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Implementation of Merdeka Curriculum: In Lesson Study Based Differentiated Learning

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Article Info

ABSTRACT

Purpose of the study: This study aims to conduct a meta-analysis of various studies discussing the implementation of the Independent Curriculum (*Kurikulum Merdeka*) in differentiated learning based on the lesson study approach across different educational levels.

Methodology: The study employs a quantitative meta-analysis method by analyzing 88 articles published between 2020 and 2025, retrieved from several academic databases such as Google Scholar, ScienceDirect, DOAJ, PubMed, WorldCat, Dimensions, and Portal Garuda.

Main Findings: The findings show a very high overall effect size (ES = 1.086; SE = 0.157). Specifically, elementary (ES = 1.049) and senior high schools (ES = 0.826) show high effects, while junior high schools demonstrate the strongest and most consistent impact (ES = 1.475).

Novelty/Originality of this study: This study's novelty lies in integrating differentiated learning with the lesson study approach under the Independent Curriculum, offering empirical evidence of its strong positive effect on learning quality across educational levels and highlighting its potential as an innovative model for improving teaching effectiveness in Indonesian schools.

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1. INTRODUCTION

Education in Indonesia continues to evolve in response to the changing times and the growing demands of society [1]. As a result, the education sector is required to continuously innovate, particularly in the development and implementation of its learning systems [2]. Historically, the Indonesian education system has undergone significant curriculum reforms, with the national curriculum having been revised eleven times since its initial implementation in 1947 [3]. The curriculum is designed and developed to align with the rapid advancement of science and technology, ensuring that educational practices remain relevant and responsive to the needs of the modern era [4]. The curriculum, as the foundational framework for educational planning, plays a crucial and strategic role in guiding all aspects of the implementation of educational activities [5]. This curriculum is oriented towards the natural potential of learners and the demands of the times, with a more flexible learning approach that focuses on the development of students' individual interests and talents [6]. In the school context, the curriculum can be regarded as the "spirit" of the education system, which must be evaluated

in an innovative, dynamic, and continuous manner to remain relevant to the development of the times, as well as advances in science, technology, and the arts [7].

In the era of rapid technological advancement, the Merdeka Curriculum emerged as a form of adaptation to the evolving demands of the times [8]. Education has undergone a significant transformation with the implementation of the Merdeka Curriculum as an effort to enhance the quality of learning through a more flexible, contextual, and student-centered approach [9]. Therefore, a curriculum that aligns with the needs of society and the world of work has become imperative, considering its strategic role in education. Accordingly, curriculum development must be grounded on a strong and solid foundation [10]. This curriculum emphasizes competency-based learning and differentiation to accommodate the diverse learning needs of individual students [11]. One of the strategies that can support the implementation of the Merdeka Curriculum is differentiated learning based on the Lesson Study approach [12].

The Merdeka Curriculum emphasizes student centered learning by providing freedom, flexibility, and differentiation according to the needs, interests, and abilities of students [13]. Differentiation in this curriculum covers aspects of content, process, and learning outcomes so that each student gains meaningful learning experiences [14]. Support this practice, the implementation of Lesson Study is one relevant strategy. Lesson Study enables teachers to collaboratively design, implement, and reflect on learning, so that the diverse needs of students can be better accommodated [15]. Through the plan do see cycle, teachers can identify learning obstacles, develop a variety of methods, and adjust learning to suit the characteristics of individual students [16].

Differentiated learning has become one of the strategies and methods that educators can implement to meet the learning needs of every student. It is an instructional approach that accommodates students' diversity in terms of learning readiness, interests, and learning profiles [17]. Lesson Study is an approach used to improve the quality of learning through the implementation of continuous professional development practices [18]. Therefore, teachers are required to adjust their learning strategies to be more responsive to individual differences within the classroom. These differences reflect the unique characteristics of each student, where every learner possesses distinct ways of acquiring knowledge and understanding their surrounding environment [19].

Several previous studies have extensively examined the Merdeka Curriculum with a focus on differentiated learning, including the following research [20]-[28]. It explains that differentiated learning is one of the key components in the Merdeka Belajar Curriculum. This concept, known as differentiated instruction, is a student-centered learning approach that considers individual student characteristics throughout the process of instructional design, implementation, and evaluation [29]. These characteristics include students' learning readiness, learning interests, and learning profiles, enabling the learning process to be more effective and inclusive [30]. It emphasizes that differentiated instruction should be grounded in meeting students' learning needs and how teachers respond to those needs within the teaching and learning process [31]. This involves taking into account students' abilities, interests, and individual needs in acquiring and understanding learning materials. Thus, this approach aims to create a more effective learning experience that aligns with the unique characteristics of each student [32]. It states that differentiated instruction is implemented with the aim of adjusting the learning process to optimally meet the learning needs of each student [33].

