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Enhancing critical thinking through differentiated instruction in primary education: A systematic literature review

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Abstract

The cultivation of critical thinking skills is a central aim of modern pedagogy. This study systematically synthesizes empirical evidence on the implementation of differentiated instruction and its contribution to developing critical thinking skills in elementary students, as examined through research designs, implementation strategies, and learning outcomes. A Systematic Literature Review (SLR) approach, reported in accordance with PRISMA 2020 guidelines, was employed. The literature search was conducted from May 15–20, 2024, using the Scopus, ERIC, and Google Scholar databases via Publish or Perish. Articles were selected according to the inclusion criteria, and the methodological quality was assessed using an adapted Mixed Methods Appraisal Tool (MMAT). Data synthesis was performed using a narrative-thematic approach. A total of 12 empirical studies published between 2020 and 2024 were analyzed, with research contexts predominantly from Indonesian elementary schools and complemented by several international studies. The review indicates that the studies primarily utilized descriptive qualitative, classroom action research, and quasi-experimental designs. Differentiated instruction was implemented according to Tomlinson's framework, incorporating differentiation across content, process, and product, and was frequently integrated with Problem-Based Learning and Project-Based Learning models. The findings demonstrate improvements in students' critical thinking skills, particularly in analytical reasoning, decision-making, and reflection, as well as enhanced motivation and learning engagement. Future research is recommended to explore the long-term impact of technology and its role in optimizing differentiated instruction.

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1. Introduction

Education plays a crucial role in shaping individuals into critical thinkers, collaborative contributors, and innovative problem solvers. In the face of rapid global changes and complex social challenges in the 21st century, educational systems are increasingly expected to cultivate these essential competencies from an early age. Among these skills, critical thinking has emerged as a core educational outcome, particularly within primary education, as it enables students to analyze information, evaluate evidence, and synthesize ideas before arriving at reasoned conclusions or decisions (Raj et al., 2022; Santi 2020). The early development of critical thinking is therefore fundamental, not only for academic achievement but also for meaningful engagement with real-world issues and social dynamics (Arifah et al., 2025; Fitriadi et al., 2024; Kartika Sari et al., 2021; Ridho et al., 2020). In this review, critical thinking is understood as a higher-order cognitive process encompassing analysis, evaluation, and synthesis, consistent with widely adopted frameworks in educational research.

Contemporary educational reforms, including those implemented in Indonesia, emphasize the strengthening of student-centred learning and the accommodation of learner diversity through adaptive pedagogical approaches. The Merdeka Curriculum reflects this paradigm shift by explicitly prioritizing flexible and student-responsive learning designs that align with the principles of differentiated instruction. This emphasis is articulated in official policy documents issued by the Indonesian Ministry of Education, Culture, Research, and Technology, which serve as the primary foundation for curriculum implementation across educational units (Kementerian Pendidikan, Kebudayaan, Riset, 2022). Such policy directions are consistent with empirical findings demonstrating that students possess diverse cognitive, motivational, and socio-emotional profiles that significantly influence learning processes and outcomes (Nepal et al., 2024; Tomlinson & Imbeau, 2023). Consequently, teachers are increasingly encouraged to design instructional practices that address classroom heterogeneity while maintaining alignment with curricular objectives.

To address this challenge, educators and researchers are increasingly turning to differentiated instruction as a pedagogical response to student diversity. This approach involves systematically tailoring the content, process, and product of learning to align with individual learner profiles, thereby fostering a more equitable and engaging educational environment (Aprima & Sari, 2022; Goyibova et al., 2025; Mijuskovic, 2024; Ramaila, 2025; Wibowo et al., 2025). By acknowledging differences in students' readiness levels, interests, and learning modalities, teachers can design learning experiences that are both appropriately challenging and supportive across varying ability levels. Furthermore, Sa'ida (2023) emphasizes that differentiated instruction promotes holistic learner development by supporting not only academic growth but also students' social and emotional competencies.

Within this context, differentiated instruction, as conceptualized by Tomlinson (2017), emphasizes the systematic adaptation of learning content, process, and product in response to

students' readiness levels, interests, and learning profiles. Content differentiation supports the development of analytical skills by providing learning materials with varying levels of complexity and abstraction. Differentiation process facilitates evaluative and critical reasoning through instructional strategies such as guided discussion, collaborative inquiry, and problem-solving activities. Meanwhile, product differentiation enables students to demonstrate learning outcomes through diverse formats, thereby fostering synthesis, reflection, and metacognitive awareness. Collectively, these components offer a theoretically coherent linkage between instructional adaptation and the core indicators of critical thinking.

A growing body of empirical research indicates that implementing differentiated instruction positively contributes to the development of critical thinking skills among primary school students (Al-Shehri, 2020; Godor, 2021; Rijal & Waluyo, 2025; Xhomara, 2022). Supporting this view, Fitra & Kurnia (2022) argue that learning practices should move beyond uniform instructional approaches toward more personalized designs that recognize students' individual potential and learning preferences. Accordingly, Tomlinson's differentiated instruction framework is positioned in this review as a pedagogical structure capable of systematically supporting the interrelated processes of analysis, evaluation, and synthesis that characterize critical thinking in primary education.

These findings reflect a broader consensus in the literature that a differentiated learning environment is conducive to the development of critical thinking skills. Several studies confirm that when differentiation is strategically applied to content delivery, learning processes, and assessment strategies, students demonstrate significant progress in reflective thinking, problem-solving, and evaluative reasoning (Avandra & Desyandri, 2023; Hayden et al., 2024; Lestari et al., 2024; Liu et al., 2022; Suryafati, 2023). Furthermore, differentiated instruction not only facilitates cognitive development but also enhances students' self-confidence, motivation, and engagement with academic tasks. This increased personal connection to learning materials supports deeper understanding and promotes more effective knowledge transfer across learning contexts.

The integration of differentiated instruction with active learning models further illustrates DI's pedagogical flexibility and potential to foster students' critical thinking skills. Instructional models such as Problem-Based Learning (PBL) and Project-Based Learning (PjBL) provide authentic contexts for inquiry, collaboration, and reflection—key conditions for the development of higher-order thinking (Deswita et al., 2024; Herliana et al., 2025; Maladzhi et al., 2024; Oktaviani & Satanti, 2024; Pratiwi & Wardani, 2024). Empirical studies suggest that when differentiated instruction is embedded within PBL or PjBL environments, students demonstrate enhanced abilities to analyze problems, construct arguments, and make informed decisions (Dela et al., 2020; Nahak & Lawa 2023).

Despite the expanding body of literature supporting the effectiveness of differentiated instruction, a significant gap remains in the systematic synthesis of empirical studies examining how differentiated instruction is operationalized and evaluated in relation to critical thinking outcomes at the primary education level. Existing research tends to focus on specific subjects or localized contexts, resulting in fragmented findings and limited comparability across studies. Moreover, the absence of an integrative analytical framework constrains educators and policymakers in drawing generalizable conclusions or deriving evidence-based recommendations for classroom practice. Addressing this gap is therefore essential to advancing both theoretical understanding and practical implementation of differentiated learning strategies.

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In response to this gap, this study aims to conduct a systematic literature review to map, evaluate, and synthesize empirical evidence on the implementation of differentiated instruction in primary schools and its relationship with students' critical thinking skills. By critically examining methodological trends, instructional strategies, and reported learning outcomes, this review seeks to provide a more comprehensive and evidence-based foundation for pedagogical decision-making, curriculum development, and educational policy formulation. Accordingly, the study is guided by the following research questions:

RQ 1. What types of research methodologies have been employed to investigate differentiated instruction in primary education?
RQ 2. How has differentiated instruction been implemented in primary school settings?
RQ 3. What evidence exists regarding the effectiveness of differentiated instruction in enhancing students' critical thinking skills?

2. Method

2.1 Research design

This study employs a Systematic Literature Review (SLR) approach, designed and reported in accordance with the PRISMA 2020 guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) as established by (Page et al., 2021). Adherence to these guidelines ensures transparency, traceability, and replicability across all stages of the review—from formulating the research questions and devising the literature search strategy to study selection, methodological quality assessment, and the synthesis of findings.

