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Development of an innovative differentiated learning model for inclusive education in the independent elementary school curriculum

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Abstract

This study addresses the limited availability of empirically validated differentiated learning models for inclusive elementary classrooms within the Merdeka Curriculum. It aims to develop and examine the feasibility, practicality, and effectiveness of an innovative differentiated learning model for Indonesian language instruction in an inclusive elementary school. The study employed research and development using the ADDIE model and involved two Indonesian language teachers, 67 fifth-grade students, and three expert validators at SD Santo Petrus Medan Johor. The resulting products consist of a teacher handbook and a student workbook integrating diagnostic assessment, learner-profile mapping, differentiated content-process-product pathways, and adaptive assessment. Expert validation placed the model in the highly feasible category (86.75%). Practicality was also high, as indicated by teacher responses (88.40%) and student responses (85.60%). Effectiveness testing revealed an increase in learning outcomes from 70.85 to 82.30 with a moderate N-gain of 0.39, while students' social skills improved by 15.20%. These findings indicate that the developed model is feasible, practical, and effective for strengthening inclusive, adaptive, and student-centered learning. The study contributes an operational syntax-based model that bridges inclusive education principles and the Merdeka Curriculum in elementary Indonesian language learning.

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1. Introduction

The central issue in contemporary elementary education is no longer whether classrooms are diverse. The more pressing question is whether instruction is sufficiently responsive to that diversity while still preserving academic rigor, classroom participation, and equitable access to meaningful

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learning. For a journal concerned with elementary teacher education, this issue is far from peripheral; it sits at the core of what effective teaching now requires (Ainscow, 2020; de Bruin, 2019; Florian, 2019).

In inclusive elementary schools, differences in readiness, interests, pace, language backgrounds, social participation, and special educational needs are addressed within the same lesson. International evidence from Australia, Belgium, Canada, Germany, Israel, the Netherlands, Singapore, Switzerland, and the United Kingdom shows that teachers are increasingly expected to respond to such heterogeneity through differentiated and inclusive pedagogy rather than uniform whole-class delivery (Bunbury, 2020; Gibbs, 2023; Katz et al., 2021; Pozas et al., 2020; Roose et al., 2024; Sewell et al., 2022; Strogilos et al., 2023; Suprayogi et al., 2022).

Differentiated instruction has become one of the most widely discussed responses to this challenge because it allows teachers to adapt content, process, product, and assessment to student needs without fragmenting the class into separate curricula. At the same time, the literature is clear on one point: differentiation works best when it is grounded in valid assessment data, supported by teacher judgment, and translated into visible classroom routines. Where those conditions are weak, differentiation often remains rhetorical, partial, or inconsistent (Coubergs et al., 2017; Hu, 2024; Kalinowski et al., 2024; Lindner & Schwab, 2020; Smale-Jacobse et al., 2019).

Recent studies reinforce that conclusion from different angles. Research on teacher collaboration shows that differentiated practice becomes more stable when teachers move beyond casual exchange toward co-construction of instructional decisions (Pozas & Letzel-Alt, 2023). Research on teacher motivation and intention likewise indicates that self-efficacy, enthusiasm, and behavioural readiness matter because differentiation demands sustained pedagogical judgment rather than occasional task variation (Bi et al., 2024; Kupers et al., 2024; Scarparolo & Subban, 2021). Studies on professional learning also show that teachers need structured support, not merely policy encouragement, if differentiated teaching is to become part of everyday classroom work (Gibbs, 2023; Lee & Griffin, 2021; Rusconi & Squillaci, 2023).

The state of the art has therefore advanced in useful ways. A substantial body of research now explains the conceptual basis of inclusive pedagogy, documents teachers' perceptions of differentiation, maps barriers to implementation, and reviews promising professional development models (Ainscow, 2020; Chandra Handa, 2019; Compen et al., 2025; Hasanah et al., 2022; Roose et al., 2024; Sewell et al., 2022). Another group of studies demonstrates that when differentiated or personalized environments are carefully designed, student engagement, motivation, and performance can improve, including in online and blended settings (Aviran & Blonder, 2023; Fontenelle-Tereshchuk, 2023; Hover & Wise, 2022; Ismail et al., 2021).

