

Research Article

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Difficulties in Learning Mathematics: Qualitative Studies Using NVivo 15

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Abstract

Background/purpose. The purposes of this study are to find out the difficulties experienced by Elementary students in learning mathematics, as well as students' and teachers' efforts to overcome those problems.

Materials/methods. This research uses a qualitative approach with a case study method. The data are collected using observation, interviews, focus group discussions, and documentation. The analysis used the Miles and Huberman model, assisted by NVivo 15 software. The informants are 170 people, consisting of students, teachers, parents, and experts.

Results. The results of the study reveal: 1) students' difficulties experienced in learning mathematics are caused by both external and internal factors. The external factors include: conventional teaching, online learning, mobile phones, and teaching materials that are considered difficult. Internal factors include fear of learning math, boredom, anxiety, carelessness, difficulty, inattention, mental block, not understanding, passivity, laziness, lack of focus, low concentration, low problem-solving, lack of confidence, and lack of enthusiasm. 2) The efforts taken by both students and teachers to solve those problems are to do enjoyable activities such as drawing, singing, storytelling, using technology, taking a break, playing games, drilling, rewarding, ice breaking, and watching (TV, videos, YouTube).

Conclusion. The difficulties experienced by students in learning mathematics can be overcome in various ways, such as the preparation of varied media, the use of technology, and addressing the individual needs of students.

1. Introduction

Mathematics is one of the disciplines that is useful in daily life. Almost all human needs are related to mathematics. This ability is a literacy skill that positively impacts a person's life. It will be difficult for a person to develop their potential if their mathematical skills are minimal. Basic mathematical abilities, such as arithmetic, multiplication, and division, form the foundation for understanding more complex mathematical concepts. If students in elementary school do not understand the basics, it is difficult for them to grasp higher concepts at the junior high school, and senior high school levels. The sustainability of this material must be appreciated by students so that the mathematics learning process can run smoothly at every level of education they encounter. The long-term impact of the foundation of mathematics is an indicator of the quality of the education system in Indonesia. Mathematical skills not only support general academic abilities but can also impact the development of critical thinking, creativity, problem-solving skills, and the ability to face challenges in the 21st century.

The results of the mathematics ability of Indonesian students show low numbers. The 2022 PISA report indicated a decrease from 379 points in 2018 to 366 points in 2022. This is the lowest number ever had since 2006. Only 18% of Indonesian students achieve Level 2 proficiency, significantly below the OECD average of 69% (OECD, 2023). Indonesian students cannot yet interpret or recognize something without direct instruction. They have difficulty mathematically representing simple situations, such as comparing distances and converting prices to different currencies. The description of the score can be seen in the following image:

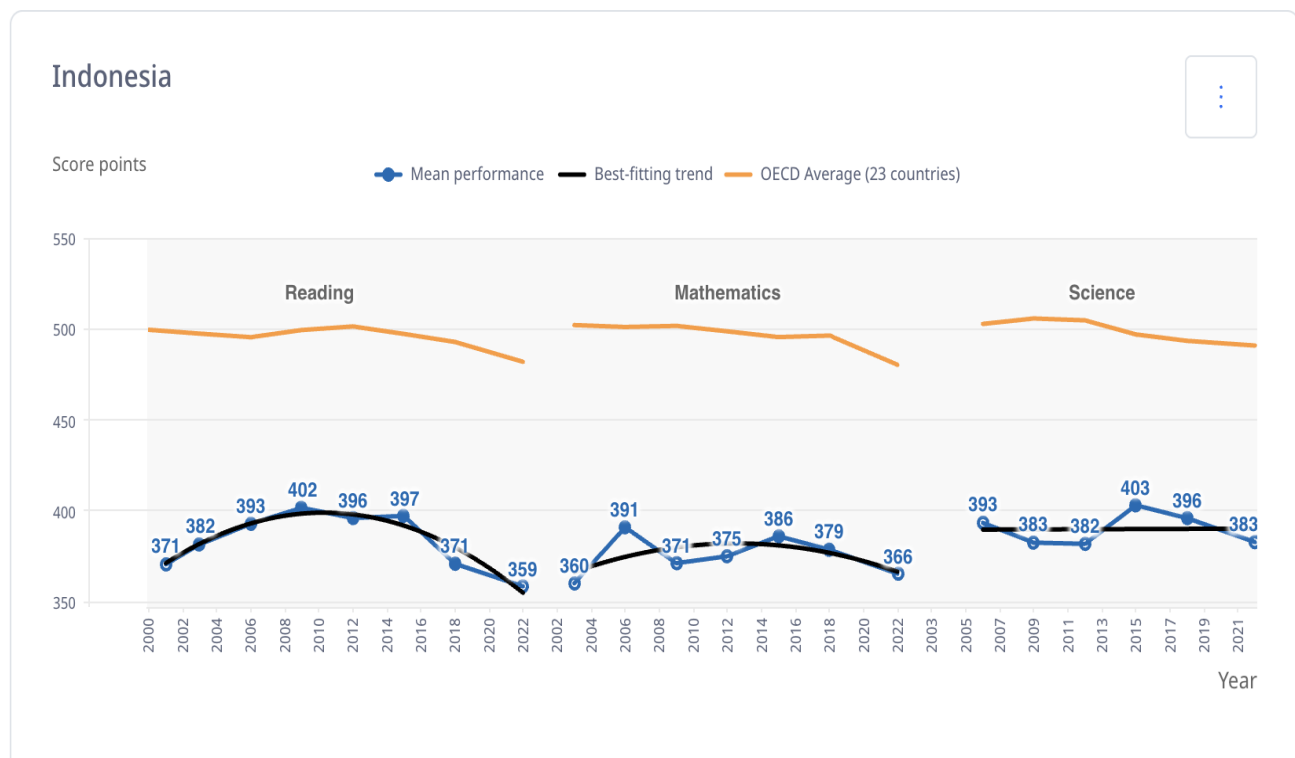


Figure 1. PISA 2022

The data submitted by PISA certainly does not stand alone. The low number of Indonesian students is due to many factors. The results of existing research illustrate how mathematics learning has shortcomings here and there. The 2022 PISA assessment phase results from learning experiences during the COVID-19 pandemic, which incidentally took place online. The use of WhatsApp applications, which involves sending photos of lesson materials and questions, hinders students' understanding of mathematics. They cannot ask questions or communicate with parents who also do not know what the question means. Although some of them employ Zoom Meetings and YouTube,

they encounter signal difficulties and limited internet quotas. This affects the quality of students' mathematics learning system (Hamdani & Priatna, 2023; Yusri et al., 2023).