This SLR aims to synthesize empirical evidence on the implementation of differentiated instruction and its implications for developing critical thinking skills among elementary school students. The synthesis process is guided by the following research questions: (1) What are the characteristic research designs used in studies on differentiated instruction? (2) What are the forms and strategies for implementing differentiated instruction in primary education contexts? and (3) What are the empirical findings concerning the development of critical thinking skills in elementary students?

2.2 Literature search strategy

The literature search was conducted from May 15–20, 2024, utilizing three primary databases of Google Scholar (via the Publish or Perish application), Scopus, and ERIC (Education Resources Information Center). The selection of these databases aimed to balance broad literature coverage with the scholarly quality of sources, a practice recommended for conducting SLRs in education. Google Scholar was employed to access a wider range of educational literature, including publications from relevant national and international journals on primary education. Scopus was used to ensure the inclusion of reputable international literature that has undergone rigorous indexing and quality control processes. ERIC was chosen as the specialized education database due to its thematic focus on learning, curriculum, and pedagogical practices, thereby enhancing the search's sensitivity to studies on differentiated instruction.

The search within the Scopus and ERIC databases was performed by querying the title, abstract, and keyword fields. For Google Scholar, the search was conducted using Publish or Perish with the publication-year filter. The search strings were formulated by combining core keywords and their relevant synonyms using Boolean operators (AND, OR). The primary search string used for Scopus and ERIC was "differentiated instruction" OR "differentiated learning" AND "critical thinking" OR "higher order thinking" AND "elementary school" OR "primary education".

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Minor adjustments were made to the Google Scholar search to accommodate its search engine, without altering the core meaning of the keywords. An example of the search string used in Scopus is shown in Figure 1.

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TITLE-ABS-KEY ( "differentiated instruction" OR "differentiated learning" AND "critical thinking" AND "primary school" OR "elementary school" )
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Figure 1. Example of the search query in the scopus database

2.3 Inclusion and exclusion criteria

The retrieved articles were screened using the inclusion and exclusion criteria previously established in Table 1. These criteria were designed to ensure that the included studies were relevant to the review's focus, demonstrated adequate scholarly quality, and were appropriate to the context of elementary education.

Table 1. Inclusion and exclusion criteria

No	Inclusion Criteria	Exclusion Criteria
1	Empirical studies (quantitative, qualitative, mixed methods, or R&D)	Systematic literature reviews or theoretical-only papers
2	Full-text articles accessible via open access	Articles not available in full-text format
3	Published between 2020 and 2024	Published before 2020
4	Focus on differentiated instruction aimed at improving critical thinking skills	Studies not focusing on differentiated instruction or critical thinking skills
5	Journal articles	Books
6	Primary school students as the research subjects	Research subjects from preschool, secondary, or tertiary education levels

Included studies comprise empirical articles (using quantitative, qualitative, mixed-methods, or research and development designs), available in full-text, open-access format, published between 2020 and 2024, that focus on differentiated instruction aimed at developing critical thinking skills and involve elementary school students as participants. Studies failing to meet these criteria are excluded from the review. The restriction to the 2020–2024 publication period is established to align with the literature search date and to capture the most recent developments in differentiated instruction within the context of 21st-century education.

2.4 Study selection process

The study selection process adhered to the PRISMA 2020 framework, encompassing the stages of identification, title and abstract screening, full-text eligibility assessment, and final inclusion. All references retrieved from the three databases were merged, and duplicates were removed prior to the initial screening stage. The screening of titles and abstracts was conducted independently by two reviewers based on predefined inclusion and exclusion criteria. Articles deemed relevant at this stage were subsequently retrieved for full-text review. Any disagreements between reviewers at each selection stage were resolved through discussion until a consensus was reached.

Reasons for exclusion at the full-text assessment stage were systematically recorded and are concisely reported in the PRISMA flow diagram. A research summary of the selection process,

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compliant with the PRISMA 2020 standard, is presented in Figure 2. To ensure clear and professional reporting, a redundant textual description of this process is not provided here, as the flow diagram offers a complete visual summary.

Through this structured and transparent selection procedure, only studies that consistently met the eligibility criteria and demonstrated relevance to the research objectives were included in the final synthesis, thereby strengthening the methodological rigor and credibility of the review findings.

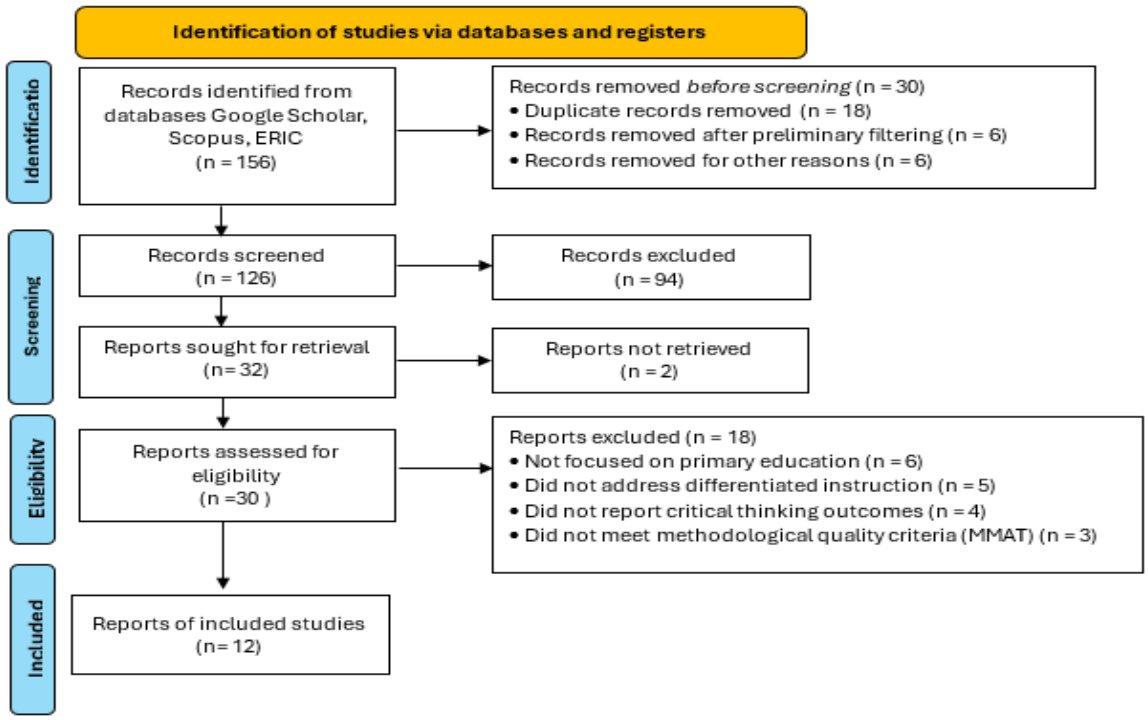

Figure 2. Identification of studies via database and registers

2.5 Study quality assessment

The methodological quality of the included studies was evaluated using the Mixed Methods Appraisal Tool (MMAT), an instrument designed to assess studies with quantitative, qualitative, and mixed-methods designs. This tool was selected due to its flexibility in evaluating the diverse methodological approaches common in educational research.

Based on the MMAT framework, five quality assessment questions (Q1–Q5) were developed. These questions were adapted from the core dimensions of methodological quality and contextualized for primary education research, as detailed below:

(Q1) Was the research design and approach clearly described and consistent with the study's objectives?
(Q2) Were the research context and the implementation of differentiated instruction sufficiently described?
(Q3) Were the data collection methods clearly outlined and appropriate for the research design?
(Q4) Were the data analysis methods reported in a systematic and rigorous manner?
(Q5) Were the research findings clearly presented and adequately supported by the data?

Each criterion was assessed using a binary response ("Yes" or "No"). An article was considered to meet the methodological quality standard if it received a minimum of four "Yes" responses out of the five criteria. This approach was employed to ensure that the included studies not only met the inclusion criteria but also exhibited sufficient methodological clarity and empirical substance. As a result, the subsequent synthesis is based on scientifically credible research evidence. In addition to determining inclusion eligibility, the quality assessment results identified methodological limitations in the primary studies. These limitations were subsequently taken into account during the interpretation and discussion of the synthesis findings.

2.6 Data extraction and synthesis

Articles that passed the selection and quality assessment underwent structured, systematic data extraction. Extracted data encompassed study characteristics, learning context, forms and strategies of differentiated instruction implementation, and empirical findings related to elementary students' critical thinking skills.