Even so, an unresolved gap remains. Much of the published work has been descriptive, survey-based, or review-oriented. Fewer studies move into model development that produces a classroom-ready, empirically validated product for inclusive elementary settings. The shortage becomes more visible in the Indonesian context, where the Merdeka Curriculum explicitly values flexibility, learner agency, diagnostic assessment, and context-sensitive teaching, yet teachers still need operational guidance to translate those principles into coherent lesson design. In other words, policy direction has outpaced the availability (Hasanah et al., 2022; Hu, 2024; Kalinowski et al., 2024; Kupers et al., 2024).

That gap matters for Indonesian language learning in elementary schools. Language classrooms in inclusive settings demand sensitivity to comprehension levels, expression, participation, social interaction, and learning support needs. Yet research integrating inclusive education, differentiated instruction, learner-profile mapping, diagnostic assessment, and adaptive

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evaluation into a single validated model for elementary Indonesian language learning remains limited. What is available more often explains the importance of differentiation than offers a tested syntax that teachers can use consistently in the classroom (Coubergs et al., 2017; Lindner & Schwab, 2020; Pozas et al., 2020; Suprayogi et al., 2022).

This study addresses that gap by developing an innovative differentiated learning model for inclusive elementary education within the Merdeka Curriculum. Its contribution is not merely thematic. It lies in developing a structured model that integrates diagnostic assessment, learner-profile mapping, differentiated content-process-product pathways, contextual materials, and adaptive assessment into an operational sequence that can be validated, tested, and revised. The novelty is therefore embedded in the model architecture itself: it links inclusive principles with classroom procedure, and it does so in a subject-specific elementary context that remains underdeveloped in the literature.

Accordingly, the study aimed to develop and examine the feasibility, practicality, and effectiveness of an innovative differentiated learning model for Indonesian language instruction in an inclusive elementary school implementing the Merdeka Curriculum. By doing so, the study seeks to provide evidence directly relevant to the journal's readership: elementary teacher educators, researchers, and practitioners who need model-based solutions that are conceptually sound, methodologically defensible, and practically usable in heterogeneous classrooms.

2. Literature review

2.1 Inclusive education

Inclusive education is best understood as a commitment to participation, dignity, access, and recognition of learner differences within ordinary schooling. It does not end with physical placement. It requires that curriculum, instruction, and assessment be organized so that all learners can engage meaningfully in shared educational experiences (Ainscow, 2020; de Bruin, 2019; Florian, 2019).This perspective shifts the focus from categorizing students to removing barriers to participation. Research across several countries has shown that inclusive classrooms become stronger when schools combine responsive teaching, accessible learning design, and collaborative professional cultures, rather than treating support for diversity as an add-on service (Bunbury, 2020; Katz et al., 2021; Sewell et al., 2022; Strogilos et al., 2023).

2.2 Independent curriculum

The Merdeka Curriculum provides curricular space for adaptive teaching by emphasizing competence development, contextual learning, diagnostic assessment, and flexibility in responding to student needs. In conceptual terms, this policy orientation is compatible with inclusive elementary education because it encourages teachers to move away from uniform lesson delivery toward more responsive and learner-sensitive planning (Hasanah et al., 2022; Hover & Wise, 2022).

However, a flexible curriculum does not automatically produce inclusive classroom practice. Teachers still need a practical model that explains how diagnostic data are gathered, how learning profiles are interpreted, how task pathways are differentiated, and how outcomes are assessed fairly among heterogeneous learners. Without that operational bridge, curricular flexibility risks remaining declarative rather than pedagogically enacted (Hu, 2024; Lee & Griffin, 2021; Rusconi & Squillaci, 2023).

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2.3 Differentiated learning

Differentiated instruction is a responsive pedagogical approach that adapts content, process, product, and learning environment to students' readiness, interests, and learning profiles. Its central assumption is simple but consequential: students can pursue shared learning goals through different pathways when those pathways are designed intentionally (Coubergs et al., 2017; Smale-Jacobse et al., 2019; Suprayogi et al., 2022).

The literature shows that differentiation is most defensible when it rests on assessment-informed planning rather than intuition alone. Teachers need usable diagnostic information, clear success criteria, appropriate task variation, and room for professional judgment. Studies on teacher self-efficacy and collaboration further indicate that differentiation is sustained not merely by goodwill, but by teacher confidence, collective planning, and implementable routines (Bi et al., 2024; Kalinowski et al., 2024; Kupers et al., 2024; Pozas & Letzel-Alt, 2023; Scarparolo & Subban, 2021).

