



Adaptive teaching strategies in the implementation of the merdeka curriculum in 3t areas: a systematic literature review

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Article info	Abstract
Keywords: merdeka curriculum, teachers' strategies, 3t areas (disadvantaged, frontier, and outermost regions), elementary schools	This study is motivated by educational disparities in 3T areas (disadvantaged, frontier, and outermost regions), which are characterized by limited infrastructure, restricted access to technology, and insufficient teacher competence in implementing the Merdeka Curriculum. These conditions necessitate the development of adaptive, context-specific learning strategies. This study aims to analyze adaptive teaching strategies and examine the relationships among contextual challenges, pedagogical adaptation, instructional strategies, and their implications for teaching practices. The study employs a Systematic Literature Review (SLR) approach based on 15 relevant scholarly articles. The findings indicate that the dominant strategy is contextual learning (26.7%), followed by Project-Based Learning (20%) and differentiated instruction (13.3%). These results suggest that teachers develop flexible strategies by utilizing local contexts and adapting instructional methods accordingly. Furthermore, this study proposes a conceptual model that illustrates the dynamic relationships among contextual challenges, pedagogical adaptation, instructional strategies, and learning implications. The model highlights that adaptive teaching strategies serve as a mediating mechanism in implementing the Merdeka Curriculum in 3T areas, and underscores the importance of strengthening teachers' adaptive competencies.

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1. Introduction

Educational disparities remain a significant global issue, particularly in regions with limited access to infrastructure, resources, and qualified teaching personnel. International reports indicate that gaps in access to and the quality of education persist in many developing countries, especially in rural and disadvantaged areas (OECD, 2019; UNESCO, 2021). This condition has an impact on the low quality of learning and on the limited opportunities for students to obtain an education

In Indonesia, this problem is increasingly evident in 3T areas (disadvantaged, frontier, and outermost regions), characterized by limited infrastructure, limited access to technology, and an uneven distribution of teaching personnel. Various studies show that implementing the Merdeka Curriculum in 3T areas still faces complex challenges, such as limited educational facilities, low teacher quality and readiness, and socio-economic conditions in communities that are less supportive (Hakim & Alfitri, 2025; Lase, 2024). In addition, teachers' low readiness to implement the curriculum is a major obstacle, particularly due to the lack of training and mentoring (Saiman et al., 2025).

The Merdeka Curriculum, as the latest education policy in Indonesia, is designed to create learning that is more flexible, relevant, and student-centered (Rudiyanto et al., 2025). This curriculum emphasizes the development of 21st-century skills, such as critical thinking, creativity, communication, and collaboration, as well as the integration of local contexts in Learning (Wulandari et al., 2025). However, its implementation at the elementary school level still faces various obstacles, particularly in aspects of management, teacher readiness, and system support (Tomasouw et al., 2024). In addition, teachers' limited understanding of technology and digital learning also poses a challenge in implementing the curriculum (Qondias & Irmawati, 2024).

On the other hand, teachers' role is a key factor in the successful implementation of the Merdeka Curriculum. Teachers not only implement the curriculum but also act as agents of change, able to adapt learning to students' needs and environmental conditions (Najah et al., 2025). Research shows that the role of "guru penggerak" (driving teachers) is crucial for optimizing curriculum implementation, particularly amid resource limitations and resistance to change (Kasim et al., 2025). In addition, strengthening teachers' competencies, including self-efficacy and locus of control, is an important factor in improving their ability to adapt to curriculum changes (Meliza et al., 2024).

Nevertheless, various studies show that teachers in 3T areas still face difficulties in designing and implementing learning that aligns with the demands of the Merdeka Curriculum. The problems that arise include difficulties with lesson planning, the use of innovative methods, and the implementation of assessments appropriate to students' characteristics (Arisandi et al., 2025). In addition, teachers' limited competence in applying various learning strategies also becomes an obstacle to creating effective Learning (Tomasouw et al., 2024).

However, amid these various limitations, teachers in 3T areas demonstrate a high level of adaptability in developing learning strategies. Research shows that teachers strive to create meaningful learning by integrating local contexts, utilizing available resources, and developing students' creativity in the learning process (Muhammad et al., 2025). This indicates that limitations are not only obstacles, but can also encourage innovation in learning practices.

In addition, the implementation of the Merdeka Curriculum is also influenced by leadership and collaboration factors within the school environment. Research shows that adaptive and collaborative leadership can support teachers in addressing challenges in curriculum implementation and improve the quality of learning in schools (Hakim & Alfitri, 2025). Thus, the

success of curriculum implementation depends not only on teachers but also on system support and the overall school environment.

Although various studies have examined the implementation of the Merdeka Curriculum in 3T areas, most continue to focus on identifying challenges and have not comprehensively examined the relationships among contextual challenges, pedagogical adaptation processes, learning strategies, and their implications for learning practices. In addition, previous studies are generally still partial and have not developed a conceptual framework that systematically explains the mechanism of learning adaptation.

Based on these gaps, this study offers a novel conceptual model of adaptive teaching strategies that explains the dynamic relationships among contextual challenges, pedagogical adaptation, learning strategies, and learning implications. This model makes theoretical contributions to understanding the process of learning adaptation in areas with limitations, as well as practical contributions to the design of more contextually and adaptively tailored learning strategies in 3T areas.

Therefore, this study aims to analyze the adaptive teaching strategies implemented by teachers in the Merdeka Curriculum in 3T areas. Specifically, this study examines the relationships between contextual challenges, pedagogical adaptation, learning strategies, and their implications for learning practices.

2. Method

2.1 Research design

This study employs a Systematic Literature Review (SLR) method guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 framework (Page et al., 2021). This approach is chosen because it allows the processes of identification, selection, evaluation, and synthesis of literature to be conducted systematically, transparently, and replicably (Nora et al., 2023). The application of PRISMA 2020 guidelines aims to ensure traceability and consistency at each stage of the research, from the formulation of research questions and the development of literature search strategies to the study selection process, the assessment of methodological quality, and the synthesis of findings.

