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Mapping Internal and External Factors Behind Students' Mathematics Learning Difficulties: A Qualitative Diagnostic Study at the Lower Secondary Level

Maria Editha Bela
Sekolah Tinggi Keguruan dan Ilmu Pendidikan Citra Bakti

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ABSTRACT:
Background: learning at the lower secondary level often presents persistent challenges for students, particularly when conceptual understanding is weak and learning environments are not supportive. Learning difficulties in mathematics cannot be viewed solely as cognitive problems, but rather as complex phenomena shaped by the interaction of internal learner characteristics and external educational contexts. Understanding these interacting factors is essential for designing instructional practices that respond to students' actual learning needs.
Aims: This study aims to map and analyze the internal and external factors that contribute to students' difficulties in learning mathematics, with a focus on how these factors influence students' engagement, conceptual understanding, and ability to apply basic mathematical operations.
Method: A qualitative descriptive approach was employed. Data were collected through classroom observations, semi-structured interviews with students and teachers, documentation, and diagnostic tests. Thirteen lower secondary students were purposively selected to represent varying levels of learning difficulty. Data analysis followed systematic stages of reduction, display, and interpretation to identify recurring patterns across data sources.
Results: The findings indicate that students' learning difficulties are influenced by internal factors such as low learning motivation, limited mastery of basic mathematical concepts, poor concentration, and reluctance to ask questions. External factors include minimal parental support, unconducive learning environments, and learning habits that prioritize non-academic activities. Diagnostic test results confirmed that these factors are closely associated with students' weak performance in mathematical problem solving.
Conclusion: The study highlights that mathematics learning difficulties emerge from the interaction between personal learning dispositions and environmental conditions rather than from instructional content alone. These findings emphasize the need for instructional strategies that strengthen foundational understanding, foster active student engagement, and create supportive learning environments both at school and at home. Teachers are encouraged to adopt more responsive and contextualized pedagogical approaches, while parents and schools should collaborate to support students' learning routines. By addressing both internal and external dimensions of learning difficulty, mathematics instruction can become more inclusive, effective, and aligned with students' real learning experiences.
Keywords: External factors, learning difficulties, mathematics education, qualitative analysis, student engagement.
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*** Corresponding author:**
Maria Editha Bela, Sekolah Tinggi Keguruan dan Ilmu Pendidikan Citra Bakti
itabella09@gmail.com

INTRODUCTION

Mathematics education at the lower secondary level continues to be a critical foundation for students' cognitive and problem-solving development across disciplines. Despite its central role, mathematics remains one of the subjects most frequently associated with learning difficulties, low engagement, and negative learning experiences among students. These difficulties often manifest not only in poor academic performance but also in students' reluctance to participate actively in classroom activities. Previous studies have emphasized that mathematical understanding requires more than procedural fluency, as it also involves conceptual reasoning and sustained engagement. When students fail to grasp basic mathematical concepts, subsequent learning becomes increasingly fragmented and discouraging. This condition is particularly concerning because early difficulties tend to persist and compound over time if left unaddressed. Consequently, understanding the nature of mathematics learning difficulties is essential for improving instructional effectiveness and student outcomes. Research on learning difficulties therefore remains a relevant and urgent topic within contemporary mathematics education (Bakker et al., 2021; Iwuanyanwu, 2021).

Learning difficulties in mathematics cannot be explained solely by students' intellectual capacity or the complexity of instructional content. A growing body of research highlights that students' learning experiences are shaped by a dynamic interaction between internal factors and external learning environments. Internal factors such as motivation, attention, self-confidence, and prior knowledge strongly influence how students engage with mathematical tasks. At the same time, external conditions including parental support, classroom climate, and learning resources significantly affect students' persistence and achievement. When these factors are misaligned, students may struggle to apply mathematical concepts even after repeated instruction. Studies on student engagement suggest that disengagement often precedes observable learning failure rather than resulting from it. This implies that learning difficulties should be understood as processes rather than isolated outcomes. Therefore, examining mathematics learning difficulties through a multifactorial lens is essential for generating pedagogically meaningful insights (Ahmed Alnaim & Sakız, 2025; Li & Li, 2024).

From an educational perspective, identifying the underlying factors of mathematics learning difficulties offers practical value for teachers, schools, and policymakers. Teachers require empirical evidence to design instructional strategies that respond to students' real learning conditions rather than relying on standardized assumptions. Schools, meanwhile, must recognize how learning environments beyond the classroom influence academic engagement. Research has shown that qualitative approaches are particularly effective in capturing students' lived experiences and learning barriers. Through qualitative inquiry, researchers can explore how students interpret mathematical learning and why certain difficulties persist. Such insights are often overlooked in large-scale quantitative assessments. As a result, qualitative diagnostic studies provide a strong basis for pedagogical reflection and intervention design. This makes the present study both timely and relevant within the broader discourse of mathematics education research (Marks et al., 2021; Rycroft-Smith & Stylianides, 2022).

