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Is maths really a 'difficult' subject for learners in Indonesia?: A case study at Tara Salvia junior high school

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Abstract

Mathematics is a crucial aspect of reasoning and problem-solving. However, mathematics is still considered a difficult subject and tends to be unpopular; therefore, there is a need for examples of enjoyable mathematics learning experiences. This study aims to explore students' experiences in mathematics learning at a private junior high school in South Tangerang, Indonesia. This research employs a qualitative approach using a case study design, conducted at a junior high school in Indonesia involving 203 students, of whom 66 responded to open-ended questions, and 6 were interviewed in depth. Additional data were obtained from two mathematics teachers and one deputy headteacher for student affairs. Data collection was carried out through semi-structured interviews, classroom observations, and document analysis. The data were analysed thematically using an interactive analysis model supported by triangulation to ensure credibility. The findings of this study indicate that students' mathematics learning outcomes were excellent across all three student groups. Mathematics became an engaging and enjoyable subject, and positive changes were observed in the students through differentiated learning. Consequently, mathematics teaching at this school can be considered a best practice. Thus, an appropriate approach to mathematics teaching is a prerequisite for stimulating students' interest in learning mathematics.

Keywords:
Case studies, Differentiated learning, Learning environment, Mathematics education, Student learning experiences

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1. INTRODUCTION

Mathematics is a core subject that plays a vital role in developing students' logical, systematic and analytical thinking skills (Kilpatrick & Swafford, 2002). Mathematics serves not only as a tool for calculation but also as a means of developing problem-solving skills and higher-order thinking (Dollo et al., 2025; Ilhamuddin et al., 2026). Strong mathematical

proficiency correlates with students' success in tackling interdisciplinary academic challenges (Mullis et al., 2020). Furthermore, mathematical literacy is a critical competence that enables individuals to understand and utilise quantitative data in everyday contexts (OECD, 2023). More broadly, mathematical proficiency contributes to the quality of a nation's human capital and economic growth (Hanushek et al., 2020).

Unfortunately, mathematics tends to be regarded and perceived as a subject that is difficult to understand, abstract, uninteresting, and boring (Hidayah et al., 2025; Kusuma et al., 2024; Sakti et al., 2024). Consequently, mathematics becomes a subject that pupils avoid. This results in low self-confidence among pupils (Hakim & Adirakasiwi, 2021; Wen & Dubé, 2022). This situation indicates that mathematics is a crucial issue and that students' negative perceptions require adequate attention so that their mathematical abilities can improve (Hakim & Adirakasiwi, 2021).

In the Indonesian context, mathematics has a poor 'image' because teaching methods are still considered to be traditional (Khotimah et al., 2021; Nugraha, 2023; Sa'dijah et al., 2021; Sari et al., 2020). Consequently, pupils' learning outcomes remain unsatisfactory. As demonstrated by the PISA results, which are not yet encouraging as student performance remains low (Altun & Akkaya, 2014). Indonesian students' mathematics scores were 386 in 2015, 379 in 2018, and 366 in 2022. In the latest 2022 PISA results, Indonesia ranked 69th out of 80 countries participating in the PISA assessment (OECD, 2023; Wijaya et al., 2024). In other words, Indonesia's PISA scores have consistently been below the global average (Dima et al., 2021; Kadir & Rukman, 2021; Khotimah et al., 2021; Luschei & Zubaidah, 2012; Pan et al., 2017). Therefore, mathematics education is one of the key issues in the Indonesian education system.

In general, the factors contributing to mathematics lessons being perceived negatively by pupils are as follows: 1) Teachers lack a thorough grasp of the subject matter (Prasanna et al., 2023); 2) Teaching approaches and methods remain teacher-centred (Prasanna et al., 2023; Winata et al., 2025); 3) Facilities and resources are inadequate; and 4) The learning environment is unsupportive (Bekker et al., 2023; Winata et al., 2025).

Recent studies on mathematics learning conducted by researchers tend to discuss the following three aspects: a) STEM integration in mathematics learning as a solution to improve the quality of the learning process, interest, motivation to learn, engagement and academic achievement of students in mathematics education (Leyva et al., 2022; Nurumova & Kudiretbai, 2024; Tambunan & Yang, 2022; Tamur et al., 2023; Tashtoush et al., 2024); b) ethnomathematics, a new approach to learning mathematics so that students can more easily understand material about mathematical concepts (Deda et al., 2024; Ditasona, 2018; Kusuma et al., 2024; Lidinillah et al., 2022; Pratama & Yelken, 2024; Tuhfatul, 2024; Wulandari et al., 2024); and c) the importance of mathematics education to improve HOTS and 21st-century skills in mathematics, which covers critical thinking, creative, communication, and collaboration skills (Abdullah et al., 2017; Fatra et al., 2022; Jailani et al., 2017; Pertiwi et al., 2021; Purnomo et al., 2021; Rachmawati et al., 2021; Sa'dijah et al., 2021). The literature tends to partially elaborate on the problems faced by students in mathematics learning. The focus is on one aspect of mathematics learning, namely innovation in mathematics learning approaches and strategies. Whilst holistic studies concerning the constituent elements—namely, a

differentiated approach, the school environment, and student-centered learning—remain limited, this study is intended to address and supplement the gaps in the existing literature.

The purpose of this study is to explore, investigate, and analyze the experiences of junior secondary school students in learning mathematics. It is essential to identify the challenges that become the primary obstacles for students in mathematics education. Correspondingly, two fundamental questions were formulated: a) Is it true that mathematics is a 'difficult' subject to understand at Tara Salvia Junior High School? b) What are the experiences of pupils at Tara Salvia Junior High School in learning mathematics? What are the mathematical abilities of students at Tara Salvia Junior High School? To answer these questions, a case study was conducted at a private junior high school in South Tangerang. The answers to these questions may provide new insights and a holistic understanding of the difficulties and obstacles that pupils have frequently complained about. The results of this study offer a "new perspective" that.

The arguments used in the preparation of this study are based on Dewey's educational paradigm Dewey (1945, 1986). Direct experience is key to effective learning. Dewey emphasises the freedom to explore and actively participate in the learning process. Learning is a dialectical process that integrates concrete experiences into abstract concepts (Kolb, 2000). This learning process encourages educators to create project-based learning, learning through direct practice and experimentation. Subject matter is taught within a context that is relevant to students' experiences and practical. In other words, effective education requires alignment and relevance to students' experiences, needs and the interests of each individual. In this approach, the teacher acts as a facilitator, helping students to explore and discover knowledge (Beard, 2018; Luo, 2024; Mutrofin, 2022; Placides & Costa, 2021).

