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Transformation of Differentiated Teaching Methods to Promote Critical Thinking in Primary School Pupils

[1]Fitri Indriani*, [1,2]Satrianawati, [3]Heldayanti
Corresponding Author: *fitri.indriani@pgsd.uad.ac.id
[1] Universitas Ahmad Dahlan, Yogyakarta, Indonesia
[2] Harbin Normal University, Heilongjiang, China
[3] Pakuan University, Bogor, Indonesia

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ABSTRACT

This study examines how differentiated instruction is implemented in primary school classrooms and its role in fostering students' higher-order thinking skills. Using a qualitative case study approach, data were collected through in-depth interviews, classroom observations, and document analysis involving five teachers from grades 1 to 5. The findings indicate that teachers adapt instructional strategies to address students' readiness levels, learning profiles, and individual interests. This pedagogical transformation is reflected in the use of contextual learning, project-based activities, reflective practices, and digital resource integration. These approaches create more inclusive and responsive learning environments. As a result, students demonstrate improved analytical reasoning, evaluative thinking, and argument construction. The study underscores that differentiated instruction not only enhances student engagement but also supports meaningful learning. It concludes that this approach is essential for meeting the demands of 21st-century education and aligns closely with the principles of the Merdeka Curriculum.

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Introduction

Critical thinking is widely recognized as a core competency required for learning in the 21st century [1], [2]. It enables students to engage in higher-order cognitive processes, including interpreting and assessing information, addressing complex problems, making well-reasoned decisions, and formulating evidence-based conclusions [3]-[5] For this reason, nurturing critical thinking from the early years of schooling is essential to support independent learning, deeper reasoning, and reflective intellectual development [6]-[8].

Nevertheless, research has shown that the critical thinking abilities of primary school students in Indonesia remain below expected standards [9], [10]. Many learners continue to depend heavily on memorization and experience difficulties in analyzing information, concluding, and evaluating arguments in a more comprehensive manner [11]-[13]. These challenges are often associated with teacher-centered instructional practices and the limited use of varied teaching approaches that encourage higher-level cognitive engagement [14]-[16]. Furthermore, existing lesson planning structures and assessment practices have not yet fully facilitated the systematic development of students' critical thinking skills [17]-[20]

Differentiated instruction is increasingly recognized as a promising approach to meeting diverse learning needs and promoting critical thinking skills [21]-[23]. This approach enables teachers to adapt content, processes, and learning products based on students' readiness, interests, and learning profiles [24]-[26].

Recent studies have shown that differentiated teaching strategies can enhance cognitive engagement, offer appropriate challenges, and foster deep understanding in heterogeneous classrooms [27], [28]. This approach creates space for teachers to design adaptive learning experiences tailored to students' varying readiness, interests, and learning styles. This aligns with the spirit of the Merdeka Curriculum, which emphasizes meaningful, inclusive, and relevant learning [29], [30].

Differentiated instruction has gained increasing attention in educational research as it is considered capable of accommodating students' diverse learning needs, readiness levels, interests, and learning profiles within the classroom [31]. This approach emphasizes adjustments in the content, process, and product of learning so that each student can engage with learning experiences that align with their individual characteristics. Previous studies and systematic reviews indicate that the implementation of differentiated instruction has the potential to enhance students' engagement and learning outcomes across various educational levels, particularly in primary education [32], [33].

However, much of the existing research tends to focus on the application of differentiated instruction within specific subject areas, such as mathematics or science, and primarily examines general cognitive learning outcomes. Consequently, a comprehensive

understanding of how differentiated instruction is implemented to foster students' critical thinking skills within the broader context of primary education remains relatively limited.

Accordingly, this study seeks to investigate the pedagogical transformation of differentiated instruction as a strategy for promoting critical thinking among elementary school students. The analysis focuses on three key dimensions: instructional planning and implementation, classroom teaching practices, and their influence on students' critical thinking development. The findings are expected to provide both conceptual insights and practical implications for designing adaptive, meaningful, and relevant learning experiences that respond to the demands of 21st-century education.

Material and Methods

This research adopted a qualitative case study design to examine the processes, interactions, and classroom dynamics that shape the implementation of differentiated instruction and its contribution to students' critical thinking development. Instead of relying on standardized pre- and post-test outcome measures typically associated with experimental research, the study focused on capturing pedagogical transformation through qualitative indicators that could be systematically observed across different stages of instructional practice.

The participants included five classroom teachers (coded G1–G5) from grades 1 to 5 at SD Muhammadiyah Kleco 1, Yogyakarta, Indonesia. These teachers were actively engaged in planning and delivering differentiated instruction within the Merdeka Curriculum framework. Participants were purposively selected due to their direct involvement in designing learning activities intended to foster students' higher-order thinking skills.

