



Development of Differentiated Learning Planning in the Outdoor Learning Mathematics Project

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ABSTRACT: The process of developing differentiated learning plans for this outdoor learning mathematics project follows the 4D model, which includes four main stages: define, design, develop, and disseminate. Each stage has a specific set of steps. The need for differentiated learning plans integrated with the outdoor learning mathematics project can be used in the mathematics learning process for statistics. This learning plan can be used as a solution as a guide in the learning process and is tailored to the characteristics of students at the school. Differentiated learning in the outdoor learning mathematics project can improve pretest and posttest results in both control and experimental classes, especially in mathematics. The final stage, dissemination, was carried out both offline at SMP Islam Kunir and the Mathematics MGMP of public and private junior high schools in Lumajang Regency, as well as online. Online dissemination was carried out by uploading Google Sites links to various popular social media platforms such as TikTok, Instagram, and Facebook, ensuring that this learning tool is widely accessible to other teachers who need it.

KEYWORDS: differentiation, learning planning, outdoor learning mathematics project, statistics

INTRODUCTION

The implementation of the Merdeka curriculum shifts the paradigm from teacher-centered to student-centered education. In this curriculum, students are the pivotal point of education. In its implementation, the government implicitly formulated this curriculum to adapt learning corridors to student characteristics and achievement levels. The Merdeka curriculum states that adapting learning to student characteristics and achievement levels is essential. In other words, educators should simply formulate a single learning plan for learning activities, supplemented with appropriate instructions or directions. This means that learning plans accommodate different learning needs, which will clearly create further bias in the implementation process. Educators must be proactive about curriculum changes (Jenkins, 2020). Of course, educational institutions must also be responsive in adapting to curriculum changes (Kandiko Howson & Kingsbury, 2021).

A teacher must prepare a learning design or lesson plan before entering the classroom and providing teaching materials to students. This is done so that teachers can provide the best learning for students in the form of optimal learning opportunities (Asari et al, 2018). Usually, in preparing learning, teachers determine several key components that are learning objectives, learning stages, teachers determine several key components, namely learning objectives, learning stages, or procedures and evaluation or assessment (Davila, 2017). Of these three main components, ideally it is assumed that the learning stages are the way teachers use instructional strategies to make students achieve certain competencies in accordance with learning objectives. Then the achievement of competencies will be measured using assessment and evaluation instruments. This can be interpreted that the learning stages must be based on learning objectives and evaluation. However, in actual practice, teachers generally only design learning stages Based on teaching experience without considering learning objectives and learning evaluation (Wiggins & McTighe, 2005). Likewise, assessment of results and evaluation must be an indicator of whether what was planned in the learning objectives has been achieved by students after learning in class. However, because evaluations are carried out at the end of learning and are usually taken from books that are not related to learning objectives, evaluation questions tend to be less appropriate to the objectives and stages of learning (Wiggins & McTighe, 2005). Therefore, evaluation must be conducted when designing learning, starting with learning objectives and related to the learning stages. In preparing learning, there must be relevance and a link between objectives, evaluation, and learning stages.

A common problem is the lack of connection between learning objectives and learning stages and learning evaluation. Teachers generally create evaluations after the learning stage has been completed, and evaluations are created or taken from



textbooks without linking them to the learning objectives and learning stages. As a result, students may not know what they should master and achieve in class (Wiggins & McTighe, 2005). It is unfair to students if they don't have a clear picture of what they should learn in class and are then assessed without having sufficient knowledge and skills. This lack of connection between learning objectives and stages and learning evaluation is likely to be detrimental to students (Nurdin, 2013; Sanjaya, 2015).

One problem observed in this study was the implementation of learning at one level, namely junior high schools. According to the observation, eighth-grade junior high schools should have implemented the Merdeka curriculum. However, observations indicate that classroom learning is still conducted conventionally, with no implementation of differentiated learning. Differentiated learning is a characteristic of the Merdeka curriculum. Differentiated learning is a series of learning activities that address students' needs in terms of learning readiness, learning profiles, interests, and talents (Aprima & Sari, 2022). Therefore, differentiated learning is an effort to adapt the classroom learning process to meet each individual's learning needs. Through differentiated learning, all students' needs in achieving competencies are accommodated according to their learning process (Herwina, 2021). Differentiated learning is a characteristic of the Merdeka curriculum. Based on Permendikbudristek Number 56 and 262 of 2022.