2. METHOD

This study employs a qualitative approach using a case study design to explore in depth students' experiences of learning mathematics through a differentiated learning approach at Tara Salvia (TS) Junior High School, South Tangerang. The case study approach was chosen as it enables the researcher to understand the phenomenon comprehensively within a real-life context. According to Yin (2018), a case study is an appropriate research strategy for examining contemporary phenomena in a real-world context when the boundary between the phenomenon and the context is not clearly visible. Furthermore, case studies are used to gain a deep understanding of a system, activity, or individual as a whole (Creswell & Creswell, 2017).

This study was conducted at SMP TS, a private school located in South Tangerang, Banten, Indonesia. The participants included all students in Years 7, 8, and 9, totaling 203 pupils. To obtain more in-depth data, 66 students were selected to answer open-ended questions, and 6 pupils participated in in-depth interviews. Additionally, 2 mathematics teachers and 1 curriculum coordinator were included as informants. Participants were chosen through purposive sampling, which involves deliberately selecting individuals relevant to the research objectives (Creswell & Creswell, 2017). The primary informants consisted of 2 mathematics teachers, 1 student affairs coordinator, and 6 students representing a range of mathematical abilities (high, medium, and low). The selection emphasized participants'

capacity to provide detailed insights into their experiences of learning mathematics and the implementation of differentiated instruction.

Data collection employed several key techniques to ensure the depth and validity of the information, including interviews, observation, and documentation (Christou, 2022; Cohen et al., 2017; Creswell & Creswell, 2017). Semi-structured interviews were conducted with mathematics teachers, pupils, and the student affairs coordinator to explore pupils' learning experiences, teaching strategies, and school policies supporting mathematics learning. The semi-structured format enabled the researcher to obtain flexible yet focused data. Classroom observations were conducted on three occasions to examine the mathematics learning process, teacher-student interactions, student engagement, and the learning environment. This approach allowed for a naturalistic understanding of classroom phenomena. Documentary data included teachers' lesson plans, diagnostic test results, student work, daily test results, school profiles, and other supporting materials such as learning policies and resources. Documentation served to corroborate findings from interviews and observations. Interview questions were aligned with the research objectives, focusing on eliciting in-depth information about the practice of mathematics learning at the school. For more details, the list of questions is presented in Table 1.

Table 1. List of interview questions

Question	Question Type	Target
Tell us about your experience in learning mathematics at school?	Open question	Student
How do you teach mathematics? What strategies do you apply in learning mathematics? What methods do you use to assess students' abilities in mathematics?	Open question	Mathematics Teacher
How does the school support the development of (maths) teachers' competencies? What is the integration of technology in differentiated learning in mathematics? Do maths teachers apply varied learning models?	Open question	Curriculum Coordinator

The data in this study were analyzed using an interactive qualitative analysis approach consisting of three main stages: data reduction, data presentation, and drawing conclusions and verification (Miles et al., 2014). Thematic analysis was applied to identify patterns, relationships, and meanings within the collected data, providing a holistic understanding of mathematics learning. Data from interviews, observations, and documentation were transcribed, selected, and categorized into specific themes such as learning experiences, learning strategies, learning environment, and students' perceptions of mathematics. The reduced data were presented as descriptive narratives, tables, and direct quotations from informants to clarify the research findings. Conclusions were drawn through in-depth interpretation, comparing various data sources, with continuous verification to ensure the consistency of the findings. To ensure data validity, source and method triangulation were employed, comparing information from different informants (teachers, students, school officials) and various techniques (interviews, observations, documentation). The study

adhered to ethical research principles, including obtaining official school permission, explaining the research objectives to participants, and maintaining the confidentiality of informants. After obtaining permission, this research was conducted. The research procedure is presented in Figure 1.

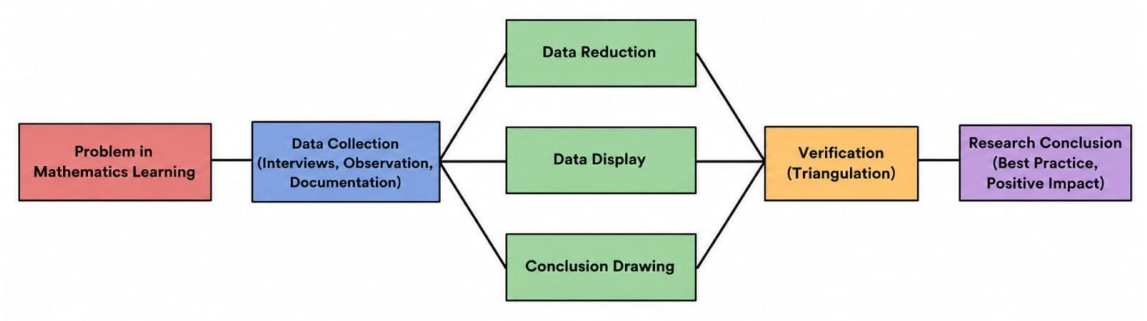


Figure 1. Case study research design

3. RESULTS AND DISCUSSION

3.1. Results

3.1.1. School Environment Observation Results

Based on direct observations at TS Middle School, South Tangerang, the school environment is beautiful, attractive, and well-organized, creating a pleasant atmosphere conducive to the learning process. Students are comfortable studying in the classroom because the arrangement of tables and chairs provides free space for students to move. The walls of the classroom are decorated with students' work as a form of teacher appreciation. Classrooms are also equipped with digital learning devices to support technology-based learning processes. There is adequate internet connectivity support, enabling students to quickly access a wide range of global learning resources. Each student brings a device that is used in learning activities. Outside the classroom, this school has an ample green open space. This space is ideal for students to relax, play, and engage in outdoor activities. There are also play facilities and exercise areas that support students in developing their motor skills, honing their sporting talents, and fostering togetherness among friends. During break time, students participate in various activities, including playing chess, table tennis, and using trampolines, as well as other sports equipment. Another important part is that the school culture that upholds the values of character, discipline, and cultural diversity realized through well-accommodated arts, culture, and extracurricular activities. A variety of student work is displayed on the terrace and in the classroom hallway. Figure 2 illustrates the school environment's atmosphere.

Figure 2. Tara Salvia junior school environment

It is important to note here that the researchers deliberately included photographs taken during their observations of the school environment at TS. The aim was to demonstrate how the school atmosphere, as perceived by the pupils, fosters a sense of comfort and makes them feel at home at school.

3.1.2. Mapping Students' Initial Abilities

TS is known for encouraging the development of student independence. The learning process uses the national curriculum as a guide for the educational unit's curriculum. The research results indicate that this school has a system in place for conducting formal diagnostic tests at the beginning of grade 7. The aim is to map the abilities of new students. Especially for mathematics, students' initial ability tests are given at the beginning of each school year to determine students' readiness to receive mathematics material at the 8th and 9th grade levels. At the beginning of grades 8 and 9, the mathematics teacher administers tests to assess students' abilities and determine the prerequisite skills required for the mathematics material. As shown in Figure 3.