Mathematics learning has limitations in the modules used. Even if there is, the modules are conventional, uninteresting, and monotonous. Research at Kudus developed the Gusjigang module for students with dyscalculia who struggle to understand mathematics. Media procurement is also intended for children with special needs who require additional support (Nelson et al., 2022; Purwaningrum et al., 2023). The research provides solutions for children with special needs. What about general children who also have difficulty in understanding mathematics? Therefore, this research is needed to fill this gap, specifically by identifying and analyzing mathematics learning difficulties of elementary school students and finding out solutions implemented by students and teachers.

The findings of this study are expected to make a practical contribution to the development of mathematics learning in elementary schools. From an academic perspective, this research can also enrich the literature review on the conditions of mathematics learning and the difficulties experienced by students and serve as a basis for teachers to develop more creative methods and media within the Indonesian context. Therefore, this research is guided by two research problems, namely: 1) what difficulties do elementary school students experience in learning mathematics? 2) What do students and teachers make efforts to overcome those difficulties?

2. Literature Review

2.1. Scope of Mathematics

Mathematical skills encompass specific domains of quantitative skills, including numeracy, number fact knowledge, counting, and calculation abilities (Lievore et al., 2025). The study also encompasses arithmetic competence and several aspects classified into cognitive, affective, problem-solving, abstract thinking, and spatial representation skills (Kholid & Aisyah, 2025). Mathematics is the ability of students to formulate, understand, implement, and interpret various mathematical concepts in relevant contexts of daily life. These capabilities consist of three elements, namely (1) context, (2) content, and (3) process. The context depends on the specific problem setting in personal, occupational, societal, and scientific contexts. At the same time, content refers to the knowledge of mathematical concepts that students need to solve problems. Meanwhile, the process refers to three categories, namely (1) formulating the situation mathematically, (2) using concepts, facts, procedures, and mathematical reasoning, and (3) interpreting, applying, and evaluating mathematical results. Mathematical concepts encompass how students understand quantity, space, shape, change, relationships, reasoning, communication, presentation, problem-solving, making connections, reflection, and communicating answers (Srikoon et al., 2024). This ability is needed in daily life by humans. The importance of mathematics is often referred to as the "bridge of knowledge," which must be facilitated by mathematics teachers (Chihodzi et al., 2023; Kulkarni, 2025).

In mathematics, there are five forms of communication, including: (1) ordinary language refers to everyday language styles; (2) verbal language is a term or language used both in writing and orally related to mathematics; (3) mathematical symbols, which are visual representations to help the audience read clearly, (4) unspoken that is not spoken but can be understood without words, and (5) quasi-mathematical language that can be understood in a specific context but not to be disseminated. Each of these forms has a description. Mathematical symbols, for example, have sub-sections such as symbols, equations, and notations that are useful for representing concepts and ideas. This section includes algebra, calculus, geometry, and statistics. This mathematical symbol became a universal language in mathematical theory (Dintarini et al., 2024; Maarif, 2024; Thinwiangthong et al., 2024).

2.2. Mathematics Learning Processes

Mathematics learning pays attention to the level of readiness and development of students in learning. According to Piaget, children's development in elementary school is in a concrete operational period (7-11 years). The characteristics of students at this age include having begun to think logically, but they are still limited. Children are already able to understand conservation, classification, series, and reversibility. Even though they have not thought abstractly, students can be taught mathematical concepts such as addition, multiplication, and division in simple terms (Asrifan et al., 2025). Students can build their knowledge with the learning facilities provided by the environment. Mathematics learning ability will continue to develop with age and development. Although there is a developmental stage formula, not all children can have the same mathematical skills at the same age. Therefore, it is necessary to conduct an initial assessment to ensure the initial position and condition of students (Wu et al., 2025).

The process of learning mathematics in elementary school also pays attention to learning steps, starting from the simplest material to the most difficult for students to understand. Teachers' efforts are also carried out repeatedly to strengthen their memory. Strengthening is carried out by taking children to activities that are close or that are carried out daily by children. These activities are more meaningful as launched by the current Indonesian government with a deep learning approach. An in-depth study of one theory is needed to help students expand their knowledge. It is also important to provide activities that lead to problem-solving by using interesting props, pictures, or media. The role of teachers in mathematics learning is as a guide or facilitator. Not only is the material presenter, but also the function is broader, creating a comfortable, fun, and non-scary learning atmosphere. Teachers can assist gradually and evaluate activities periodically, both in formative and summative assessments (Kumar, 2024; Wolterinck et al., 2024; Zhang et al., 2024).

2.3. Mathematics Learning Difficulties

Difficulties in learning mathematics are caused by many factors, including the quality of a teacher's ability to teach, the condition of students, and classroom management (Asp et al., 2025). Studies conducted by Asp show that these three factors, if managed properly, will result in the achievement of maximum students' mathematics learning outcomes, and their confidence will emerge by itself. Teachers must know the child's cultural background, family background, and economic status. Multicultural factors must also be included in the preparation of lesson plans and classroom management. If teachers do not understand students' attitudes and behaviors, it could be a trigger for stress in teaching. On the other hand, students also experience stress when teachers provide learning methods that students do not like. Alemany's study said that gender also affects students' learning conditions. Boys and girls have different learning attitudes, so teachers also have to adapt to their gender (Alemany-Arrebola et al., 2025).