METHOD

This study used a development research method. The research developed learning planning with valid, practical, and effective criteria. The device development model used was the Thiagarajan model, also known as the four-D (4D) model, which consists of four stages: define, design, develop, and disseminate.

1. The Define stage involved analyzing the objectives and limitations of the material to establish learning requirements: a) Initial-final analysis: Interviews with educators and students regarding student learning activities during the teaching and learning process, b) Student analysis: Examining the characteristics of eighth-grade students at SMP Islam Kunir, including their background knowledge and cognitive development, c) Concept analysis: Compiling, detailing, and identifying statistical concepts. Searching and reading references from AKM files and mathematics learning resource books for eighth-grade junior high school students, d) Task analysis: Developing students' numeracy skills through selecting questions tailored to Learning Outcomes (CP), and d) Specification of learning objectives: Converting objectives from task analysis and concept analysis into specific objectives for developing learning devices to determine students' numeracy skills. Formulate learning objectives based on the Statistics material CP.

2. Design stage for designing differentiated learning tools for the outdoor learning mathematics project: a) Media selection: Identify learning media appropriate to the Statistics topic based on student characteristics, task analysis, and concept analysis. b) Format selection: Select a format for designing the content and topics to be tested. The format for developing differentiated learning tools for the Outdoor Learning Mathematics project. c) Initial design: Design all learning tools (Learning Tools, Student Worksheets, and Numeracy Ability Test packages) and produce a draft 1. d) Test preparation: Develop a grid and scoring guidelines based on the student's numeracy ability indicators to be achieved. The test questions are on Statistics material.

3. The Development stage produces a revised draft of the learning tools based on expert input and trial data: a) Expert Validation: Draft 1 is assessed by experts based on content, construct, and language validity. If valid, draft 1 can be piloted. If it is not valid, Draft 1 is revised until it is valid and named Draft 2. The validators consist of two mathematics education lecturers (at least a Master's degree) and one junior high school teacher (at least a Bachelor's degree and certified). b) Field Trial: Small Group Trial: Draft 2 was piloted on six eighth-grade students outside the pilot, control, and experimental classes to determine the readability of the learning tools. Large Group Trial (Field Test): Draft 2 was piloted in the pilot class. The trial results were practical tools. If impractical, revisions were made and then re-piloted. If practical, Draft 3 was produced. Draft 3 was piloted using a non-equivalent control group design to compare the effectiveness of using differentiated learning plans in the Outdoor Learning Mathematics project.

4. Dissemination Stage: This stage involves the use of differentiated learning plans in the Outdoor Learning Mathematics project on a wider scale. The product, in the form of a hard file, was distributed to school libraries and mathematics teachers at the research schools. The product was also distributed in soft file form via social media. The data analysis techniques for each criterion are outlined as follows:



1. Data Analysis of Instrument Validity.
2. The learning instruments and research instruments used must meet the minimum validity criteria before being tested, with a $3 \leq VA < 4$ interval (Hobri, 2021).
3. Data Analysis of Practicality
A learning instrument is considered practical if the results of observations of its implementation demonstrate that it meets at least the good criteria, with a $75\% \leq SR \leq 100\%$ interval (Hobri, et al., 2020). Interviews with mathematics teachers at SMP Islam Kunir revealed no changes to the instrument as a whole.
4. Data Analysis of Instrument Effectiveness.
The effectiveness of the instrument is measured by the following criteria:
 - a. Data analysis of student numeracy test results. The instrument is considered effective if at least 75% of the total students have completed the learning outcomes, with a minimum passing grade of 70.
 - b. Data analysis of student responses. Student responses to the learning tools are considered good if the majority of students respond positively to each indicator ($\geq 75\%$).
 - c. Interview results.

RESULTS AND DISCUSSION

Research result

This stage explains the process and results of developing differentiated learning tools for a valid, practical, and effective outdoor learning mathematics project, as well as a statistical analysis of the improvement in numeracy skills of eighth-grade students at SMP Islam Kunir.