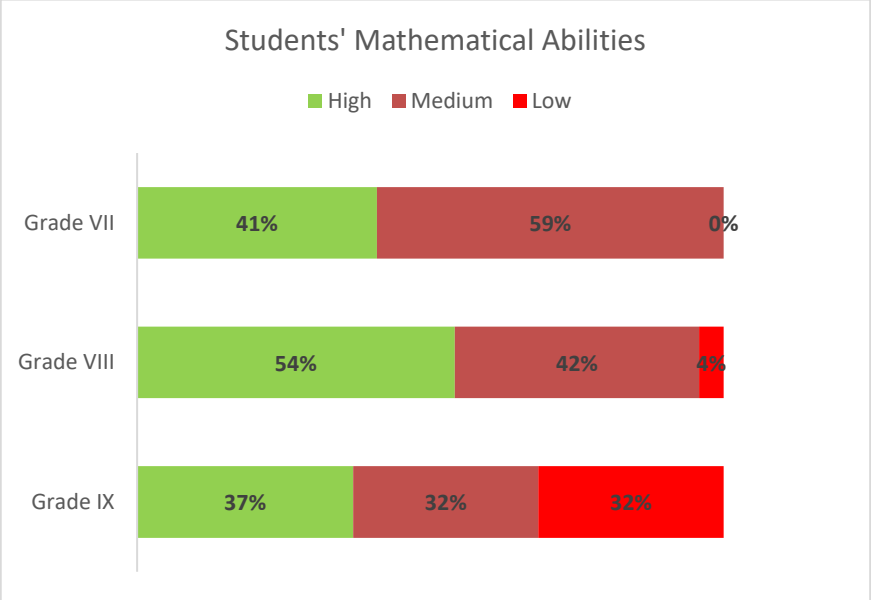


Figure 3. Students' initial mathematical abilities

Figure 3 shows that students' initial abilities are grouped into three: high, medium, and low. In class VII, most students' initial abilities fell within the medium category, and none had low initial abilities. Most of the students in class VIII have high category mathematical abilities, while in class IX, students' initial mathematical abilities are balanced between high, medium, and low.

3.1.3. Students' Perceptions about Mathematics

In line with the aim of this research, the following presents the perceptions of Tara Salvia's students regarding Mathematics to date, based on their responses in the questionnaire administered (see Table 2).

Table 2. Students' perceptions on mathematics

Students' Condition	Grade	Students' Opinions	Informant	Student abilities
Students like mathematics	IX	Sometimes I like it because I understand and can solve problems. Mathematics is fun, but sometimes I also get confused. There is group work so that you can ask friends.	R1, R2, R6, R7, R8, R9, R11, R14, R16	Students with high and medium mathematics abilities
		Depends on the material studied. If I understand, I like it. But if it's difficult, I'll just get used to it. However, if the teacher teaches well, I can usually do it.	R3, R4	
		I like mathematics because it is fun and makes me critical.	R5, R20	
		I like mathematics because the subject is challenging and confusing.	R10, R12	
		I love mathematics, a fascinating subject, and the glowing skin and feelings that need to be rationalized.	R17, R21	

Students' Condition	Grade	Students' Opinions	Informant	Student abilities
	VIII	When working on math problems, it may look interesting and fun, but sometimes it's also challenging.	R24, R27	Students with medium mathematics abilities
		I like it because every question and problem given always arouses my curiosity and interest.	R32	
		I have liked mathematics since I was little. However, I prefer to explain the material first and then do the questions, not the other way around.	R26	Students with high mathematical abilities
		I believe that I need a solid foundation in mathematics, and despite facing challenges, I continue to strive to learn it. I like counting.	R34, R35	
		I love working on projects (mockups, questionnaires, diagrams). If the teacher asks questions, it tends to be less interesting for me. In practice, I am more creative and willing to take on the challenge.	R43, R44, R45	
		I like it because the teacher is engaging, but the material can be somewhat complicated.	R30, R31, R38, R39,	Students with high and medium mathematics abilities
		I enjoy writing notes, listening to the teacher explain them, and then learning new concepts.	R40	Students with low mathematical abilities
	VII	I like mathematics because it is complex and challenges me; there are exciting moments, and the teachers are also engaging.	R47, R50	Students with medium mathematics abilities
		I like math lessons because they are fun, and even though they can be difficult at times, I can follow them; the teachers are engaging.	R53, R62, R63	
		I like mathematics because the material is interesting and I understand it quickly. Learning mathematics is fun; it requires precision, but there are numerous assignments.	R48, R52, R60, R61, R65, R67	Students with high and medium mathematics abilities
		I like mathematics because the tasks are not complex, but easy and necessary for the future.	R56, R57	
		I think it depends on who teaches and how they teach. However, the point is that I enjoy mathematics because I enjoy learning new things. However, sometimes the teacher's delivery method is less constructive and a bit sarcastic, which annoys me, whereas the teacher's delivery method is more engaging and clear. Overall, I prefer studying alone because it is more productive, and I think I am more focused and motivated.	R64	Students with high mathematical abilities

Students' Condition	Grade	Students' Opinions	Informant	Student abilities
Students dislike mathematics	IX	Not really, I don't like it because mathematics is difficult to understand, and it makes me dizzy.	R13, R19	Students with low mathematical abilities
		I think mathematics is complex, but it can be fun if I understand it. I'm lazy studying mathematics.	R15	
		No, because mathematics requires non-human level thinking skills.	R18	
	VIII	I don't like calculating, and sometimes mathematical material is complicated; it has a bad stigma.	R22, R25, R29	Students with medium mathematics abilities
		I think mathematics is too complex, and I often struggle to keep up with the subject matter.	R28, R36	
		Because the material is becoming increasingly confusing, complicated, and unpleasant.	R23	Students with high mathematical abilities
		Because math makes me feel less intelligent (decreases my confidence and self-esteem).	R41	
		Because it's difficult to memorize the formulas, and if there are questions, they are often confusing and sometimes don't make sense.	R33, R37, R42	Students with high and medium mathematics abilities
	VII	I don't like mathematics because I'm not good at it and I'm not particularly interested in the subject.	R46	Students with medium mathematics abilities
		I don't like mathematics because the lessons are difficult, and I don't understand them. But sometimes the lessons are fun.	R49, R51, R55	
		It depends on the material; for example, I like scale but don't like geometry. I don't like it because it's difficult, but if you understand, it's fun.	R54, R68	
		I don't like studying mathematics, because solving even one problem requires many methods. Mathematics is difficult to understand until I confuse myself.	R59	
		I don't like mathematics because calculations and other formulas are a bit difficult for me.	R58, R66	Students with high mathematical abilities

Students' opinions about Mathematics vary, with some finding it enjoyable and others not. Students with high and medium abilities generally like mathematics. However, some students in grades 7 and 8 possess high mathematical abilities, but they dislike Mathematics. This data is quite interesting because students who dislike Mathematics tend to have lower learning outcomes, but this data is inversely proportional.