Data synthesis employed a narrative-thematic approach, given the diversity of research designs and study contexts among the included works. The processes of coding and theme grouping were conducted independently by two reviewers, guided by the research questions, and subsequently harmonized through discussion until consensus was achieved. All analytical steps were systematically documented to maintain an audit trail, ensuring transparency, consistency, and traceability throughout the synthesis process.

3. Results

The research findings are presented through a narrative–thematic synthesis of 12 articles that met the inclusion and quality criteria for this systematic literature review.

3.1 Quality assessment

A quality appraisal was conducted to ensure the analyzed articles demonstrated adequate methodological rigor and relevance. The appraisal was based on five indicators (Q1–Q5). Those are the clarity of the research design, the clarity of the differentiated instruction strategy, the relevance to the development of critical thinking, the clarity of the reporting of research findings, and the appropriateness of the data analysis and presentation.

Table 2. Quality assessment results

No	Authors	Titles	Year	Journal	QA1	QA2	QA3	QA4	QA5	Included
1	(Fitriana et al., 2024)	Analisis penerapan pembelajaran berdiferensiasi dengan model pembelajaran berbasis masalah pada materi IPAS di sekolah dasar	2024	Pendas	Y	Y	Y	Y	Y	√
2	(Deswita et al., 2024)	Peningkatan Kemampuan Berpikir Kritis Peserta Didik Pada Pembelajaran IPAS Kelas V Melalui Pendekatan Pembelajaran Berdiferensiasi	2024	Jitera	Y	Y	Y	Y	Y	√

No	Authors	Titles	Year	Journal	QA1	QA2	QA3	QA4	QA5	Included
3	(Avandra & Desyandri, 2023)	Implementasi Pembelajaran Berdiferensiasi terhadap Keterampilan Berpikir Kritis Siswa pada Pembelajaran IPA Kelas VI SD 5	2023	Didaktik	Y	Y	Y	Y	Y	√
4	(Lestari et al., 2024)	Implementation of Differentiated Learning to Enhance Elementary School Students' Mathematical Critical and Creative Thinking Skills	2024	Int. J. of Elementary Education	Y	Y	Y	Y	Y	√
5	Nahak & Ndapa Lawa, 2023)	Pengaruh Pembelajaran Berdiferensiasi dalam Model Project Based Learning terhadap Kemampuan Berpikir Kritis Siswa Kelas IV SDI Barai 2	2023	HINEF	Y	Y	Y	Y	Y	√
6	(Dela et al., 2020)	Analisis Penggunaan Model Pembelajaran dalam Mempelajari IPAS di Sekolah Dasar yang Berdiferensiasi	2020	Basicedu	Y	Y	Y	Y	Y	√
7	(Suryafati, 2023)	Peran Pembelajaran Berdiferensiasi dalam Meningkatkan Keterampilan Berpikir Kritis dan Pemahaman Konsep IPA di Sekolah Dasar	2023	PeDaPAUD	Y	Y	Y	Y	Y	√
8	(Putri & Rachmadyanti, 2024)	Analisis Pembelajaran Berdiferensiasi untuk Meningkatkan Keterampilan Berpikir Kritis pada Muatan IPS SD	2024	JPGSD	Y	Y	Y	Y	Y	√
9	(Sarie, 2022)	Implementasi Pembelajaran Berdiferensiasi dengan Model Problem Based Learning pada Siswa Sekolah Dasar Kelas VI	2022	Tuna Nusantara	Y	Y	Y	Y	Y	√
10	(Fajari, 2020)	Improving elementary school's critical thinking skills through three different PBL-assisted learning media viewed from learning styles	2020	Je-LKS	Y	Y	Y	Y	Y	√
11	(Anggoro et al., 2024)	Differentiated instruction based on multiple intelligences as promising joyful and meaningful learning	2024	IJERE	Y	Y	Y	Y	Y	√
12	(Cayir & Balci, 2023)	Differentiated instruction based on multiple intelligences as promising joyful and meaningful learning	2023	Educational Research and Reviews	Y	Y	Y	Y	Y	√

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The selected studies originate from a variety of education-focused journals, with authors representing both national and international institutions. Thematically, all articles share a consistent focus on implementing differentiated instruction in elementary schools to enhance students' critical thinking skills. This thematic consistency confirms the alignment of the analyzed articles with the purpose and scope of this systematic literature review.

The comprehensive quality evaluation ensures that the chosen articles possess adequate methodological rigor and strong thematic relevance. As presented in Table 2, the inclusion criteria are consistently applied across all studies, thereby guaranteeing the reliability and coherence of the synthesized findings. These twelve studies subsequently serve as the foundation for a thematic synthesis on the effectiveness of differentiated instruction as a pedagogical strategy for fostering critical thinking skills among elementary students.

3.2 Key findings in the reviewed studies

The findings are organized according to three main focal areas. Those are (1) the types of research designs employed in studies on differentiated instruction in elementary schools, (2) the implementation strategies for differentiated instruction, and (3) the impact of differentiated instruction on students' critical thinking skills. All findings are derived from the 12 articles published between 2020 and 2024.

3.3 Research designs on differentiated instruction in elementary schools

The analysis reveals that research on differentiated instruction in elementary schools employs a variety of research designs. To maintain analytical consistency and avoid double-counting, each article was classified into a single primary research design based on its dominant methodological approach.

According to this classification, the quasi-experimental design was the most frequently used, employed in 5 studies (41.7%). This was followed by descriptive qualitative research, which was applied in 4 studies (33.3%). Classroom Action Research (CAR) was utilized in 2 studies (20%), while Design and Development Research (DDR) was the least frequently used design, appearing in only 1 study (8.3%). The distribution of these research designs is concisely presented in Table 3.

Table 3. Types of research designs and their representation in the literature review

No	Research Designs	Number of Studies	Percentage (%)	Main Purpose / Focus	Example Studies
1	Descriptive Qualitative	4	33.3	Explore classroom strategies and responses in natural contexts	Fitriana et al., (2024), Dela et al., (2024), (Putri & Rachmadyanti, 2024), (Sarie, 2022)
2	Classroom Action Research (CAR)	2	20	Iteratively improve instruction and track outcomes	(Avandra & Desyandri, 2023), (Deswita et al., 2024),
3	Quasi-Experimental	5	41,7	Examine the causal impact of differentiated instruction	(Cayir & Balci, 2023), (Fajari,2020) (Lestari et al., 2024), Nahak & Ndapa Lawa, 2023), (Suryafati, 2023),
4	Design and Development Research (DDR)	1	8.3	Develop and evaluate instructional tools	(Anggoro et al., 2024)

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The analyzed literature demonstrates a clear predominance of quasi-experimental research, indicating a strong emphasis on quantitatively examining the effectiveness of differentiated instruction on students' critical thinking skills. Quasi-experimental designs are particularly appropriate for investigating causal relationships in educational settings where full randomization is not feasible, while still allowing for systematic comparison between experimental and control groups (Creswell & Creswell, 2018; Shadish et al., 2002). The reviewed studies commonly employ pre-test and post-test measures, providing robust empirical evidence of instructional effectiveness while accounting for classroom variability (Lestari et al., 2024; Suryafati, 2023).

Descriptive qualitative research was employed as a complementary approach to provide contextual insights into the implementation of differentiated instruction. This design enables researchers to explore instructional strategies, classroom interactions, and student responses in natural learning environments without substantially disrupting instructional processes (Rusandi & Rusli, 2021).

Classroom Action Research (CAR) further reflects a practitioner-oriented focus on iterative instructional improvement. Studies adopting this approach typically follow the Kemmis and McTaggart cyclical model, engaging teachers in continuous processes of planning, action, observation, and reflection to refine differentiated instructional strategies in response to diverse learner needs (Avandra & Desyandri, 2023; Deswita et al., 2024).

The remaining study employed Design and Development Research (DDR), emphasizing the systematic design and empirical validation of instructional materials or learning media tailored to specific educational contexts and student profiles (Anggoro et al., 2024). Although limited in number, the inclusion of DDR points to a developing interest in pedagogical design research that integrates instructional innovation with evidence-based validation.

Regarding data collection techniques, the reviewed studies employed observation, tests, interviews, document review, and questionnaires. The use of multiple data collection techniques within a single study indicates an effort to enhance data validity through triangulation.

