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Barriers to Achieving Mathematics Proficiency: Synthesis of Research

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Abstract. Mathematics education plays a crucial role in students' academic development and real-world problem-solving. However, many high school students in the Philippines struggle to attain the expected learning competencies (ELCs)—defined as the grade-level mathematical skills and knowledge prescribed in the K to 12 curriculum. This literature review examines current research to identify and synthesize key factors contributing to the non-attainment of these competencies. Using a narrative review approach, the study analyzed peer-reviewed articles, policy reports, and local studies published from 2014 to 2024, focusing on challenges in secondary mathematics education. Twelve key factors were identified, including perceived irrelevance of mathematics to real-life, curriculum overload and fragmentation, time constraints, foundational gaps, ineffective teaching strategies, lack of classroom engagement, negative student attitudes, low student motivation, insufficient access to resources, misuse of technology, and ineffective assessment formats. These factors, both individually and collectively, hinder students' ability to achieve proficiency in mathematics. The review highlights the impact of these barriers on student learning. It suggests that addressing these challenges requires a comprehensive approach, including curriculum reforms, enhanced teacher training, and increased access to resources. Additionally, fostering a supportive learning environment that integrates real-world applications and utilizes clear, engaging teaching strategies can improve student motivation and achievement. This review emphasizes the need for continued research into these factors and their interactions to develop targeted interventions that can support students in overcoming the barriers to mathematics success.

Keywords: Mathematics proficiency barriers; Literature review; Learning competencies; Mathematics education; Student engagement; Teaching strategies.

1.0 Introduction

Mathematics education is widely regarded as essential to students' academic success and their ability to navigate real-world challenges. It is also central to achieving Sustainable Development Goal 4 (SDG 4), which promotes inclusive, equitable, and quality education for all. Despite its importance, a large number of high school students—particularly in the Philippines—struggle to attain expected learning competencies (ELCs), which refer to the grade-level knowledge and skills defined by the national K to 12 curriculum. These learning gaps often manifest as difficulties in understanding core mathematical concepts, impeding students' progress to more advanced topics (Hiebert & Grouws, 2007; Boaler, 2016).

These challenges are not isolated but stem from a complex interplay of individual, instructional, and systemic factors. Globally and locally, research highlights concerns such as curriculum overload, lack of instructional time, disengaging teaching methods, low motivation, and insufficient learning support as key contributors to mathematics underachievement (Schmidt et al., 2005; OECD, 2020; Chen et al., 2023; Leek et al., 2024). In the Philippines, these issues are further compounded by resource limitations and contextual mismatches in curriculum implementation, particularly in rural and under-resourced schools. This literature review responds to the growing need to synthesize these interrelated barriers by addressing two key questions: (a) What are the main factors contributing to Filipino students' non-attainment of expected competencies in high school mathematics?, and (b) How do these factors-spanning cognitive, instructional, and ecological domains—interact to shape students' learning outcomes?

Grounded in Bronfenbrenner's ecological systems theory and supported by cognitive-affective models of learning (Bronfenbrenner, 1979; Pekrun, 2006), this review offers a comprehensive view of the factors that hinder mathematics proficiency. Its timeliness lies in the urgent call for targeted interventions aligned with both global education goals and the local realities of Philippine public schools. By identifying these factors and clarifying their implications, this review aims to inform teacher training, curriculum reforms, and educational policy. Ultimately, it contributes a localized and evidence-based foundation for designing practical solutions to close the mathematics learning gap and support student success.

2.0 Methodology

2.1 Research Design

This study employed a qualitative literature synthesis to explore and understand the various barriers to achieving mathematics proficiency in secondary education. Rather than conducting primary data collection, the study focused on reviewing, analyzing, and integrating existing research related to students' failure to meet expected learning competencies in mathematics. The chosen approach is grounded in the belief that systematically examining existing knowledge allows for a deeper appreciation of recurring patterns, gaps, and contextual nuances. Through this synthesis, the study aimed to consolidate evidence from both local and international literature to provide a coherent account of the most pressing challenges in mathematics education today.

2.2 Source Selection and Inclusion Criteria

To ensure a comprehensive review, the literature search was conducted using several reputable academic databases, including Taylor and Francis, ERIC, Research Gate, PubMed, and ScienceDirect. Keywords such as "mathematics proficiency," "learning barriers," "curriculum overload," "student engagement," "assessment in mathematics," and "secondary mathematics education" were used in various combinations. The search focused on peer-reviewed journal articles, academic books, and educational reports published between 2005 and 2025. For inclusion, each source had to meet the following criteria: it must be written in English, focus on mathematics learning at the secondary school level, and discuss factors that negatively influence students' academic performance or competencies in mathematics. Studies that provided either empirical findings or theoretical insights were included, while opinion pieces, editorials, and sources without accessible full texts were excluded. The emphasis was on ensuring that all selected sources offered substantial contributions to understanding systemic and classroom-based challenges in mathematics instruction.