Theoretical discussions also distinguish differentiation from simple individualization or random task simplification. Differentiation remains tied to common learning intentions, whereas the pathways, pacing, support, and products may vary. That distinction matters in inclusive classrooms because effective responsiveness should expand participation without lowering intellectual expectations for particular groups of students (Lindner & Schwab, 2020; Roose et al., 2024; Strogilos et al., 2023).

2.4 Relationship between inclusive education, independent curriculum, and differentiated learning

The theoretical framework of this study places those three constructs in a layered relationship. Inclusive education provides the ethical and pedagogical foundation. The Merdeka Curriculum provides curricular flexibility and policy legitimacy. Differentiated instruction provides the operational mechanism for addressing learner diversity in daily classroom practice. The three are therefore not separate agendas; they are interdependent dimensions of one instructional problem.

Within this framework, diagnostic assessment functions as the entry point, learner-profile mapping as the interpretive mechanism, differentiated content-process-product design as the instructional core, and adaptive assessment as the evaluative component. This conceptual alignment informed the development of the model, the handbook, and the student workbook examined in the present study. The framework also explains why the study focuses not only on learning outcomes, but on practicality, usability, and social participation in inclusive elementary classrooms (Abuhassna & Alnawajha, 2023; Coubergs et al., 2017; Hasanah et al., 2022; Rusconi & Squillaci, 2023).

3. Method

3.1 Research design

This study employed research and development (R&D) using the ADDIE model, which consists of analysis, design, development, implementation, and evaluation. The model was selected because it offers a systematic route from problem identification to product validation and revision, while still allowing iterative improvement at each stage. For instructional product development in school contexts, this sequence is methodologically appropriate because it integrates needs analysis, prototype construction, field testing, and evidence-based refinement within a single design logic (Abuhassna & Alnawajha, 2023).

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The research was conducted at SD St. Petrus Medan Johor. The participants consist of two Indonesian language teachers, 67 fifth-grade students distributed across Class 5A and Class 5B, and three expert validators representing Indonesian language content, learning media, and Indonesian language pedagogy. The product developed in this study comprised a teacher handbook and a student workbook designed around diagnostic assessment, learner-profile mapping, differentiated content, differentiated process, differentiated product, and adaptive assessment.

At the analysis stage, the researchers examined the instructional problem through a preliminary study, a focused literature review, classroom observation, and interviews with teachers. This stage is intended to identify the gap between the demands of inclusive practice under the Merdeka Curriculum and the actual availability of an operational differentiated learning model for Indonesian language instruction. The analysis also considered the heterogeneity of learner readiness, participation patterns, and special learning needs present in the school context.

At the design stage, the analysis findings were translated into product specifications and learning syntax. The researchers determined instructional objectives, differentiation procedures, organization of materials, adaptive activities, assessment strategies, and the structure of the teacher handbook and student workbook. Particular attention was given to coherence so that the model would not function as a loose set of strategies, but as an integrated pedagogical sequence that teachers could follow in practice.

At the development stage, the prototype was produced and submitted to three experts for validation. Validation used a five-point Likert-scale instrument that examined content suitability, readability, clarity, attractiveness, implementability, and potential effectiveness. Open-ended comments were also provided to allow validators to suggest revisions to language, sequence, examples, visual presentation, and classroom usability. Those comments were used to revise the product before field implementation.

The field trial involved two stages of evidence gathering. First, practicality evidence was collected through teacher and student response questionnaires as well as classroom observation during product use. Second, evidence of effectiveness was gathered through pre-test-post-test measures of learning outcomes and structured observations of students' social skills during implementation. This design allowed the study to examine not only whether the model was acceptable, but whether it produced educationally meaningful effects in authentic classroom use.

3.2 Data, instrument, and analysis

Data were therefore collected through multiple instruments: expert validation sheets, teacher response questionnaires, student response questionnaires, interview notes, classroom observation sheets, learning outcome tests, and social-skill observation forms. The use of multiple sources strengthened analytical rigor because feasibility, practicality, and effectiveness were not inferred from a single indicator alone. Instead, the findings were triangulated across expert judgment, user response, classroom process, and student performance.

Quantitative data were analyzed descriptively using average scores, percentages, and N-gain. Expert validation and user responses were interpreted according to predetermined criteria so that claims regarding feasibility and practicality remained transparent and replicable. Learning outcomes were analyzed by comparing pre-test and post-test mean scores and subsequently calculating N-gain to determine the magnitude of improvement. Social-skill gains were described based on structured observational evidence collected during implementation.

