

Differentiated Instruction For Enhancing Literacy And Numeracy At SD Muhammadiyah Plus Probolinggo

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ABSTRACT

This study aims to analyze the implementation of differentiated learning in improving students' literacy and numeracy in SD Muhammadiyah Plus Probolinggo. The research uses a qualitative approach with a case study design. Data were collected through classroom observation, semi-structured interviews with teachers and students, and open-ended questionnaires, then analyzed using reflexive thematic analysis. The results showed that differentiated learning was implemented through four main mechanisms, namely identification of students' learning readiness, differentiation of learning processes, adjustment of literacy and numeracy activities, and provision of formative feedback on an ongoing basis. Teachers used diagnostic assessments and observation of student development as the basis for determining the difficulty level of tasks, flexible grouping, scaffolding forms, and enrichment. In literacy learning, differentiation is carried out through variations in the difficulty level of text, vocabulary, and question types, while in numeracy learning it is carried out through variations in the complexity of the problem, the use of concrete media, visual representation, and gradual support in problem solving. The findings also show that differentiation contributes to students' learning engagement, confidence, independence, reading comprehension, and problem-solving ability. The novelty of this research lies in the conceptualization of differentiated learning as an adaptive pedagogical system that links student needs mapping, instructional decisions, and formative evaluation cyclically in the context of Islamic basic education. This research provides practical implications for teachers and schools in designing literacy and numeracy learning that is more responsive to student diversity.

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1. INTRODUCTION

The changing global educational landscape places educational psychology as an important foundation in understanding how learners' cognitive, motivational, emotional, and social

characteristics interact with the learning process in the classroom (Martin, 2023). The perspective of contemporary educational psychology emphasizes that the quality of learning is not only determined by the material provided, but also by the learning ability to respond to motivation, engagement, self-regulation skills, and different learning needs of each student (Martin, 2023; de Ruig et al., 2023). Teacher-student relationships, instructional support, and an organized classroom climate are also related to the development of self-regulated learning, especially in elementary school students who are still building metacognitive, motivational, and behavioral regulation skills (de Ruig et al., 2023). Meta-analytical evidence suggests that low academic achievement is associated with lower competency beliefs, goal orientation, motivation, and self-regulation strategies, so that uniform learning has the potential to fail to respond to the psychological and academic diversity of students (Fong et al., 2023). In this context, adaptive learning practices are becoming increasingly relevant because instructional processes and motivation are two interconnected domains of educational psychology in determining students' academic engagement and development (Martin, 2023). Thus, the need for an approach that is able to accommodate variations in students' readiness, abilities, and learning responses is an important pedagogical as well as psychological issue in contemporary elementary education (Hu, 2024).

One of the approaches that has developed to respond to the heterogeneity of students is differentiated instruction, which is the systematic adaptation of learning based on different needs, readiness, abilities, and learning characteristics of students (Hu, 2024). A systematic review of 61 empirical studies on K–12 education shows that differentiated learning has been applied in various educational contexts, with a particularly prominent application to mathematics and language learning in elementary schools (Hu, 2024). Cross-contextual evidence also shows that differentiation can be done through flexible grouping, adjustment of materials and assignments, assessment of student needs, use of technology, and modification of learning evaluation processes and forms (Hu, 2024; Griful-Freixenet et al., 2020). In the context of reading learning, the application of data-based differentiated instruction shows that the use of assessment results to adjust learning can reduce the influence of differences in initial abilities on learning growth, so that students with different ability levels get more balanced developmental opportunities (Förster et al., 2022). Studies on teacher competency development also show that professional development programs on differentiated learning produce a moderate effect on teachers' differentiated knowledge, attitudes, and practices, especially when training is integrated with certain subject areas (Kahmann et al., 2022). However, the success of differentiated learning is greatly influenced by teacher competence, the quality of diagnostic assessments, the ability to adapt learning activities, and school conditions that support responsive learning practices (Langelaan et al., 2024).