Meanwhile, during the interviews, the students stated that they enjoy the lessons for various reasons. As detailed in the following excerpt.

"Actually, since elementary school, I have enjoyed mathematics because I believe it is a subject that sharpens the brain's ability to think critically and think outside the box." (Informant 1, March 4, 2024).

"……. Mathematics at school is good and fun because the teacher explains the material in various ways, allowing us to understand it more easily. For example, this may include using visuals, pictures, or videos. Then, when I was confused about a math problem, I asked the teacher, and the teacher was able to explain it in very detail. Even though the teacher only explains the method and the formula, it sharpens us to calculate carefully. When my friends needed help, they also stretched out their hands to help me count." (Informant 1, March 4, 2024).

"Yes, I like it. Because I think mathematics is interesting. It's a bit curious to try to solve it." (Informant 2, March 6, 2024).

"The math teacher was engaging, but sometimes I struggled to understand the material. I asked the teacher, and the teacher was kind and quickly helped me." (Informant 2, March 6, 2024).

"I'm pretty happy when I study mathematics, because usually if I'm confused while studying at school, I can ask the teacher for help. The teacher will answer and explain how to solve the problem correctly, as well as what the results will be." (Informant 3, March 6, 2024).

"The teacher usually explains how to do the questions, and we are told to do them ourselves. The teacher then checks the results. If we are confused, we can ask a friend, because then the friend can teach us." (Informant 3, March 6, 2024).

"Happy because, as long as we understand what we are studying, mathematics is enjoyable. The important thing is to understand what is being studied. The teacher is fun." (Informant 4, March 5, 2024).

"The teacher is fun, not fierce, so you don't have to worry about math lessons. Some tasks are done in groups." (Informant 4, March 5, 2024).

"Yes, sometimes if you don't understand, you get stressed, sis. However, if we truly understand the material, we can enjoy learning, and it will become easier to do so." (Informant 5, March 5, 2024).

"It's fun to study mathematics, and my friends are also fun. If you don't understand, ask your friends, then ask the teacher too, so I can understand. I like studying mathematics, even though I'm not that smart." (Informant 5, March 5, 2024).

"I enjoy Mathematics because I think they are fun, especially since the TS teachers usually like to give us questions to discuss in groups." (Student 6, March 6, 2024).

"TS teachers like to give us questions for group discussion, or do it ourselves so we are trained to count and solve problems." (Student 6, March 5, 2024).

3.1.4. Teacher Learning Strategies

The curriculum and programs at Tara Salvia Middle School are tailored to meet the students' needs. The aim is to develop their potential in four aspects — physical, cognitive, social, and emotional —optimally and in balance, under the umbrella of spiritual values. The curriculum refers to the National Curriculum, with enrichment from various foreign curricula. Curriculum development is carried out independently by paying attention to depth, breadth, and continuity. In the learning process, teachers adapt their strategies to the material, goals, and the characteristics of the students. The assessment for student learning outcomes is carried out holistically, balancing aspects of knowledge, attitudes, and skills (observation, *February 2024*).

The differentiated learning approach is one of the approaches applied by teachers in the learning process. To implement differentiated learning, teachers need to assess students' initial abilities through diagnostic tests. Based on the test results, students are divided into three study groups: those with high, medium, and low abilities. The following details the teaching strategies of the two mathematics teachers at TS, as obtained through in-depth interviews with the teachers on Friday and Monday, March 1-4, 2024, at Tara Salvia Middle School.

Teacher 1

> *"To design learning, I pay attention to the characteristics of students, so that later, when studying, all students can follow suit."*
>
> *"I pay attention to all students without favoritism. In one class, there are usually students from different religious, ethnic, and cultural backgrounds. Teaching uses different and varied methods to facilitate students' learning characteristics."*
>
> *"Every week, I make a reflective journal or a kind of self-reflection on what good things I did in studying."*
>
> *"I appreciate good children's actions, such as independence, good ethics. This has a huge impact on children so that they feel comfortable in learning."*

Teacher 2

> *"In planning Mathematics, I create diverse content and questions by taking into account the diversity of students' abilities."*
>
> *"……. I always encourage and train students to learn independently in mathematics learning. They work on math problems independently, solve them, and systematically write the steps. If there is an error, then it must be repeated. Children are not allowed to use calculators but must do questions with scribbled paper."*
>
> *"Grade 9 students forget a lot of basic mathematics material, so students are asked to recall material they have not yet mastered by providing group exercises. Especially for grade 9 students who already have a high school target in mind, they usually study diligently and enthusiastically."*
>
> *"In the learning process, I use various methods such as creating visual material with the help of a projector, providing learning videos, and students are always directed to discuss with their friends."*

> *"Every semester, I give projects for students to work on independently. Students are given one topic, for example, numbers with powers and root forms. Each student is given the freedom to determine what project they will create. The final assessment in Mathematics is taken from daily tests, assignments, and projects."*

Differentiated learning is an approach that accommodates students' strengths and learning needs through independent learning strategies. Based on the results of observations – *February 2024*, teachers facilitate students according to their needs, talents, and learning styles. Because each student has different characteristics, they should not be given the same treatment in teaching. In differentiated learning, the diversity of learning includes the diversity of content, processes, and products. The following is an example of a learning design created by a teacher (see Table 3).

Table 3. Examples of mathematical differentiation

Criteria	Low Skills	Average Skills	High Skills
Based on content	The floor of a room in a house is square with a side length of 9 m. The floor will be installed with square ceramic tiles with a side length of 30 cm. How many ceramic tiles are needed for the room?	Mr. Tono bought a square plot of land for IDR 3,125,000.00. If each 1 $m2$ costs IDR 125,000.00, what is the length of the side of the land?	If the integers a and b satisfy $\sqrt{5}-\sqrt{6}\sqrt{5}+\sqrt{6}=a+b\sqrt{30}$, then the value of $a \times b$=…
Based on product	Given that point A (1,2) and point B are 3 units to the left of A and 5 units down from point A, what are the coordinates of point B in the Cartesian coordinate system? Draw the Cartesian coordinates.	Quadrilateral ABCD has point coordinates A (−6, −2), B (2, −2), C(4, 4), and D (−4, 4). Draw a quadrilateral ABCD on the coordinate plane. Then, could you figure out the type of flat shape formed?	Given points P (−6, 5), Q (−6, −4), R (8, 5), and S (xs, ys). To form a square, the possible coordinates of S are.... Then draw a picture.
Critical Questions that invite students to think critically	Are the results of your calculations rational numbers? Explain.	How do you get the results?	is it OK if b is negative? Give a reason.