There is a gap in the literature regarding the implementation of the Merdeka Curriculum in Lesson Study-based differentiated learning, as most previous studies have only discussed the three separately. Therefore, this study aims to conduct a meta-analysis of relevant studies to identify patterns, trends, and the effects of implementing the Merdeka Curriculum in Lesson Study-based differentiated learning at various levels of education.

2. RESEARCH METHOD

This research employed a quantitative meta-analysis approach. Meta-analysis is a type of research conducted by summarizing, reviewing, and analyzing data from previous research studies that have been published [34]. The data in this study were collected by searching for relevant articles from both international and national journals through online databases using specific keywords, namely "Merdeka Curriculum," "Differentiated Learning," and "Lesson Study," within the time span of 2020 to 2025 [35]. The research procedure in this study followed the steps described by [36] , as illustrated in Figure 1. These steps involved identifying and selecting relevant articles, reviewing the content of the studies, extracting the necessary data, and analyzing the findings to draw comprehensive conclusions regarding the implementation of the Merdeka Curriculum in differentiated learning based on Lesson Study [37]. The meta-analysis research process is as shown in Figure 1.
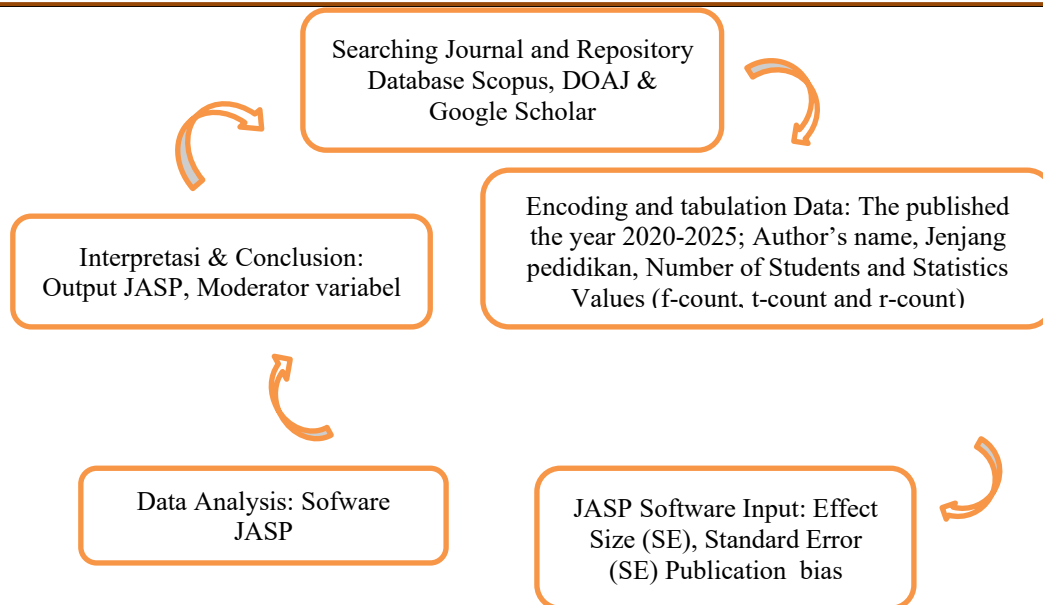
Figure 1. Research Procedure

Figure 1 presents the flow of the meta-analysis research process [38], which consists of the following steps: Conducting a systematic search for relevant articles from indexed databases such as Google Scholar, ScienceDirect, DOAJ, PubMed, WorldCat, Dimensions, and Portal Garuda based on the predetermined criteria. Performing coding and tabulation using Microsoft Excel, which includes information such as the year of publication, author(s), educational level, class, sample size (N), F-value, t-value, and r-value.

$$F = t^2 \dots (1)$$

$$t = \sqrt{F} \dots (2)$$

$$r = \frac{r}{\sqrt{t^2 + N - 2}} \dots (3)$$

Converting the F and t values into r values using the following formulas:

$$Z = ES = 0,5. \ln \frac{1 + r}{1 - r} \dots (4)$$

$$ES = \sqrt{\frac{1}{N - 3}} \dots (5)$$

$$p = ES = \frac{1}{N} \dots (6)$$

Drawing conclusions. The criteria for drawing conclusions are based on the category of the level of effect, which is determined by the values of Effect Size (ES) and Standard Error (SE). The classification of ES values is presented in Table 1.