Table 4. Data collection techniques used in the reviewed studies

No	Data Collection Techniques	Number of Studies Using It	Purposes / Descriptions	Example Articles
1	Observation	7	To monitor teaching implementation and student engagement	Fitriana et al. (2024), Deswita et al. (2024), Avandra & Desyandri (2023), Lestari et al. (2024), Nahak & Ndapa Lawa (2023), Sarie (2022), Putri & Rachmadyanti (2024)
2	Testing	8	To assess students' learning outcomes and critical thinking	Fitriana et al. (2024), Deswita et al. (2024), Lestari et al. (2024), Nahak & Ndapa Lawa (2023), Sarie (2022), Fajari et al. (2020), Anggoro et al. (2024), (Cayir & Balci, 2023)
3	Interviews	4	To gain in-depth insights from teachers and students	Deswita et al. (2024), Nahak & Ndapa Lawa (2023), Sarie (2022), Putri & Rachmadyanti (2024)
4	Documentation	3	To analyze teaching plans, student work, and classroom records	Fitriana et al. (2024), Nahak & Ndapa Lawa (2023), Sarie (2022)
5	Questionnaires	4	To gather survey-based feedback and perceptions	Lestari et al. (2024), Fajari et al. (2020), Anggoro et al. (2024), (Cayir & Balci, 2023)

3.4 Implementation strategies of differentiated instruction

The reviewed studies consistently underscore the critical role of differentiated instruction in addressing diverse students' learning needs, particularly through adjustments to content,

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process, and product. For content differentiation, learning materials are adapted to align with students' readiness levels and interests, enabling targeted concept delivery that enhances engagement and understanding (Aprima & Sari, 2022). Process differentiation is implemented through strategies such as flexible grouping, tiered tasks, and multimodal teaching, which accommodate students' learning styles and cognitive capacities (Cayir & Balci, 2023; Sa'ida, 2023). Product differentiation allows students to demonstrate their understanding through varied formats, including presentations, written reflections, and collaborative projects tailored to their strengths and preferences (Kenney et al., 2024).

Across multiple studies, differentiated instruction is integrated into established active learning frameworks, thereby reinforcing its impact. For instance, Fitriana et al. (2024) and Pratiwi and Wardani (2024) implemented a Problem-Based Learning (PBL) approach combined with differentiation to foster inquiry-based learning, collaborative thinking, and problem-solving among students. Similarly, Nahak dan Lawa (2023) and Dela et al. (2020) integrated Project-Based Learning (PjBL) with differentiation strategies, allowing students to pursue flexible pathways in completing and presenting their learning tasks. These models enhance learner autonomy and promote deeper cognitive processing.

A key strategy emphasized across the studies is the use of diagnostic assessment to establish learner profiles, encompassing academic readiness, learning preferences, and motivational factors. This profiling forms the basis for designing tiered learning activities and enables more personalized feedback mechanisms. For example, Cayir & Balci (2023) implemented a problem-solving mathematics-based differentiated instruction for gifted elementary students by leveraging readiness profiles, which significantly enhanced both their problem-solving attitudes and critical thinking skills. A similar finding was reported by Anggoro et al. (2024), who integrated differentiation with multiple intelligence-based learning media to improve critical reasoning and conceptual mastery. Teachers were also observed using interactive learning modules, Higher-Order Thinking Skills (HOTS)-based worksheets, and multimedia platforms to diversify instruction while aligning it with learning objectives.

Furthermore, teacher practice is pivotal for sustaining effective differentiation. Teachers employed formative assessment, peer assessment, and reflective cycles to continuously adapt their instruction. The use of observational notes, student work samples, and collaborative learning tasks facilitated ongoing monitoring of student progress. Studies such as those conducted by Putri and Rachmadyanti (2024) and Sarie (2022) indicate that when differentiation is consistently applied, it fosters a more inclusive learning environment and enhances student engagement. These practices underscore the essential role of professional judgment, planning, and responsiveness in implementing differentiated instruction at the primary school level.

To provide a clearer overview of variations in differentiated instruction, Table 5 presents a classification of differentiated learning approaches used at the primary school level, based on the literature review.

Table 5. Classification of differentiated instruction approaches

No	Strategy Types	Descriptions	Example Studies
1	Content Differentiation	Adjusting instructional materials based on student readiness and interests	Putri & Rachmadyanti (2024), Sarie (2022)
2	Process Differentiation	Using flexible grouping, tiered tasks, and learning stations for diverse learning styles	Deswita et al. (2024), (Cayir & Balci, 2023)
3	Product Differentiation	Allowing students to show understanding through varied outputs like projects or reflections	Lestari et al. (2024), Anggoro et al. (2024)
4	Integration with Problem-Based Learning (PBL)	Tailoring group tasks within inquiry-based learning environments	Fitriana et al. (2024)

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No	Strategy Types	Descriptions	Example Studies
5	Integration with Project-Based Learning (PjBL)	Encouraging autonomy and flexible task completion in real-world projects	Nahak & Ndapa Lawa (2023), Dela et al. (2020)
6	Use of Diagnostic Assessments	Profiling student needs to design tiered tasks and monitor learning progress	Anggoro et al. (2024), Sarie (2022), (Cayir & Balci, 2023)
7	Media and Materials Adaptation	Using HOTS-based worksheets, interactive modules, and multimedia tools	Anggoro et al. (2024), Fajari et al. (2020)
8	Teacher Practices and Reflection	Implementing feedback cycles, peer evaluation, and reflective teaching	Putri & Rachmadyanti (2024), Fitriana et al. (2024)

3.5 Effects of differentiated instruction on students' critical thinking

Analysis of the 12 selected studies consistently reveals a positive effect of differentiated instruction on various dimensions of students' critical thinking skills. Key areas for improvement include students' ability to identify problems logically, evaluate and construct arguments, make evidence-based judgments, and apply analytical reasoning in decision-making. This cognitive progress was particularly evident in studies employing Classroom Action Research (CAR) and quasi-experimental designs. For instance, Deswita et al. (2024) observed a 55.95% increase in students' critical thinking ability from the pre-cycle to the third cycle. Similarly, Avandra and Desyandri (2023) reported an increase from 40% in Cycle I to 87.5% in Cycle II. These findings underscore the iterative benefits of differentiated instruction when implemented within structured classroom settings.

Further validation is provided by quasi-experimental studies, which employed rigorous statistical analyses to compare learning outcomes between experimental and control groups. Nahak and Lawa (2023) demonstrated a significant difference in mean scores: 78.87 for the differentiated instruction group and 65.40 for the control group. In another study, Suryafati (2023) reported a high N-Gain score of 77.74% and a statistically significant p-value ($p < 0.001$), confirming the robustness of the differentiated approach in enhancing critical thinking. These findings are corroborated by Cayir and Balci (2023), who used a pre-test–post-test quasi-experimental design and reported a significant improvement in students' critical thinking skills following the implementation of differentiated instruction ($p < .05$), thereby confirming the effectiveness of this approach in developing higher-order thinking skills.

Subject-specific implementations further reinforce these positive outcomes. In mathematics, studies by Lestari et al. (2024) and Pratiwi dan Wardani (2024) report improvements in logical reasoning, problem-solving, and creative thinking. Related science studies, such as that by Fitriana et al. (2024), demonstrate enhanced student abilities in hypothesis generation, evidence evaluation, and conceptual clarity. In the fields of Islamic education and social studies, differentiated instruction fostered reflective thinking and ethical reasoning (Putri & Rachmadyanti, 2024; Sarie, 2022).

Beyond cognitive gains, several studies highlight the affective and motivational benefits of differentiated instruction. Students with higher readiness, in particular, demonstrated greater autonomy, confidence, and engagement when provided with learning tasks aligned with their interests and abilities. For instance, Anggoro et al. (2024) noted that instruction tailored to students' multiple intelligences fostered a more meaningful learning experience and deeper critical reasoning. Teachers who adapted instruction using diagnostic feedback and media-based tools observed increased learner participation and ownership.

Media and technology also play a crucial role in amplifying the impact of differentiation. The study by Anggoro et al. (2024) demonstrates the use of differentiated learning media developed through the ADDIE model, resulting in improved mastery of critical-reasoning concepts. Similarly,

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Fajari (2020) found that integrating multimedia platforms with PBL-based strategies effectively supports higher-order thinking by aligning instruction with students' preferred learning styles.