(Data source: mathematics teacher lesson plan)

Tara Salvia, the school principal, provides space for teachers to be creative in planning and selecting the appropriate teaching methods and strategies for the mathematics materials and the needs of each student. In implementing differentiated learning, teachers can select various learning activities based on content, process, or product. As expressed by the teacher in the following interview excerpt:

"..... In mathematics learning, I use different content according to students' abilities. Usually, students are grouped in 3-4 people, then they work on the worksheets that I have provided." (Informant 1, March 1, 2024).

"I give students assignments to create projects according to their abilities and creativity. Each semester, one project assignment is given." (Informant 2, March 1, 2024).

Teachers also use aspects of product diversity according to students' abilities. For students with low abilities, the teacher asks them to create a flower garden and color it orange to represent the fraction ¼. Students with medium abilities are asked to demonstrate specific fractions with concrete objects, while students with high abilities make number lines.

Based on direct observation of the classroom on *Friday, March 1, 2024*, during the math lesson, a pleasant learning atmosphere was present. Students were actively involved, enthusiastic, and joyful. Students volunteered to do the practice questions given by the teacher in front of the class. Students also volunteered to help their friends who had difficulty solving the questions given by the teacher (see Figure 4).

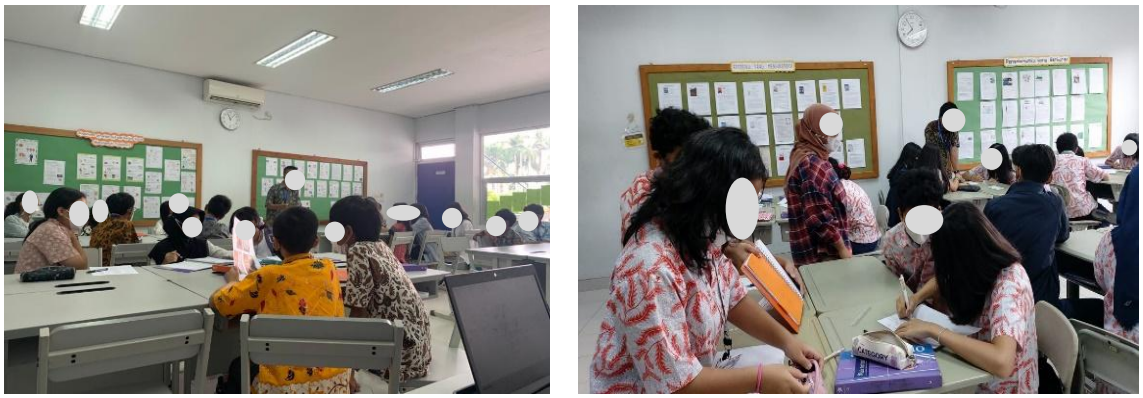


Figure 4. Students' activities in the class

3.1.5. Students' Mathematical Ability

Students' mathematical abilities are assessed comprehensively, including aspects of knowledge, attitudes, and skills. The cognitive aspect is measured through daily tests based on the teaching material and learning achievements. In contrast, the affective and psychomotor aspects are assessed through projects according to the student's level. The assignments given are tailored to the material and learning outcomes. The following are the results of students' mathematics learning (see Figure 5).

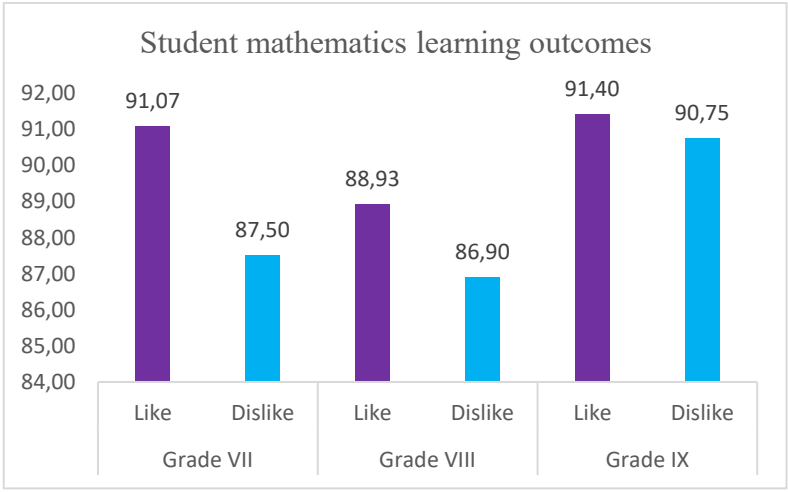


Figure 5. Student mathematics learning outcomes

Figure 5 shows that the learning outcomes of students who like mathematics and those who do not are relatively the same. Assessment of students' mathematical abilities is not limited to tests. Teachers conduct holistic assessments that encompass all aspects of a student's abilities, including cognitive, affective, and psychomotor aspects.

3.1.6. Student Project Results

The tasks given to the students are adjusted to the mathematics material being studied. In the algebra material, students are asked to describe themselves using algebraic forms. Each of them describes in different ways according to their abilities. As shown in the following student's work (see Figure 6).

Translate:

Figure 6. Student self-description using algebraic concepts

The students' work in Figure 6 demonstrates their understanding of the concept of fractions in algebraic form. When students can effectively create problems, they can also solve them. One way for teachers to find out students' abilities in learning is by creating math problems. This is also one way for teachers to assess students' mathematical abilities. Students complete this task individually.

Additionally, the teacher assigns tasks in groups. Because Tara Salvia Middle School employs differentiated learning, the assignments given are adjusted to each student's abilities. The teacher assigns students to create mathematical game media related to the concept of exponents and roots. Students produce various media. The following illustrates some of the results of students' group work (see Figures 7 to 9).