This SLR aims to synthesize empirical evidence on teachers' strategies for implementing the Merdeka Curriculum in elementary schools in 3T areas (disadvantaged, frontier, and outermost regions), and to analyze the relationship between these strategies and the contextual challenges they face. In addition, this study aims to develop a conceptual model of adaptive teaching strategies in resource-constrained environments, as a theoretical contribution to the study of curriculum implementation in 3T areas.

The following research questions guide the synthesis process in this study:

- (1) What types of teachers' strategies are used in implementing the Merdeka Curriculum in elementary schools in 3T areas?
- (2) How do contextual challenges in 3T areas influence the selection and implementation of teachers' strategies?
- (3) What conceptual model can be developed to explain adaptive teaching strategies in environments with limited resources?

2.2 Literature search strategy

At this stage, the literature search was conducted through the Scopus and Google Scholar databases. The selection of these two databases aims to balance quality and breadth of

literature coverage, with Scopus providing reputable international articles that have undergone rigorous selection. At the same time, Google Scholar complements the search with national publications relevant to elementary education in 3T areas (disadvantaged, frontier, and outermost regions).

The search was conducted using the Publish or Perish (PoP) application, with a publication year range of 2020–2025. The search in the Scopus database was conducted across the title, abstract, and keywords fields, while in Google Scholar, it was conducted in the Publish or Perish application, with filtering by publication year.

The search strategy was systematically developed using a combination of main keywords and relevant synonyms, with Boolean operators (AND, OR), to ensure comprehensive search results that other researchers can replicate.

Based on the initial search results, 820 articles were retrieved from Google Scholar and Scopus. Subsequently, all articles were processed through the PRISMA stages, which include identification, screening, eligibility assessment, and inclusion based on predetermined inclusion and exclusion criteria in this study.

The literature search strategy used in this study is presented in Table 1.

Table 1. Literature search strategy

Keywords	Journal	Number of Articles
("elementary teachers" OR "primary teachers") AND ("remote areas" OR "3T areas") AND ("teaching strategies" OR "Merdeka Curriculum")	Google Scholar	600
("teacher pedagogical practices" OR "teaching strategies") AND ("Merdeka Curriculum") AND ("disadvantaged regions" OR "3T areas")	Google Scholar	200
("teacher strategies" OR "teaching strategies") AND ("Merdeka Curriculum") AND ("elementary school" OR "primary education") AND ("3T areas")	Scopus	20
Total Number of Articles		820

2.3 Inclusion and exclusion criteria

The obtained articles were screened using the predetermined inclusion and exclusion criteria outlined in Table 2. These criteria were designed to ensure that the included studies are relevant to the research focus, have adequate scientific quality, and are aligned with the context of the implementation of the Merdeka Curriculum in elementary schools in 3T areas (disadvantaged, frontier, and outermost regions).

Table 2. Eligibility criteria

No	Inclusion	Exclusion
1	Year 2020–2025	< 2020
2	Journal articles, conference proceedings	Books, unpublished reports
3	Articles available in full-text	Articles not available in full-text
4	Studies on the implementation of the Merdeka Curriculum in elementary schools in 3T areas	Studies that do not discuss the Merdeka Curriculum or teachers' strategies
5	Empirical studies (quantitative, qualitative, mixed methods, or research and development/R&D)	Systematic literature reviews or purely theoretical articles
6	Articles focusing on the elementary school level or cross-level studies (elementary–junior secondary) that include data at the elementary level	Studies at educational levels other than elementary school

The study selection criteria in this research were established to ensure the relevance and completeness of the analyzed sources. The included studies comprise journal articles and conference proceedings from 2020 to 2025, available in full text, given that studies on the implementation of the Merdeka Curriculum in elementary schools in 3T areas are still limited in journal publications; therefore, conference proceedings are used as complementary sources. The selected studies are empirical research (quantitative, qualitative, mixed-methods, or R&D), including cross-level studies that include data at the elementary school level. Articles that do not meet these criteria, such as those published before 2020, not available in full-text, not relevant to the topic, purely theoretical in nature, or not focused on the elementary school level, were excluded from the selection process.

2.4 Study selection process

The study selection process in this research follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) 2020 framework, which comprises four main stages: identification, screening, eligibility assessment, and inclusion.

At the identification stage, the literature search was conducted using the Publish or Perish application integrated with the Google Scholar and Scopus databases. Based on the search results using the predetermined keywords, a total of 820 articles were obtained. Subsequently, duplicate data were removed, reducing the number of articles to 795, which were ready to enter the initial screening stage. The screening stage involved reviewing titles and abstracts to assess initial suitability against the inclusion criteria. At this stage, 612 articles were eliminated because they were not relevant to the research topic, did not align with the focus of the study, were not scientific articles (for example, opinion pieces or editorials), or did not address the context under study. Thus, 183 articles were obtained and proceeded to the full-text retrieval stage.

At the full-text retrieval stage, efforts were made to obtain the complete manuscripts of each article. However, 131 articles could not be accessed in full due to access limitations (paywalls), the unavailability of documents online, or incomplete manuscript content. Therefore, only 52 articles could be further analyzed at the eligibility assessment stage.

The eligibility stage was conducted through an in-depth review of the 52 articles, assessing their suitability to the research focus, methodological quality, and relevance to the study context. At this stage, several articles were excluded due to non-compliance with the inclusion criteria, inadequate research methodology, or limitations in the data presented. The final results show that 15 articles met all criteria and were deemed eligible for inclusion in the research synthesis.