Collectively, these findings affirm that, when implemented judiciously, differentiated instruction contributes significantly to the development of students' critical thinking skills across diverse subject areas and learner profiles. Strategies such as tiered tasks, flexible grouping, and responsive feedback mechanisms ensure that instruction remains student-centred and impactful. Consistent with these results, Table 6 summarises the reported impacts of differentiated instruction on students' critical thinking skills, indicating that this approach not only enhances academic outcomes but also cultivates essential competencies for success in the 21st century.

Table 6. Reported effects of differentiated instruction on students' critical thinking skills

No	Studies / Sources	Subject Areas	Reported Effects
1	Deswita et al. (2024)	General / IPAS	Critical thinking improved by 55.95% across 3 cycles
2	Avandra & Desyandri (2023)	Science	Increased from 40% (Cycle I) to 87.5% (Cycle II)
3	Nahak & Ndapa Lawa (2023)	General (PjBL context)	Mean score: 78.87 (experimental) vs 65.40 (control)
4	Suryafati (2023)	Science	N-Gain = 77.74%
5	Fitriana et al. (2024)	Science	Enhanced hypothesizing and evidence evaluation
6	Lestari et al. (2024)	Mathematics	Improved critical and creative thinking in high-ability students
7	Anggoro et al. (2024)	Cross-subject / Technology-integrated	Critical reasoning rose with media tailored to intelligences
8	Putri & Rachmadyanti (2024)	Islamic Education and Civics	Promoted reflective judgment and ethical reasoning
9	Fajari et al. (2020)	Cross-subject / Media-supported	Media-enhanced PBL supported higher-order thinking
10	Dela et al., (2024)	General / IPAS	Improved conceptual understanding, student engagement, and critical thinking through differentiated learning models.
11	Sarie (2022)	Islamic Education	Supported reflective thinking and student autonomy
12	Cayir & Balci (2023)	Mathematics	A significant increase in critical thinking skills and mathematical problem-solving attitudes was observed ($p < 0.05$).

4. Discussion

This section presents a synthesis and interpretation of the Systematic Literature Review (SLR) findings, explicitly aligning them with the stated research questions. The discussion is structured to address each research question based on the reviewed evidence, connect it to relevant theory and empirical findings, and conclude with practically framed implications. All citations from the results section are retained to maintain consistency and academic integrity.

4.1 Characteristics of research trends in differentiated instruction

The analysis of the literature reviewed in this systematic literature review (SLR) indicates that research on differentiated instruction in elementary schools is predominantly quantitative, employing quasi-experimental designs. These studies are complemented by qualitative research, classroom action research, and Design and Development Research (DDR). The predominance of quasi-experimental designs reflects a strong research orientation toward examining the effects of differentiated instruction on student outcomes, including academic achievement, student engagement, and critical thinking skills (Kiani et al., 2022; Dixon et al., 2014) This pattern positions quasi-experimental research as the primary methodological trend in the existing literature.

Qualitative research and classroom action research emerge as complementary methodological trends that provide rich, contextualized insights into the implementation of differentiated instruction in authentic classroom settings. These approaches foreground

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teachers' adaptive practices in modifying content, learning processes, and instructional products to accommodate students' diverse needs, readiness levels, and learning profiles (Rusandi & Rusli, 2021). In parallel, Design and Development Research (DDR) and Research and Development (R&D) studies reflect an innovation-oriented trajectory, emphasizing the creation and validation of instructional tools and learning platforms tailored to differentiated learning environments.

Exemplified by Anggoro et al. (2024), this strand of research prioritizes the integration of educational technology and cross-curricular design grounded in students' multiple intelligences, thereby offering practical instructional models that support the development of students' critical reasoning skills. Although less prevalent, these studies underscore a growing reliance on digital media and adaptive learning systems, signalling a shift toward more flexible, scalable, and data-informed differentiated learning models suited to increasingly digitalized classrooms (Asriadi et al., 2023; Kunicina et al., 2025).

Despite these contributions, this SLR also identifies several methodological limitations in the current body of research on differentiated instruction. These limitations include the limited application of mixed-methods designs, the scarcity of cross-contextual studies, and the minimal use of data triangulation, all of which may reduce the strength of causal inferences (Creswell & Poth, 2018). Furthermore, the predominance of studies conducted in the Indonesian context requires caution in generalizing the findings, as the implementation of differentiated instruction is strongly influenced by curriculum characteristics, learning cultures, and the availability of educational resources across different educational settings (Annemieke E et al., 2019).

4.2 Strategies in differentiated instruction

A synthesis of the instructional strategies reported in the reviewed studies indicates that differentiating content, process, and product serves as the principal framework for the effective implementation of differentiated instruction (Tomlinson & Imbeau, 2023). This finding suggests that the efficacy of differentiated instruction is not determined by the isolated application of its individual components but rather by the coherence of the instructional design and the alignment of differentiation strategies with the targeted cognitive objectives.

Diagnostic assessment emerged as a key condition for explaining when and why differentiation functions optimally. Teachers who systematically employ formative assessment can adjust task complexity to align with student readiness, thereby ensuring that differentiation transcends mere activity variation and genuinely facilitates meaningful learning (Putra, 2023). Conversely, when diagnostic assessment is limited or intuitive, differentiation tends to remain superficial.

The integration of active learning methods such as Problem-Based Learning (PBL) and Project-Based Learning (PjBL) enhances the effectiveness of differentiation by providing space for open-ended tasks, student choice, and collaboration (Ilham, 2024). However, the SLR findings also reveal that these strategies are particularly effective when teachers possess adequate planning competence and sufficient institutional support. Without these prerequisites, the complexity of planning for differentiation can potentially increase teacher workload and impede the sustainability of the practice (Awofala & Lawani, 2020).

The use of adaptive instructional media and technology also functions as a catalyst for differentiation. HOTS-based worksheets, multimedia modules, and digital platforms enable more flexible and responsive learning customization (Ruan & Lu, 2025; Wang & Song, 2024; Yavuz, 2020). Nevertheless, the effectiveness of technology remains contingent on its alignment with learning objectives and student profiles (Vongkulluksn et al., 2020).

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4.3 The impact of differentiated instruction on critical thinking

The literature synthesis indicates that differentiated instruction consistently has a positive impact on students' development of critical thinking across subjects. This impact is not only evident in the empirical findings of the reviewed studies but is also congruent with established learning theories and broader empirical evidence beyond the analyzed research corpus.

Theoretically, the effectiveness of differentiated instruction aligns with social constructivist theory, which posits that knowledge is actively constructed through the interaction between learning experiences and social context (Vygotsky, 1978). Differentiation allows teachers to tailor the level of learning challenge to students' zone of proximal development, thereby fostering deeper cognitive engagement. This principle is also consistent with cognitive load theory, which states that learning is more effective when cognitive demands are aligned with students' processing capacity (Sweller et al., 2019).

From a critical-thinking pedagogy perspective, the findings of this SLR reinforce the argument that instructional approaches that provide choice, autonomy, and open-ended tasks are more effective at cultivating higher-order thinking skills. Critical thinking is widely conceptualized as a higher-order cognitive process involving analysis, evaluation, and reasoned judgment (Ennis, 2011; Facione 2015). These scholars argue that critical thinking develops when students are actively engaged in analytical reasoning, evaluative judgment, and evidence-based decision-making. However, critical thinking does not represent a single, unified construct; rather, it has evolved through diverse philosophical and educational traditions, resulting in multiple complementary interpretations within contemporary educational research (Vendrell-Morancho & Moya, 2025). Within this conceptual framework, differentiated instruction creates conducive learning conditions by offering varied learning pathways that support student autonomy and engagement, while maintaining alignment with established cognitive standards.

Empirical evidence beyond the scope of this SLR further supports these findings. (Hattie, 2012) mentioned that meta-analyses indicate that student-centred teaching strategies, including adaptive instruction and formative feedback, have large effect sizes on student achievement and thinking. Similarly, international research demonstrates that differentiation combined with formative assessment significantly enhances student engagement and reasoning, particularly in heterogeneous classroom settings (Deunk et al., 2018; Van Geel et al., 2019).