2.3 Data Analysis

Once relevant studies were gathered, a structured process of thematic analysis was employed to identify recurring patterns and themes, following the guidelines of Braun and Clarke's (2006) six-step thematic analysis process. This method involved familiarization with the data, generating initial codes, searching for themes, reviewing themes, defining and naming themes, and finally producing a coherent narrative synthesis. Through this process, twelve major themes emerged, each representing a distinct barrier to mathematics proficiency.

2.4 Scope and Limitations

This synthesis prioritized breadth and representativeness over depth in any single context, aiming to capture a broad spectrum of issues affecting secondary mathematics education. While the study integrated both global and Philippine-based literature, the interpretation of findings was strongly informed by the local educational context. It is important to note, however, that unpublished theses, conference proceedings, and non-English language sources were excluded, which may limit the inclusion of some potentially valuable insights. Furthermore, while the review offers a comprehensive overview of the literature, it does not include statistical analyses or quantitative effect size comparisons. As such, the conclusions drawn should be viewed as interpretive and descriptive rather than predictive. Nonetheless, the methodology applied provides a credible and coherent synthesis that captures the multidimensional nature of the barriers to mathematics proficiency among high school students.

3.0 Discussion

3.1 Barriers to Mathematics Proficiency

This literature review focuses on the negative factors that contribute to the non-attainment of expected learning competencies in high school mathematics. It identifies and discusses twelve key factors: 1) Irrelevance of Mathematics to Real-Life Applications, 2) Curriculum Overload and Fragmentation, 3) Time Constraints and Class Schedule Interruptions, 4) Foundational Gaps and Remedial Needs, 5) Ineffective Teaching Strategies and Instructional Ambiguity, 6) Lack of Classroom Engagement in Mathematics, 7) Negative Student Attitudes Toward Mathematics, 8) Low Student Motivation, 9) Insufficient Access to Traditional Resources, 10) Limited Access to Online Platforms and Videos, 11) Misuse of Technology, and 12) Ineffective Assessment Formats and Feedback Processes. Each factor is discussed in detail to provide insights into how they hinder students' ability to achieve the desired learning outcomes in mathematics.

Irrelevance of Mathematics to Real-Life Applications

One of the key factors contributing to the non-attainment of mathematics learning competencies is the perceived irrelevance of mathematical concepts to real-life applications. When students fail to see the practical value of mathematics in their everyday lives, they often lack the motivation and engagement necessary to fully invest in the subject (Dagdag & Cardona, 2018; Dagdag, 2019; Dagdag, 2020; Dagdag & Dagdag, 2020). Research indicates that students' learning outcomes are negatively affected when they do not perceive mathematics as applicable to real-world situations (Boaler, 2016). The absence of real-world connections makes abstract concepts seem disconnected from students' personal experiences, resulting in disengagement and reduced comprehension (Schoenfeld, 2014).

Integrating real-life applications into the curriculum is challenging due to the abstract nature of specific mathematical topics, such as algebra and geometry, which often appear detached from everyday use. This disconnect limits students’ ability to relate classroom learning to practical scenarios, further hindering their academic achievement. When real-world contexts are not effectively incorporated, students miss opportunities to develop problem-solving skills that are essential for their future careers (Czaplinsk et al., 2019; Sarkar et al., 2019; Fettes et al., 2020). Thus, the failure to contextualize mathematics diminishes students' motivation and weakens their understanding of essential concepts (Freudenthal, 1991).

Curriculum Overload and Fragmentation

Curriculum overload and fragmentation are significant barriers to achieving expected learning competencies in mathematics. Overloading the curriculum with an excessive number of topics forces teachers to cover material quickly, often without giving students enough time to fully grasp and apply foundational concepts (Dagdag, 2020). As a result, students develop a superficial understanding of the content, which impairs their ability to build on previous knowledge in subsequent lessons (Schmidt et al., 2005). This rushed pace compromises learning outcomes, as students are not afforded adequate time for practice and mastery of concepts (Hiebert & Grouws, 2007).