All stages of the study selection process are presented concisely in the PRISMA flow diagram in Figure 1. This presentation aims to provide a transparent and systematic overview of the literature selection process, thereby enhancing the clarity and accountability of the research reporting. Through a systematic, transparent, and replicable selection procedure, this study ensures that only relevant and high-quality studies are included in the analysis, thereby supporting the validity and credibility of the findings.

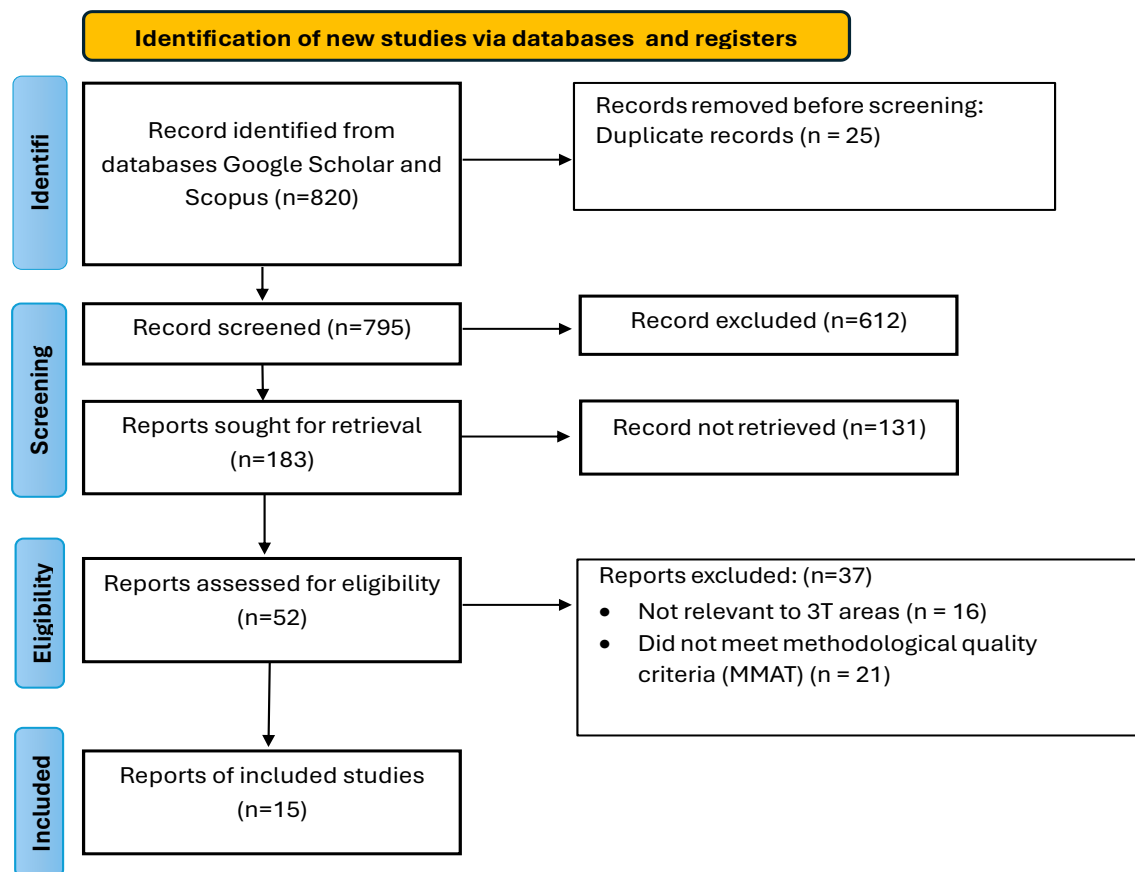


Figure 1. Identification of studies via databases and registers

2.5 Study quality assessment

The methodological quality of the studies included in this research was assessed using the Mixed Methods Appraisal Tool (MMAT), an instrument for evaluating studies that employ quantitative, qualitative, or mixed-methods approaches. The selection of this instrument is based on its ability to assess various research designs commonly used in education.

Referring to the MMAT framework, five assessment criteria (Q1–Q5) were developed and adapted to the context of the implementation of the Merdeka Curriculum in 3T areas, as follows: (Q1) Is the research design and approach clearly described and appropriate to the research objectives?

(Q2) Is the research context (including the characteristics of 3T areas) and the learning strategies implemented by teachers adequately described?

(Q3) Are the data collection methods clearly described and appropriate to the research design?

(Q4) Are the data analysis methods reported systematically and appropriately?

(Q5) Are the research findings presented clearly and supported by adequate data?

Each criterion was assessed using a binary scale, namely "Yes" or "No." A study is considered to meet the methodological quality standard if it obtains at least four "Yes" responses out of the five established criteria. This approach is used to ensure that the analyzed studies are not only relevant but also possess adequate methodological quality and empirical evidence strength.

In addition to serving as a basis for determining study eligibility, the quality assessment results are used to identify methodological limitations in the primary studies. These limitations are taken into account in the interpretation and discussion of the synthesis results, thereby enhancing the credibility of the research findings.

2.6 Ekstraksi and sintesys data

The articles that had passed the selection and quality assessment stages were subsequently subjected to a systematic, structured data extraction process. The extracted data include study characteristics, the learning context, the forms and strategies teachers use to implement the Merdeka Curriculum, and empirical findings on learning strategies in elementary schools in 3T areas.

Data synthesis was conducted using a narrative-thematic approach, accounting for the diversity of research designs and study contexts across the analyzed articles. The coding and thematic grouping processes were carried out independently by two researchers based on the research questions, and the results were aligned through discussion until agreement was reached.

All stages of the analysis were systematically documented to maintain an audit trail, thereby ensuring transparency, consistency, and traceability in the data synthesis process.

3. Results

The research findings are presented through a narrative-thematic synthesis of 15 articles that have met the inclusion criteria and quality assessment in this systematic literature review.