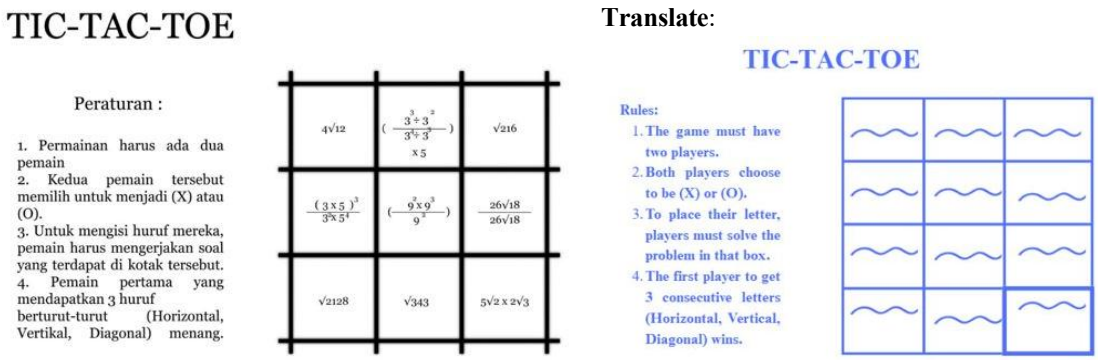
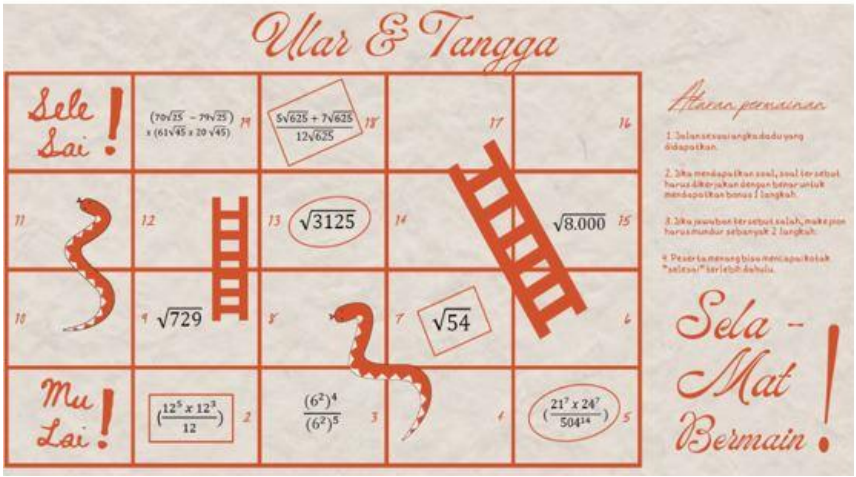


Figure 7. The results of the low group's student work



Translate:

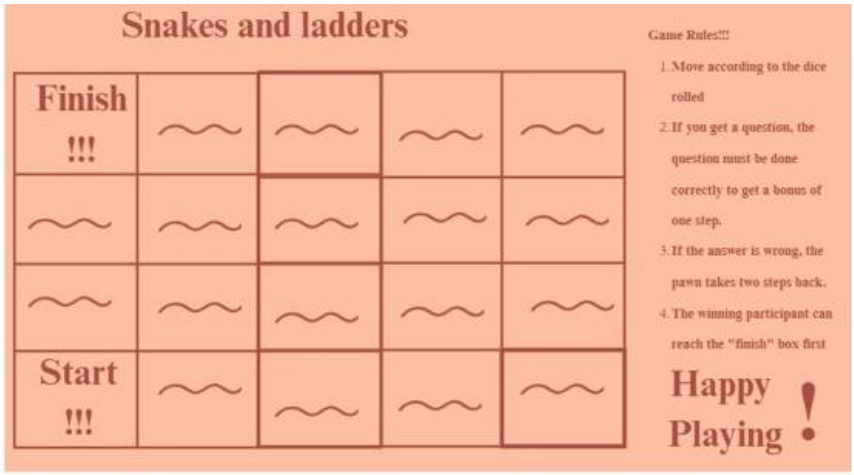


Figure 8. The work of students with moderate abilities

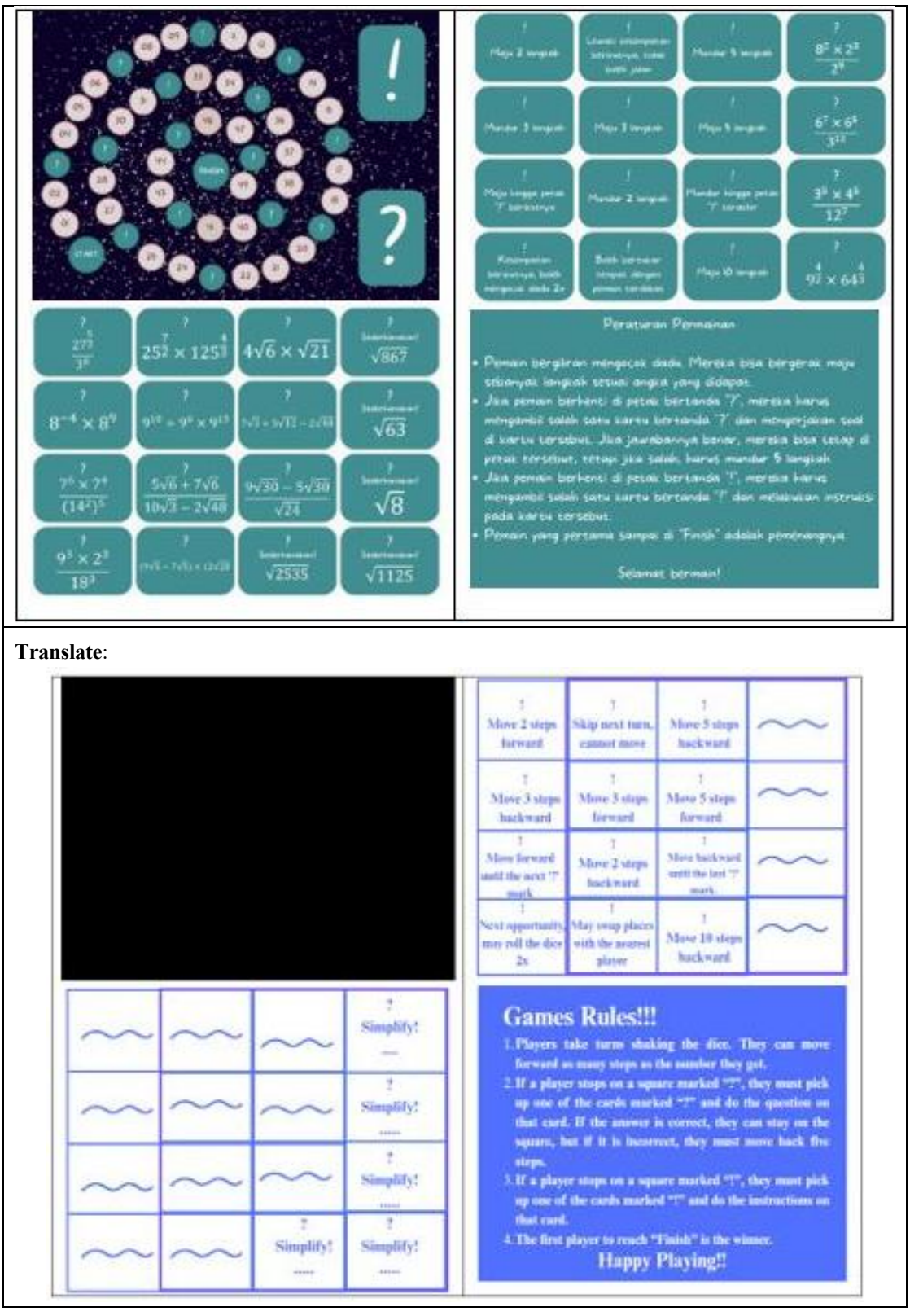


Figure 9. High-ability students' work results

Teachers give students the freedom to be creative according to their abilities in completing assignments. There are differences in students' work in terms of mathematical concepts, completeness, and creativity. Students with low and medium abilities create simpler