Tabel 1. Classification of Glass's effect size

Effect size (ES)	Category
$0.20 \leq ES < 0.50$	Small Effect
$0.50 \leq ES < 0.80$	Moderate Effect
$0.80 \leq ES < 1.30$	High Effect
$1.30 \leq ES$	Very High Effect

Table 1 presents the final stage, namely the publication bias test. The criteria used indicate that if the p-value of the rank-test is greater than 0.001 (p-value > 0.001), then the data used in this study is considered to be biased. In addition, publication bias can also be determined using the equation $5k + 10 < NR$, where k represents the number of data points and NR refers to the file-safe number [39].

3. RESULTS AND DISCUSSION

In this study, data collection was carried out, resulting in a total of 100 data sets, of which 88 met the research criteria. The collected data included Fisher's test values (f), Student's t-test values (t), and the sample size (N) of each study. Additionally, information regarding the learning methods and educational levels was also gathered for further processing or analysis based on specific criteria [40]. The available data showed the presence of both f and t values, which were subsequently converted into correlation values (r), and further transformed into Effect Size (ES) and Standard Error (SE). The overview of the level of education is as shown in Table 2.

Table 2. Based on Educational Level

Educational Level	N	Estimate	p-value	RE Model	Category
Elementary School	33	1.049	<.001	1.05 [0.63,1.47]	Very High
Junior High School	23	1.475	<.001	1.47 [1.00,1.95]	Very High
Senior High School	32	0.826	<.001	0.83 [0.56,1.10]	Very High

The results of this analysis indicate that the educational level has a very high influence on the measured factors. Each level elementary school, junior high school, and senior high school demonstrates different estimate values; however, all show a very high level of significance (p-value < 0.001). This suggests that the differences in influence across educational levels are not incidental but rather reflect a strong relationship with the factors under investigation. Nevertheless, the magnitude of the effect varies among educational levels, with the junior high school level demonstrating the strongest influence compared to elementary school and senior high school. At the elementary school level, the estimate value of 1.049 indicates that the measured factor has a substantial impact. The confidence interval (0.63–1.47) suggests that the effect may vary, ranging from moderate to substantial. Since the lower bound is less than 1, it is possible that under certain conditions, the effect at the elementary school level may not always be strong. However, given the statistically significant p-value, the elementary school level still exhibits a high level of influence on the analyzed factors. This indicates that education at the elementary level provides a meaningful impact, although the effect may fluctuate depending on specific circumstances [41].

Meanwhile, the junior high school level demonstrated the highest estimate value, reaching 1.475, with a confidence interval of (1.00–1.95). This value indicates that the influence of the measured factor is greatest at the SMP level. Furthermore, the lower bound of the confidence interval being exactly at 1 suggests that the effect is almost always significant and stable. Therefore, the junior high school level exerts the strongest and most consistent impact compared to both elementary school and senior high school. This may indicate that the junior high school period represents a critical phase in shaping the influence of the factor being examined. At the senior high school level, the estimate value of 0.826 reflects a smaller effect compared to elementary school and junior high school. The confidence interval (0.56–1.10) indicates that, under certain conditions, the effect may be relatively small or even approach non-significance, as the lower bound falls below 1. Nevertheless, since the p-value remains < 0.001, this result is still considered statistically significant. In other words, while senior high school continues to exhibit a high level of influence, its effect size is relatively weaker than that of elementary school and junior high school. Overall, these results indicate that educational level has a very high impact on the measured factor. Despite the variation in effect size across levels, the results at all educational stages consistently demonstrate a statistically significant influence. With the p-values being remarkably small (< 0.001) across all levels, it can be concluded that these findings did not occur by chance but are supported by strong statistical evidence [42]. Table 3 presents the distribution of the studies based on the year of publication.