Data collection took place over six months, spanning from January to June 2024. Information was obtained through in-depth interviews, systematic classroom observations, and document review, including teaching modules, lesson plans, and student worksheets. Observations were conducted across multiple phases of implementation in order to capture the initial classroom context as well as the instructional changes that emerged after differentiated instruction was introduced. Particular attention was given to students' critical thinking behaviors, such as their ability to pose questions, articulate reasoning, and provide reflective responses during the learning process.

Data analysis was carried out using the interactive framework developed by Miles and Huberman [34]. This model involves three core phases: (1) condensing the data, (2) organizing and displaying the data, and (3) drawing conclusions, followed by ongoing verification.

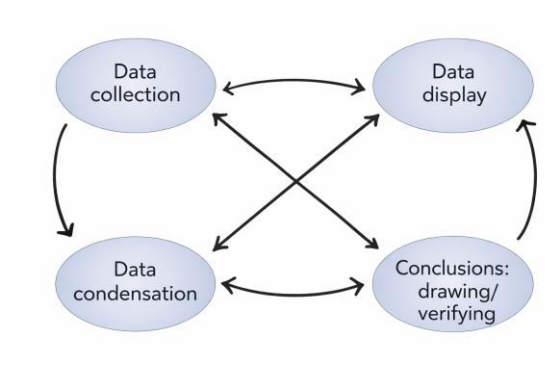


Fig. 1. Data analysis

Ethical principles were strictly adhered to in all phases, including obtaining permission from the school and maintaining the anonymity of the respondents by assigning them codes G1 to G5.

Results and Discussions

A. Planning and implementation of differentiated instruction

Interviews and observations of teachers in grades 1 to 5 revealed that the planning and implementation of differentiated instruction were based on the students' willingness to learn, learning profiles, interests, and learning styles. The triangulated data in Table 1 show the different strategies that teachers used to adapt instruction to the characteristics of their students.

Table 1. Triangulation of data on the planning and implementation of differentiated instruction

Informant Code	Interview Results	Results of the Observation	Form of Differentiation
G1	Conduct an initial assessment of reading, writing, and arithmetic skills, dividing students into groups according to their abilities.	Students with good reading skills work on the tasks independently, while the teacher guides other students.	*Willingness to learn*
G2	Adapt to the students' learning styles (visual, auditory, kinesthetic).	Activities such as creating posters, singing, and playing educational games are tailored to individual learning styles.	Learning profile
G3	Provision of a selection of tasks and flexible group division.	Groups of students work on tasks such as drawing, writing stories, and giving oral presentations.	Interests and learning style
G4	Use interest questionnaires and learning profiles to determine the strategy.	Thematic projects aligned with students' interests, such as creating posters, writing, and making videos.	Interests and learning profiles
G5	Based on the students' reflections and the initial assessment, they are given a free choice of learning method.	Students fill out a reflection journal and select learning activities.	Readiness and interest

These results indicate that the teacher has effectively implemented differentiated instruction, utilizing various approaches tailored to the individual needs of the students. This practice aligns with the theory of differentiated instruction, which emphasizes adapting content, processes, products, and learning environments [35].

These findings are consistent with broader research trends indicating that differentiated instruction is increasingly oriented toward adaptive implementation that responds to students' diverse learning needs, particularly in primary education [36]. The teachers involved in this study reflect this tendency by applying differentiation strategies in their classrooms in practical and context-sensitive ways that align with students' characteristics and learning environments. Summary of key findings:

- Teachers conduct a diagnostic pre-assessment to determine students' reading, writing, and arithmetic skills (readiness).
- Modifying classroom activities in response to learners' individual profiles and dominant learning modalities, including visual, auditory, and kinesthetic preferences.
- Providing a selection of tasks (selection board) and flexible grouping according to interests and learning styles.
- Use of questionnaires on interests and reflections to determine appropriate learning strategies.
- Freedom for students to choose the learning method they consider most effective.

Table 2 summarizes how teachers plan and implement differentiated instruction across five cases. Each teacher emphasizes different aspects, including readiness, learning profiles, and student interests. Strategies include skill-based grouping, varied activities, flexible tasks, and reflective choices, demonstrating adaptive practices that align instruction with diverse student needs and learning characteristics.

