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Research Trends on Differentiated Mathematics Learning in Indonesia: A Systematic Literature Review

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Abstract

The paradigm shift from teacher-focused learning to one that emphasizes the active role of students makes the differentiation approach one of the main pedagogical strategies in responding to students' diverse learning needs. In Indonesia, a number of studies on differentiated learning have been carried out. The aim of this study is to identify and explore research trends regarding differentiated learning in Indonesia. Systematic Literature Review (SLR) is a method used to review scientific articles published in the Scopus and SINTA databases. The focus of the study is on the implementation of differentiated mathematics learning. The results of the study show a significant increase in the number of publications related to this topic in 2024. The majority of published articles are qualitative research. The mathematics topic that is most often the object of study is geometry. The majority of data analysis methods apply the Miles and Huberman model analysis, while the research subjects are generally elementary school students. Based on these findings, this study recommends that future research expand the variety of methodological approaches, not only limited to qualitative and quantitative approaches, but also include classroom action research and development research aimed at producing instructional products to support differentiated mathematics learning.

Keywords: *Differentiated Mathematics Learning; Study; Systematic Literature Review*

Introduction

The shift in perspective from teacher-centered learning to more student-centered learning has made the differentiation approach one of the leading pedagogical strategies to address students' learning needs (Aliyeva, 2021). Differentiated learning has long been suggested as a pedagogical approach to accommodate students' individuality and diversity (Marks et al., 2021). Previous research has shown that learning with a differentiated learning approach supports the diverse needs of students in mathematics classrooms. The goal of teachers in differentiated classrooms is to enable students to make connections with prior learning and build their knowledge quickly and efficiently (Hackenberg et al., 2021).

Differentiated learning is effective when learning is student-centered. The characteristics of this approach are focusing on student needs by building student knowledge through tasks (de Jager, 2023). Continuous assessment of student understanding ensures effective learning and teaching. It also helps

students build understanding and recognize the relevance and usefulness of what they are learning, encourages collaborative learning management, and promotes active engagement in the learning process. Teachers have many options to use a variety of teaching strategies and learning approaches in the classroom that are student-centered. This process ensures that all students are closely connected to the essential knowledge necessary for understanding (Tomlinson, 2017).

Various studies on differentiated mathematics learning have been developed in Indonesia. The results of Anggareni and Juandi's (2023) literature review related to differentiated mathematics learning are about the explanation of the impact of implementing differentiated learning in improving students' mathematics competence. The literature review of Kurnia et al., (2025) also provides a description related to differentiated mathematics learning, namely the explanation of the principles, stages, and implementation of differentiated learning in mathematics learning.

The purpose of this study is to collect various information from various previous studies related to differentiated mathematics learning in Indonesia by using a systematic literature review of scientific articles in mathematics education journals indexed in the Scopus database and SINTA-accredited journals. This study was designed to respond to five main questions, namely: (1) How is the development of the number of studies on differentiated mathematics learning? (2) What are the various research designs applied in these studies? (3) Who are the subjects of focus in these studies? (4) What mathematical materials are the focus of the studies? (5) What data analysis methods are most commonly used in these studies?

Method

Data Sources and Search Strategy

This study follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) rules (Page et al., 2021). Differentiated mathematics learning articles were retrieved through the Scopus and Science and Technology Index (SINTA) databases. Scopus is used for global journals while SINTA is for accredited national publications. Article searches were carried out systematically using the keywords listed in Table 1 in the search column.

Table 1. Search Keywords

Database	Keywords and Filters
Scopus	•Search using: TITLE-ABS-KEY (“differentiated mathematics” OR “personalized mathematics learning”) •Filter: Source Type (Journal), Document Type (Article), Language (English), Open Access (All open access)
SINTA	•On the SINTA journal page, use the filter: Subject Area (Education) •Journal search with the keyword “mathematics” •In selected journals, search for articles using the following keywords: “differentiated”, “differentiated mathematics”, “personalized”. “differentiation”, “differentiation mathematics”.

Article Selection Criteria and Procedures

This study focuses on empirical articles in English or Indonesian that have been peer-reviewed and published in mathematics education journals. In addition, restrictions were made only on research articles (not literature reviews or opinions) to ensure the methodological quality and empirical relevance of the data analyzed. In particular, the included articles must discuss mathematics differentiation in Indonesia. Furthermore, the five inclusion criteria (IC) and the five exclusion criteria (EC) applied in this study are presented in Table 2.