3.1 Quality assessment

The quality assessment was conducted to ensure that the analyzed articles have adequate methodological rigor and relevance. This assessment is based on five indicators (Q1–Q5), namely the clarity of the research design, the clarity of the research context and the learning strategies implemented by teachers, the appropriateness of data collection methods, the clarity of the reporting of research findings, and the accuracy of data analysis and presentation.

Tabel 3. Quality assessment results of included studies using mmat

No	Authors	Titles	Year	Journal	Q	Q	Q	Q	Q	Included
					A	A	A	A	A	
					1	2	3	4	5	
1	(MS, 2025)	Penerapan Pendekatan Deep Learning dalam Kurikulum Merdeka: Penguatan Kompetensi Guru di Sekolah Dasar Kepulauan Seribu	2025	(IJCSE)	Y	Y	Y	Y	Y	√
		Adaptation of Independent Curriculum in								

No	Authors	Titles	Year	Journal	Q A 1	Q A 2	Q A 3	Q A 4	Q A 5	Included
2	(Sirojuddin et al., 2025)	Remote Elementary Schools: A Field Study in Disadvantaged, Frontier, and Outermost Areas	2025	Al-Hayat: Journal of Islamic Education	Y	Y	Y	Y	Y	√
3	(Wulandari et al., 2025)	Keterbatasan Kompetensi Guru dalam Implementasi Kurikulum Merdeka: Studi Kasus di SDN Sanding 2	2025	Kalam Cendekia: Jurnal Ilmiah Kependidikan	Y	Y	Y	Y	Y	√
4	(Muhammad et al., 2025)	Persepsi Guru Terhadap Implementasi Kurikulum Merdeka Di Wilayah 3T: Studi Kasus SD Negeri Juanga, Pulau Morotai	2025	Jurnal Ilmiah Wahana Pendidikan	Y	Y	Y	Y	Y	√
5	(Yusmandi et al., 2025)	Strategi Kepemimpinan Kepala Sekolah Dasar dalam Implementasi Kurikulum Merdeka di Daerah 3T di Kabupaten Sintang	2025	VOX EDUKASI	Y	Y	Y	Y	Y	√
6	(Lase, 2024)	Implementasi Kurikulum Merdeka pada Daerah 3T dan Kendala Guru dalam Penerapannya	2024	Jurnal Education and development	Y	Y	Y	Y	Y	√
7	(Meliza et al., 2024)	Implementasi Manajemen Kurikulum Merdeka pada Sekolah Dasar di Kabupaten Bireuen	2024	JPPP	Y	Y	Y	Y	Y	√

No	Authors	Titles	Year	Journal	Q A 1	Q A 2	Q A 3	Q A 4	Q A 5	Included
8	(Hakim & Alfritri, 2025)	The Implementation of Kurikulum Merdeka in Islamic Education in the 3T Regions of North Lombok	2025	MODELING	Y	Y	Y	Y	Y	√
9	(Qondias & Irmawati, 2024)	Studi Analisis Permasalahan Pembelajaran Kelas 4 pada Kurikulum Merdeka Sekolah Dasar Katolik Waerana II	2024	Jurnal Pendidikan Inklusi Citra Bakti	Y	Y	Y	Y	Y	√
10	(Tomasouw et al., 2024)	The Challenges of the Kurikulum Merdeka Implementation in 3T Area	2024	KnE Social Sciences	Y	Y	Y	Y	Y	√
11	(Harefa et al., 2024)	Implementation Of The Merdeka Curriculum In 3T Areas (Underdeveloped , Frontier, and Outermost) Elementary Schools in Namohalu Esiwa Sub-District	2024	Elementaria Edukasia	Y	Y	Y	Y	Y	√
12	(Saiman et al., 2025)	Ketercapaian Kurikulum Merdeka dan Kesiapan Guru di Daerah 3-T	2025	Jurnal Pendidikan dan Kebudayaan	Y	Y	Y	Y	Y	√
13	(Arisandi et al., 2025)	Pengembangan Modul Implementasi Kurikulum Merdeka untuk Penguatan Locus of Control dan Self Efficacy Guru di Wilayah	2025	VOX EDUKASI	Y	Y	Y	Y	Y	√

No	Authors	Titles	Year	Journal	Q A 1	Q A 2	Q A 3	Q A 4	Q A 5	Included
14	(Kasim et al., 2025)	3T Kabupaten Sintbeang	2025	Edum Journal	Y	Y	Y	Y	Y	√
		Peran Guru Penggerak dalam Optimalisasi Pelaksanaan Kurikulum Merdeka di Sekolah Dasar: Studi Kasus di SD Negeri Kolaka Utara								
15	(Rusadi Letasado et al., 2024)	Analisis Perspektif Kurikulum Merdeka Dalam Pengembangan Kreativitas Siswa Sekolah Dasar Di Daerah 3T	2024	MIMBAR PGSD FLOBAMORATA	Y	Y	Y	Y	Y	√

3.2 Key findings in the reviewed studies

The findings of this study are systematically organized into three main focuses. First, identifying various strategies used by teachers in implementing the Merdeka Curriculum in elementary schools in 3T areas (disadvantaged, frontier, and outermost regions). Second, analyzing the influence of the contextual challenges characteristic of 3T areas on teachers' selection and implementation of learning strategies. Third, developing a conceptual model that explains adaptive teaching practices as a response to resource limitations in the learning environment. All of these findings were obtained through a synthesis of 15 articles published between 2020 and 2025, selected based on the inclusion criteria established in this study.

3.3. Teachers' Strategies in the Implementation of the Merdeka Curriculum in 3T Areas

In implementing the Merdeka Curriculum in 3T areas, teachers face various challenges, including limited facilities and access to technology, as well as geographical conditions and diverse student characteristics. To address these issues, teachers employ various learning strategies tailored to students' needs and the surrounding environmental conditions (Afendi et al., 2019).