1. Define Stage

This stage focuses on establishing the requirements needed to develop a learning plan. There are five main steps in this stage: pre-post analysis (the Merdeka curriculum used, lesson planning, a differentiated approach to the outdoor learning mathematics project, and the results of interviews and student responses), student analysis (understanding student characteristics as a basis for developing differentiated learning plans based on the outdoor learning mathematics project), concept analysis (identifying, detailing, and systematically organizing statistical materials as a means to achieve the appropriate Phase D Learning Outcomes (CP). Successful material design is key to the effectiveness of the teaching and learning process), task analysis (detailing the content of the teaching materials to be presented in the outdoor learning mathematics project learning tools according to the Phase D Learning Outcomes for the statistics material), and setting learning objectives (concretely formulating the learning targets students want to achieve after studying the statistics material, referring to the appropriate Phase D Learning Outcomes (CP).

2. Design Stage

This stage aims to design a prototype Learning Plan that is relevant to the needs identified in the definition stage. This design process involves three main steps, namely the selection of learning media (identifying effective means to deliver statistical material in the context of a differentiated outdoor learning mathematics project), the selection of learning formats (selection of approaches, strategies, models, methods, and learning resources that support differentiated learning in the outdoor learning mathematics project), and the initial design or initial design (aimed at producing an initial draft 1 of the learning device that will be used in the research. The learning device developed consists of a learning plan designed for two learning meetings of the outdoor learning mathematics project).

At this stage, research instruments were also developed, including a learning device validation sheet, an observation sheet for the implementation of the learning device, a student response questionnaire for the learning, and a student interview guide. The initial draft of the learning device and research instruments will then be validated by experts before being piloted. The learning device was developed with reference to the principles of the Independent Curriculum and adapted to the Learning Objectives (TP) formulated for statistics material (Phase D). This learning device is designed to accommodate the outdoor learning mathematics project learning activities that will be carried out over three meetings. Each meeting has a time allocation adjusted to the needs of exploration outside the classroom. This learning device contains detailed learning objectives to be achieved at each meeting, the steps of the outdoor learning mathematics project learning activities that apply the principle of differentiation, various learning media to be used, including utilizing the surrounding environment as the main learning resource, and assessments appropriate to the



outdoor learning mathematics project activities and learning objectives. The first meeting will focus on the basic concept of data centralization in the surrounding environment. The second meeting will discuss the concept of data dissemination and its application in real-life situations outside the classroom. The special characteristic of the developed learning tool is the emphasis on learning activities outside the classroom (outdoor learning mathematics project) that allow students to learn through direct experiences and in accordance with their lives. In addition, this learning tool is designed to facilitate differentiated learning, where teachers can adjust the approach and tasks according to the individual learning needs of students. This learning tool contains at least: information (name of compiler, institution, level, phase, class, time allocation, statistical subject matter), identification (student identification, subject identification and graduate profile dimensions), learning design (learning outcomes, cross-disciplinary, learning topics, learning objectives, pedagogical practices, learning partners, digital utilization, group learning), learning experiences, and learning assessments. An overview of the learning tool (outdoor learning mathematics project and differentiated learning, sequence of activities, assessment plan), detailed and differentiated steps of outdoor learning mathematics project learning activities, learning materials presented in the context of the outdoor learning mathematics project, assessments (formative during the outdoor learning mathematics project activities, and summative through numeracy tests), teacher and student reflections, and appendices (glossary and bibliography).

The research instruments developed include:

- a. Learning Device Implementation Observation Sheet: Used to observe and record how teachers implement differentiated learning devices in the outdoor learning mathematics project. Aspects observed include the implementation of planned learning steps, classroom management during outdoor activities, interactions between teachers and students, and the use of the environment as a learning resource.
- b. Student Response Questionnaire: Contains closed-ended and open-ended questions to gather student feedback regarding their learning experiences using differentiated learning devices in the outdoor learning mathematics project. Aspects assessed include engagement in outdoor activities, understanding of statistics material, the benefits of differentiated learning, and increased interest in learning mathematics.
- c. Student Interview Guide Sheet: Contains a list of guiding questions for in-depth student interviews regarding their learning experiences with differentiated learning devices in outdoor learning mathematics and how they perceive its impact on their understanding of social arithmetic material and their numeracy skills.