The rationale of this study is grounded in the need to move beyond surface-level explanations of mathematics learning difficulties. Many existing studies focus primarily on instructional methods or curriculum design without sufficiently examining students' perspectives and contextual

conditions. While innovative pedagogical tools and learning models have been widely explored, their effectiveness varies depending on learners' readiness and learning environments. Research on active learning and personalized instruction suggests that instructional innovation alone cannot address learning difficulties without understanding learner characteristics. Furthermore, studies in mathematics education increasingly emphasize responsiveness to students' cognitive and affective needs. However, there remains limited qualitative evidence that systematically maps both internal and external factors influencing learning difficulties at the lower secondary level. Without such mapping, interventions risk being fragmented or ineffective. Therefore, this study is designed to provide a holistic diagnostic understanding of mathematics learning difficulties. By doing so, it contributes empirical insights that can inform more responsive and inclusive instructional practices (Dignath et al., 2022; Lapidot-Lefler, 2025).

Recent studies in mathematics and education research have increasingly examined learning difficulties through the lenses of engagement, cognition, and instructional context. Vale & Barbosa, (2023) emphasized that active learning strategies can improve mathematical understanding, yet their success depends on students' motivation and classroom dynamics. Abukhousa, (2025) demonstrated that cognitive engagement plays a crucial role in students' mathematical reasoning processes. Olivares, (2024) highlighted that socio-constructivist approaches support problem-solving skills but require strong foundational understanding. Annuš & Kmeť, (2024) argued that personalized learning environments can reduce learning barriers when aligned with students' needs. Zin & Mahmud, (2024) identified environmental and institutional constraints as key challenges in effective mathematics instruction. Prathibha et al., (2024) found that modern pedagogical tools improve learning outcomes only when students are actively engaged. López et al., (2022) showed that school engagement is closely linked to students' emotional and social experiences. Fitrah et al., (2025)further demonstrated that integrated learning models influence cognitive development through engagement mechanisms. N. Zhang et al., (2025) emphasized the importance of responsive teaching in addressing diverse learning needs. Collectively, these studies underscore the importance of examining learning difficulties as multifaceted phenomena shaped by individual and contextual factors

Although previous studies have explored student engagement, instructional strategies, and learning environments, several gaps remain evident. Most existing research focuses on either pedagogical innovation or learner outcomes without systematically connecting them to students' lived learning difficulties. Quantitative approaches dominate the literature, often overlooking students' subjective experiences and contextual realities. Furthermore, studies that address engagement frequently do so in technology-enhanced or higher education contexts, leaving lower secondary mathematics underexplored. There is also limited integration of diagnostic assessments with qualitative inquiry in existing research. As a result, the specific mechanisms through which internal and external factors jointly shape learning difficulties remain insufficiently understood. Few studies provide detailed mapping of these factors within authentic classroom settings. This gap limits the development of targeted instructional interventions. Therefore, a qualitative diagnostic approach is needed to bridge this disconnect and provide context-sensitive insights.

The purpose of this study is to analyze and map the internal and external factors that contribute to students' difficulties in learning mathematics at the lower secondary level. This study seeks to explore how students' motivation, conceptual understanding, and learning habits interact with

environmental and social conditions. It aims to identify recurring patterns of learning difficulty through classroom observation, interviews, and diagnostic assessment. By integrating multiple data sources, the study intends to provide a comprehensive picture of students' learning experiences. The findings are expected to clarify how engagement and foundational understanding influence mathematical performance. This study also aims to inform teachers about critical areas requiring pedagogical attention. Ultimately, the research seeks to support the development of more responsive instructional strategies. Through this purpose, the study contributes to the broader goal of improving mathematics learning outcomes through evidence-based educational practices.

METHOD

Research Design

This study employed a qualitative descriptive research design to explore students' mathematics learning difficulties through an in-depth and context-sensitive approach. A qualitative design was selected because the research sought to understand learning difficulties as experienced and interpreted by students within authentic classroom settings. This approach allows for rich descriptions of behavioral patterns, perceptions, and contextual influences that cannot be adequately captured through quantitative measures alone. Qualitative descriptive research is particularly suitable for educational studies aiming to map learning challenges without imposing predetermined theoretical frameworks. The design emphasizes naturalistic inquiry, enabling the researcher to examine learning processes as they occur in real instructional environments. Data were collected over multiple classroom sessions to ensure consistency and credibility of findings. The use of multiple data sources strengthened the trustworthiness of the study through triangulation. This design aligns with recommendations in qualitative education research that emphasize diagnostic exploration of learning difficulties (Stone et al., 2023).