The analysis of 15 articles shows that the most frequently used learning strategy is contextual learning (26.7%), which links the material to students' real-life experiences and local cultural relevance. Project-Based learning is used by 20% of teachers to develop students' skills through contextual projects, while differentiated instruction, teacher leadership, and teacher collaboration are each implemented by 13.3% of teachers. Other less frequently applied strategies include the utilization of local resources, adaptive blended/offline learning, the development of modules or teaching materials, and character strengthening/mindful learning, each at 6.7%. These percentages reflect the variety of strategies teachers use to adapt learning to the conditions of 3T areas and to students' needs and abilities.

Tabel 4. Classification of teaching strategies in the implementation of the merdeka curriculum in 3t regions

No	Learning Strategy	Number of Articles	Percentage (%)	Main Focus / Objective	Example Studies
1	Contextual Learning	4	26.7%	Linking material to students' real-life experiences in 3T areas, local cultural relevance	Zulela (2025), Sirojuddin et al. (2025), Yusmandi et al. (2025), Hakim & Alfitri (2025)
2	Project-Based Learning (PjBL / P5)	3	20%	Developing students' skills through contextual projects	Indah Permatasari Lase (2024), Fitri Dwi Rahmadhani et al. (2025), Letasado et al. (2024)
3	Differentiated Instruction	2	13.3%	Adjusting learning to students' needs and abilities	Jolanda Tomasouw et al. (2024), Hesti Wulandari et al. (2025)
4	Utilization of Local Resources	1	6.7%	Using the local environment and culture as learning media	Fitri Dwi Rahmadhani et al. (2025)
5	Adaptive Blended / Offline Learning	1	6.7%	Adjusting learning to technological limitations	Arisandi, Dike, & Andayani (2025)
6	Teacher Leadership & Collaboration	2	13.3%	Teacher empowerment, learning communities, supervision, and collaboration with stakeholders	Meliza et al. (2024), Kasim et al. (2025)
7	Development of Modules / Teaching Materials	1	6.7%	Supporting teachers in implementing the Merdeka Curriculum adaptively	Dimas Qondias & Yohana Irmawati (2024)
8	Character Strengthening / Mindful Learning	1	6.7%	Enhancing teacher competence, reflection, and student-centered learning	Rifaid Saiman et al. (2024)

Based on Table 4. The most frequently applied learning strategy by teachers in 3T areas is contextual learning, with 4 articles (26.7%) emphasizing the linkage of material to students' real-life experiences and local cultural relevance (Zulela, 2025; Sirojuddin et al., 2025; Yusmandi et al., 2025; Hakim & Alfitri, 2025). The Project-Based Learning (PjBL / P5) strategy appears in 3 articles (20%) and aims to develop students' skills through contextual projects that encourage active learning experiences (Indah Permatasari Lase, 2024; Fitri Dwi Rahmadhani et al., 2025; Letasado et al., 2024).

Differentiated instruction and teacher leadership & collaboration are each reported in 2 articles (13.3%). Differentiated instruction adjusts learning to students' abilities and needs (Jolanda Tomasouw et al., 2024; Hesti Wulandari et al., 2025), while leadership and collaboration emphasize teacher empowerment, learning communities, supervision, and stakeholder involvement (Meliza et al., 2024; Kasim et al., 2025).

Other, more specific strategies that appear in one article each (6.7%) include the utilization of local resources, adaptive blended/offline learning, the development of modules/teaching

materials, and character strengthening/mindful learning. These strategies help teachers adapt learning to resource limitations, utilize the surrounding environment, support the adaptive implementation of the Merdeka Curriculum, and enhance teacher competence as well as student-centered Learning (Fitri Dwi Rahmadhani et al., 2025; Arisandi, Dike, & Andayani, 2025; Dimas Qondias & Yohana Irmawati, 2024; Rifaid Saiman et al., 2024).

Thus, this table shows that teachers in 3T areas implement a variety of strategies, adapting to local contexts and resource constraints while maintaining a focus on meaningful, student-centered learning.

3.4 The influence of contextual challenges in 3t areas on the selection and implementation of teachers' strategies

A literature review of 15 studies shows that teachers in 3T areas face various contextual challenges that directly influence the selection and implementation of learning strategies in the Merdeka Curriculum. These challenges include limited access to technology, a lack of learning resources and facilities, diverse student abilities, limited teacher competence, difficult geographical conditions, and low levels of collaboration and teacher motivation (Mariyam, 2019). The diversity of these challenges indicates that learning practices in 3T areas cannot be implemented uniformly but require adaptive adjustments to local conditions.

One form of such adjustment is limited access to technology and the internet, which encourages teachers to implement blended or adaptive offline learning strategies. In this condition, teachers prepare modules and learning materials that can be used without reliance on digital technology, enabling the learning process to continue effectively (Arisandi et al., 2025). This condition shows that technological limitations do not halt the learning process, but instead encourage the emergence of more flexible alternative strategies.

In addition to technological limitations, the lack of learning resources and facilities also becomes a significant challenge. To address this, teachers utilize local resources, such as the surrounding environment and local culture, as learning media. The use of this local context not only addresses facility limitations but also makes learning more relevant and meaningful for students (Rahmadhani et al., 2025).

On the other hand, the diversity of students' abilities in 3T classrooms requires teachers to adjust learning strategies more specifically. In this case, teachers implement differentiated instruction by adapting materials, methods, and assessments according to students' needs (Tomasouw et al., 2024). This finding is reinforced by Wulandari et al. (2025), who show that differentiation is an important strategy in addressing student heterogeneity in 3T areas. This indicates that adaptation occurs not only due to environmental factors but also due to student characteristics.