3. Development Phase

The Development Phase aims to produce a revised draft of the learning plan based on expert validation. Validated instruments are then piloted in two stages: a small group pilot to measure readability and a large group pilot to evaluate their practicality and effectiveness. The details of the activities in this phase are:

- a. Expert Appraisal: Validation is conducted to assess the feasibility of the learning plan and research instruments (student activity observation sheets, instrument implementation observation sheets, student response questionnaires, interview guidelines). This process aims to obtain input, suggestions, and evaluations from experts on the initial draft of the instruments and tools. The validation sheets are compiled based on relevant quality indicators and use a rating scale of one to four. Validation is conducted by three validators: two lecturers specializing in mathematics education and a mathematics teacher at SMP Islam Kunir. The validation results, along with the experts' suggestions, are used as the basis for revising Draft 1, resulting in Draft 2, which meets the validity criteria and is ready for pilot testing.
- b. Field Trial (development testing): The trial of the learning tools was conducted in two stages: a small group trial and a large group trial. The small group trial aimed to evaluate the readability of the tools, ensuring the text was easy to read and understand for students. Meanwhile, the large group trial was conducted to measure the practicality and effectiveness of the learning tools, which had been declared valid and passed the readability test.

4. Dissemination Stage

The final stage of this development research focused on the dissemination of the differentiated mathematics lesson plan for Outdoor Learning Mathematics, which had been validated and declared practical, reliable, and effective. Dissemination was carried out offline by distributing physical documents in the library of SMP Islam Kunir and the MGMP Mathematics forum for public and private junior high schools in Lumajang Regency. Furthermore, online dissemination was conducted by uploading



digital copies of the learning tools to Google Drive and sharing links through social media platforms such as TikTok, Instagram, and Facebook, thus facilitating access for other teachers.

Discussion

The results of the development research conducted on grade VIII B students showed that the developed learning plan met the criteria of validity, practicality, and effectiveness. The validity of the learning plan was assessed based on a feasibility test by three validators to ensure the device functioned as an appropriate measurement tool. A summary of the validation results from the three validators is shown in Table 1.

Table 1. Validator Result Criteria

Validator	Hasil	Kriteria
Validator 1	3,83	Valid
Validator 2	3,67	Valid
Validator 3	3,75	Valid
Rata-rata	3,75	Valid

The learning process was conducted at SMP Islam Kunir. The following is the activity schedule in Table 2.

Table 2 Learning implementation schedule

No	Date	Time		Activity
		Control Class	Experimental Class	
1	November,11 2025	hours 1 and 2	hours 4 and 5	pretest
2	November,12 2025	hours 4 and 5	hours 1 and 2	Lesson 1
3	November,13 2025	hours 4 and 5	hours 3 and 4	Lesson 2
4	November,14 2025	hours 1 and 2	-	Posttes
5	November,15 2025	-	hours 2 and 3	Posttes

Practicality is measured by observing the implementation of the lesson plan, as shown in Table 3

Table 3. Results of Observations of Lesson Implementation

Meeting	Results	Criteria
Meeting 1	3,78	Valid
Meeting 2	3,67	Valid
Average	3,73	Valid