Other research explains that difficulties in learning mathematics are caused by students' cognitive abilities, problem-solving procedures in learning mathematics, and the presence of external factors. The external factors in question are such as classes that are too full, the fear and anxiety experienced by students, students' low understanding of previous mathematical concepts, teachers' low ability to teach, and the limitations of teaching materials that schools have. To overcome this problem, the government should provide more intensive training to teachers to ensure they have financial sufficiency and can increase their knowledge in education. The professional development of teachers has an impact on the provision of quality teaching materials and media (Husna et al., 2024; Mavuso, 2022; Waswa & Al-kassab, 2023). Pedagogic competence can be improved with full awareness of a teacher.

2.4. Learning Supporting Media and Methods

Learning mathematics can begin early, just like learning to read. At the elementary school age, students can grasp concepts easily. Literacy identification in elementary school students can be seen from several aspects, including knowledge, context, and attitude. It is essential to determine whether students are interested in learning mathematics and actively engaged in the learning process. Showing a high curiosity in applying mathematical formulas in and outside the classroom. The teacher also considers the factors of students' learning readiness, ability, and age. This factor is supported by using media and methods suitable for students, particularly in mathematics learning (Setyo Utaminingsih & Purwati, 2024; Susiani et al., 2022).

Experts have widely researched learning methods and media for mathematics. Realistic Mathematics Education (RME), for instance, has been effectively utilized to enhance the learning outcomes of mathematics students in elementary school (Fauzan et al., 2024; Sutarni et al., 2024). The LEPscO framework for driving teachers in Indonesia has also yielded maximum results (Gustiningsi et al., 2024). Artificial Intelligence (AI) in mathematics learning in elementary schools is also rampant today (Li, 2024). Schools in various countries have adopted tools such as Ernie Bot and ChatGPT. It is not surprising that the sophistication of technology in learning has given rise to a new paradigm in mathematics education.

Technology can provide convenience in compiling materials, facilitating learning, and helping students understand mathematical concepts. Distance learning also offers diverse workspaces with various models, directly and indirectly (Han et al., 2024; Sun, 2016). Learning becomes more flexible and has an extensive reach. Classrooms are not limited to walls but can also extend into remote areas. Although there are many pros and cons to using this technology, the fact remains that technology continues to develop at an increasingly rapid pace.

The preparation of good learning methods and media is inseparable from the readiness and skills of teachers in organizing them. Before teachers begin teaching, they typically receive education in teaching preparation, training, and career development (López-Serentill, 2024). Teachers are also prepared to manage the classroom, both physically and psychologically, by demonstrating a sense of care for students and being confident, friendly, and attentive to their needs (Fernández-César et al., 2024). The controversy surrounding teachers' mathematics teaching is significant, as it ensures the learning process runs smoothly. By understanding students' difficulties in learning mathematics, teachers can determine the necessary steps for each of these problems.

3. Methodology

This research employed a qualitative approach, utilizing case studies to investigate the topic. This method can be used to study literacy, one aspect of which is mathematics in elementary schools (Hidayat et al., 2025). This approach was adopted because the difficulties in learning mathematics in elementary school were examined as a case study. The research was participated by 170 informants, consisting of 70 elementary school students, 27 teachers, 70 parents, and 3 experts from campus academics and practitioners in the field of mathematics:

Table 1. Number of Informants

No	Participants	Total
1	Student	70
2	Teacher	27
3	Parent	70
4	Expert	3
	Total	170

Data collection techniques included direct observation, in-depth interviews, documentation, and focus group discussions. Observation was carried out in the classroom while students were learning mathematics. During the study, photos and videos were collected for analysis. In-depth interviews were conducted in person with students. Meanwhile, both teachers and parents were interviewed by using Google Forms, and the experts were invited to participate in focus group discussions.

The data analysis employed the Miles and Huberman model (Miles et al., 2014), covering the steps of data reduction, data presentation, conclusion, and data verification. This process is assisted by NVivo 15 software (Release 15.1.3).