However, the implementation of these learning strategies is also influenced by teachers' limited competence and experience. To address this, teachers develop adaptive modules and teaching materials to help design more structured learning aligned with the demands of the Merdeka Curriculum (Qondias & Irmawati, 2024). This effort shows that strengthening teacher capacity is an important part of the learning adaptation process. Furthermore, difficult geographical conditions and limited mobility encourage teachers to link learning with students' real-life contexts. Contextual Learning is implemented by integrating daily experiences, local culture, and the surrounding environment into learning materials (Zulela, 2025). This finding is also supported by Sirojuddin et al. (2025) and Yusmandi et al. (2025), who show that local context becomes the main source of learning in remote areas. In addition, Hakim and Alfitri (2025)

emphasize that integrating local context is key to implementing the Merdeka Curriculum in 3T areas.

In addition to instructional factors, institutional aspects also influence learning practices. Low levels of collaboration and support within the school environment encourage teachers to develop leadership and professional collaboration through learning communities, supervision, and stakeholder involvement (Meliza et al., 2024). This is reinforced by Kasim et al. (2025), who show that professional collaboration plays an important role in improving the effectiveness of curriculum implementation. On the other hand, challenges in increasing teacher motivation and engagement are also an important concern. To address this, teachers implement character-strengthening and mindful learning strategies that emphasize reflection, student-centered learning, and the development of professional competence (Saiman et al., 2024). These strategies show that teachers' psychological aspects also play a role in the success of learning implementation.

Meanwhile, in efforts to develop students' skills, teachers implement Project-Based Learning (PjBL), which involves students in projects based on real-life contexts. This strategy has been proven to enhance students' creativity, critical thinking, and collaboration (Lase, 2024). This finding is also supported by Rahmadhani et al. (2025) and Letasado et al. (2024), who show that PjBL is effective in developing students' skills in 3T areas.

Thus, it can be concluded that contextual challenges in 3T areas are not only obstacles but also drivers of the emergence of adaptive, contextual, and innovative learning strategies. The various strategies implemented indicate that teachers can adjust their learning practices to the conditions they face, enabling the effective implementation of the Merdeka Curriculum. The details of the relationship among challenges, strategies, and the impact of adjustments are shown in Table 5.

Tabel 5. Relationship between contextual challenges and adaptive teaching strategies in 3t regions

No	Contextual Challenges in 3T	Number of Articles	Selected Teacher Strategies	Impact / Strategy Adjustment	Example Studies
1	Low internet access / technological limitations	1	Adaptive Blended / Offline Learning	Modules and materials are designed for offline or minimal-technology use.	Arisandi, Dike, & Andayani (2025)
2	Limited learning resources & facilities	1	Utilization of Local Resources	The surrounding environment and local culture are used as learning media	Fitri Dwi Rahmadhani et al. (2025)
3	Diversity of students' abilities and needs	2	Differentiated Instruction	Materials, methods, and assessments are adapted to students' abilities	Jolanda Tomasouw et al. (2024), Hesti Wulandari et al. (2025)
4	Limited teacher competence/experience	1	Development of Modules / Teaching Materials	Teachers are supported with adaptive modules to assist in the implementation of	Dimas Qondias & Yohana Irmawati (2024)

No	Contextual Challenges in 3T	Number of Articles	Selected Teacher Strategies	Impact / Strategy Adjustment	Example Studies
				the Merdeka Curriculum	
5	Geographical conditions / limited mobility	4	Contextual Learning	Materials are linked to students' real-life experiences and to local cultural and environmental relevance.	Zulela (2025), Sirojuddin et al. (2025), Yusmandi et al. (2025), Hakim & Alfitri (2025)
6	Lack of collaboration and support	2	Teacher Leadership & Collaboration	Teachers are empowered through learning communities, supervision, and collaboration with stakeholders.	Meliza et al. (2024), Kasim et al. (2025)
7	Low teacher engagement and motivation	1	Character Strengthening / Mindful Learning	Teachers are trained in reflection, focus on student-centered learning, and competence improvement	Rifaid Saiman et al. (2024)
8	Challenges in developing students' skills	3	Project-Based Learning (PjBL / P5)	Students are involved in contextual projects to develop skills and creativity.	Indah Permatasari Lase (2024), Fitri Dwi Rahmadhani et al. (2025), Letasado et al. (2024)

3.5 Conceptual model of adaptive teaching strategies in the implementation of the merdeka curriculum in 3t areas

The conceptual model in this study was developed based on the findings in the results section, which indicate relationships among contextual challenges, pedagogical adaptation, teachers' instructional strategies, and their implications for learning practices in 3T areas. These findings indicate that the implementation of the Merdeka Curriculum does not occur linearly, but rather through an adaptive process influenced by environmental conditions and teachers' professional capacity.

At the initial stage, contextual challenges act as the main factors shaping learning practices. These challenges include technological limitations, a lack of facilities and learning resources, diverse student abilities, limited teacher competence, and difficult geographical conditions (Aryasatya Rafa Prayitno et al., 2025). Various studies show that infrastructure constraints and low teacher readiness are major obstacles to implementing the Merdeka Curriculum in 3T areas (Lase, 2024). These findings are also supported by Hakim and Alfitri (2025) and Saiman et al. (2025), who emphasize that environmental conditions and resource limitations greatly influence learning effectiveness. In addition, Wulandari et al. (2025) and Tomasouw et al. (2024) show that the diversity of students' abilities and limited teacher competence further complicate curriculum implementation in 3T areas.

In response to these challenges, teachers adapt their pedagogy by adjusting teaching methods, instructional materials, and strategies to the local context. This adaptation is reflected in learning practices that integrate students' real-life experiences and utilize local resources in the learning process (Sirojuddin et al., 2025). In addition, Rahmadhani et al. (2025) show that a contextual approach enhances the relevance of learning, while Arisandi et al. (2025) emphasize the importance of flexible strategies in the face of technological constraints. This indicates that pedagogical adaptation serves as a bridge between curriculum demands and classroom realities.