The effectiveness of differentiation also extends across disciplines while remaining contextually dependent. In mathematics and science, differentiation proves effective when tasks are designed to demand analytical reasoning and evidence-based justification. Conversely, in religious and values education, differentiation fosters ethical dialogue and moral reflection (Mardiyah & Solihat, 2023). This finding aligns with the view of Shavelson et al. (2019) that the development of critical thinking must be contextually integrated within academic disciplines rather than taught as a content-independent skill.

Beyond cognitive impacts, the corpus's findings are consistent with international literature on the affective dimensions of learning. Research by Ryan & Deci (2020), within the framework of self-determination theory, autonomy, competence, and social relatedness are prerequisites for strong intrinsic motivation. Differentiation, particularly when it provides meaningful learning choices, fulfils these three psychological needs, thereby strengthening student motivation and engagement (Martella et al., 2020; Nahdhiah & Suciptaningsih, 2024; Somnam et al., 2025).

Technology-assisted differentiation can also be understood through the lens of adaptive digital learning theory. Literature indicates that technology is effective in enhancing critical thinking when used to provide personalized feedback and adaptive learning pathways, not

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merely as a tool for content delivery (OECD, 2021; Vongkulluksn et al., 2020). This finding aligns with the results of studies in the corpus, which imply an amplified impact of differentiation when digital media is used in alignment with learning objectives (Ayeshung et al., 2023; Osifo, 2019).

Nevertheless, evidence from both the corpus and external literature confirms that differentiated instruction is not a context-free approach. Its effectiveness is highly contingent upon teacher competence, the quality of diagnostic assessment, workload, class size, as well as curriculum and policy support (Azzahra & Muhajir, 2023; Samsudi et al., 2024; Sin, 2021). Therefore, the implications of these SLR findings extend beyond pedagogy to encompass structural considerations, demanding teacher professional development and systemic support for the implementation of differentiated instruction to be sustained and to have a tangible impact.

4.4 Limitations of the review

This systematic literature review has several limitations that warrant consideration. First, there is potential for database bias due to the predominance of studies conducted within the Indonesian context and the restriction to open-access articles, which consequently limits the diversity of the analyzed research contexts. Second, publication bias likely occurred, as studies reporting positive or significant results tend to be published and indexed more readily than those with non-significant or negative findings. This condition may lead to an overestimation of the effectiveness of differentiated instruction relative to its true impact. Therefore, future reviews are recommended to incorporate grey literature and broaden the database's scope to obtain a more balanced body of empirical evidence. Third, variability in the methodological quality and research design of the primary studies, including differences in research duration, intervention intensity, and the instruments used to measure critical thinking skills, limits the generalizability and the strength of causal inferences that can be drawn from the findings. Consequently, the results of this review should be interpreted as indicative rather than conclusive and should be confirmed through more rigorous, longitudinal, and multi-contextual future research.

5. Conclusion and implications

This systematic literature review synthesizes 12 empirical studies published between 2020 and 2024 and indicates that research on differentiated instruction in primary education is predominantly dominated by quasi-experimental designs, which represent the primary methodological trend, followed by descriptive qualitative studies, classroom action research, and Design and Development Research. This pattern reflects a dual focus on empirically examining student learning outcomes and understanding classroom implementation processes. However, the limited use of mixed-methods designs, longitudinal studies, and multi-site research constrains the generalizability of the findings. In instructional practice, differentiated instruction is implemented by adapting content, processes, and learning products to students' readiness, interests, and learning profiles, supported by diagnostic and formative assessment, flexible grouping, tiered assignments, and the integration of active learning models such as Problem-Based Learning and Project-Based Learning.

Overall, the reviewed studies consistently demonstrate that differentiated instruction has a positive impact on students' critical thinking skills, as evidenced by improved learning outcomes and enhanced abilities in analysis, evaluation, and problem-solving. These findings align with constructivist perspectives that emphasize the role of cognitive challenge and meaningful learning experiences in the development of critical thinking. Nevertheless, the predominance of

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studies conducted in the Indonesian context, along with variations in research designs, measuring instruments, and intervention durations, warrants caution when generalizing the findings. Therefore, future research is encouraged to employ standardized measures of critical thinking, adopt longitudinal research designs, explore long-term effects, and examine the role of technology in optimizing the implementation of differentiated instruction.

Credit authorship contribution statement

First Author contributed to conceptualization, methodology, formal analysis, data curation, and writing – original draft. **Second Author** contributed to methodology. **Third Author** contributed to formal analysis and data curation. **Fourth Author** contributed to writing original draft. **Fifth Author** contributed to investigation, and writing review and editing. **Sixth Author** contributed to resources and project administration. **Last Author** contributed to formal analysis, data curation, and supervision.

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 is not required. All data used in this study were obtained from secondary sources that have been publicly published and are openly accessible

Declaration of AI statement

Portions of this manuscript were drafted, edited, and enhanced using AI. The authors used this tool to improve grammar. All AI-generated content was thoroughly reviewed, edited, and validated by the authors, who take full responsibility for the final content.

References

Al-Shehri, M. S. (2020). Effect of differentiated instruction on the achievement and development of critical thinking skills among sixth-grade science students. *International Journal of Learning, Teaching and Educational Research*, *19*(10), 77–99. https://doi.org/10.26803/ijlter.19.10.5

Annemieke E, S.-J., Meijer, A., Helms-Lorenz, M., & Maulana, R. (2019). Differentiated instruction in secondary education: A systematic review of research evidence. *Frontiers in Psychology*, *10*, 3–15. https://doi.org/10.3389/fpsyg.2019.0236

Anggoro, S., Fitriati, A., Thoe, N. K., Talib, C. A., & Mareza, L. (2024). Differentiated instruction based on multiple intelligences as promising joyful and meaningful learning. *International Journal of Evaluation and Research in Education* , *13*(2), 1194–1204. https://doi.org/10.11591/ijere.v13i2.24791

Aprima, D., & Sari, S. (2022). Cendikia : Media jurnal ilmiah pendidikan analisis penerapan pembelajaran berdiferensiasi dalam implementasi Kurikulum Merdeka pada pelajaran matematika SD. *Cendikia : Media Jurnal Ilmiah Pendidikan*, *13*(1), 95–101. https://doi.org/10.35335/cendikia.v13i1.2960

Arifah, I. N., Murtiyasa, B., Kholid, M. N., Sutama, & Rahmawati, L. E. (2025). Analysis of critical thinking skills in solving hots based mathematics problems reviewed from students' metacognition. *AIP Conference Proceedings*, 1–15. https://doi.org/10.1063/5.0290013

Asriadi, M., Hadi, S., Istiyono, E., & Retnawati, H. (2023). Does differentiated instruction affect learning outcome systematic review and meta-analysis. *Journal of Pedagogical Research*, *7*(5), 18–33. https://doi.org/10.33902/JPR.202322021

Avandra, R., & Desyandri. (2023). Implementasi pembelajaran berdiferensiasi terhadap keterampilan berpikir kritis siswa pada pembelajaran IPA kelas VI SD. *Didaktik : Jurnal Ilmiah PGSD STKIP Subang*, *8*(2), 2944–2960. https://doi.org/10.36989/didaktik.v8i2.618

Awofala, A., & Lawani, A. (2020). Increasing mathematics achievement of senior secondary school students through differentiated instruction. *Journal of Educational Sciences*, *4*(1), 1–19. https://doi.org/10.31258/jes.4.1.p.1-19

Ayeshung, R. I. (2023). Evaluation of instructional media in learning among physics education students and their academic performance in cross river university of technology calabar, nigeria. *International Journal of Multidisciplinary Research and Analysis*, *6*(8), 9–12. https://doi.org/10.47191/ijmra/v6-i8-49

Azzahra, T. A., & Muhajir, M. (2023). Implementation of the Kurikulum Merdeka in Arabic language learning. *Inovasi Kurikulum*, *20*(2), 261–274. https://doi.org/10.17509/jik.v20i2.59793

Cayir, A., & Balci, E. (2023). The effect of differentiated instruction on gifted students critical thinking skills and mathematics problem solving attitudes. *Educational Research and Reviews*, *18*(12), 392–398. https://doi.org/10.5897/err2023.4375

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: choosing among five approaches* (4th ed.). SAGE Publications.

Creswell, J. W., & Creswell, J. D. (2018). *Research design: Qualitative, quantitative, and mixed methods approaches*. SAGE Publications.