Although the literature shows the potential for differentiated instruction, evidence on its contribution to improving literacy and numeracy skills simultaneously is still inconsistent and leaves an important research gap (Hu, 2024; Kahmann et al., 2022). A comprehensive study shows that mathematics and language are the two areas that are most often differentiated contexts, but the effectiveness of the strategies used still varies based on differentiation methods, student characteristics, duration of implementation, evaluation instruments, and school context (Hu, 2024). In fact, a meta-analysis of professional development programs in differentiated learning found a fairly clear increase in teacher capacity, but did not find a consistent improvement in student learning outcomes, suggesting a gap between teachers' ability to differentiate and their impact on students' academic competence (Kahmann et al., 2022). Research on data-based differentiation in reading learning also did not find a uniform primary effect on reading comprehension, although such interventions were able to reduce growth gaps based on students' initial abilities (Förster et al., 2022). The findings suggest that the literature still needs a more contextual explanation of how differentiation is designed, practiced, and directly linked to the development of literacy as well as numeracy, rather than simply testing whether differentiation results in improved learning outcomes (Hu, 2024; Langelaan et al., 2024). This gap is becoming increasingly important in Indonesia's primary education as literacy and numeracy require an instructional response to the heterogeneity of student learning readiness, while international evidence suggests that the effectiveness of differentiation is highly contextual and cannot be assumed to apply automatically to every school (Hu, 2024; Kahmann et al.,

2022).

Based on these gaps, this study offers novelty by operationalizing differentiated learning as a series of practices that connect learning needs assessment, student readiness mapping, content differentiation, process differentiation, product differentiation, flexible grouping, and formative assessment with the development of students' literacy and numeracy skills in one Islamic basic education context, namely SD Muhammadiyah Plus Probolinggo (Hu, 2024; Griful-Freixenet et al., 2020). The novelty of the research is not placed only in the use of differentiated learning as a pedagogical approach, but in the identification of operational mechanisms that explain how teachers' decisions regarding content, processes, assignments, learning groups, and feedback are adjusted to variations in students' readiness in literacy and numeracy activities (Langelaan et al., 2024; Hu, 2024). This approach is important because the success of differentiation requires a connection between teachers' knowledge of student characteristics, instructional design, assessments, and pedagogical responses carried out during the learning process (Langelaan et al., 2024). This research is thus expected to produce an empirical-contextual model of differentiation practices that can explain not only the form of strategies used by teachers, but also how these strategies are directed to strengthen literacy and numeracy in the Muhammadiyah basic education environment (Hu, 2024; Martin, 2023).

Based on this framework, this study aims to analyze in depth the differentiated learning strategies used to improve students' literacy and numeracy skills at SD Muhammadiyah Plus Probolinggo by placing the diversity of student needs as the basis for instructional decision-making (Hu, 2024; Langelaan et al., 2024). The analysis is directed at how teachers identify students' learning needs and readiness, how content, processes, products, groupings, and assessments are adjusted, and how these practices are directed at meaningful literacy and numeracy activities (Hu, 2024; Griful-Freixenet et al., 2020). This focus is in line with the perspective of educational psychology that places the interaction between student characteristics, motivation, self-regulation, and instructional quality as interrelated components in producing effective learning (Martin, 2023; de Ruig et al., 2023). Thus, the research questions asked are: How is differentiated learning strategies applied to improve student literacy and numeracy in SD Muhammadiyah Plus Probolinggo? The questions are directed to produce an empirical understanding of the patterns, processes, and mechanisms of differentiation that can be used as a basis for developing literacy and numeracy learning practices that are more responsive to student diversity (Hu, 2024; Langelaan et al., 2024).

2. METHODS

This study uses a qualitative approach with a case study design to gain an in-depth understanding of how differentiated learning is designed and implemented in the development of students' literacy and numeracy in a specific elementary school context (Kahmann et al., 2024). The case study design was chosen because it allows learning practices to be analyzed contextually through a combination of evidence from observed learning behaviors, teacher experiences, and student experiences, as previous differentiated learning research uses interviews and observations to capture teacher practices authentically (Kahmann et al., 2024; Grecu, 2023). The research was conducted at SD Muhammadiyah Plus Probolinggo, East Java, Indonesia, which is positioned as a case of Islamic basic education with diverse student characteristics in readiness, ability, and learning needs (Langelaan et al., 2024). The focus of the research is directed at differentiation practices related to student needs assessment, content adjustments, learning processes, learning products, student groupings, and activities that support literacy and numeracy skills (Langelaan et al., 2024; Kahmann et al., 2024).

The study participants were designed to consist of 8 teachers and 20 students, who were selected using purposive sampling based on their direct involvement in literacy and numeracy learning activities and experiences of participating in differentiated learning (Wutich et al., 2024). Teachers were selected from classes that actively implemented a variety of learning strategies, while students were selected taking into account variations in academic abilities and learning readiness in order for the data to describe a heterogeneous learning experience (Kahmann et al., 2024). Of the 20 students, approximately 12 students were interviewed individually, while all 20 students filled out an open-ended questionnaire to expand the variety of experiences recorded in the data (Braun et al., 2021). The number of interviews can be developed during the research process if the variety of information is inadequate, because the

adequacy of the qualitative research sample is determined by the richness of the data, the purpose of the analysis, and the ability of the data set to produce an adequate pattern of meaning, not solely by the mechanically determined sample size (Wutich et al., 2024).