Table 2. Summary of results for planning and implementing differentiated instruction

Teacher Code	Differentiation focus	Example
G1	Readiness	Classification of students according to reading, writing, and arithmetic skills.
G2	Learning profile	Activities according to learning style, such as creating posters or singing.
G3	Interests and learning style	Different task selection and flexible group division.
G4	Interests and learning profile	Thematic projects are adapted to the interests of the students.
G5	Readiness and interests	Reflection and selection of learning activities by students.

The importance of planning based on readiness and learning profiles demonstrates teachers' awareness of students' different abilities and learning preferences. This is

particularly relevant for primary education in Indonesia, where students are very heterogeneous. With this approach, teachers can avoid ineffective, one-sided learning methods and replace them with personalized and meaningful practices. This implementation also supports the "Independent Curriculum" policy, which emphasizes inclusive and context-based learning.

B. Transforming teaching practice in the classroom

The data from interviews and observations indicate that the learning transformations implemented by teachers (G1–G5) encompass active approaches and direct experiences, the utilization of the environment as a learning resource, the integration of information and communication technologies (ICT), project-based learning, and the personalization of the learning process. Table 3 below summarizes the triangulation of data on the transformation of teaching practice in the classrooms.

Table 3. Triangulation of data on the transformation of teaching practice in the classroom

Teacher Code	Interview Results	Observation Results	An aspect of Transformation
G1	Learning through play and concrete activities.	Learning stations, educational games.	An active approach and direct experiences.
G2	Contextualization with the environment.	Outdoor measurement exercises, group discussions.	Use of the environment as a learning resource.
G3	Use of technology and a simple presentation.	Students create and present slides.	Integration of ICT and communication.
G4	Thematic project across multiple subjects.	Creation of visual aids, writing reports, and presentations.	Project-based learning
G5	Differentiation and reflection on learning.	Learning objective board, reflection sessions, and selection of activities.	Personalization and personal responsibility for the learning process

The pedagogical transformation identified in this study reflects a shift from conventional teacher-centered learning routines toward a more student-centered and experiential approach. In the early stages of implementation, classroom activities were still largely dominated by uniform tasks and one-way instructional patterns. However, in subsequent stages, teachers began to adopt more flexible strategies such as learning stations, contextual outdoor activities, simple technology-based presentations, cross-subject thematic projects, and reflective sessions that provided students with opportunities to make learning choices. Thus, this transformation not only represents methodological innovation but also indicates a change in students' roles toward becoming more active and independent participants in the learning process.

The findings suggest that teachers have reshaped their instructional practices by integrating appropriate technologies and learning content in response to the demands of contemporary learners. This pedagogical redesign involves shifts in teaching approaches,

methods, learning media, and students' roles, as reflected in innovations such as playful activities, contextual learning experiences, the use of simple digital tools, project-based tasks, differentiated instruction, and reflective learning practices. The following section provides documentation of these transformative classroom activities.



Fig. 1. Learning with visual aids



Fig. 2. Group discussion



Fig. 3. Students presenting in front of the class

This finding is supported by previous studies emphasizing the importance of teachers' professional creativity in designing meaningful and differentiated lessons. Teachers who actively engage in professional learning communities tend to develop more innovative and reflective teaching practices, including the integration of digital technologies, collaborative learning approaches, and instructional designs that support student autonomy in learning [37], [38].

The learning transformation observed in this study illustrates a clear transition from traditional teacher-dominated instruction toward a more student-oriented approach. In this context, the teacher functions primarily as a facilitator and learning companion rather than merely a transmitter of information. This shift is reflected in the provision of multiple learning pathways, students' active engagement in reflective activities, and the integration of technology and environmental resources as meaningful contextual learning media. The project-based practices implemented by G4, along with the digital presentations developed by G3, indicate improvements in students' critical thinking and broader 21st-century competencies. These findings align with Oktaviani and Satanti [39] who reported that problem-based learning and differentiated strategies effectively enhance students' computational thinking and collaborative skills. Summary of findings on the transformation of classroom teaching practice:

- An active approach and experiential learning through playful activities.
- Use of the environment as a contextual learning resource.
- Integration of simple technologies, such as the creation and presentation of slides.
- Project-based learning across subjects.
- Personalization through reflection and choice in the learning process

Table 4 presents the transformation of learning practices across five teachers, highlighting key shifts toward active, contextual, and student-centered approaches. Examples include learning stations, environmental tasks, student-created presentations, project-based outputs, and reflective activities, illustrating how instruction evolves to promote engagement, personalization, and meaningful learning experiences.