Table 3. Year of Publication

Variable	Classification	N	p-Rank test	RE Model	Category
Publication years	2020-2025	88	0.269	1.08 [0.85, 1.31]	Very High

Based on the publication year variable within the range of 2020–2025, a total sample size (N) of 88 was obtained. The p-value of the Rank test was 0.269, indicating that there was no statistically significant difference based on the rank test analysis. Furthermore, the results of the Random Effect (RE) Model showed an effect size value of 1.08 with a confidence interval ranging from 0.85 to 1.31. This interval reflects that the observed effect remains within a relatively stable range, with a minimum possible effect of 0.85 and a maximum of 1.31. Based on these results, the publication year variable is categorized as having a "Very High" effect, suggesting that this factor has a substantial influence despite the p-Rank test not indicating statistical significance [43]. Nevertheless, the results of the Random Effect Model demonstrate that the estimated effect remains at a relatively high level. as for the overall summary of the data. as shown in Table 4.

Table 4. Presents the Overall Data Summary

Study	Year	Level	N	ES	SE	Category
Study 1	2020	PS	10	3.70582	0.37796	Very High
Study 2	2020	PS	10	1.48143	0.37796	High Effect
Study 3	2022	PS	40	0.04173	0.1644	Small Effect
Study 4	2023	PS	33	0.00898	0.18257	Small Effect
Study 5	2023	PS	22	3.70003	0.22942	Very High
Study 6	2023	PS	21	3.65349	0.2357	Very High
Study 7	2023	PS	28	0.0002	0.2	Small Effect
Study 8	2024	PS	54	0.27925	0.14003	Small Effect
Study 9	2023	PS	30	1.53112	0.19245	Very High
Study 10	2023	PS	25	0.11443	0.2132	Small Effect
Study 11	2024	PS	58	0.00294	0.13484	Small Effect
Study 12	2024	PS	58	1.4797	0.13484	Very High
Study 13	2023	PS	20	2.2805	0.24254	Very High
Study 14	2020	PS	28	0.00843	0.2	Small Effect
Study 15	2020	PS	162	0.21727	0.07931	Small Effect
Study 16	2020	PS	139	0.22451	0.08575	Small Effect
Study 17	2020	PS	194	0.6444	0.07236	Medium Effect
Study 18	2023	PS	160	0.03659	0.07981	Small Effect
Study 19	2022	PS	130	0.50035	0.08874	Small Effect
Study 20	2024	PS	31	0.1014	0.18898	Small Effect
Study 21	2025	PS	38	0.00083	0.16903	Small Effect
Study 22	2024	PS	34	2.99525	0.17961	Small Effect
Study 23	2023	PS	29	0.13734	0.19612	Small Effect
Study 24	2024	PS	25	0.12065	0.2132	Small Effect
Study 25	2024	PS	31	0.60196	0.18898	Medium Effect
Study 26	2024	PS	60	2.99891	0.13245	Very High
Study 27	2024	PS	25	0.80604	0.2132	High Effect
Study 28	2020	PS	50	1.47643	0.14586	Very High
Study 29	2024	PS	15	0.55754	0.28868	Medium Effect
Study 30	2024	PS	34	1,0234	0.17961	High Effect
Study 31	2024	PS	25	0.53265	0.2132	Medium Effect
Study 32	2023	PS	30	0.59715	0.19245	Medium Effect
Study 33	2024	PS	18	3.12166	0.2582	Very High
Study 34	2022	JHS	24	2.77586	0.21822	Very High
Study 35	2023	JHS	28	3.40483	0.2	Very High
Study 36	2023	JHS	92	2.92064	0.106	Very High
Study 37	2023	JHS	70	3.04638	0.12217	Very High
Study 38	2023	JHS	138	0.63158	0.08607	Medium Effect
Study 39	2025	JHS	30	1.92181	0.19245	Very High
Study 40	2025	JHS	28	1.75683	0.2	Very High
Study 41	2023	JHS	26	3.56622	0.20851	Very High
Study 42	2023	JHS	28	1.18794	0.2	Very High
Study 43	2023	JHS	70	0.43253	0.12217	Small Effect
Study 44	2022	JHS	60	1.27614	0.13245	High Effect
Study 45	2024	JHS	50	0.58719	0.14586	Medium Effect
Study 46	2024	JHS	106	0.36091	0.09853	Small Effect
Study 47	2024	JHS	73	1.34193	0.11952	Very High
Study 48	2024	JHS	64	3.60624	0.12804	Very High
Study 49	2023	JHS	210	0.35317	0.0695	Small Effect
Study 50	2024	JHS	300	0.54217	0.05803	Medium Effect
Study 51	2024	HS	250	0.19286	0.06363	Small Effect
Study 52	2024	JHS	64	0.81823	0.12804	Small Effect
Study 53	2023	JHS	90	1.27859	0.10721	High Effect
Study 54	2024	JHS	73	1.34193	0.11952	Small Effect
Study 55	2024	JHS	69	0.33353	0.12309	Small Effect
Study 56	2024	JHS	352	0.39739	0.05353	Small Effect
Study 57	2020	HS	58	0.16627	0.13484	Small Effect
Study 58	2020	HS	124	0.02082	0.09091	Small Effect