Data collection was carried out through classroom observations, semi-structured interviews, and open-ended questionnaires, so that the same phenomenon can be examined through several data sources as a form of methodological triangulation (Kahmann et al., 2024). Non-participatory observation was carried out at least in six learning sessions that contained literacy and/or numeracy activities to record how teachers identified differences in student needs, formed study groups, adjusted assignments, provided scaffolding, used learning materials, and conducted formative assessments (Kahmann et al., 2024; Langelaan et al., 2024). Semi-structured interviews with teachers explore differentiation planning, the basis for determining student needs, content modifications, processes and products, literacy-numeracy strategies, implementation barriers, as well as evaluation of student development, as interviews allow researchers to explain the pedagogical reasons behind practices observed in the classroom (Grecu, 2023; Kahmann et al., 2024). Student interviews use age-appropriate language to explore experiences regarding assignment variety, difficulty levels, teacher support, activity choices, group work, and their perceptions of reading, writing, problem-solving, and numeracy activities (Braun & Clarke, 2021). The questionnaire uses open-ended questions so that students can describe the learning experience in their own words, as qualitative surveys are a legitimate method of obtaining broad and diverse textual data from participants (Braun et al., 2021).

The research instruments consist of observation guidelines, teacher interview guidelines, student interview guidelines, and open questionnaires developed based on the dimensions of differentiated instruction practice and literacy-numeracy development goals (Langelaan et al., 2024). Before use, the instruments are reviewed by primary education and learning experts to ensure the appropriateness of indicators, question clarity, and language readability for elementary school students, as the quality of thematic research depends on the alignment between research questions, data collection, and analytical approaches (Braun & Clarke, 2021). All interviews were recorded with the consent of the participants, transcribed verbatim, anonymized using codes such as T1–T8 for teachers and S1–S20 for students, and equipped with field notes from the observation results (Braun & Clarke, 2021). Because participants included children, parental informed consent and child consent were obtained prior to data collection as part of the research procedure.

Data were analyzed using reflexive thematic analysis following the stages of data familiarization, initial coding, initial theme construction, theme development and review, theme definition and naming, and preparation of final interpretation (Braun & Clarke, 2021). Coding was carried out inductively as well as directed by the research focus on the form and mechanism of literacy-numeracy differentiation, with interview data, questionnaires, and observation notes compared to identify convergent and different patterns (Braun & Clarke, 2021; Kahmann et al., 2024). Transcript management and encoding processes can be performed using NVivo 14, while trail audits, analytical memos, source triangulation, and presentation of representative citations are used to increase the transparency and credibility of interpretation (Braun & Clarke, 2021). Inferential statistical tests are not used because questionnaires function as a source of qualitative textual data, rather than as quantitative measurement instruments, so that all data sources are integrated at the development and interpretation stage of the theme (Braun et al., 2021; Braun & Clarke, 2021).

3. RESULTS AND DISCUSSION

3.1. Research Results

The results showed that differentiated learning at SD Muhammadiyah Plus Probolinggo was implemented through four main mechanisms, namely identification of students' learning readiness, differentiation of the learning process, adjustment of literacy and numeracy activities, and provision of formative feedback. Teachers first conducted initial assessments and observations of student development to obtain information on reading ability, text comprehension, numeracy skills, learning independence, and mentoring needs. The findings of the interviews showed that teachers not only used academic grades as the basis for grouping, but also considered students' responses to questions, ability to complete assignments, and levels of independence during learning. The information was then used

to determine the appropriate form of differentiation.

At the learning process stage, teachers apply flexible grouping, scaffolding, and enrichment. Students who have difficulty get help gradually through example, joint work, the use of concrete media, and direct mentoring, while students who show higher readiness are given more challenging tasks. Groupings are not permanent, but they can change as students progress. This pattern shows that differentiation is not only done through differences in material, but also through the level of support, complexity of tasks, and forms of learning activities.