Qualitative data from validator comments, interviews, and classroom observations were analyzed thematically to explain why the product was considered feasible, practical, or still in need

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of refinement. This combination of quantitative and qualitative analyses was necessary because the study's purpose was not only to measure product quality but also to understand how the model functioned in an inclusive elementary classroom.

Table 1 presents the criteria used to interpret the average validation score and to judge product feasibility at the expert review stage. In ethical terms, the study was conducted with institutional permission, with voluntary participation, with confidentiality of student data, and for academic use only. Because the intervention focused on instructional improvement in a regular school setting, the ethical priority was to ensure that no learner was disadvantaged by participation in the trial.

Table 1. Validation score

Average Validation Score	Feasibility Category
4.51 – 5.00	Very Feasible
3.51 – 4.50	Worth
2.51 – 3.50	Decent Enough
1.51 – 2.50	Less Feasible
1.00 – 1.50	Not Feasible

4. Results

This section presents the findings in a sequence that aligns with the research objectives: first, identifying the instructional problem and the model's design requirements; second, examining the product's feasibility and practicality; and third, evaluating its effectiveness in improving learning outcomes and social participation.

4.1 Results related to the need analysis and model design

The first research objective was to identify the instructional needs of an inclusive elementary classroom implementing the Merdeka Curriculum and to translate those needs into a differentiated learning model. The analysis showed a clear mismatch between the diversity present in the classroom and the instructional tools available to teachers. Although the school had adopted inclusive education and the Merdeka Curriculum, teachers still reported difficulty in converting learner differences into systematic lesson decisions. They need a model that could organize diagnostic information, task variation, and adaptive assessment in a form that remains manageable in daily teaching.

The design response to that problem was the development of a teacher handbook and a student workbook structured around differentiated content, process, and product. The design also incorporated learner-profile mapping, inquiry-oriented activities, contextual materials, and rubric-based assessment. In practical terms, the model was intended to reduce ambiguity in lesson planning while preserving pedagogical flexibility. This result is crucial because it reveals that the product did not emerge from abstract preference, but from an identified classroom need.

4.2 Results of product feasibility and practicality

The second objective was to test whether the product was feasible and practical. Expert validation produced an average score of 86.75%, placing the model in the highly feasible category. This result indicates that the experts judged the product to be conceptually appropriate, readable, implementable, and relevant to inclusive Indonesian language instruction. Their suggestions focused on refinement rather than redesign, which strengthens the argument that the model had achieved substantial internal coherence before classroom implementation.

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Practicality testing also yielded strong results. Teacher responses reached 88.40%, while student responses reached 85.60%, both in the very good category. Teachers indicate that the handbook clarified planning steps, helped them organize differentiated activities, and made assessment expectations more explicit. Students responded positively to the variety of tasks and to the greater opportunity to participate based on their readiness and interests. These findings reveal that the model was not only theoretically acceptable but also workable in the lived conditions of an inclusive elementary classroom.

4.3 Results of product effectiveness

The third objective was to examine whether the model improved learning outcomes and social skills. The effectiveness test implies that students' average score increased from 70.85 on the pre-test to 82.30 on the post-test, with an N-gain of 0.39, indicating a moderate effect. The gain is moderate rather than dramatic, but it is still educationally meaningful because it was produced in a heterogeneous classroom where instructional responsiveness is inherently complex.

In addition to cognitive improvement, students' social skills increased by 15.20%. Observations during implementation reveal stronger self-confidence, greater willingness to cooperate, better tolerance in group activities, and more active participation in classroom interactions. This result is significant for inclusive elementary education because the success of instruction cannot be judged by academic scores alone; it must also be read through the lens of the quality of participation and peer interaction that the classroom enables.

5. Discussion

The findings reveal that the developed model contributes to the field in three interconnected ways. First, it translates inclusive education from principle into pedagogical procedure. International scholarship has repeatedly argued that inclusion becomes meaningful only when teaching itself is redesigned to accommodate learner diversity (Ainscow, 2020; de Bruin, 2019; Florian, 2019; Lindner & Schwab, 2020). The present study extends that argument by showing that in an elementary Indonesian language classroom, a structured differentiation of syntax can make the redesign more visible and usable.

Second, the study strengthens the evidence that differentiation is most effective when it begins with diagnostic understanding rather than with ad hoc task variation. The model's reliance on learner-profile mapping and adaptive assessment aligns with research indicating that differentiated instruction depends on assessment-informed planning rather than intuition alone (Coubergs et al., 2017; Hu, 2024; Kalinowski et al., 2024; Kupers et al., 2024; Smale-Jacobse et al., 2019). This is one reason the model achieved both high feasibility and high practicality: it gave teachers a concrete logic for deciding what to differentiate and why.