Table 2. Article Selection Criteria

Inclusion Criteria (IC)		Exclusion Criteria (EC)	
IC1	Articles from Scopus indexed or SINTA accredited journals	EC1	Articles from journals that are not indexed by Scopus or not accredited by SINTA
IC2	The article discusses mathematical differentiation in Indonesia	EC2	The article does not discuss mathematical differentiation in Indonesia.
IC3	Articles in Indonesian or English	EC3	Articles in languages other than Indonesian or English
IC4	The research subjects are students, university students or teachers in Indonesia.	EC4	The research subjects were not students, university students or teachers in Indonesia
IC5	Articles are quantitative, qualitative, PTK, or development research.	EC5	Articles outside quantitative, qualitative, PTK or development research

The article selection process follows three main stages according to PRISMA, namely: (1) identification, (2) screening, and (3) inclusion (Page et al., 2021). In the identification stage, a search was carried out using the designed keywords (Table 1) on two databases and 78 articles were obtained. After removing 47 duplicate articles using Mendeley bibliography software, 31 articles remained. The screening stage was carried out by reviewing the titles and abstracts of the 31 articles based on the inclusion and exclusion criteria, resulting in 28 articles that potentially met the requirements. Furthermore, a full content examination of the 28 articles was carried out to ensure compliance with the criteria. Finally, 24 articles were selected for analysis in this systematic review. The article selection process is visualized in Figure 1, following the PRISMA flow.

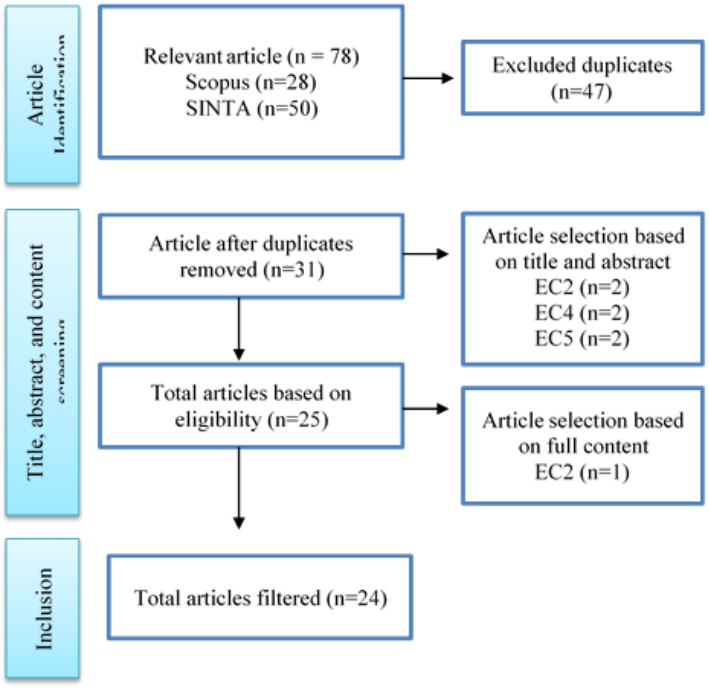

Figure 1 Stages of extracting articles on differentiated mathematics learning

Data Analysis

The articles that passed the selection were then grouped into several categories according to the aspects that had been determined, with the help of Microsoft Excel as a data organization tool. The analysis was carried out with a guide that was a modification of the content analysis guidelines by Susetyarini and Fauzi (2020) with several aspects of the analysis displayed in Table 3. Overall, there were seven aspects studied, namely: (1) number of publications per year; (2) type of research; (3) research subjects; (4) mathematics topics; (5) data analysis methods. However, aspects (1) and (4) are open because they do not have standard indicators from previous research. Then the results of the analysis are presented in the form of bar charts and tables.

Table 3. Aspects and Categories for Content Analysis

Aspect	Category	
Type of research	A.1. R&D A.2. Action Research	A.3. Qualitative research A.4. Quantitative research
Research subject	B.1 Elementary School Students B.2 Junior High School Students B.3 Senior High School Students	B.4 College Student B.5 Teacher
Data Analysis Methods	C.1 Miles and Huberman Analysis C.2 Descriptive Statistical Analysis C.3 Percentage C.4 t-test C.5 Bogdan and Biklen Analysis C.6 N-Gain	C.7 Linear Regression C.8 KMO Test C.9 Bartlett's test C.10 Mann-Whitney U Test C.11 Anova

Finding and Discussion

Number of Publications

The number of published articles shows the trend of research on differentiated mathematics learning over a certain period of time. In the graph in Figure 2, it can be seen that articles focusing on differentiated mathematics learning began to appear in 2018, but the number was still very limited until 2023. A significant increase in the number of publications occurred in 2024, namely eight articles, followed by five articles in 2025. This increase can be associated with the implementation of the Merdeka Curriculum which began to be tested since 2021/2022 and was applied more widely as an option in the 2022/2023 academic year (Wahyudin et al., 2024). This curriculum emphasizes the importance of meeting students' learning needs individually and contextually, thus encouraging more research related to differentiated learning in Indonesia (BSKAP, 2022).