Table 4. Summary of results on the transformation of learning practices

Teacher Code	An aspect of Transformation	Example from Practice
G1	Active and experience-oriented learning	Learning stations and educational games.
G2	Contextual learning	Measurements in the environment and group discussions.
G3	Technology integration	Presentations created by students.
G4	Project-based learning	Creation of visual aids and thematic reports.
G5	Personalization and reflection	Reflection session and selection of learning activities.

This pedagogical transformation is closely associated with the strengthening of students' critical thinking skills, as learners are increasingly encouraged to justify their choices, evaluate various problem-solving approaches, collaborate in group discussions, and reflect on their learning processes. Therefore, the shift in instructional strategies not only constitutes a form of pedagogical adaptation but also serves as a foundation for students' cognitive empowerment in primary school classrooms.

C. Impact of differentiated instruction on students' critical thinking skills.

Although this study did not employ standardized pre- and post-tests as in an experimental design, evidence of students' critical thinking development was documented through classroom observations conducted at both the initial and later stages over the six-month implementation of differentiated instruction. In the early stage, students tended to provide brief responses and still relied heavily on teacher guidance. However, as differentiated instruction was gradually implemented, follow-up observations revealed more active learning behaviors, including increased questioning, clearer reasoning, comparison of alternative solutions, and reflective responses to their own work. These qualitative shifts serve as indicators of pedagogical transformation as well as the strengthening of students' critical thinking processes.

In this qualitative study, the development of students' critical thinking skills was also supported by learning artifacts that demonstrated changes in students' engagement and the quality of their responses throughout the implementation process, thus serving as qualitative indicators of development before and after the transformation of teaching practices.

The evidence obtained through triangulation of interview data, classroom observations, and instructional document review consistently suggests that differentiated instruction

supports the development of students' critical thinking behaviors. Over the course of implementation, students increasingly displayed the capacity to articulate reasoning, assess problem-solving strategies, construct arguments, and participate in metacognitive reflection, indicating a gradual strengthening of higher-order thinking skills. This influence includes students' ability to provide explanations and predictions, analyze and evaluate different approaches, formulate arguments, address problems, and reflect on their learning experiences. Table 5 summarizes the triangulated findings associated with these critical thinking indicators.

Table 5. Triangulated data on the effects of differentiated instruction on critical thinking skills

Teacher Code	Interview Results	Observation Results	Indicators of Critical Thinking
G1	Use of simple open-ended questions.	Students explain their choice of images or simple actions.	Reasoning and predicting
G2	Promoting the comparison of learning strategies.	Discussion of two possible solutions to a task.	Analyzing and evaluating the methods.
G3	Task selection and encouraging students to express their opinions.	Presentation and discussion of the content of a story.	Expressing opinions and formulating arguments.
G4	Use of problem-oriented projects.	Discussing solutions to environmental pollution and developing group conclusions.	Problem analysis and synthesis of ideas.
G5	Promotion of reflection and evaluation among peers.	Peer review of classmates' work and individual reflection.	Evaluation, assessment of arguments, and metacognition

The findings indicate that differentiated instruction creates space for active participation and students' cognitive empowerment through the use of diverse learning media, flexible grouping, task choice, reflective activities, and problem-oriented projects. Teachers do not merely deliver content; rather, they encourage students to ask questions, explain concepts, compare alternatives, draw conclusions, and evaluate learning outcomes.

Document analysis of student learning artifacts, particularly written work samples, further strengthens the findings regarding the contribution of differentiated instruction to the development of critical thinking. Students' writing demonstrates their ability to construct responses independently and coherently in accordance with instructional guidelines, reflecting cognitive engagement in understanding task contexts and expressing ideas in their own words. Within the framework of product differentiation, this written task provides students with opportunities to demonstrate understanding based on their learning readiness. These artifacts serve as evidence that the learning process is not merely oriented toward task completion, but also fosters emerging reasoning, reflective communication, and individual

responsibility in learning at the primary school level. Fig. 4 shows the example of student product.