work in mathematical concepts, creativity, and game steps. This differs from those with high abilities, who can create examples of diverse mathematical concepts and demonstrate good creativity. However, teachers appreciate the diversity of students' abilities as seen in the assessment of student learning outcomes.

3.1.7. Education Policy at Tara Salvia Middle School

To obtain complete information, the researchers also conducted interviews with the school's student affairs department. He stated, “Since its inception, TS School has upheld a vision that prioritizes character development. Learning is not merely aimed at enhancing knowledge but, more importantly, at fostering attitudes such as honesty, discipline, and adherence to rules.” The school aims to deliver high-quality education while adopting a distinctive approach to understanding students’ backgrounds. “We believe that each student possesses different abilities and needs.” Based on this perspective, the school conducts diagnostic analyses and assessments to identify students’ academic, emotional, and social capacities and requirements. Drawing on the results of these diagnostic assessments, teachers are able to determine appropriate learning programs, including suitable student grouping aligned with their needs. The school also implements a mentoring system in which each student is assigned a mentor who provides guidance and support for both their academic and social development.

Classroom observations indicated that TS School implements differentiated learning, defined as the adaptation of instructional materials based on students’ abilities and the use of diverse learning resources (observation, *March 2024*). In the instructional process, teachers deliver learning materials by selecting appropriate methods aligned with students’ ability levels (low, middle, and high). Furthermore, students are allocated learning time that corresponds to their respective levels of ability. The assessment of students’ competencies focuses on the learning process, learning outcomes, and the products generated by students (teacher interviews and classroom observations, *March 2024*). The vice principal for student affairs also stated that special attention is given to teaching staff to ensure that they carry out their duties professionally. The school provides regular annual training for teachers, including training in leadership skills, strategies for teaching word problems, and the implementation of differentiated instruction. Teachers are also allowed to discuss with the curriculum team to design the materials and to deal with obstacles in the classroom. Good cooperation among fellow teachers is fostered, enabling them to support and help one another in carrying out teaching and learning activities.

TS School integrates technology into the learning process, as evidenced by each student bringing a laptop to access digital learning resources (classroom observation, *March 2024*). In mathematics classes, students utilize software to construct geometric models and complete project-based tasks, such as developing physical models. During each session, students present the progress of their projects (teacher interview). At the end of the semester, students present their learning outcomes and reflections at the Student-Led Conference (SLC), providing parents with an opportunity to see their child's progress. Students are allowed to practice exploring concepts and principles to solve mathematical problems. The goal is for them to develop creativity and practical skills through projects such as making science mock-

ups. Then, the "Market Day" event is a means of developing students' entrepreneurial skills. They are allowed to design and implement sales strategies that range from cost planning and profit analysis to packaging design, production processes, and marketing techniques. Students sell their products to juniors to practice fundamental business concepts.

3.2. Discussion

This study explores the experiences of Tara Salvia junior high school students in learning mathematics. The findings indicate that the implementation of differentiated learning in mathematics enhances the enjoyment of the learning process and promotes students' active engagement in learning. This approach can meet the diverse needs of students, is more adaptive, and inclusive in the school environment (DiLeo, 2024; Hayati et al., 2024; Hidayat et al., 2023; Insorio, 2024; Muksalmina et al., 2024; Santrock, 2008). The key to the success of the school lies in the integration of three important elements as the foundation of the learning process. The first foundation is a competent educator with knowledge and skills in mathematics pedagogy. A skilled educator can choose the right learning approach to accommodate the students' needs. School leaders have a concern for the quality of human resources among educators, who are continually considered and improved through regular, continuous, and sustainable training. Based on interviews with teachers, it is evident that they attend workshops on mathematics learning annually, and the training has a significant impact on the development of their enthusiasm and teaching skills. This is reinforced by the results of interviews with students, who admit that mathematics teachers can design, choose the right method, and create an interesting and easy learning process in which students are actively involved. This can happen because teachers have a strong command of pedagogy and understand the unique needs of each student in Mathematics. At the beginning of each academic year, mathematics teachers administer a diagnostic test to map students' mathematical abilities in order to determine their level of readiness for participating in mathematics learning. The results are presented in Figure 3. Based on these findings, teachers are able to select appropriate instructional approaches in accordance with students' abilities and learning styles.

The second foundation is a conducive school environment, as shown in Figures 2 and 4. A conducive environment is characterized by neat and clean classrooms and the school environment with a calm and quiet atmosphere. This atmosphere fosters an environment that supports reading, thinking, and learning. This school offers comprehensive facilities and infrastructure, including digital learning, chess, card games, dominoes, sports, and a canteen. The modern and comprehensive learning environment at Tara Salvia School provides a sense of comfort, safety, and fun for students to thrive in this educational setting. The third foundation is a good collaboration and communication among parents, teachers, and the school. Teachers always report the development of each student with parents. Meanwhile, the teachers and the school receive a positive support from the parents. This good cooperation positively affects students and the relationship between teachers, the school, and the parents. Thus, the educational process can run smoothly.

The results of this study indicate that the success of mathematics learning practices in TS schools is due to a strong pedagogical foundation, specifically professional educators who

possess a good knowledge and understanding of pedagogy. Dewey (1945, 1986), a prominent figure in modern education, stated that an effective and optimal learning process is carried out based on experience and tailored to the needs of each student.

The differentiated learning approach has been introduced in Indonesia, such as at SMP Tara Salvia, where it is applied in mathematics learning to create an inclusive and adaptive learning environment. The conceptual basis of this approach is rooted in Dewey's educational concept, which emphasizes that effective and optimal education is a learning process that gives individuals the freedom to explore, create, and actively participate in learning according to the needs of each student. He invites and encourages educators to create project-based learning, learning processes through direct practice and experimentation, and inclusive group collaboration-learning with a flexible curriculum. Subjects are taught in a context relevant to students' experiences and practical. In other words, effective education requires relevance to students' experiences, needs, and interests. In this approach, the teacher acts as a facilitator, helping students explore and discover knowledge (Beard, 2018; Luo, 2024; Mutrofin, 2022; Placides & Costa, 2021).