Participants

The participants in this study consisted of thirteen lower secondary students selected through purposive sampling. This sampling technique was used to ensure that participants represented varying levels of mathematics learning difficulty. Students were identified based on classroom performance, teacher recommendations, and observable learning behaviors. The selection focused on students who demonstrated persistent challenges in understanding basic mathematical concepts. In addition to students, one mathematics teacher was included as an informant to provide instructional and contextual perspectives. The relatively small number of participants allowed for in-depth data collection and analysis. Ethical considerations were addressed by obtaining informed consent and ensuring participant confidentiality. Purposive sampling is widely recognized as appropriate for qualitative educational research focusing on specific learning phenomena (Magnone & Yezierski, 2024; Samuel & Merkebu, 2025).

Instruments

Data were collected using multiple instruments to capture a comprehensive picture of students' learning difficulties. Classroom observations were conducted to document students' engagement, attention, and interaction during mathematics lessons. Semi-structured interviews were used to explore students' perceptions, learning habits, and experiences related to mathematics learning. Interviews with the teacher provided additional insights into instructional practices and classroom

dynamics. A diagnostic mathematics test was administered to assess students' mastery of basic concepts and procedural understanding. Documentation, including students' written work and learning notes, was also analyzed to support data triangulation. The use of multiple instruments enhanced the credibility of the findings by cross-validating data sources. Such methodological triangulation is considered essential in qualitative educational research to ensure depth and rigor (Arias Valencia, 2022; Morgan, 2024).

Data Analysis Plan

Data analysis followed a systematic qualitative analysis procedure consisting of data reduction, data display, and conclusion drawing. First, raw data from observations, interviews, and diagnostic tests were transcribed and organized. Relevant data were then coded and grouped into categories reflecting internal and external factors influencing learning difficulties. Patterns and relationships across data sources were identified through iterative comparison. Data displays in the form of narrative summaries and tables were used to facilitate interpretation. Preliminary interpretations were continuously reviewed to ensure consistency with the data. The analysis process was conducted reflexively to minimize researcher bias. This analytical framework is consistent with established qualitative data analysis models in educational research (Bingham, 2023; Nicmanis, 2024).

Trustworthiness and Ethical Considerations

Several strategies were implemented to ensure the trustworthiness of the study. Credibility was enhanced through triangulation of observations, interviews, diagnostic tests, and documentation. Prolonged engagement in the classroom allowed the researcher to gain a deeper understanding of students' learning behaviors. Member checking was conducted by clarifying interview responses with participants to reduce misinterpretation. Dependability was supported by maintaining a clear record of data collection and analysis procedures. Confirmability was addressed by documenting analytic decisions and reflecting on potential researcher bias. Ethical principles were upheld through informed consent and participant confidentiality. These procedures align with established standards for rigor in qualitative educational research (Berkovich & Grinshtain, 2023, pp. 1999–2018).

RESULTS AND DISCUSSION

Results

The results of this study are organized based on data obtained from classroom observations, interviews, and diagnostic assessments. To ensure clarity and coherence, the findings are presented through descriptive narratives supported by tables and a conceptual figure. This presentation allows readers to clearly identify patterns of learning difficulties and understand how different factors interact to influence students' mathematics learning outcomes.

Table 1 presents a synthesized overview of the internal and external factors contributing to students' mathematics learning difficulties. The table categorizes factors into internal dimensions, external dimensions, and observable learning outcomes, based on triangulated data sources. Internal factors include low motivation, limited conceptual understanding, and poor concentration, which were consistently identified across observations, interviews, and diagnostic tests. External factors primarily relate to limited family support and unconducive learning environments, as reported during student interviews. Learning outcomes are reflected in low diagnostic performance and difficulties in applying mathematical concepts. The table demonstrates that learning difficulties are

not caused by a single factor but emerge from the interaction of multiple conditions. This structured summary strengthens the empirical foundation of the findings by consolidating evidence from different instruments.