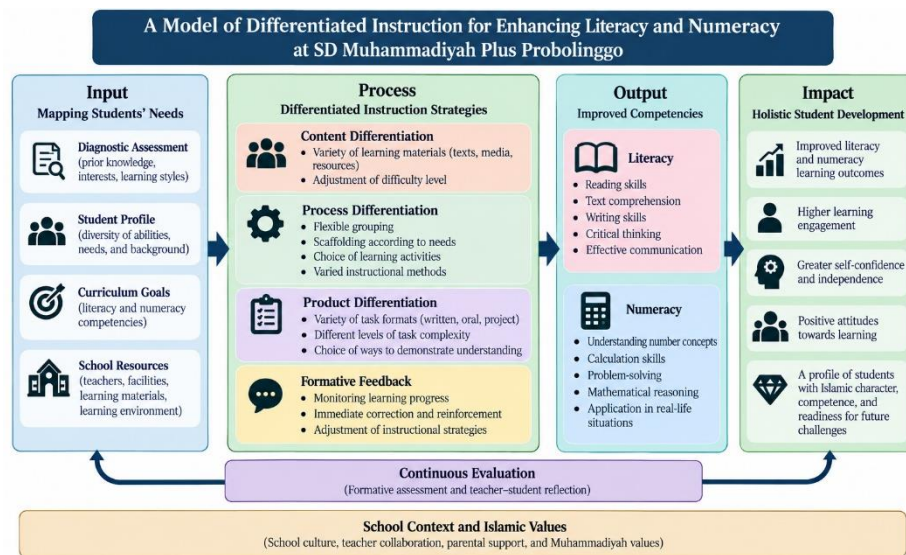


Figure 1. A Model of Differentiated Instruction for Enhancing Literacy and Numeracy at SD Muhammadiyah Plus Probolinggo.

In literacy learning, differentiation is seen in variations in the difficulty of the text, the complexity of vocabulary, and the type of questions given to students. Students with lower initial abilities acquire simpler texts and literal questions, while students who are more prepared are directed towards inferential and analytical questions. In numeracy learning, teachers distinguish between the difficulty of the questions, the use of visual and concrete representations, and the form of scaffolding in problem solving. Students report that these adjustments help them understand reading and solve problems more confidently.

Overall, the results of the study show that differentiated learning functions as an adaptive process that integrates diagnostic assessment, content differentiation, processes and products, flexible grouping, and formative feedback. The implementation not only supports literacy and numeracy skills, but also increases student learning engagement, courage to try, confidence, and independence. These findings confirm that the success of differentiation in SD Muhammadiyah Plus Probolinggo lies in the ability of teachers to adjust learning in a sustainable manner based on the actual needs of students.

3.2 Discussion

The model in Figure 1 shows that differentiated learning at SD Muhammadiyah Plus Probolinggo is more appropriately understood as an adaptive learning system rather than simply assigning different tasks to students, because learning readiness mapping is the basis for continuous adjustment of content, processes, products, and feedback (Hu, 2024; Langelaan et al., 2024). These findings are in line with the systematic review of Hu (2024), who showed that differentiated instruction is most often applied to mathematics and language at the elementary school level by taking into account differences in students' abilities, needs, and achievements (Hu, 2024). Theoretically, the input-process-output pattern in Figure 1 extends the meaning of differentiation from instructional techniques to information-based pedagogical decision-making processes about students, a characteristic that is also emphasized in research on teacher differentiation assessment and planning (Kalinowski et al., 2024). Thus, diagnostic assessments in the model have psychological and pedagogical functions because they allow teachers to determine the level of challenge that is more in line with the student's actual abilities than using a one-size-fits-all approach (Hu, 2024; Kalinowski et al., 2024).

The differentiation of content, processes, and products in the research findings also indicates that the improvement in literacy and numeracy is not primarily generated by the diversity of activities, but by the correspondence between student needs and teachers' instructional responses (Langelaan et al., 2024; Hu, 2024). In literacy, this interpretation is supported by research on data-based differentiated instruction which shows that the use of early ability data can help teachers respond to the heterogeneity of reading achievement and produce more equitable learning development between students' ability levels (Karst et al., 2022). The broader literature on differentiated literacy instruction also places flexible grouping, modification of reading materials, and adjustment of support as important mechanisms for bringing literacy demands together with the individual needs of learners (Puzio et al., 2020). In numeracy, the findings of the study can be interpreted on the same principle, as the K-12 review shows that mathematics is one of the main areas of differentiation and that grouping based on ability is the most frequently used strategy (Hu, 2024). Therefore, the use of concrete media, variations in the complexity of the questions, scaffolding, and problem-solving tasks in Figure 1 should not be understood as simplifying the curriculum for specific students, but as providing different pathways to the same numeracy competencies (Hu, 2024; Langelaan et al., 2024).