Dela, S. A., Firdaus, E., & Utami, I. I. S. (2024). Analisis penggunaan model pembelajaran dalam mempelajari ipas di sekolah dasar yang berdiferensiasi. *Jurnal Basicedu*, *8*(5), 3740–3749. https://doi.org/10.31004/basicedu.v8i5.8248

Deswita, H., Siregar, N., & Hardi, S. P. (2024). Peningkatan kemampuan berpikir kritis peserta didik pada pembelajaran ipas kelas v melalui pendekaan pembelajaran berdiferensiasi. *Journal in Teaching and Education Area*, *1*(3), 401–416. https://doi.org/10.69673/xmes4q45

Deunk, M. I., Smale-Jacobse, A. E., de Boer, H., Doolaard, S., & Bosker, R. J. (2018). Effective differentiation Practices:A systematic review and meta-analysis of studies on the cognitive effects of differentiation practices in primary education. *Educational Research Review*, *24*, 31–54. https://doi.org/10.1016/j.edurev.2018.02.002

Dixon, F. A., Yssel, N., McConnell, J., & Hardin, T. (2014). Differentiated Instruction, professional development, and teacher efficacy. *Journal for the Education of the Gifted*, *37*(2), 111–127. https://doi.org/10.1177/0162353214529042

Ennis, R. H. (2011). *The nature of critical thinking: An outline of critical thinking dispositions and abilities*.

Fajari, L. E. W. (2020). Improving elementary school's critical chinking skills through three different pbl-assisted learning media viewed from learning styles. *Journal of E-Learning and Knowledge Society*, *16*(1), 55–64. https://doi.org/10.20368/1971-8829/1135193

Facione, P. A. (2015). *Critical thinking: What it is and why it counts*. Insight Assessment.

Fitra, & Kurnia, D. (2022). Pembelajaran berdiferensiasi dalam perspektif progresivisme pada mata pelajaran IPA. *Jurnal Filsafat Indonesia*, *5*(3), 250–258. https://doi.org/10.23887/jfi.v5i3.41249

[e-**ISSN 2598-5949** | p-**ISSN 2303-1514**]

Fitriadi, F., Herpratiwi, H., Yulianti, D., Setiyadi, A. G. B., Hariri, H., Sunyono, S., Haenilah, E. Y., & Mukhlis, H. (2024). Enhancing critical thinking in elementary education: a systematic review of effective learning models. *Multidisciplinary Reviews*, *8*(6), 6–15. https://doi.org/10.31893/multirev.2025157

Fitriana, E., Nisa, A. F., & Cahyani, B. H. (2024). Analisis penerapan pembelajaran berdiferensiasi dengan model problem based learning pada materi IPAS di sekolah dasar. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, *9*(1), 5567–5580. https://doi.org/10.23969/jp.v9i1.11817

Godor, B. P. (2021). The many faces of teacher differentiation : Using q methodology to explore teachers preferences for differentiated instruction the many faces of teacher differentiation : Using methodology to explore teachers preferences for differentiated instruction. *The Teacher Educator*, *56*(1), 43–60. https://doi.org/10.1080/08878730.2020.1785068

Goyibova, N., Muslimov, N., Sabirova, G., Kadirova, N., & Samatova, B. (2025). Differentiation approach in education: Tailoring instruction for diverse learner needs. *MethodsX*, *14*, 4–9. https://doi.org/10.1016/j.mex.2025.103163

Hattie, J. (2012). *Visible learning for teachers: maximizing impact on learning*. Routledge.

Hayden, S. M., Gubbins, E. J., Cody, R. A., & Boldt, G. T. (2024). Teachers' perceptions of differentiation following a math curriculum implementation study. *Journal for the Education of the Gifted*, *47*(1), 3–29. https://doi.org/10.1177/01623532231215092

Herliana, F., Serevina, V., Maula, I., Farhan, A., Halim, A., Mukhlis, Susilawati, Susanna, & Tari, S. (2025). Developing project-based learning tools with vak multi-modality differentiation to enhance students conceptual understanding. *Journal of Physics: Conference Series*, *3139*(1), 3–15. https://doi.org/10.1088/1742-6596/3139/1/012082

Ilham, M. (2024). Implementasi pembelajaran asynchronous berbasis project pada mata pelajaran IPS di Sekolah Dasar. *Al-TA'DIB: Jurnal Kajian Ilmu Kependidikan*, *17*(1), 51–70. https://doi.org/10.31332/atdbwv17i1.9255

Kartika Sari, M., Sudiyanto, S., & Bayu Kurniawan, S. (2021). Critical thinking skills profile of fourth grade elementary school students in science learning. *ICLIQE 2021: Proceeding of The 5th International Conference on Learning Innovation and Quality Education*, 1–4. https://doi.org/10.1145/3516875.3516968

Kementerian Pendidikan, Kebudayaan, Riset, dan T. R. I. (2022). *Panduan pembelajaran dan asesmen Kurikulum Merdeka*.

Kenney, A. W., Langley, S. D., Hemmler, V., Callahan, C. M., Gubbins, E. J., & Siegle, D. (2024). Different or differentiated ? recoupling policy and practice in an era of accountability. *educational policy*, *38*(1), 134–160. https://doi.org/10.1177/08959048231153612

Kiani, K. M., Shah, N. H., & Azhar, M. T. (2022). Effectiveness of instructional planning and strategies of teachers as a national professional standard for teachers in Pakistan. *Journal of Education and Social Studies*, *3*(3), 194–204. https://doi.org/10.52223/jess.20223303

Kunicina, N., Rakhimova, K., Caiko, J., & Mansurova, M. (2025). Adaptive multidimensional e-learning systems. *2025 ieee 12th workshop on advances in information, Electronic and Electrical Engineering (AIEEE)*, 1–6. https://doi.org/10.1109/AIEEE66149.2025.11050765

Lestari, F., Alim, J. A., & Noviyanti, M. (2024). Implementation of differentiated learning to enhance elementary school students' mathematical critical and creative thinking skills. *International Journal of Elementary Education*, *8*(1), 178–187. https://doi.org/10.23887/ijee.v8i1.64295

[e-**ISSN 2598-5949** | p-**ISSN 2303-1514**]

Liu, Z., Yin, H., Cui, W., Xu, B., & Zhang, M. (2022). How to reflect more effectively in online video learning: Balancing processes and outcomes. *British Journal of Educational Technology*, *53*(1), 114–129. https://doi.org/10.1111/bjet.13155

Maladzhi, R. W., Nemavhola, F., Ntunka, M. G., Moloi, K., Mthombeni, N. H., & Tsoe, M. S. (2024). Addressing challenges and solutions for scaling up project-based learning initiatives in large engineering programs. *2024 World Engineering Education Forum Global Engineering Deans Council (WEEF-GEDC)*, 1–9. https://doi.org/10.1109/WEEF-GEDC63419.2024.10854922

Mardiyah, F. H., & Solihat, R. (2023). Differentiated instruction analysis on the topic of cell reproduction in 12th grade of senior high school. *Assimilation Indonesian Journal of Biology Education*, *6*(2), 109–116. https://doi.org/10.17509/aijbe.v6i2.58538

Martella, A. M., Klahr, D., & Li, W. (2020). The relative effectiveness of different active learning implementations in teaching elementary school students how to design simple experiments. *Journal of Educational Psychology*, *112*(8), 1582–1596. https://doi.org/10.1037/edu0000449

Mijuskovic, M. (2024). Enhancing EFL pedagogy through differentiated homework assignments: A montenegrin experiment. *Moderna Språk*, *118*(3), 189–213. https://doi.org/10.58221/mosp.v83i2.17575

Nahak, R. L., & Ndapa Lawa, S. T. M. (2023). Pengaruh pembelajaran berdiferensiasi dalam model project based learning terhadap kemampuan berpikir kritis siswa Kelas IV SDI Barai 2. *HINEF : Jurnal Rumpun Ilmu Pendidikan*, *2*(2), 62–69. https://doi.org/10.37792/hinef.v2i2.1008

Nahdhiah, U., & Suciptaningsih, O. A. (2024). Optimization of Kurikulum Merdeka through differentiated learning: Effectiveness and implementation strategy. *Inovasi Kurikulum*, *21*(1), 349–360. https://doi.org/10.17509/jik.v21i1.65069

Nepal, S., Walker, S., & Dillon-Wallace, J. (2024). How do Australian pre-service teachers understand differentiated instruction and associated concepts of inclusion and diversity. *International Journal of Inclusive Education*, *28*(2), 109–123. https://doi.org/10.1080/13603116.2021.1916111

OECD. (2021). *OECD digital education outlook 2021: Pushing The Frontiers With AI, Blockchain and Robots*. OECD Publishing.