Curriculum fragmentation further exacerbates this issue by presenting mathematical topics in isolation, without clear connections between them. This lack of continuity prevents students from forming meaningful links between different mathematical concepts, hindering their ability to understand how various topics relate to one another. For example, the spiral curriculum, which revisits topics periodically, often results in fragmented learning, as students move on to new material before they have fully mastered earlier concepts (Ma, 2010). Such fragmentation prevents students from building a solid foundation in mathematics, which is critical for their success in more advanced topics (OECD, 2020).

Time Constraints and Class Schedule Interruptions

Time constraints and interruptions to the class schedule contribute significantly to the non-attainment of expected mathematics learning competencies (Dagdag & Cardona, 2018; Dagdag, 2019; Dagdag, 2020). Limited instructional time forces teachers to condense lessons and skip important topics or examples, thereby hindering students' ability to understand key concepts. Research shows that when instructional time is constrained, students do not have enough opportunities to practice or explore mathematical ideas in depth (Hong & Choi, 2018; Wright & Park, 2021; Fitriati et al., 2023). This lack of time for in-depth learning leads to shallow understanding and poor retention of mathematical concepts.

Class schedule interruptions, such as extracurricular activities, holidays, and administrative duties, further disrupt the continuity of lessons. Studies indicate that these disruptions often lead to rushed lessons or missed content, leaving gaps in students' mathematical understanding (Leek et al., 2024). These interruptions also create a fragmented learning experience, contributing to disengagement and a lack of motivation to persist through challenging mathematical problems (Carmona, 2020). The inconsistent delivery of lessons, combined with the limited time available for instruction, exacerbates the difficulties students face in mastering mathematics.

Foundational Gaps and Remedial Needs

Foundational gaps in mathematics are a critical factor contributing to the non-attainment of learning competencies (Dagdag, 2019; Dagdag, 2020). When students lack mastery of basic mathematical skills, such as number sense, addition, subtraction, and multiplication, they struggle to comprehend more advanced concepts (Chinn, 2020; Makhubele, 2021). These gaps in foundational knowledge create significant barriers to students' progression in mathematics (Nortvedt & Siqveland, 2018; Jackson, 2020). Without a strong foundation in basic concepts, students find it difficult to understand more complex topics, such as fractions, decimals, and algebra, which are essential for success in high school mathematics.

The early identification of learning gaps is crucial to addressing these issues. Diagnostic assessments can help pinpoint specific areas where students need additional support (Daucourt et al., 2019; Johnson & Barker, 2022; Betts et al., 2023). When these gaps are not addressed, students continue to struggle with new content, leading to frustration and disengagement. Remedial programs, such as small-group instruction and peer tutoring, are effective strategies for helping students close these foundational gaps (Slavin & Lake, 2008; Brower et al., 2017; Lawson et al., 2019). However, the lack of targeted interventions in many schools contributes to the persistence of these gaps, further hindering students' progress.

Ineffective Teaching Strategies and Instructional Ambiguity

Ineffective teaching strategies and instructional ambiguity are significant factors in the failure to achieve expected mathematics learning competencies. When teachers fail to present mathematical concepts in a clear, structured, and engaging manner, students often struggle to comprehend and apply the material. Research shows that instructional clarity is essential for reducing cognitive overload and ensuring that students can retain and apply mathematical knowledge (Hattie, 2008; Hawrot et al., 2023). However, when teachers lack the pedagogical skills necessary to communicate mathematical ideas effectively, students are left confused and unable to grasp key concepts (Güler & Çelik, 2018; Chew & Cerbin, 2020; English et al., 2023).

Instructional ambiguity can also arise when teachers fail to provide sufficient explanations or examples, leaving students to rely on their intuition to make sense of complex ideas. This lack of clarity undermines students' confidence and contributes to their inability to succeed in mathematics. Furthermore, students' diverse learning needs require differentiated instruction, which can be difficult for teachers to implement effectively without adequate training and resources (Smets et al., 2020; Zelalem et al., 2022). As a result, the lack of clear, practical teaching strategies exacerbates students' difficulties in mastering mathematics.

Lack of Classroom Engagement in Mathematics

A critical factor hindering students' attainment of mathematics competencies is a lack of classroom engagement. When students are disengaged from the learning process, they are less likely to actively participate in lessons, apply problem-solving strategies, or retain mathematical concepts. Engagement is multidimensional, encompassing behavioral, emotional, and cognitive aspects of learning (Bowden et al., 2019; Lin, 2021; Xu et al., 2023). When students are not emotionally invested in the subject or do not engage in deep thinking about mathematical ideas, their understanding and retention of concepts are limited, leading to poor academic outcomes (Ramirez et al., 2018; Qi, 2024).