Furthermore, this adaptation process results in a variety of adaptive teaching strategies. The dominant strategies include contextual Learning, Project-Based Learning (PjBL), and differentiated instruction, which are used to enhance student engagement and the relevance of Learning (Indra Gunawan et al., 2024; Jlassi & Zakarneh, 2025). In addition, under conditions of limited technology, teachers also implement blended or offline learning strategies and utilize local resources as alternative approaches to Learning (Letasado et al., 2024). Findings from Rahmadhani et al. (2025) and Sirojuddin et al. (2025) indicate that this variety of strategies reflects teachers' ability to adapt learning flexibly and contextually.

The subsequent adaptive teaching strategies have implications for learning practices. Learning can continue effectively despite limitations and become more relevant to students' life contexts. Research shows that contextual and project-based approaches can increase student engagement in the learning process (MS, 2025). In addition, collaborative support among teachers, schools, and communities is also an important factor in supporting the successful implementation of the Merdeka Curriculum (Hakim & Alfitri, 2025; Meliza et al., 2024).

Thus, the resulting conceptual model shows that implementing the Merdeka Curriculum in 3T areas is an adaptive process comprising four main components: contextual challenges, pedagogical adaptation, adaptive teaching strategies, and learning implications. These four components are dynamically interconnected: contextual challenges drive pedagogical adaptation, adaptation produces appropriate learning strategies, and these strategies shape more flexible, contextually responsive learning practices. To clarify the relationships among these components, the conceptual model is presented in Figure 2.

Figure 2 shows that the implementation of the Merdeka Curriculum in 3T areas does not occur linearly, but rather through an adaptive process influenced by the interaction between contextual challenges, pedagogical adaptation, and teaching strategies implemented by teachers. These relationships result in learning practices that are more flexible, contextual, and responsive to students' needs, thereby emphasizing the role of adaptive strategies as a mediating mechanism in curriculum implementation.

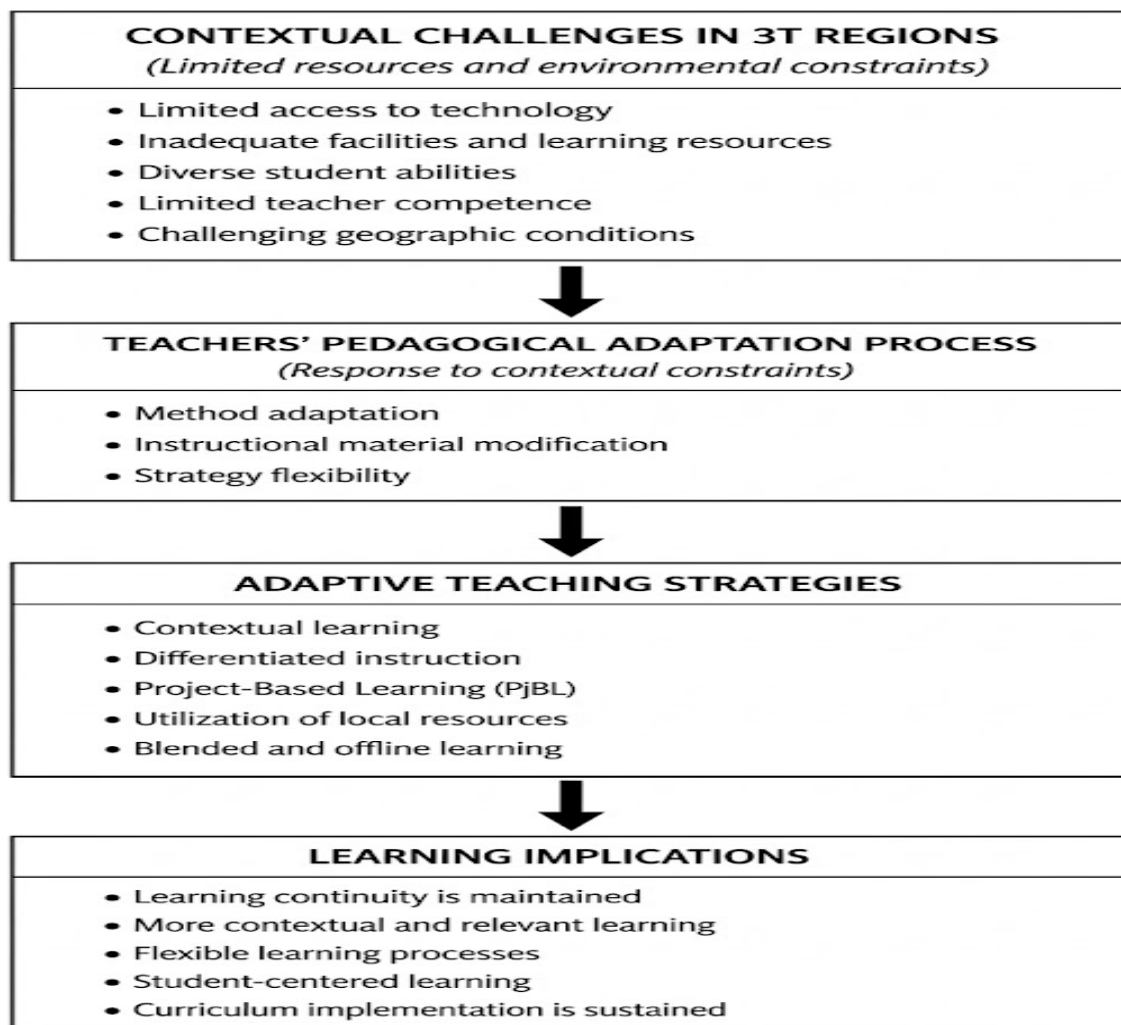


Figure 2. Conceptual model of adaptive teaching strategies in the implementation of the merdeka curriculum in 3t regions

3. Discussion

The research findings indicate that the most dominant learning strategy in the implementation of the Merdeka Curriculum in 3T areas is contextual learning, followed by Project-Based Learning (PjBL) and differentiated instruction. The dominance of contextual learning indicates that teachers tend to relate learning materials to students' real-life experiences as a response to resource limitations. This is in line with the contextual teaching and learning approach, which emphasizes the connection between material and students' life contexts (Aziz et al., 2019), as well as constructivist theory, which states that knowledge is constructed through experience and social interaction (Dewi & Elisa, 2025; Piaget, 197 C.E.; Vygotsky & Cole, 1978).