However, the relationship between differentiation and improved literacy and numeracy needs to be interpreted critically because international evidence has not been fully consistent regarding the direct impact of differentiation on student learning outcomes (Kahmann et al., 2022; Karst et al., 2022). Karst et al. (2022), for example, did not find a significant major effect of data-based differentiated instruction on reading comprehension compared to the control group, although the intervention reduced the influence of early ability on student learning gains. Similarly, Kahmann et al.'s (2022) meta-analysis showed that differentiated professional development programs had a moderate effect on teacher knowledge and practice, but that improvements in teacher competence did not automatically result in improved student learning outcomes. These counter findings are important because they suggest that differentiation is not an intrinsically effective intervention; The impact depends on the accuracy of assessment, the quality of assignments, teacher competence, the intensity of implementation, and the connection between learning adaptation and subject objectives (Kahmann et al., 2022; Langelaan et al., 2024). Thus, the increase in literacy, numeracy, confidence, and involvement seen in this qualitative research should be understood as a developmental mechanism and perception, not causal evidence regarding the magnitude of the improvement in learning outcomes (Karst et al., 2022; Kahmann et al., 2022).

Another important aspect of Figure 1 is the position of formative feedback and continuous evaluation as a cycle that returns learning outcome information towards the next needs mapping, so that differentiation takes place dynamically and not as a permanent categorization of student abilities (Kalinowski et al., 2024; Hu, 2024). This interpretation is reinforced by the findings of Kalinowski et al. (2024) that teacher assessment activities when planning learning are positively related to the application of differentiation for students with different levels of achievement. Flexible grouping in research models also has significance because overly rigid differentiation risks turning transient ability variations into fixed ability labels, whereas adaptive practices demand re-evaluation based on students' actual development (Hu, 2024). In addition, a review of high-ability students suggests that differentiation should not only serve as a remedy for students who are struggling, but also provide adequate academic challenges for higher-ability students (Ziernwald et al., 2022). This reinforces the study's findings that scaffolding and enrichment are two mechanisms that must run together in order for differentiation to maintain the principle of fairness without standardizing students' learning experiences (Ziernwald et al., 2022; Hu, 2024).

Theoretically, this study proposes that the relationship between differentiation and literacy-numeracy development works through the chain of student profiling → adaptive instructional decisions → differentiated learning experiences → formative feedback → competency development, so that the main contribution of the model lies in the interconnectedness between these components, rather than in a single differentiation technique separately (Langelaan et al., 2024; Hu, 2024). The placement of school context and Islamic values as the foundation of the model also indicates that the implementation of differentiation is contextual, in line with research showing that factors of school organization, collaboration, professional culture, and institutional support can be both facilitators and

inhibitors of the success of differentiation (Langelaan et al., 2024; Bi et al., 2024). Practically, schools need to avoid the meaning of differentiation as creating different learning tools for each student and instead prioritize simple diagnostic assessments, flexible groupings, multi-level assignments, scaffolding, enrichment, and feedback that can be applied sustainably by teachers (Hu, 2024; Kalinowski et al., 2024). Teacher professional development should also be specific to literacy and numeracy learning because meta-analyses show that differentiation training tied to subject domains is more effective in improving teacher practice than overly general differentiation training (Kahmann et al., 2022). Thus, Figure 1's contribution is to offer a differentiation model that is cyclical, contextual, and responsive, while affirming that the success of improving literacy and numeracy depends on the quality of the relationship between student needs diagnosis, teacher instructional decisions, and continuous evaluation of learning progress (Hu, 2024; Langelaan et al., 2024; Kahmann et al., 2022).

4. CONCLUSION

This study shows that differentiated learning at SD Muhammadiyah Plus Probolinggo functions as an adaptive approach that connects learning readiness mapping, content, process, and product differentiation, flexible grouping, scaffolding, and formative feedback to support students' literacy and numeracy development. The novelty of the research lies in the meaning of differentiation not as a mere variation of tasks, but as a pedagogical decision-making system that takes place cyclically based on the actual needs of students and integrated with the context of Islamic elementary schools. These findings expand the theoretical understanding of differentiated instruction by emphasizing that its effectiveness depends on the connection between diagnostic assessments, instructional responses, and continuous evaluation, rather than on one separate differentiation technique.

Practically, this study emphasizes the importance of strengthening teacher competence in mapping student readiness, designing graded assignments, providing proportional support, and maintaining grouping flexibility so that literacy and numeracy develop without ignoring individual differences. In the broader literature context, the results of this study are in line with the findings that differentiation has the potential to strengthen learning engagement and access, but its impact remains strongly influenced by the quality of implementation and the school context. The limitations of the study lie in the qualitative design of one school, the limited number of participants, and the absence of longitudinal measurements of changes in student ability. Further research is suggested using mixed methods design, multi-site studies, and pre-post measurements to test the relationship between the intensity of differentiation and literacy-numeracy development more robustly.

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