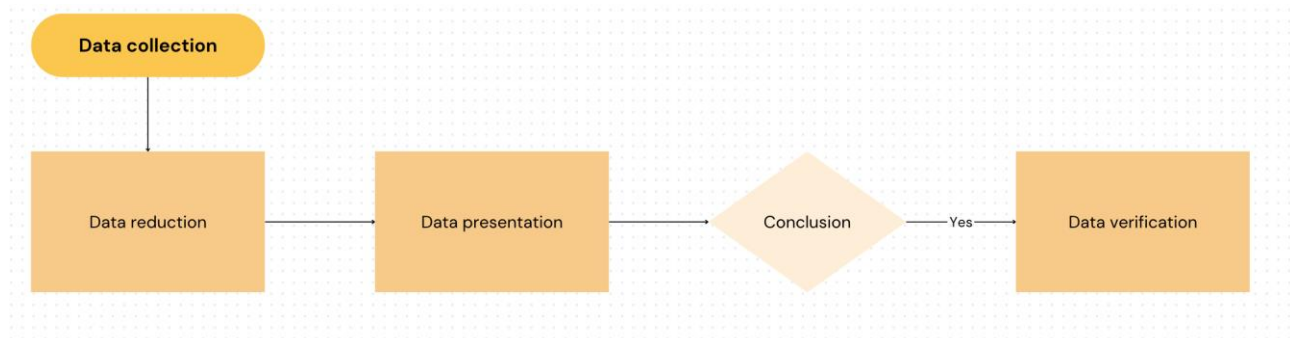


Figure 2. Miles and Huberman Model

The data obtained from the informant are described inductively, starting from small units and progressing to conclusions (Creswell & Creswell, 2023). Qualitative data analysis was conducted by grouping transcripts of observation notes, interviews, focus group discussions, and documentation into separate folders. This process was called data condensation. The folder was inserted into the NVivo 15 system by creating a new project and importing all the data into the 'Organize' menu. The coding process began with the data and provided cases for all data. The study also examined the relationship between internal and external factors contributing to mathematics difficulties among elementary school students. This relationship enabled interconnectedness between two factors. The analysis step was completed by visualizing the results through the 'Hierarchy Chart' menu. The display was a 'Treemap', where words were compared by the number of coding references (Sunburst). The next view was in the form of a mind map consisting of a 'Child' and a 'Sibling'. On the 'Explore' menu, the Word Frequency includes a 'Summary' and 'Word Cloud' in the 'Run Query'. After this stage the relationship could be seen as the end of the visualization. After the data was displayed, the researcher made conclusion before the data were verified. The data were analysed in triangulation by NVivo 15 as shown in the following steps:

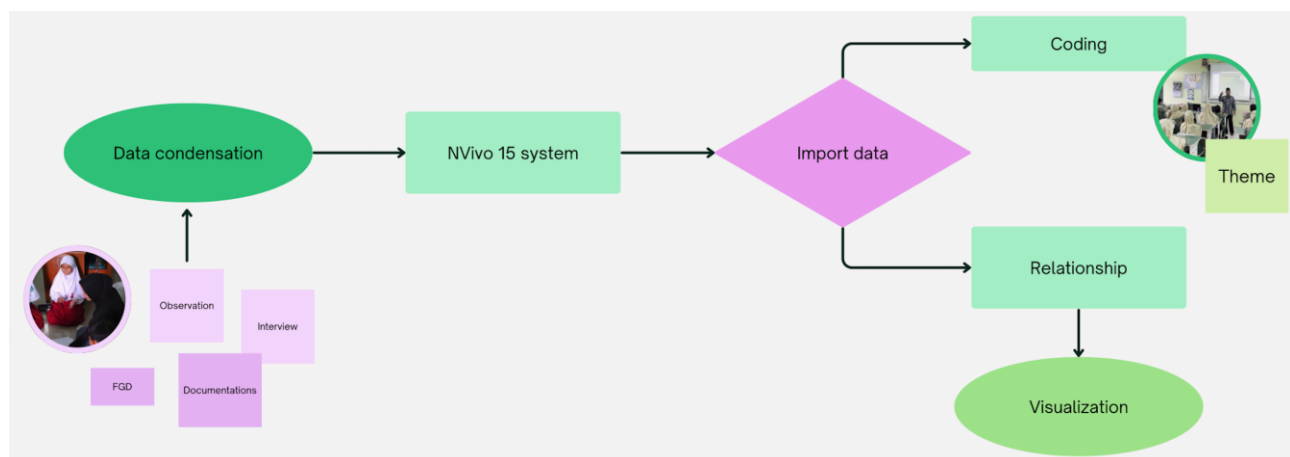


Figure 3. Analysis Steps with NVivo 15

Before conducting the research, permission was asked from the school to conduct an in-depth interview with the students during the break. All the informants were informed that the data were used for the research purpose only and would be kept confidential and not disseminated in detail, including the informant's name. Names of the informants were presented by using codes or initials. A research ethics form was submitted to the head of the research institution at the university for the legality of the implementation of safe and humanistic research. The ethical exemption number was 10.114.C/KEPK-FKMUMJ/V/2024.

4. Results

The results of this study are reported qualitatively. The keywords of mathematics learning difficulties among the students were analyzed in the data source system as follows:

Table 2. Data Sources

No	Data form	Source
1	FGD	Note
2	Documentation	Photos/Videos
3	Interview	Note
4	Observation	Note

From Table 2 above, it was clear that the data of this study were from FGD, documentation, interviews, and observations. The analyzed data through the NVivo 15 system were as follows:

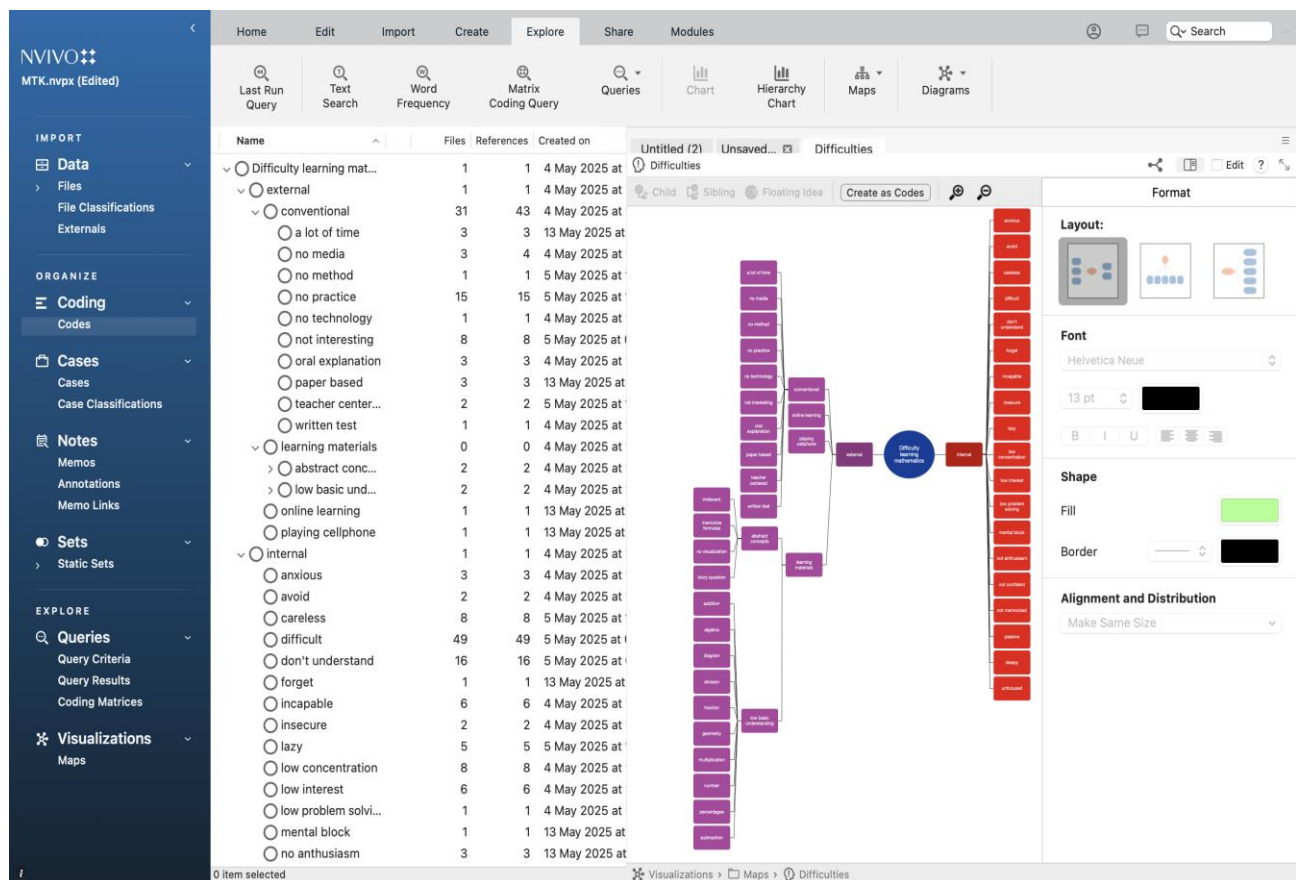


Figure 4. Data View in NVivo 15

To find out the most frequently appearing words the process when to 'Run Query' (Summary) as presented on Table 3 below:

The words displayed in 'Word Cloud' were varied in size, showing that frequently occurring words were in larger fonts. For example, the word "difficult" appears to be the largest in the picture, meaning that the students in learning mathematics often experience this word. After this, the visualization in the form of a 'Hierarchy Chart' (Treemap) was displayed in two parts, namely difficulties in learning mathematics and the solutions. The following Figure 5 displays 'Treemap':

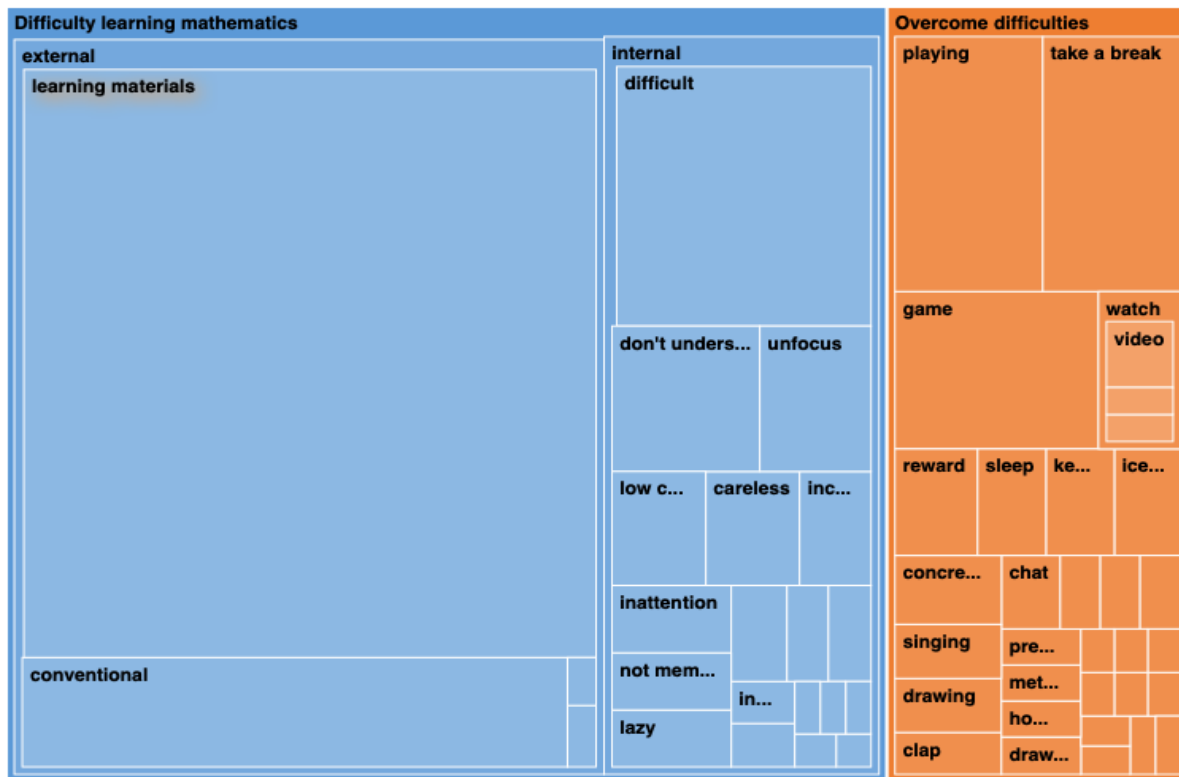


Figure 6. Hierarchy Chart (Treemap)

The chart was divided into blue and orange, in which the blue part described students' difficulties in learning mathematics due to external and internal factors, and the orange part displayed the efforts in overcoming difficulties. This illustration is summarized in the following 'Sunburst' feature:

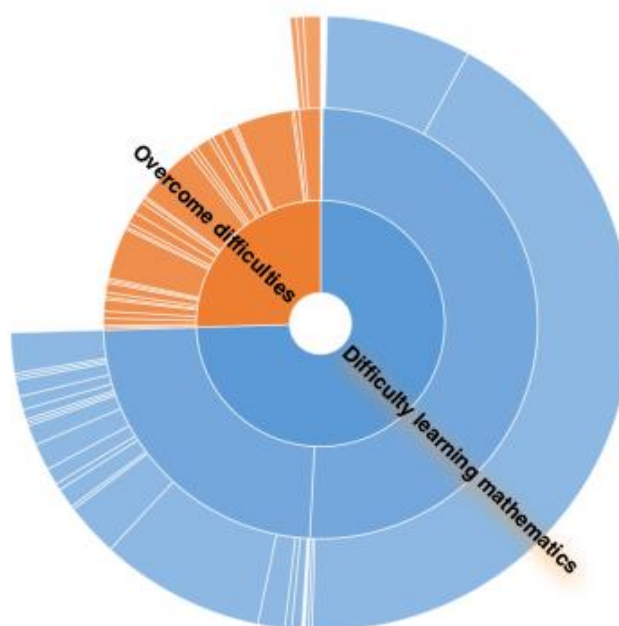


Figure 7. Hierarchy Chart (Sunburst)

4.1. Students' Math Difficulties

It was found from the analysis data that students' difficulties in learning mathematics were due to external and internal factors, as mapped in the following Figure 8:

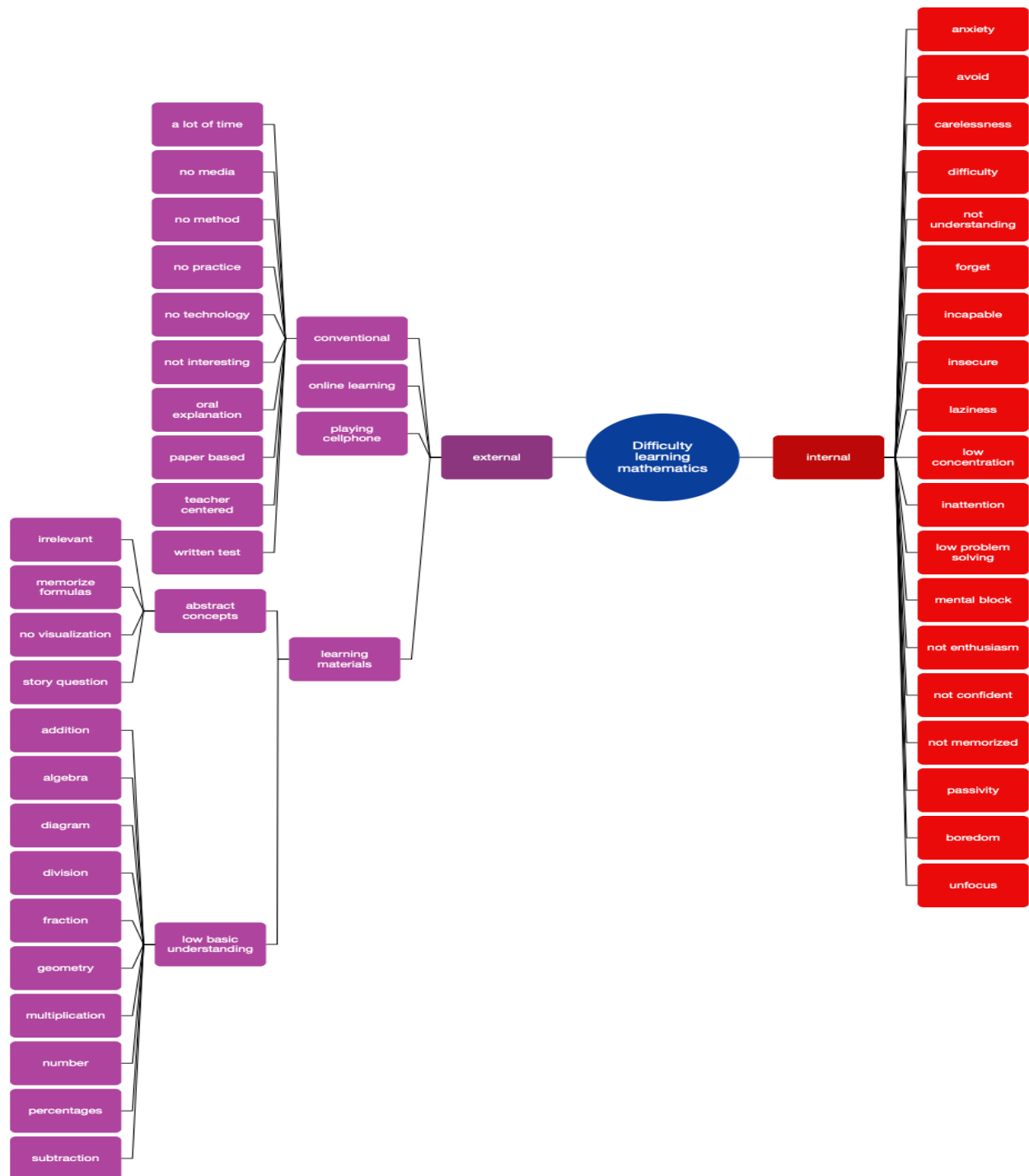


Figure 8. Mind Map: Difficulties in Learning Mathematics

The external factors included conventional teaching, online learning, mobile phone use, and difficult learning materials. In conventional teaching, the teaching process was teacher-centered, did not use media, not interesting, paper-based, limited practice, the absence use of technology, and the method applied by the teacher was not effective, hence it took a long time for the students to understand the learning concepts because they were taught not using real objects. The learning process was predominantly memorizing formulas, and there were no clear visualizations or study cases. The materials considered difficult by the students were addition, algebra, diagrams, division,

fractions, geometry, multiplication, numbers, percentages, and subtraction. Difficulties in learning mathematics from internal factors of students were found, such as feeling anxious, avoiding, being careless, finding it difficult to understand, finding it easy to forget, feeling incapable, feeling insecure, feeling lazy, having low concentration, inattention, low problem-solving, having a mental block, not being enthusiastic, not being confident, being passive, being bored, and being unfocused. These external and internal factors were found simultaneously in learning. The two had a relationship that affected one another.