In addition, the implementation of PjBL and differentiated instruction indicates that teachers aim to foster active, adaptive learning. Research shows that these strategies can improve student engagement and learning outcomes, though their implementation remains constrained by teacher competence and resource limitations (Abdullah et al., 2023; Decristan et al., 2019; Photo & Mohale, 2024). Findings from various studies also show that teachers in 3T areas integrate local contexts, culture, and students' experiences into learning as an adaptive strategy (Muhammad et al., 2025; Sirojuddin et al., 2025).

The selection of these learning strategies is inseparable from the conditions in 3T areas, which are characterized by limited infrastructure, limited access to technology, and teacher competence. Research shows that the implementation of the Merdeka Curriculum in 3T areas faces various challenges, such as low teacher readiness, lack of training, and limitations in facilities and learning resources (Hakim & Alfitri, 2025; Saiman et al., 2025; Tomasouw et al., 2024; Wulandari et al., 2025). In addition, various technical problems in planning, implementation, and assessment of learning also become obstacles in curriculum implementation (Qondias & Irmawati, 2024).

In addressing these limitations, teachers implement pedagogical adaptations by modifying learning strategies, simplifying materials, and using local resources. This adaptation is reflected in the development of learning modules, the use of contextual approaches, and innovation in learning practices (Arisandi et al., 2025; Nurteteng et al., 2024; Photo & Mohale, 2024). This indicates the presence of teacher agency, namely the ability of teachers to adjust curriculum implementation according to local conditions (Priestley et al., 2013), and is also in line with the concept of adaptive teaching, which emphasizes teachers' flexibility and responsiveness to students' needs (CORNIO, 2008; Decristan et al., 2019; Suh et al., 2024).

The findings of this study also show that the implementation of the Merdeka Curriculum in 3T areas is dynamic and non-linear, rather than influenced solely by contextual factors or teacher capacity. This aligns with previous studies showing that the success of curriculum implementation largely depends on teacher readiness, institutional support, and environmental conditions (Molapo & Pillay, 2018; Sharp et al., 2011). In addition, school leadership and stakeholder collaboration play an important role in supporting successful curriculum implementation (Meliza et al., 2024; Yusmandi et al., 2025).

The conceptual model developed in this study shows that adaptive teaching strategies mediate between contextual challenges and learning practices. This model emphasizes that the relationship between contextual challenges, pedagogical adaptation, learning strategies, and learning implications is dynamic and interrelated, in line with ecological theory in education, which emphasizes the interaction between individuals and their environment (Bronfenbrenner, 1979).

The implications of this study highlight the importance of strengthening teachers' adaptive competencies through continuous training and the development of learning grounded in local contexts. In addition, support from school principals and stakeholders is also needed to create a conducive learning ecosystem (Meliza et al., 2024; Yusmandi et al., 2025). However, this study has limitations because it uses only a literature review approach and a limited number of sources; therefore, future research is recommended to conduct empirical studies to test the conceptual model developed.

4. Conclusion and implications

Based on the results of the systematic literature review of 15 articles, it can be concluded that the implementation of the Merdeka Curriculum in 3T areas is influenced by various contextual challenges, such as technological limitations, lack of facilities and learning resources, diversity of students' abilities, as well as limited teacher competence. These conditions encourage teachers to develop adaptive, context-specific learning strategies to address environmental limitations. The dominant strategies used are contextual learning, followed by Project-Based Learning (PjBL) and differentiated instruction, which indicate that teachers strive to create learning that is relevant, flexible, and student-centered. In addition, teachers adapt pedagogy by using local resources, developing learning modules, and adjusting teaching methods to students' needs and environmental conditions.

This study develops a conceptual model of adaptive teaching strategies that illustrates the dynamic relationships among contextual challenges, pedagogical adaptation, learning strategies, and learning implications, in which adaptive teaching strategies function as a mediating mechanism that bridges contextual limitations with the successful implementation of the curriculum. The implications of this study emphasize the importance of strengthening teachers' adaptive competencies through continuous training, developing learning grounded in local contexts, and collaborative support from schools, government, and educational stakeholders in creating a responsive and sustainable learning ecosystem in 3T areas.

Credit authorship contribution statement

First author contributed to conceptualization, methodology, formal analysis, data curation, and writing – original draft. **The second author** contributed to methodology, validation, and data analysis. **The third author** contributed to formal analysis, data curation, and writing – review and editing. **The last author** contributed to supervision, project administration, and final manuscript review.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have influenced the work reported in this paper.

Data Availability Statement

The data that support the findings of this study are derived from publicly available literature sources, which are cited within the manuscript. No primary data were collected in this study.

Ethical Declaration

This study did not involve human participants or animals. Therefore, ethical approval was not required. All data used in this study were obtained from publicly published, openly accessible secondary sources.

Declaration of AI statement

Portions of this manuscript were edited and refined using ChatGPT (OpenAI) to improve language clarity, structure, and academic writing quality. The AI tool was used solely as an assistive writing aid. All content has been carefully reviewed, revised, and validated by the authors, who take full responsibility for the accuracy, originality, and integrity of the final manuscript.

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