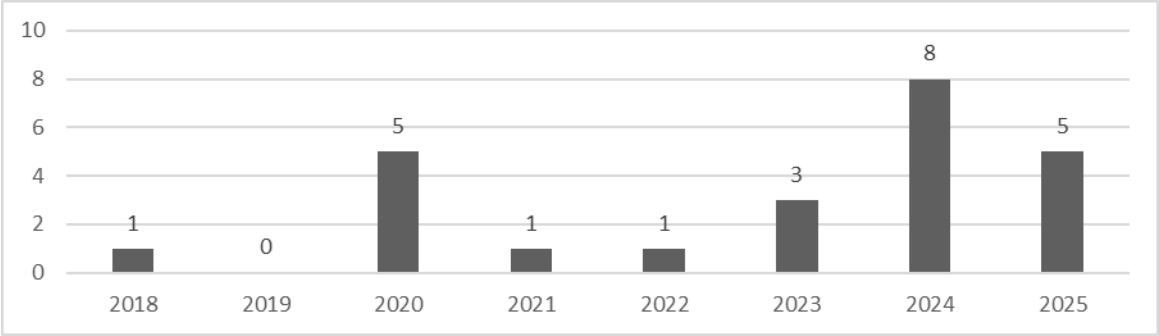

Figure 2. Data on the Number of Research Related to Differentiated Mathematics Learning

The increasing trend of publications shows that the differentiated learning approach is increasingly recognized and applied in the world of education in Indonesia, especially in mathematics learning. Differentiated learning is understood as a proactive approach in designing and implementing the teaching and learning process by considering the differences in readiness, interests, and learning styles of each student (Tomlinson, 2014). In Indonesia, the implementation of this approach is becoming increasingly important due to the high variation of students in terms of academic ability, socio-cultural background, and economic status.

Most of these publications come from researchers' responses to real problems that occur in the school environment. One of the most frequently raised issues is the need to design mathematics learning that is responsive to student diversity. Research in this trend focuses on how teachers adapt learning strategies, design differentiated Student Worksheets (LKPD), and evaluate the effectiveness of the differentiation approach to improving student learning outcomes.

The increasing number of studies on differentiated mathematics learning is believed to be able to make a significant contribution to the progress of education in Indonesia. This belief is based on the view that the main purpose of research is to encourage improvements in educational practices (Coburn & Penuel, 2016). In addition, research results have the potential to influence educational practices for several reasons, including: (1) the findings obtained can be used as credible and relevant references for educational practitioners; (2) these findings can be an important basis for making educational policies at various levels, both national, regional and certain institutions; and (3) research has the potential to shape or change teachers' perceptions of the learning process.

Type of Research

The type and design of research play an important role in determining the purpose and focus of a scientific study. Figure 3 shows that qualitative (11 publications) and quantitative (9 publications) research approaches dominate studies on differentiated mathematics learning in Indonesia. This finding indicates that the majority of researchers focus more on exploring phenomena in the field, teacher and student perceptions, and the statistical effectiveness of differentiated approaches. Qualitative approaches are widely used to understand the complexity of learning practices in real contexts (Creswell, 2018), while quantitative approaches are generally used to measure certain variables such as student abilities or learning outcomes (Fraenkel et al., 2019).