In many cases, students become disengaged due to monotonous teaching methods that fail to capture their interest or cater to diverse learning styles. Traditional, teacher-centered approaches may not adequately stimulate students' curiosity or foster active participation (Eronen & Kärnä, 2017). Additionally, large class sizes and limited resources can make it difficult for teachers to provide individualized attention, leaving many students feeling left behind or overlooked (Tran et al., 2019). The lack of engagement not only undermines students' academic achievement but also diminishes their motivation to continue learning mathematics (Deci & Ryan, 1985).

To combat disengagement, schools must implement more interactive and student-centered teaching methods that promote active learning and collaboration. Using problem-based learning, simulations, and group work can help students connect with the material and see its relevance to real-world problems (Chang & Hwang, 2024). Providing more opportunities for students to engage in the learning process can improve their interest and understanding of mathematics.

Negative Student Attitudes toward Mathematics

Students' negative attitudes toward mathematics are another significant factor that impedes their ability to achieve the expected learning competencies (Dagdag & Calimag, 2023). Negative attitudes, such as math anxiety, low self-confidence, and a lack of interest, create substantial barriers to success. Research has shown that students with negative attitudes toward mathematics are less likely to engage in the subject, avoid math-related tasks, and perform poorly on assessments (Luttenberger et al., 2018). These attitudes often stem from previous negative experiences with the subject, cultural stereotypes about math ability, and a lack of supportive learning environments (Alam & Mohanty, 2023).

The self-fulfilling prophecy effect compounds the impact of negative attitudes on mathematics achievement: students who believe they are not capable of succeeding in mathematics are less likely to invest effort or persist through challenges (Rohde et al., 2020). When students lack confidence in their mathematical abilities, they often disengage from learning and avoid seeking help, leading to further struggles and a downward spiral of underachievement.

To improve students' attitudes, educators must create a supportive and positive classroom environment where effort and persistence are valued over innate ability. By promoting a growth mindset and emphasizing the idea that mathematical abilities can be developed through practice, teachers can help reduce math anxiety and encourage students to take risks and embrace challenges (Alam & Mohanty, 2023). Integrating real-world applications and demonstrating the relevance of mathematics to students' lives can also increase their interest and engagement, helping to shift negative attitudes toward more positive ones.

Low Student Motivation

Motivation is a key driver of student success, especially in subjects like mathematics, where sustained effort and persistence are essential for mastering complex concepts. However, low student motivation is a significant factor that contributes to the non-attainment of learning competencies in mathematics. Students who lack motivation are less likely to engage with the material, complete assignments, or actively participate in class discussions. Motivation can be intrinsic, driven by internal desires to understand and master the content, or extrinsic, influenced by external factors such as grades or rewards (Deci & Ryan, 1985). While intrinsic motivation is linked to deeper

Learning and sustained effort (Kwarikunda, Schiefele, Ssenyonga & Muwonge, 2021), low motivation—whether intrinsic or extrinsic—can significantly hinder students' academic performance in mathematics.
The expectancy-value theory provides insight into how students' motivation is shaped by their beliefs about their ability to succeed in mathematics (Zhang & Jiang, 2024). When students believe they cannot succeed or do not value mathematics, they are less likely to exert effort or persist in learning. Furthermore, extrinsic motivation driven solely by rewards or grades can fail to foster the intrinsic motivation necessary for long-term achievement

in mathematics (Treacy, 2017).

Teachers play a pivotal role in fostering motivation by creating a learning environment that emphasizes autonomy, competence, and relatedness. Providing students with opportunities to explore mathematical concepts independently, offering choices in learning activities, and recognizing their effort can help enhance intrinsic motivation (Deci & Ryan, 1985). Encouraging a sense of ownership over their learning and showing how mathematics is relevant to their personal and professional goals can also increase students' motivation to engage with the material.

Insufficient Access to Traditional Resources

The lack of sufficient access to traditional resources, such as textbooks, workbooks, and teacher-prepared materials, can hinder students' learning in mathematics. While these resources are fundamental to instruction, their effectiveness is diminished when they are outdated or insufficient to meet the diverse needs of students. Research has shown that traditional resources often fail to address the varying learning styles and abilities of students, which is particularly problematic in classrooms with a wide range of academic skills (Melese, 2019). Additionally, outdated textbooks may not align with current teaching methods, leading to confusion and misinterpretation of mathematical concepts (Schoenfeld, 2022).

The reliance on traditional resources without sufficient supplementary materials can also limit students' engagement with the subject. Textbooks, for example, may focus too heavily on procedural knowledge, neglecting the development of higher-order thinking skills like problem-solving and critical analysis (Rind & Mari, 2019). This narrow focus on rote memorization may contribute to students' inability to apply their knowledge in real-world contexts, which is essential for mastering mathematics.