4.2. How to Overcome Difficulties in Learning Mathematics

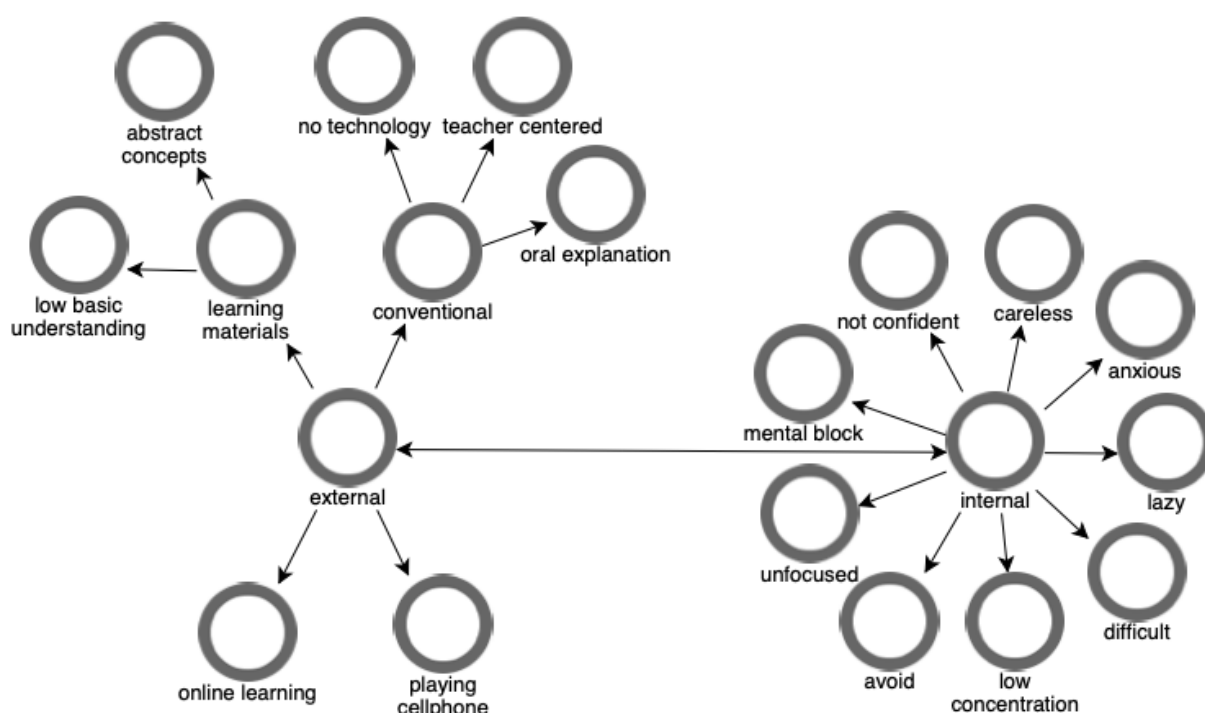
Although students experienced difficulties in learning mathematics, they made efforts to overcome these problems, as seen in the following figure:



Figure 9. Mind Map: Students' Efforts to Solve Difficulties in Learning Mathematics

The efforts did by teachers and students to cope with problems in learning mathematics were such as changing materials, clapping, demonstrating, drawing, evaluating, going home, ice breaking, using LMS, motivating, pressing the pen, giving rewards, singing, still studying, taking a break, walking around, chatting, using concrete objects, drawing attention, entertaining, gaming, doing homework, keep going, watching (TV, YouTube, video), playing, drilling, staying silence, sleeping, storytelling, utilizing technology, and using creative method. As teachers and students said, these efforts were successful in decreasing problems experienced by students in learning mathematics.

Both external and internal factors were correlated one another as seen in the following figure:

**Figure 10.** The Connection between External and Internal Factors

External factors affected the internal aspects of the student and vice versa. If students learn conventionally, which is not interesting, it can result in a mental block or not focusing on learning. Likewise, if students feel unconfident in learning mathematics, the learning material is challenging to understand, particularly in the abstract and complex areas. The teachers used these two factors to pay attention to the learning environment and the mood of students so that the learning process will be more meaningful.

5. Discussion

The grouping of factors causing students' mathematics learning difficulties was simplified into two: external and internal.

5.1. Students' Difficulties in Learning Mathematics

5.1.1. External Factors

Based on the study's findings, it was found that a conventional teaching process caused difficulties in learning mathematics. This means that learning applied teacher-centered approach. The material was delivered orally with minimal media. Teachers did not use technology and teaching techniques were less attractive. Learning used package books or paper-based test forms without direct practice. It took a long time to understand the concepts taught by the teacher. This

conventional approach should be improved by innovating and training teachers to master student-centered teaching strategies (Aragón et al., 2024; Janardhanan & Charles, 2024). If this is not done, then learning will not change for the better.

The online learning process also made it difficult for students to learn mathematics (Sugilar et al., 2021). Based on previous research, it was found that online learning, such as Zoom meetings and WhatsApp, raises problems for students. Parents who did not understand the material were unable to help their children during the learning. Besides, internet connection, bad signals and limited quotas became other issues. Even though online learning during the COVID-19 pandemic has decreased, some schools still carry out online and or hybrid learning (Hamdani & Priatna, 2023; Yuberta et al., 2022).