Oktaviani, D., & Satanti, S. (2024). Improving unplugged computational thinking skills through integrated problem-based and differentiated learning in Indonesia. *Acta Paedagogica Vilnensia*, *52*, 93–110. https://doi.org/10.15388/ActPaed.2024.52.10

Osifo, A. (2019). *Improving collaboration in blended learning environments through differentiated activities and mobile-assisted language learning tools*. https://doi.org/10.33965/ml2019_201903l001

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ*, *372*, 71–79. https://doi.org/10.1136/bmj.n71

Pratiwi, S. D., & Wardani, K. W. (2024). Implementasi pembelajaran berdiferensiasi dengan model problem based learning (pbl) untuk meningkatkan kemampuan berpikir kritis siswa pada mata pelajaran matematika Kelas 5. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, *9*(2), 5122–5132. https://doi.org/10.23969/jp.v9i2.14497

Putra, G. S. (2023). The misconception in differentiated instruction practices: A literature review. *open journal of social sciences*, *11*(01), 305–315. https://doi.org/10.4236/jss.2023.111022

[e-**ISSN 2598-5949** | p-**ISSN 2303-1514**]

Putri, N. M. S., & Rachmadyanti, P. (2024). Analisis pembelajaran berdiferensiasi untuk meningkatkan keterampilan berpikir kritis pada muatan IPS SD. *Jpgsd*, *12*(1), 1–15. https://ejournal.unesa.ac.id/index.php/jurnal-penelitian-pgsd/article/view/59264

Raj, T., Chauhan, P., Mehrotra, R., & Sharma, M. (2022). Importance of critical thinking in the education. *World Journal of English Language*, *12*(3), 126–133. https://doi.org/10.5430/wjel.v12n3p126

Ramaila, S. (2025). Unveiling the Potential: A systematic review on harnessing the affordances of differentiated instruction. *Journal of Teaching and Learning*, *19*(2), 41–56. https://doi.org/10.22329/jtl.v19i2.8561

Ridho, S., Ruwiyatun, R., Subali, B., & Marwoto, P. (2020). Analisis kemampuan berpikir kritis siswa pokok bahasan klasifikasi materi dan perubahannya. *Jurnal Penelitian Pendidikan IPA*, *6*(1), 10–15. https://doi.org/10.29303/jppipa.v6i1.194

Rijal, A., Aswarliansyah, A., & Waluyo, B. (2025). Effectiveness of differentiated learning in mathematics: insights from elementary school students. *Journal of Education and Learning (EduLearn)*, *19*(1), 241–248. https://doi.org/10.11591/edulearn.v19i1.21806

Ruan, S., & Lu, K. (2025). Adaptive deep reinforcement learning for personalized learning pathways: A multimodal data-driven approach eith real-time feedback Optimization. *Computers and Education: Artificial Intelligence*, *9*, 5–15. https://doi.org/10.1016/j.caeai.2025.100463

Rusandi, & Rusli, M. (2021). Merancang penelitian kualitatif dasar/deskriptif dan studi kasus. *Al-Ubudiyah: Jurnal Pendidikan Dan Studi Islam*, *2*(1), 48–60. https://doi.org/10.55623/au.v2i1.18

Ryan, R. M., & Deci, E. L. (2020). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Press.

Sa'ida, N. (2023). Implementasi pembelajaran berdiferensiasi untuk meningkatkan kreativitas anak. *Kiddo: Jurnal Pendidikan Islam Anak Usia Dini*, *4*(2), 101–110. https://doi.org/10.19105/kiddo.v4i2.9400

Samsudi, S., Supraptono, E., Utanto, Y., Rohman, S., & Djafar, T. (2024). Unraveling the Merdeka Curriculum: Exploring differentiated instruction's impact on student learning. *Jurnal Ilmiah Peuradeun*, *12*(2), 517. https://doi.org/10.26811/peuradeun.v12i2.1131

Santi, E. S. (2020). Penerapan model group investigation (gi) untuk meningkatkan kemampuan berpikir kritis siswa di kelas tinggi. *Utile: Jurnal Kependidikan*, *5*(2), 123–133. https://doi.org/10.37150/jut.v5i2.492

Sarie, F. N. (2022). Implementasi pembelajaran berdiferensiasi dengan model problem based learning pada siswa sekolah dasar kelas VI. *Tunas Nusantara*, *4*(2), 492–498. https://doi.org/10.34001/jtn.v4i2.3782

Shadish, W. R., Cook, T. D., & Campbell, D. T. (2002). Experimental and quasi-experimental designs for generalized causal inference. Houghton Mifflin.

Shavelson, R. J., Liu, O. L., Ruiz-Primo, M. A., & Bransford, J. D. (2019). *On the assessment of higher-order thinking skills*. OECD Publishing.

Sin, K. K. T. (2021). Curriculum development as a tool for professional development. *Gile Journal of Skills Development*, *1*(2), 29–43. https://doi.org/10.52398/gjsd.2021.v1.i2.pp29-43

Suryafati, N. E. (2023). Peran pembelajaran berdiferensiasi dalam meningkatkan keterampilan berpikir kritis dan pemahaman konsep IPA di sekolah dasar. *PeDaPAUD: Jurnal Pendidikan Dasar Dan PAUD*, *2*(3), 137–146. https://doi.org/10.47165/pedapaud.v2i3.633

Somnam, S., Wongtip, K., & Buaphanngam, S. (2025). The development of a literacy curriculum using activity-based learning, digital curriculum and spatial identity to enhance literacy

[e-**ISSN 2598-5949** | p-**ISSN 2303-1514**]

skills of elementary students. *Journal of Curriculum and Teaching*, *14*(2), 13–26. https://doi.org/10.5430/jct.v14n2p13

Sweller, J., Ayres, P., & Kalyuga, S. (2019). *Cognitive load theory*. Springer.

Tomlinson, C. A. (2017). *How to differentiate instruction in academically diverse classrooms*. ascd.

Tomlinson, C. A., & Imbeau, M. B. (2023). *Leading and managing a differentiated classroom*. Association For Supervision And Curriculum Development (ASCD).

Van Geel, M., Keuning, T., Vrielink, M., & Zwart, R. (2019). Assistive hearing technology for deaf and hard-of-hearing spoken language learners. *Education Sciences*, *9*(2), 153–160. https://doi.org/10.3390/educsci9020153

Vendrell-Morancho, M., & Moya, A. V. (2025). Mapping critical thinking: key contributions for rethinking education. *Educação e Pesquisa*, *51*, 4–17. https://doi.org/10.1590/s1678-4634202551278119en

Vongkulluksn, V. W., Xie, K., & Hawk, N. A. (2020). Investing time in technology: Teachers' value beliefs and time cost profiles for classroom technology integration. *Teachers College Record*, *122*(12), 1–38. https://doi.org/10.1177/016146812012201214

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Wang, W., & Song, S. (2024). Real time wireless adaptive learning systems using reinforcement learning and iot for smart education. *2024 Cross Strait Radio Science and Wireless Technology Conference (CSRSWTC)*, 1–4. https://doi.org/10.1109/CSRSWTC64338.2024.10811643

Wibowo, S., Wangid, M. N., & Firdaus, F. M. (2025). The relevance of vygotsky's constructivism learning theory with the differentiated learning primary schools. *Journal of Education and Learning (EduLearn)*, *19*(1), 431–440. https://doi.org/10.11591/edulearn.v19i1.21197

Xhomara, N. (2022). Critical Thinking: Student centred teaching approach and personalised learning, as well as previous education achievements, contribute to critical thinking skills of students. *International Journal of Learning and Change*, *14*(1), 101–120. https://doi.org/10.1504/IJLC.2022.119513

Yavuz, A. C. (2020). The effects of differentiated instruction on turkish students' l2 achievement, and student and teacher perceptions. *Eurasian Journal of Applied Linguistics*, *6*, 313–335. https://doi.org/10.32601/ejal.776002

[e-**ISSN 2598-5949** | p-**ISSN 2303-1514**]