Third, the practical findings indicate that teachers are more willing to sustain differentiated practice when resources reduce planning ambiguity and support professional judgment. This aligns with studies from Australia, Germany, Indonesia, and the Netherlands showing that collaboration, teacher efficacy, and implementable learning resources are major enabling conditions for differentiated instruction (Bi et al., 2024; Gibbs, 2023; Hasanah et al., 2022; Pozas & Letzel-Alt, 2023; Pozas et al., 2020; Scarparolo & Subban, 2021; Suprayogi et al., 2022). The teacher handbook in this study appears to have served precisely that function.

The moderate N-gain in academic achievement is also consistent with broader international evidence. Differentiation rarely produces immediate, large effects in heterogeneous classrooms

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because its influence is mediated by the quality of planning, teacher expertise, student readiness, and classroom constraints. Even so, the literature indicates that well-structured differentiation can improve access to learning, achievement, motivation, and engagement over time (Aviran & Blonder, 2023; Chandra Handa, 2019; Compen et al., 2025; Ismail et al., 2021; Katz et al., 2021; Lee & Griffin, 2021). In that context, the gain observed in this study should be read as credible and educationally relevant rather than overstated.

The improvement in social skills deserves equal attention. Inclusive education is not only about content mastery; it is also about belonging, participation, and interaction. Prior studies have shown that responsive pedagogy can strengthen student engagement and classroom climate when learners are given legitimate pathways to participate without being pushed to the margins of a lesson (Bunbury, 2020; Fontenelle-Tereshchuk, 2023; Katz et al., 2021; Sewell et al., 2022; Strogilos et al., 2023). The present findings support that view. Students did not simply score higher; they also appeared more willing to cooperate, contribute, and remain involved in shared learning activities.

From a scientific standpoint, the study is significant within the scope of elementary teacher education because it contributes a model-based intervention rather than another purely conceptual endorsement of differentiation. The novelty lies in combining five elements that are often discussed separately—diagnostic assessment, learner-profile mapping, differentiated pathways, contextual Indonesian language materials, and adaptive evaluation—into one operational design that was validated and tried out in an inclusive elementary school. This makes the contribution both theoretical and practical.

At the same time, the study's claims should be proportionate to the evidence. The sample was limited, the intervention period was relatively short, and the social-skill indicator relied on structured observation. Those limitations do not weaken the relevance of the findings, but they do set the boundary of generalization. For that reason, the study should be read as a strong design-based contribution with promising evidence, not as a final universal model for every inclusive context.

6. Conclusion

The study underlines that the differentiated learning model developed for Indonesian language instruction in an inclusive elementary school meets the criteria of feasibility, practicality, and effectiveness. Feasibility was demonstrated by an expert validation score of 86.75%; practicality by positive teacher and student responses of 88.40% and 85.60%, respectively; and effectiveness by an increase in learning outcomes from 70.85 to 82.30, with an N-gain of 0.39, accompanied by a 15.20% improvement in students' social skills. Taken together, these findings reveal that a structured differentiation model can support both academic progress and inclusive participation in the Merdeka Curriculum context.

The contribution of the study lies in providing an operational model that connects inclusive education principles with classroom-level decision-making. Nevertheless, the findings are limited by several constraints: the study involved only one school, the implementation period was limited, and social skills were measured through structured observation. Future research should therefore test the model across wider school settings, longer intervention periods, and different subject areas while incorporating more varied measures of social-emotional learning and, where appropriate, formalized ethics review procedures.

For practice, the model may serve as a reference for elementary teachers seeking clearer procedures for implementing differentiated instruction in inclusive classrooms. For research, the

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subsequent step is not simply replication, but extension: examining how the model performs across subjects, grade levels, and school cultures, and how teacher collaboration and school leadership shape the sustainability of differentiated practice over time.

Statement of Transfer of Responsibility

The preparer/editor did not received the necessary data or information required to complete and verify the following sections: Credit authorship contribution statement, declaration of competing interest, data availability statement, ethical approval/ethical declaration, acknowledgements, and AI disclosure statement. Accordingly, full academic and legal responsibility for the content and accuracy of these statements is hereby transferred to the authors, including any consequences arising from non-compliance with the target journal's policies and applicable ethical standards.

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