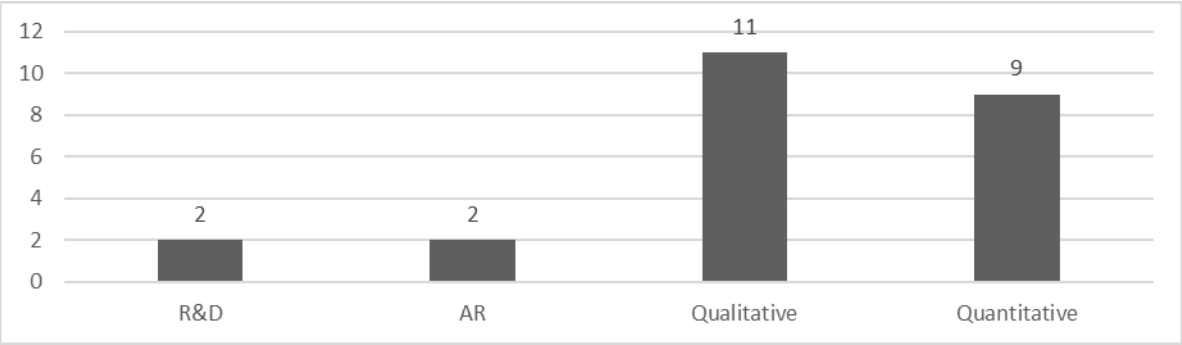

Figure 3. Distribution of Differentiated Mathematics Learning Research Based on Research Type

However, the number of publications for classroom action research (CAR) and development research (R&D) is only two publications each. In fact, the type of CAR research has an important role in improving teacher learning practices reflectively through the cycle of action, observation, and reflection (Kemmis & McTaggart, 2016). Meanwhile, the type of R&D research is very relevant in producing applicable learning innovations such as producing products in the form of learning devices or learning

media according to student needs (Sugiyono, 2016). Therefore, the small number of this type of research shows that the opportunity to develop differentiated mathematics learning products and practices in Indonesia is still very open, so this is a great potential for future research.

Research Subject

The research subjects play an important role in obtaining relevant empirical data to answer the research focus. Referring to Figure 4, it can be seen that the most dominant subjects used in research on differentiated mathematics learning are elementary school students (8 publications). The dominance of elementary school level shows that the application of differentiated learning is widely explored in the early phase of formal education. This is in line with Tomlinson's opinion (2014) that in differentiated learning, teachers need to respond to students' needs individually, not assume that they are uniform. At the elementary school level, differences in students' learning readiness, interests, and learning styles tend to be more visible, thus encouraging the need for the application of an adaptive learning approach.

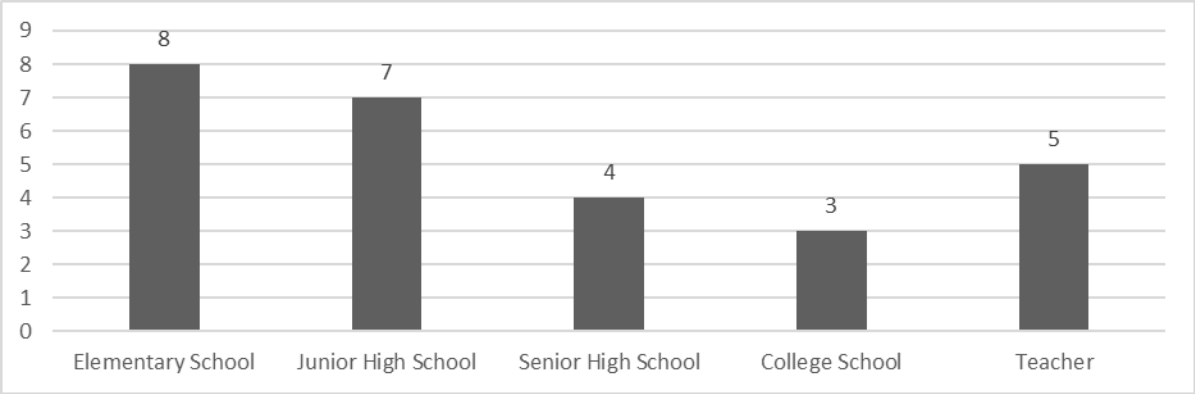

Figure 4. Distribution of Research Subjects in Various Differentiated Mathematics Learning Studies

However, the number of studies involving teachers and higher education levels is still relatively minimal compared to subjects from elementary and secondary education levels. In fact, teachers have a central role in designing and implementing differentiation strategies in the classroom (Tomlinson, 2017). Therefore, research that directly involves teachers is important to provide a more comprehensive picture of the challenges and practices of differentiation in the field. On the other hand, studies involving students or prospective teachers also need to be increased to determine the extent of their readiness to apply the principle of differentiation in the future.

Mathematics Topics Studied

Some mathematical topics tend to be more frequently studied in research on differentiated mathematics learning. Based on Table 4, geometry is the most widely studied topic, with six publications. This dominance shows that geometry is a complex and challenging material to teach uniformly, because it requires visual spatial abilities, abstract reasoning, and mastery of shape and space. This complexity encourages teachers to apply a differentiation approach so that learning can be more tailored to students' readiness, interests, and learning preferences (Tomlinson, 2014).