Study	Year	Level	N	ES	SE	Category
Study 59	2020	HS	35	1.17462	0.17678	High Effect
Study 60	2020	VHS	30	0.69939	0.19245	Medium Effect
Study 61	2021	HS	27	1.26373	0.20412	High Effect
Study 62	2022	HS	76	0.15618	0.11704	Small Effect
Study 63	2022	HS	30	1.51253	0.19245	Very High
Study 64	2022	HS	36	1.70806	0.17408	Very High
Study 65	2022	HS	72	1.39719	0.12039	Very High
Study 66	2023	HS	103	0.07595	0.1	Small Effect
Study 67	2023	VHS	269	1.75729	0.06131	Very High
Study 68	2023	HS	33	0.39502	0.18257	Small Effect
Study 69	2023	HS	127	2.25653	0.0898	Very High
Study 70	2023	HS	66	0.31704	0.12599	Small Effect
Study 71	2023	HS	74	0.53651	0.11868	Medium Effect
Study 72	2023	HS	50	0.86307	0.14586	High Effect
Study 73	2023	VHS	15	1.48358	0.28868	Very High
Study 74	2023	VHS	58	0.41936	0.13484	Small Effect
Study 75	2023	VHS	80	0.04188	0.11396	Small Effect
Study 76	2023	VHS	60	3.07785	0.13245	Very Hingh
Study 77	2023	VHS	75	1.9471	0.11785	Very Hingh
Study 78	2024	HS	60	0.11007	0.13245	Efek Kecil
Study 79	2024	HS	71	0.50623	0.12127	Small Effect
Study 80	2024	HS	106	0.47357	0.09853	Small Effect
Study 81	2024	HS	25	0.27268	0.2132	Small Effect
Study 82	2024	HS	378	0.3299	0.05164	Small Effect
Study 83	2024	HS	72	0.80887	0.12039	Medium Effect
Study 84	2024	HS	19	1.78745	0.25	Very High
Study 85	2024	HS	72	0.32917	0.12039	Small Effect
Study 86	2024	HS	60	0.47864	0.13245	Small Effect
Study 87	2025	HS	29	0.00962	0.19612	Small Effect
Study 88	2025	HS	26	0.16016	0.20851	Small Effect
Average				1.086291	0.157432	Very High

Based on the data obtained, the average Effect Size (ES) was 1.086 with a Standard Error (SE) of 0.157. Based on the classification used, this value is included in the "Very High" category which indicates that the variable tested has a strong influence in the context of the research analyzed [44]. At the primary school level, the results showed a wide variety of effects. Some studies recorded very high effect sizes such as in Study 1 (ES = 3.70582), Study 5 (ES = 3.70003), and Study 6 (ES = 3.65349), indicating that the variables tested had a very strong influence. However, there are also studies that show small effects, such as Study 3 (ES = 0.04173) and Study 4 (ES = 0.00898), which indicates that not all studies at the primary level show significant effects. At the junior high school level, the majority of studies showed a higher effect size than the primary school level. Some studies recorded very high effect sizes such as in Study 35 (ES = 3.40483), Study 36 (ES = 2.92064), and Study 37 (ES = 3.04638), indicating that the variables studied had a substantial impact at the junior high school level. However, there are also some studies that show small to medium effects, such as Study 43 (ES = 0.43253) and Study 45 (ES = 0.58719), indicating that not all studies at this level have a large impact.