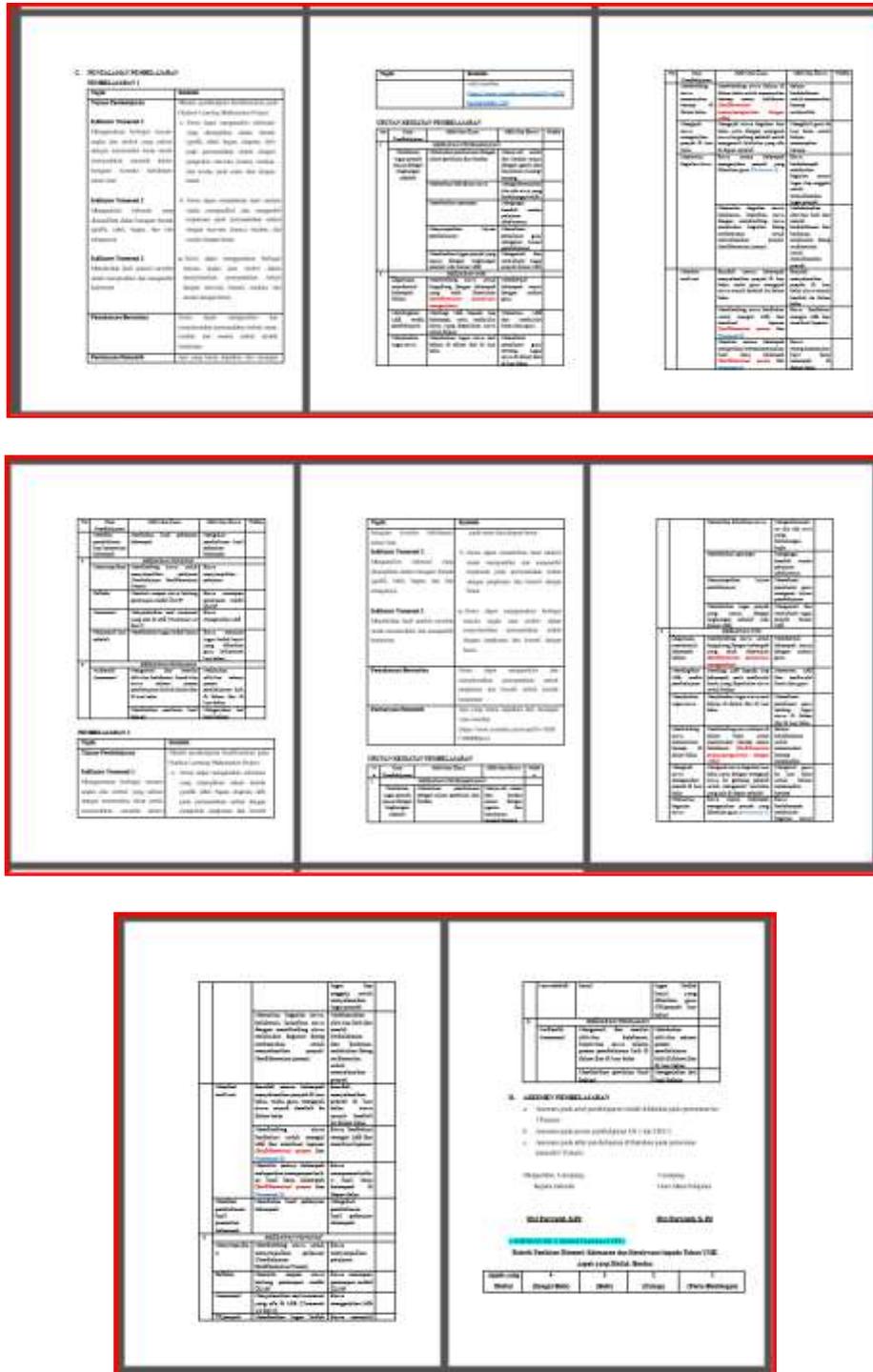
Meanwhile, effectiveness is assessed by the results of the student questionnaire responses, as shown in Table 4.

Table 4. Student Questionnaire Responses

Meeting	Results	Criteria
Meeting 1	3,37	Valid
Meeting 2	3,62	Valid
Average	3,50	Valid

A lesson plan that is appropriate, that is, it meets the criteria of being valid, practical, and effective, is shown in Figure 1.

Figure 1. Developed lesson plan



The learning implementation process is carried out using the learning plan developed as shown in Figure 2.

Figure 2. Learning implementation.



The results of the tests conducted before and after learning are shown in Table 4.

Table 4. Table of pretest and posttest results.

Description	pretest		posttest	
	kontrol	eksperimen	kontrol	eksperimen
Highest Score	75	80	80	100
Lowest Score	15	30	25	33
Class Average	68	70	71	73
Number of students achieving scores >70	13	15	16	19
Number of students achieving scores <70	12	10	9	6
Percentage of classical completeness	52%	60%	64%	76%

DISCUSSION

During the trial, several dynamics occurred in the learning process. At the beginning of the first meeting, some students remained passive in group discussions. However, in subsequent stages, some students became more active and expressed their opinions, especially when the group needed guidance. In the second meeting, students showed greater enthusiasm, the learning activities were conducive, and they actively collaborated in solving problems. Combining differentiated learning with the outdoor learning mathematics project will create a strong synergy in honing students' numeracy skills. This aligns with the characteristics of the outdoor learning mathematics project model, which encourages students to actively engage in everyday problems, find new solutions, share knowledge, and collaborate. The outdoor learning mathematics project also provides opportunities for students to formulate their own learning needs, become independent learners, and engage in problem-solving (Fidan & Tuncel, 2019).