Dewey (1986) emphasized that learning must be rooted in the experiences and real-life situations of students. This encourages them to be actively involved with their learning environment because their interests, understanding, and knowledge could grow rapidly (Luo, 2024; Mutrofin, 2022; Placides & Costa, 2021). Teachers' competence in selecting, utilizing, and implementing appropriate instructional approaches in accordance with the varying levels of students' abilities and individual needs (Fouze & Amit, 2018; Supriyadi et al., 2024; Verner et al., 2019). This can create a meaningful learning atmosphere (Johnston et al., 2023; Molendijk et al., 2025; Silvino de Lima et al., 2022). According to Tomlinson (2001), differentiation places and creates an interesting and enjoyable learning atmosphere because students can feel the subject matter according to their respective level and speed in learning. By grouping students based on ability, adjusting the learning approach based on the interests, needs, and learning styles of students, the differentiated approach can increase motivation and learning outcomes, especially in classes with diverse competency levels.

Differentiated learning involves the adjustment of three key aspects of instruction, namely content, process, and product. These components provide teachers with the flexibility to design instructional materials that accommodate students' needs, interests, abilities, and learning pace, thereby enabling them to achieve optimal learning outcomes (Lidiawati et al., 2024; Siregar et al., 2023). The three forms of differentiation approaches are applied in TS, and the results are presented in Table 3. TS teachers apply content differentiation (see Table 3) by selecting learning materials adjusted to the students' ability levels. The students' ability levels can be known through the student ability mapping test given at the beginning of each school year (see Figure 3). Students with high abilities are given additional, more complex materials, such as algebra problems with multiple variables (see Figures 6 and 9). Meanwhile, students with medium and low abilities are given more basic materials to help them understand basic mathematical concepts (see Figures 7 and 8). The results of interviews with teachers revealed that the content differentiation strategy could provide challenges for more advanced students while ensuring that other students can follow the materials. Students with different abilities require different approaches so that they understand the materials well. By providing

materials according to their ability levels, they can develop optimally. Students with high abilities stated that the additional material made them feel challenged, while students with medium and low abilities felt more confident because the material presented was not too difficult for them.

Process differentiation is implemented through the use of varied teaching methods, such as group discussions, problem/project-based learning, and the use of visual media. During the observation, students were grouped based on their abilities, where each group was given different tasks. Students with high abilities worked collaboratively to solve more complex problems, while those with medium and low abilities were given additional guidance to help them understand the material. The application of the product differentiation model allows students to demonstrate their understanding through diverse forms of assignments that suit their learning styles and levels. In the context of this research, TS students were given the freedom to be creative in producing work according to their abilities. According to the teacher's assessment, this strategy can foster students' self-confidence.

Variations in teaching methods, such as group discussions, use of visual media, and gamification of digital-based learning materials in a differentiated approach, have proven to be effective and optimal. Students with low abilities become confident because the material follows their ability level, while students with high abilities feel challenged by more complex tasks. Thus, the integration of differentiation (content, process) can reduce the gap in student abilities in heterogeneous classes. According to Yessingeldinov et al. (2022), in Kazakhstan schools, a differentiated approach was found to be effective in learning mathematics in heterogeneous classes with diverse student needs. This finding corresponds to the study in Malaysia (Kamarulzaman et al., 2022) and in America (Courtney, 2021; Herner-Patnode & Lee, 2021).

The results of the study on Tara Salvia confirm the findings of previous studies that learning mathematics with a differentiated approach can increase students' learning motivation, increase students' active involvement in the learning process, and improve their learning outcomes (Aisah, 2024; Koimah et al., 2024; Rijal et al., 2025). In addition, differentiated learning can increase students' level of understanding of mathematics concepts, develop logical, critical, and creative thinking skills, and foster students' self-confidence because mathematics is often considered difficult (Santrock, 2008; Tomlinson & Allan, 2000). Besides, it can effectively manage the diverse levels of students in the classroom (Koimah et al., 2024). This approach is applicable in classes with diverse students to meet the needs of students with different ability levels (Aisah, 2024; Koimah et al., 2024; Rijal et al., 2025; Sulistyaningsih, 2024).

This study suggested that differentiated learning is highly relevant to the Indonesian context, which has a highly diverse classroom. This diversity requires an adaptive and flexible teaching approach that can accommodate the needs of each student. The success of this approach requires an inclusive educational environment, so all students feel valued and supported. It fosters a conducive and positive learning atmosphere that encourages collaboration and support from fellow students and parents. Also, schools should provide regular and ongoing professional development programs for teachers to equip them with the skills required to improve students' mathematical literacy. Furthermore, the learning process

should be centered on a small number of students. The challenges faced include the limited number of professional teachers, and securing policy support is often a difficult task. The implications of this study for mathematics learning practices in schools are that the professional skills of teachers with positive support from school leaders and parents are the primary keys to creating a fun mathematics learning process (de Proença et al., 2022; Insorio, 2024; Rajak & Dey, 2025; Rina & Hasanah, 2024; Santrock, 2008).

4. CONCLUSION

This study revealed that mathematics is not always a subject that students dislike, find uninteresting, or find confusing. Teachers should create enjoyable learning experiences by presenting subject matter in a contextually relevant manner, tailored to the level of ability and individual needs of students, within the context of their life experiences. This requires teacher skills in choosing effective strategies, methods, or approaches in teaching, such as integrating technology into gamified mathematics learning. This study shows that students at Tara Salvia find mathematics interesting because it encourages and trains them to think critically, logically, and systematically. Mathematics is also fun because teachers use the right approach in the learning process. They involve students in actively participating in their learning. Positive responses and results become stronger because they are highly supported by a good learning environment, characterized by a moderate student-to-teacher ratio and a good relationship between the school and the parents. The integration of the three important elements as the foundation of education is the primary key to the success of mathematics learning practices at Tara Salvia.

From the perspective of mathematics education, this study contributes to the development of mathematics education and science teaching at both theoretical and practical levels. Apart from the findings presented in the previous section, this study has methodological limitations, as it only involves students from a single school. Therefore, the findings of this study cannot be generalized to all schools regarding mathematics learning. To complement the results, future research should involve students from other schools to obtain broader and more holistic information regarding mathematics learning practices, which can be used as important input for the government to formulate effective mathematics education policies in Indonesia.

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Author Contribution : MF: Conceptualization, Formal analysis, Methodology, Visualization, and Writing - original draft; AAS: Conceptualization, Formal analysis, Methodology, Writing - original draft, Writing - review & editing; MFNLbA: Supervision, and Validation.

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