Meanwhile, at the senior high school level, the results showed considerable variation in effects. Some studies with high effect sizes include Study 63 (ES = 1.51253), Study 64 (ES = 1.70806), and Study 67 (ES = 1.75729), which indicates that the variables tested have a very large impact. However, there are also some studies that show small to medium effects, such as Study 57 (ES = 0.16627) and Study 58 (ES = 0.02082), which indicates that not all studies at the high school level show significant effects. In addition to primary and junior secondary schools, studies were also conducted in various types of schools within senior secondary schools, including Madrasah Aliyah and Vocational High Schools. In some schools at the senior high school level, most studies showed effect sizes in the small to medium category, such as in Study 59 (ES = 1.17462) and Study 85 (ES = 0.32917). However, there were also some studies that recorded very high effect sizes, such as in Study 76 (ES = 3.07785) and Study 77 (ES = 1.9471), indicating that the variables tested had a strong influence on various schools in senior high school [45].

This study indicate that, in general, the variables tested have a very strong influence on improving learning outcomes, although there are variations at each level of education [46]. At the elementary school level, the influence of the variables studied is not always consistent, with some studies showing a very significant impact, while others show a low influence [47]. Conversely, at the junior high school level, the influence tends

to be more even and stronger, indicating that the application of these variables is more appropriate to the characteristics of students at this level. At the senior high school level, the findings show considerable diversity, both in public schools, madrasas, and vocational schools. Some studies show a high effect, but others are in the moderate to low category [48]. This indicates that the effectiveness of the variables studied depends not only on the level of education but also on the learning context, student characteristics, and the conditions of the school where the research was conducted [49]. Overall, the analysis results show that the average Effect Size value in this study is very high, namely 1.086 with a Standard Error of 0.157. This finding indicates that the integration of differentiated learning in the Merdeka Curriculum through the Lesson Study approach has a significant impact on improving the quality of learning at various levels of education, although there are variations in results between studies. When compared to previous studies, such as Hattie's findings which state that an Effect Size above 0.4 is considered high, these results show effectiveness that far exceeds this threshold [50].

This means that interventions based on differentiated learning and teacher collaboration through Lesson Study have great potential to be implemented widely in the context of Indonesian education. The implication of these findings is that a collaborative, reflective, and adaptive approach to learning that is tailored to students' needs should be the main strategy in implementing the Merdeka Curriculum. The Ministry of Education and policy makers need to provide ongoing training and guidance to teachers in implementing Lesson Study as part of their professional development. As a brief recommendation, further research should focus on longitudinal studies to evaluate the long-term impact and examine the effectiveness of this model in more specific educational contexts, such as schools in 3T areas or vocational schools. This study's novelty lies in integrating differentiated learning with the lesson study approach under the Independent Curriculum, offering empirical evidence of its strong positive effect on learning quality across educational levels and highlighting its potential as an innovative model for improving teaching effectiveness in Indonesian schools and The limitations of this study lie in the number and variety of studies analysed, as well as the different school contexts. Therefore, the results of this study cannot be fully generalised to all regions or levels of education in Indonesia.

4. CONCLUSION

Based on the results of a meta-analysis of 88 studies, it can be concluded that the implementation of the Merdeka Curriculum through differentiated learning integrated with a subject-based approach has a very significant impact on improving the quality of learning at various levels of education. This strategy is not only effective in responding to students' learning needs in a more inclusive and reflective manner, but also encourages professional collaboration among teachers in designing and evaluating the learning process. This reinforces the view that the integration of differentiated learning with lesson study is an adaptive, contextual, and relevant model to support the implementation of the Merdeka Curriculum in Indonesia.

These findings not only provide a scientific basis for strengthening education policy, but also serve as a moral call for educators to continue serving through learning practices that respect every student's right to learn according to their potential. Thus, this research not only answers academic needs, but also makes a real contribution to the fight for fair, humane and sustainable education. Further research is recommended to explore contextual factors in greater depth and develop implementation models that are responsive to the characteristics of each educational unit, so that the results not only have a theoretical impact but can also be directly applied in equitable educational practices.

AUTHOR CONTRIBUTIONS
SR was responsible for the research design, data collection, data analysis, and manuscript preparation. RJ and WA, contributed to conceptual development, research methodology guidance, and critical review of the manuscript. All authors have read and approved the final version of the manuscript.

CONFLICTS OF INTEREST
The author(s) declare no conflict of interest.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY
The authors declare that no artificial intelligence (AI) tools were used in the generation, analysis, or writing of this manuscript. All aspects of the research, including data collection, interpretation, and manuscript preparation, were carried out entirely by the authors without the assistance of AI-based technologies.

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