Table 1. Summary of Factors Influencing Mathematics Learning Difficulties

Dimension	Indicators	Data Sources
Internal factors	Low motivation, weak conceptual understanding, limited concentration	Observation, interviews, diagnostic tests
External factors	Limited parental support, unconducive learning environment	Interviews
Learning outcomes	Low diagnostic scores, difficulty applying concepts	Diagnostic tests

Following the tabular summary, the relationships among these factors are further clarified through Figure 1, which provides a conceptual representation of the findings. Figure 1 illustrates how internal factors and external factors interact to shape students' learning behaviors, which in turn influence mathematics learning outcomes. Internal factors such as motivation and conceptual understanding are shown to directly affect students' engagement in learning activities. External factors, including family support and learning environment, either reinforce or weaken these internal conditions. The figure highlights learning behavior, such as disengagement and task avoidance, as a mediating element between influencing factors and learning outcomes. Diagnostic performance is positioned as the final outcome of this interaction. This conceptual model helps explain why learning difficulties persist when both internal and external conditions are unfavorable.

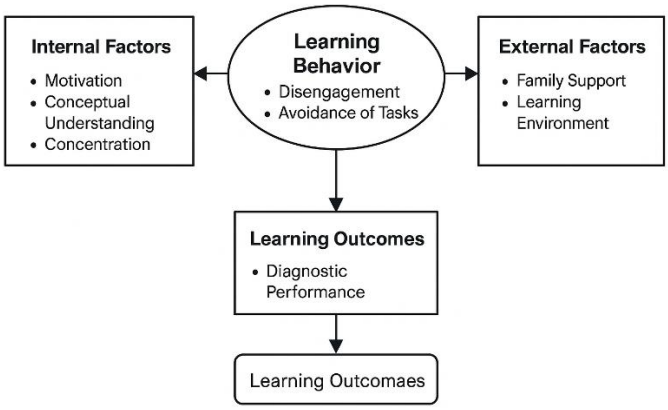

Figure 1. Conceptual model of internal and external factors influencing mathematics learning difficulties

The integration of Table 1 and Figure 1 enhances the interpretability of the results by linking descriptive data with analytical representation. While Table 1 provides concrete empirical categories derived from the data, Figure 1 synthesizes these categories into a coherent explanatory framework. Together, they demonstrate that students' mathematics learning difficulties are systemic rather than incidental. The alignment between observational data, interview responses, and diagnostic test results reinforces the credibility of the findings. This structured presentation supports the argument that effective instructional responses must address both learner-related and environmental factors. Consequently, the results section provides a clear and well-organized basis for the subsequent discussion of theoretical and pedagogical implications.

Discussion

The findings of this study align with prior research emphasizing the role of student engagement in mathematics learning. Low engagement observed in this study reflects patterns reported in studies on active learning and cognitive involvement (Vale & Barbosa, 2023; Abukhousa, 2025). Students who disengage early tend to experience cumulative learning difficulties over time. The diagnostic results further support the view that conceptual understanding is central to mathematical competence. Similar conclusions have been drawn in socio-constructivist studies emphasizing meaning-making processes (Olivares, 2024). Weak foundational understanding limits students' ability to apply procedures effectively. This study reinforces the argument that engagement and cognition are inseparable in mathematics learning. Therefore, learning difficulties should be addressed through pedagogical designs that prioritize conceptual clarity.

Internal factors identified in this study, particularly motivation and attention, are consistent with findings in personalized learning research. Annuš and Kmeť (2024) highlighted that learning personalization can mitigate disengagement when aligned with learner readiness. Students in this study lacked confidence in their mathematical abilities, which reduced their willingness to participate. This reluctance mirrors findings from studies on student self-perception and learning persistence. Motivation emerged not as a fixed trait but as a context-dependent condition. When instruction failed to connect with students' experiences, motivation declined further. These findings suggest that motivational challenges are pedagogically addressable rather than inherent. Teachers play a crucial role in shaping students' learning dispositions.

External factors also played a significant role in shaping learning difficulties. Limited parental involvement and unconducive home environments were repeatedly mentioned by students. These findings correspond with research on educational context and learning support systems (Zin & Mahmud, 2024; López et al., 2022). Students who lacked structured study routines outside school struggled to reinforce classroom learning. Environmental noise and competing activities reduced opportunities for focused practice. Such conditions exacerbate existing cognitive difficulties. The interaction between home and school environments therefore deserves greater attention. Addressing learning difficulties requires coordinated efforts beyond classroom instruction.

The integration of diagnostic testing with qualitative inquiry strengthened the analytical depth of this study. Diagnostic results provided concrete evidence of learning gaps identified through observation and interviews. This approach aligns with recommendations for mixed qualitative diagnostics in education research (Rath, 2025). Fitrah et al. (2025) similarly demonstrated that learning outcomes must be interpreted alongside engagement indicators. By triangulating data sources, this study avoided over-reliance on self-reported perceptions. The alignment between diagnostic scores and behavioral data increased the credibility of findings. This methodological integration contributes to the robustness of the discussion. It also supports the argument that learning difficulties are multidimensional.