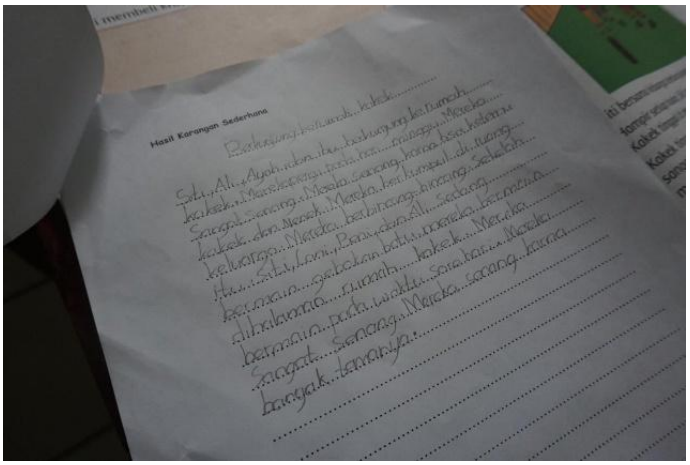


Fig. 4. Sample of student-written work

These results are consistent with Nafisah and Marmoah [40] who demonstrate that the case method, combined with active learning, effectively improves students' critical thinking skills. Students are trained to identify problems, explore solutions, and communicate their opinions rationally—a process that was also observed in the practice of teachers G3, G4, and G5 in this study. Observation of G4's project practice reveals that students can synthesize and evaluate solutions in groups, demonstrating a high level of critical thinking. This finding is also consistent with previous research demonstrating that STEM-integrated project-based learning promotes students' reflective and analytical thinking through engagement with authentic, real-world problems [41].

Key outcomes regarding how differentiated instruction supports the growth of students' critical thinking abilities include;

- Improved ability to explain reasons and make predictions.
- Ability to analyze and evaluate different problem-solving methods.
- Ability to structure arguments and express opinions critically.
- Ability to analyze complex problems and synthesize thoughts.
- Reflection and metacognitive assessment through peer review and discussion

Table 6 highlights the role of differentiated teaching in fostering students' critical thinking. Teachers promote skills such as explanation, analysis, argumentation, synthesis, and metacognition through questioning, discussions, presentations, problem-based projects, and peer reflection, demonstrating how varied instructional practices support deeper thinking and meaningful student engagement. Overall, these findings indicate a strong alignment between differentiated strategies and the development of higher-order thinking skills.

Table 6. Summarizes the key findings regarding the role of differentiated teaching practices

Teacher Code	Indicators of Critical Thinking	Example
G1	Explanation and prediction	Simple open questions allow students to explain their choices.
G2	Analysis and evaluation	Discussion comparing strategies for solving the task.
G3	Argument	Presentation and discussion of the content of the story.
G4	Problem analysis and synthesis	Problem-oriented project and discussion of solutions to environmental pollution.
G5	Metacognitive evaluation	Peer review and reflection on the work results of fellow students.

The application of differentiated instructional strategies that respond to students' diverse learning needs helps create a classroom environment that promotes deep cognitive engagement. Learners are encouraged to participate actively by posing questions, analyzing ideas, and evaluating information, which are key components of critical thinking. In addition, reflective activities and peer-based assessment support metacognitive development, enabling students not only to think critically but also to become more aware of their own thinking processes. This perspective is especially important within Indonesian primary education, where effective and adaptive learning approaches are essential for strengthening students' critical thinking capacities.

Conclusion

This study demonstrates that differentiated instruction in primary schools can enhance the quality of teaching practices through more adaptive strategies that respond to students' readiness, interests, and learning profiles. Pedagogical transformation is reflected in the implementation of active and contextual learning activities, technology integration, project-based tasks, and more personalized learning experiences that promote student participation and autonomy. This approach also contributes to the development of higher-order thinking behaviors, including analytical reasoning, evaluation, argumentation, and metacognitive reflection. Therefore, differentiated instruction represents a relevant pedagogical strategy for supporting 21st-century competencies and the implementation of the Merdeka Curriculum in elementary education.

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Conflict of Interest

The authors confirm that no competing interests or conflicts of interest were identified in relation to the design, implementation, analysis, or reporting of this research.

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Authors



Fitri Indriani is a lecturer in the Department of Basic Education at Ahmad Dahlan University, Yogyakarta, Indonesia. Her academic work focuses on enhancing teacher competence, character education, learner development, instructional strategies, and lesson planning. She has actively contributed to research in primary education and curriculum development. Her interests center on improving teaching quality and fostering meaningful learning in elementary schools. (email: fitri.indriani@pgsd.uad.ac.id).



Satrianawati is an academic engaged in the field of special and basic education. She earned her bachelor's degree from Halu Oleo University and a master's degree from Yogyakarta State University. Currently, she is pursuing further studies at the School of Education, Harbin Normal University, China. Her interests include inclusive education and educational leadership. She is committed to advancing educational practices. (email: satrianawati@gmail.com).



Heldayanti is an undergraduate student in Elementary School Teacher Education at Ahmad Dahlan University, Yogyakarta, Indonesia. She is currently undertaking a teacher professional education program at Pakuan University, Bogor. Her academic interests focus on classroom teaching practices, student engagement, and professional development for future educators. She is dedicated to becoming a competent elementary teacher. (email: heldayanti326@gmail.com).