Table 4. Distribution of Mathematics Topics in Several Differentiated Mathematics Learning Studies

Mathematics topics	Number of Publications
Numbers	4
Algebra	4
Geometry	6
Trigonometry	2
Numerical Methods	1

In addition to geometry, the topics of number and algebra also received significant attention, with four publications each. This statement is in line with that of the National Council of Teachers of Mathematics (2000) which emphasized that number and algebra are important foundations in the development of complex mathematical understanding. On the other hand, the topics of trigonometry and numerical methods tend to be studied less frequently. The low attention to these topics may be due to the fact that these materials are usually taught at higher levels of education, where the application of differentiated learning is not as widespread as at the elementary level.

Data Analysis Methods

The next step after data collection in a study is to process and analyze the data. Accuracy in choosing a data analysis method greatly determines the validity of the research instrument. The data analysis methods used in the study of differentiated mathematics learning are shown in Figure 5. Based on the figure, more than 24 types of data analysis were recorded, because some studies applied more than one analysis method.

Of all the methods used, the Miles and Huberman data analysis technique is the most dominant one applied by researchers. Furthermore, data analysis in the form of percentage calculations, t-tests, and descriptive statistical analysis are also widely used. Descriptive statistics provide an overview of the size of the data center, such as mean, median and mode, as well as measures of data distribution, such as standard deviation and variance. Meanwhile, the t-test is used to test hypotheses and assess the impact of independent variables on dependent variables separately. As seen in Figure 5, the t-test is also used to compare the averages of two groups to determine whether the difference is significant or not.

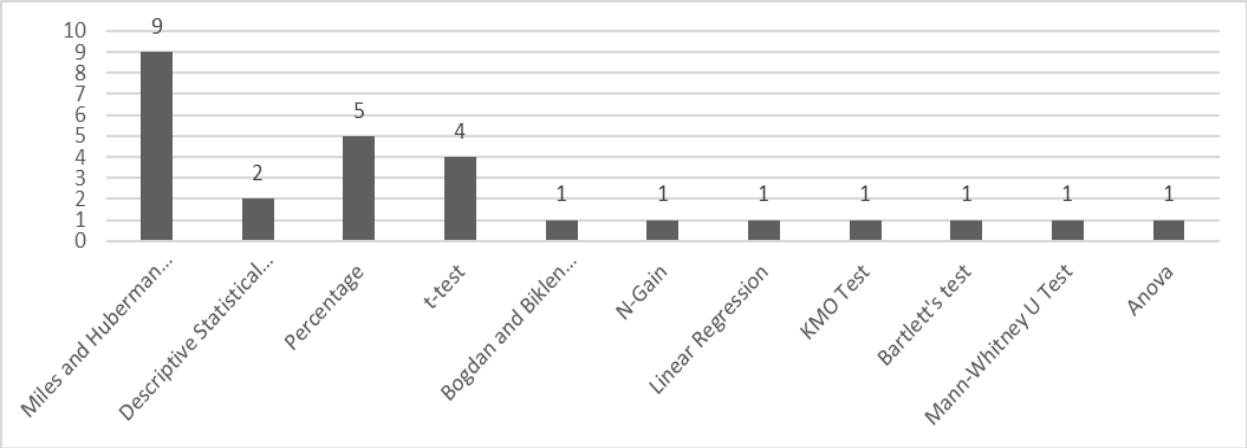

Figure 5. Data Analysis Methods in Differentiated Mathematics Learning Research

Conclusion

The number of research publications related to differentiated mathematics learning has increased significantly in 2024. The most dominant type of research published is studies with qualitative research where the majority of these studies aim to explore phenomena in the field, teacher and student perceptions, and understand the complexity of learning practices. The most frequently researched mathematics topic is geometry, because geometry is a complex material that requires visual spatial abilities, abstract reasoning, and mastery of shape and space. The data analysis method most widely applied in research on differentiated mathematics learning is the Miles and Huberman analysis model, meanwhile, the research subjects are mostly focused on elementary school students. Based on this literature study, several recommendations have been produced, the first of which is to increase the intensity of the implementation of Classroom Action Research (CAR) and Development Research to develop instructional products in differentiated mathematics learning. Second, most of the subjects of differentiated mathematics learning research are elementary and junior high school students. Thus, further research is needed involving high school and college students. The limitations of this literature study lie in its focus which only covers five aspects as previously described. Therefore, further literature studies are needed that explore other aspects in order to broaden insights and enrich the treasury of research related to differentiated mathematics learning.

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