Frequent use of mobile phones also affected students' focus in learning math. The findings of this study showed that the students were more interested in using their mobile phones than studying. They spent time playing games or watching videos aired by the media. The negative influence of excessive mobile phone use was obtained. Students had difficulty controlling themselves and had low learning achievement in class. Therefore, they suggested decreasing the use of mobile phones to become more focused on learning (Chen et al., 2025; Ma et al., 2023).

Another external factor was math learning materials, which were considered challenging because the concepts were abstract and not concrete. Abstract concepts were irrelevant to daily life; there was much memorizing formulas, no clear visualization, and study cases. Basic knowledge of materials such as addition, algebra, diagrams, division, fractions, geometry, multiplication, numbers, percentages, and subtraction was a material that students considered difficult (Karagiannakis et al., 2024). Of all the materials mentioned, the division was said to be the most difficult one. According to Kholid & Aisyah (2025), teachers should classify the materials ranging from the simplest to the most complex ones.

5.1.2. Internal Factors

The results of this study found that the internal factors that caused difficulties in learning mathematics were anxiety, avoidance, carelessness, difficulty, not understanding, forgetting, being incapable, insecure, laziness, low concentration, low interest, low problem-solving, mental block, not enthusiasm, not confident, not memorized, passive, sleepy, and unfocused. Difficulties in learning mathematics come from internal factors that affect cognitive and emotional development. How do they think about math, solve problems mathematically, and perceive math lessons themselves? Often, students find math lessons difficult and have a negative perception of them before trying them (Aruvee & Vintere, 2023; Lima et al., 2019). These cognitive and emotional aspects also affect the success of student learning in the long term. The difficulties in learning mathematics that students often experience in elementary school continue into higher education. This is unfortunate, even though mathematics is the basis of all existing sciences.

Emotional levels such as anxiety, tension, and discomfort affect students' performance in learning. These factors are also influenced by students' lack of math knowledge, learning strategies, application of mathematics in real life, limited exam time, personality type, lack of confidence, and stereotypes related to mathematics. Specifically, the difficulty of learning mathematics is termed dyscalculia and dyspraxia (Vintere, 2021). The learning environment, which teachers and parents facilitate, also affects students' learning difficulties. Often, teachers do not know that their students have dyscalculia due to a lack of knowledge and teacher training about the science.

5.2. Efforts to Overcome Difficulties in Learning Mathematics

Behind the difficulties of learning mathematics discussed earlier, students, teachers, and parents had strategies to overcome these difficulties. Some of the efforts made were changing materials,

clapping, demonstrating, drawing, evaluating, going home, ice breaking, using LMS, motivating, pressing the pen, rewarding, singing, still studying, taking a break, walking around, chatting, using concrete objects, drawing attention, entertaining, using game, doing homework, keep going, watching (TV, YouTube, video), playing, drilling, staying silence, sleeping, storytelling, utilizing technology, and applying creative method. Interestingly, some of the students were also squeezing their pens when they were stressed about math. According to the students, by doing so, they felt better, and they could adjust their focus to be even more stable. Some students like clapping hands to avoid tension while studying. drawing funny things, singing, and playing.

Based on the results of previous research, several ideas were found to make the mathematics learning process more interesting, including creating an attractive LMS (Desai et al., 2022), more interactive learning modules (Lestari et al., 2021; Purwaningrum et al., 2023), gamification (Atin et al., n.d.), learning using Artificial Intelligence (AI) (Qiu et al., 2022), and conducting more appropriate evaluations or tests (Van den Ham & Heinze, 2022). These efforts are to anticipate learning difficulties from external and internal factors because both are interrelated with each other.

6. Conclusion

The difficulty of learning mathematics is a problem that still exists today. Issues arise from within the students and from outside the students. Both have roles to complete. In this study, difficulties experienced by the students in learning mathematics were varied, due to external and internal factors. In order to deal with these problems, both teachers and students made several efforts to make mathematics enjoyable, including using the latest media and methods, so that they would not be bored with learning.

This research suggests that the use of AI and gamification in learning mathematics should be tried by teachers in order to adapt to the times. Learning the characteristics of students who like art can also be aligned with math skills, such as inviting students to sing math material or play multiplication. It is also essential to provide support from parents and the government, considering that the learning process is not a solo endeavor. This research report is the foundation for teachers or advanced research to develop a more challenging and interesting mathematics learning strategy. A suitable research scheme is the application by creating prototype products that can be tested on a small, medium, and large scale.

7. Limitations and Suggestions

This research has limitations, including qualitative research, which cannot directly solve students' problems. More comprehensive follow-up research is needed because qualitative research only describes the results of observations and interviews. Applying appropriate strategies, media, or methods can solve the problem of difficulty in learning mathematics concretely. The researcher recommends further research with TRL (Technology Readiness Level) equivalent to levels 4-6 to be implemented more in elementary schools. Difficulties are also experienced when interviewing students who are of elementary school age. It takes a trick to make them friendly in answering the interviewer's questions so that the data generated is valid. To overcome this problem, researchers studied the characteristics of elementary school children and provided a comfortable time for them to talk.

Declarations

Author Contributions. W.W.: Literature review, conceptualization, writing, fundraising. R.W.: methodology, data analysis, manuscript preparation. S.A.P.: validation, qualitative guidelines. H.A.: implementers in the field, observation, and interviews. K.P.R: documentation, administration.

Conflicts of Interest. The authors declare no conflict of interest.

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Ethical Approval. This research is supported by ethical approval with the following numbers: 10.114.C/KEPK-FKMUMJ/V/2024.

Data Availability Statement. The data for this research is available from the author of the correspondence. If needed, the author can send the required data. All data is subject to research and writing rules and codes of conduct. The writing process uses Grammarly to check the correctness of the English composition, and NVivo 15 software to analyze qualitative data. The Scopus AI license is only for reading and searching for relevant sources for the literature study.

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