When differentiated learning in the outdoor learning mathematics project is applied in an outdoor learning context, the natural environment becomes a living laboratory rich in numeracy opportunities. Students can directly calculate, compare, and analyze data from everyday scenarios, such as determining the number of vehicles passing in front of the school in a given time, the average number of vehicles passing, and determining what time of day traffic is busy in front of the school. These concrete



experiences help concretize abstract numeracy concepts, making them easier to understand and remember (Ratnasari, 2020; Ratnasari, 2021). Outdoor environments also increase student motivation and engagement, as physical activity and nature exploration reduce boredom and stimulate multiple senses (Ratnasari, 2020).

Furthermore, integration with differentiated learning ensures that each student receives support and challenges tailored to their individual needs. Teachers can facilitate process differentiation by providing differentiated support between student groups. The strong group receives minimal guidance and more complex challenges, encouraging independence. Meanwhile, the super group receives more targeted support to strengthen understanding. The strong group receives intensive support and more structured instruction to help them master basic numeracy concepts (Tomlinson, 2014; Santrock, 2011). This approach recognizes that students have different readiness levels, interests, and learning profiles, thus preventing frustration and increasing confidence in learning numeracy (Fauzi et al., 2024). Thus, the combination of the three creates a numeracy learning experience that is comprehensive, relevant, motivating, and effective for each student.

Furthermore, the use of outdoor mathematics learning in this study is supported by a recent study by Setiawan and Haryani (2023), which found that outdoor learning improves understanding of mathematical concepts through real-world contexts. Rohmah and Pratiwi (2020) also emphasized the effectiveness of exploring the outdoor environment in developing numerical literacy, consistent with the increase in the proportion of advanced students in the experimental group. Overall, the results of this study confirm the positive synergy between differentiated learning and outdoor mathematics learning. This finding aligns with recent literature emphasizing the importance of contextual and experiential learning (Sari & Susilawati, 2024; Indrawati & Nugraha, 2021), which has been shown to be effective in facilitating a deeper understanding of numeracy and encouraging students to achieve higher levels of competency, as demonstrated by the dominance of the advanced category in the experimental class.

Based on the research conducted, several strengths and weaknesses were identified, both in the research process and the implementation of the learning tools. One weakness of this study is the limited number of sessions. This study only conducted two sessions covering the topics of sales, purchases, profit and loss, and discounts. Ideally, at least four sessions are needed to cover this material in greater depth and provide sufficient time for students to understand and master the concepts. Furthermore, the conflict between the research schedule and the school farewell preparations presented a constraint. This resulted in some learning sessions or research activities not being able to be carried out optimally because students were involved in non-academic activities, or because they were not carried out during school hours. This situation slightly affected the continuity and focus of learning.

The advantage of the differentiated learning tools developed in the outdoor learning mathematics project is that the learning plan is structured according to the latest curriculum, the Merdeka Curriculum. This plan implements differentiated learning and utilizes outdoor learning methods. It also presents learning steps systematically at each meeting, making it easier for teachers to implement and for students to follow the learning flow. This approach allows students to directly apply mathematical concepts in real-world contexts, making learning more meaningful and engaging.

CONCLUSION

The findings of this study indicate that the implementation of differentiated learning in the Outdoor Learning Mathematics Project improved eighth-grade students' numeracy skills in statistics. This conclusion is supported by a significant difference in the mean posttest scores between the experimental and control groups. Differentiated learning in the Outdoor Learning Mathematics Project, supported by concrete media, effectively helped students develop meaningful understandings of statistics, apply systematic problem-solving strategies, and improve critical thinking and communication skills. Therefore, differentiated learning in the Outdoor Learning Mathematics Project is recommended for sustainable implementation in mathematics teaching, supported by effective classroom management, optimal discussion facilitation, the provision of innovative learning resources, and teacher professional development. Future research is recommended to expand the scope across various educational levels and contexts and to examine additional variables such as learning motivation, creativity, and mathematical communication skills to strengthen the empirical evidence and further contribute to the field of mathematics education.

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