Overall, this study contributes to the growing literature that frames mathematics learning difficulties as complex and contextually embedded phenomena. Zhang et al. (2025) emphasized the importance of responsive teaching in addressing diverse learner needs. The present findings support this perspective by showing that difficulties arise from misalignment between instruction and learner conditions. Pedagogical responsiveness must therefore address both cognitive and environmental dimensions. This study extends existing research by providing a qualitative diagnostic mapping at the

lower secondary level. Such mapping is essential for designing targeted interventions. Consequently, the discussion underscores the value of context-sensitive educational research.

Implications

The findings of this study have important implications for mathematics instruction at the lower secondary level. Teachers should prioritize strengthening students' conceptual understanding before advancing to procedural complexity. Instructional strategies that promote active engagement and student participation are essential. Teachers are encouraged to create supportive classroom climates that reduce students' fear of making mistakes. Diagnostic assessments should be used regularly to identify learning gaps early. Schools should also involve parents in supporting students' learning routines at home. Collaboration between teachers and families can reinforce learning continuity. Professional development programs should equip teachers with strategies for addressing learning difficulties holistically. These implications support the development of more inclusive mathematics education practices.

Limitations

Despite its contributions, this study has several limitations that should be acknowledged. The small number of participants limits the generalizability of the findings. The study focused on a single educational context, which may not reflect broader instructional conditions. Data were collected within a limited time frame, restricting longitudinal interpretation. Students' self-reported experiences may also be influenced by social desirability. The diagnostic test focused primarily on basic mathematical concepts. More advanced content areas were not examined. Future studies may incorporate classroom interventions to observe changes over time. Recognizing these limitations helps contextualize the findings responsibly.

Suggestions

Future research should expand participant samples across diverse school settings. Longitudinal designs would allow researchers to track changes in learning difficulties over time. Intervention-based studies could examine the effectiveness of targeted instructional strategies. Combining qualitative diagnostics with quantitative measures may further strengthen analysis. Research on parental engagement in mathematics learning should be deepened. Studies could also explore teacher beliefs and instructional decision-making processes. Technology-supported learning tools may offer additional insights into engagement dynamics. These suggestions aim to advance research that informs evidence-based mathematics education practices.

CONCLUSION

This study offers a qualitative diagnostic perspective on mathematics learning difficulties by demonstrating the interaction between internal learner characteristics and external learning conditions. The findings indicate that difficulties in mathematics learning are not merely the result of low academic ability but arise from sustained issues related to motivation, conceptual understanding, and concentration. These internal challenges are closely influenced by external factors such as family support and the quality of students' learning environments. Evidence from observations, interviews, and diagnostic tests consistently shows that disengagement and task avoidance precede poor learning outcomes. Weak mastery of foundational concepts further limits students' ability to apply mathematical reasoning effectively. The integration of multiple data sources enhances the robustness

of the findings. This study therefore reframes mathematics learning difficulties as systemic rather than individual problems. Such a perspective contributes to a more nuanced understanding of learning challenges in lower secondary mathematics education.

From an instructional perspective, the findings highlight the importance of responsive and diagnostic-based teaching practices. Mathematics instruction should prioritize conceptual understanding and student engagement rather than procedural repetition alone. Teachers are encouraged to use diagnostic assessments to identify learning barriers at an early stage. Supportive classroom climates and meaningful learning interactions can help reduce students' reluctance to participate. The role of families is also critical in reinforcing learning routines beyond the classroom. Methodologically, this study demonstrates the value of qualitative inquiry in capturing learning experiences that standardized assessments often overlook. The findings provide practical insights for educators seeking to design more inclusive learning environments. Overall, this study contributes to international discussions on improving mathematics learning through context-sensitive and student-centered approaches.

AUTHOR CONTRIBUTION STATEMENT

Maria Editha Bela solely contributed to all stages of this study. She was responsible for the conceptualization of the research, including the formulation of the research objectives and design. Data collection was conducted by the author through classroom observations, interviews, documentation, and diagnostic assessments. She also performed data analysis, interpretation of findings, and development of the conceptual framework. The author drafted, revised, and finalized the manuscript, ensuring its intellectual content and academic integrity. All decisions related to methodology, analysis, and presentation of results were made independently by the author. The author approved the final version of the manuscript for submission. The author takes full responsibility for the content of this article.

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