as a representation of

location but also as an analytical tool to understand implementation variations more comprehensively.

To clarify the direction of implementation in each school, **Table 7**, presents a synthesis of deep learning implementation directions that directly refer to the map visualization results.

Table 7. Direction of Deep Learning Implementation in Geography Learning across Schools in Surakarta

School	Direction of Implementation	Main Emphasis	Implementation Meaning
State High School 1	Accelerating contextual and reflective learning practices	Technology integration, geography projects, and local-global issues	Learning is focused on enhancing meaningful learning experiences and ensuring the consistent integration of deep learning
State High School 2	Strengthening teaching practices and ensuring consistency in the learning process	Reflective learning and active student engagement	Focus on stabilizing the quality of the learning process
State High School 3	Fostering a culture of reflective and collaborative learning	Project-based learning and spatial mapping	Systematic and sustainable implementation
State High School 4	Improving the quality of the learning process	Exploration, reflective discussion, and digital adaptation	Gradual expansion based on school readiness
State High School 5	A phased approach to implementing deep learning practices	The relevance of the material to real-life contexts	Gradual enhancement of meaningful learning experiences
State High School 6	Strengthening teachers' pedagogical capacity	Reflective planning and the use of digital media	Focus on improving the quality of teachers as key actors
State High School 7	Strengthening the foundations of deep learning	Teacher–student interaction and contextual learning	Initial setup to create meaningful learning
State High School 8	Adaptation of resource-based learning strategies	Discussions, local case studies, reflective learning	Optimizing learning within constraints
State High School 9	Initial standardization of deep learning practices	Contextual planning and the meaning of learning	Gradual strengthening of the implementation foundation

Source: Authors' strategic synthesis (2026).

The findings in **Table 7**. underscore one key point: the implementation of deep learning is not uniform but varies systematically across schools. The map is not merely a visualization; it reveals a structure of differentiation ranging from foundational reinforcement to the acceleration of learning practices. This indicates that variability in implementation is determined more by internal capacity than by geographical factors.

Schools with an acceleration-oriented approach demonstrate a consolidation of curriculum, reflective practices, and contextual learning experiences. This aligns with the finding that deep learning is effective when learning shifts from procedural activities toward authentic, problem- and project-based experiences (Pujawati et al., 2025; Rickles et al., 2019). This integration also reflects the principle of meaningful learning in the Merdeka Curriculum,



which emphasizes the connection between concepts and real-world contexts (Andayanie et al., 2025; Prihantoro et al., 2025). In other words, schools in this category have moved beyond the adoption phase and entered the institutionalization phase of the practice.

Conversely, the group focused on consolidation and capacity building indicated that the main challenge lies not in policy, but in the consistency of practices and pedagogical competence. These findings are consistent with implementation studies in Indonesia that reveal an implementation gap between curriculum design and classroom practice (Khairunnisa et al., 2025; Saputra et al., 2025). In this context, teachers' capabilities are a key factor. The literature confirms that school leadership and professional learning communities play a direct role in improving the quality of teaching practices (Buchari et al., 2025; Murdjoko et al., 2025). In other words, without capacity building, policies do not automatically translate into practice. On the other hand, the foundational and adaptive trajectories indicate that some schools are still in the early stages of implementation, focusing on stabilizing

the learning process and adapting to resource constraints. However, these findings do not merely highlight limitations but also reveal adaptive strategies. The use of discussions, local case studies, and contextual approaches demonstrates that deep learning can thrive even under resource-constrained conditions. This aligns with the approaches of differentiated instruction and context-based learning, which emphasize the flexibility of strategies according to the context (Antoro et al., 2026; Prihadi et al., 2026).

Conceptually, this pattern of differentiation reinforces the argument that the implementation of deep learning is a gradual process that follows an institutional learning trajectory, rather than a single intervention (Yuliani et al., 2026). In the context of the Merdeka Curriculum reform, this also reflects the dynamics of schools adapting to policies that are flexible yet demand a high level of capacity (Nugroho et al., 2025b; Soedjono et al., 2025). Thus, variations in implementation are not deviations, but rather a logical consequence of a decentralized policy approach.

Furthermore, these spatially based findings offer methodological insights.



The mapping approach allows for the identification of cross-institutional patterns that are not apparent in single-case analyses. This aligns with network-based and cross-institutional approaches to educational evaluation, which emphasize the importance of relational analysis in understanding the complexity of the education system (Fang & Xiao, 2025). Thus, the map in this study serves as an analytical tool to reveal the structure of implementation differentiation, rather than merely a geographical representation.

Overall, these findings point to one key implication: strategies for implementing deep learning must be differentiated, tailored to each school's specific context and capacity. A one-size-fits-all approach risks widening the implementation gap. Therefore, policy strengthening must be accompanied by capacity-based interventions, instructional leadership, and the development of teacher learning communities so that the transformation toward deep learning can occur systemically and sustainably.

CONCLUSIONS

This study reveals that the implementation of the Deep Learning

Approach in geography education across public high schools in Surakarta remains in a transitional stage. Although schools have established important foundations through curriculum alignment, teacher competencies, and emerging reflective learning practices, implementation is not yet consistently institutionalized. The findings indicate that implementation is shaped by the interaction between internal factors, including leadership, learning culture, and resources, and external factors such as curriculum policies, administrative demands, and academic pressures. The SWOT analysis further demonstrates that schools exhibit different levels of readiness and implementation trajectories. Consequently, deep learning implementation cannot be approached through uniform policies but requires context-based strategies. Schools at earlier stages need support in strengthening pedagogical capacity and implementation consistency, while more advanced schools should focus on expanding contextual, reflective, and experience-based learning practices. This study contributes to the understanding of deep learning implementation as an adaptive and context-dependent process rather than a



straightforward translation of policy into practice. Several limitations should be acknowledged. First, the study was limited to public high schools in Surakarta, which may restrict the transferability of findings to other educational contexts. Second, the analysis relied primarily on qualitative data obtained from school stakeholders, making the findings dependent on participants' experiences and perceptions. Third, the SWOT analysis was conducted qualitatively and did not incorporate quantitative weighting techniques to rank strategic factors. Future studies may expand the geographical scope, involve a wider range of educational institutions, and integrate mixed-method approaches to strengthen strategic prioritization and comparative analysis.

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