To address these issues, it is necessary to diversify the resources available to students and teachers. Supplementing traditional materials with interactive tools, real-world problem sets, and digital resources can enhance student engagement and understanding (Dragseth, 2019; Maphosa, 2024; Quinlan et al., 2024). Additionally, providing teachers with professional development on how to integrate a range of resources into their instruction effectively can ensure that they meet the diverse needs of their students and foster a deeper understanding of mathematical concepts.

Limited Access to Online Platforms and Videos

Limited access to online platforms and digital resources is another significant barrier to achieving mathematics learning competencies. The increasing reliance on digital tools in education has highlighted the gap between schools with access to technology and those without. Many students, particularly those in underfunded schools, face challenges in accessing online resources such as educational videos, interactive tools, and learning management systems. Without access to these resources, students miss opportunities to engage with mathematical concepts outside of the classroom, reducing their ability to reinforce learning and gain additional perspectives on complex topics (Lo et al., 2021).

The lack of access to online platforms also limits students' ability to review lessons at their own pace. For example, platforms like Khan Academy and YouTube provide instructional videos that allow students to revisit lessons and practice problem-solving techniques at home, enhancing understanding and retention (Zainuddin & Perera, 2017; Ding et al., 2022). However, in schools with limited technology, students are unable to benefit from these flexible, self-paced learning opportunities, putting them at a disadvantage compared to their peers in more well-resourced schools.

To address this issue, it is crucial to increase access to digital platforms and ensure that all students have the tools they need to succeed. Schools should consider investing in technology infrastructure, such as providing students with laptops or tablets and ensuring reliable internet access. Additionally, teachers can incorporate low-tech solutions, such as providing printed resources and alternative methods for engaging students with digital content, ensuring that all learners have the opportunity to benefit from online learning.

Misuse of Technology
While technology has the potential to enhance learning outcomes, its misuse can contribute to the failure to achieve mathematics learning competencies. Overreliance on technological tools, such as calculators and educational software, can undermine the development of critical thinking and problem-solving skills. When students become dependent on technology for solving mathematical problems, they may fail to develop the necessary skills to approach problems manually or without digital assistance (Hiebert & Grouws, 2007). This overreliance on technology can lead to shallow learning, as students may skip important steps in the problem-solving process and focus solely on obtaining the correct answer.

Moreover, when technology is misused—such as for entertainment or social media—students can become distracted, leading to disengagement from the learning process (Hattie, 2008). In classrooms where technology is not managed correctly, students may be more focused on gaming or browsing the internet than on engaging with the material, which ultimately reduces the effectiveness of the lesson.

To mitigate the misuse of technology, educators must ensure that technology is integrated into the learning process purposefully and strategically. Teachers should carefully consider when and how to use technological tools, ensuring that students understand the underlying mathematical principles before relying on technology for assistance. A balanced approach that uses technology to support, rather than replace, traditional learning methods can help ensure that students develop both computational skills and conceptual understanding (Hattie, 2008).

Ineffective Assessment Formats and Feedback Processes
Ineffective assessment formats and feedback processes are contributors to the failure to achieve expected mathematics learning competencies. Traditional assessment methods, such as multiple-choice tests, often fail to capture the depth of students’ understanding, as they focus primarily on procedural knowledge rather than on critical thinking and problem-solving abilities (Dagdag & Dagdag, 2020; Cui et al., 2023; Oc & Hassen, 2024). These assessments can lead to a narrow view of student achievement, neglecting the development of higher-order cognitive skills essential for mastering mathematics.

Furthermore, feedback processes that are delayed, vague, or overly general can hinder students' ability to improve. Research indicates that feedback is most effective when it is timely, specific, and directly linked to students' learning goals (Hattie, 2008; Fisher et al., 2025). Without detailed feedback, students are left uncertain about their mistakes and how to correct them, which impedes their progress in understanding mathematical concepts (Fergus & Petrick Smith, 2022).

To address these challenges, it is necessary to diversify assessment formats to include performance-based tasks, project work, and collaborative problem-solving activities that allow students to demonstrate their understanding in more authentic and comprehensive ways (Ajjawi et al., 2023). Additionally, feedback should be provided promptly, ideally within a day or two, and should be constructive and actionable. Formative assessments, such as quizzes or peer evaluations, should be used regularly to monitor students’ progress and guide instructional decisions, ensuring that students have the opportunity to revise and improve their understanding before moving on to new material (McCallum & Milner, 2020; Yan et al., 2021).

4.0 Conclusion
This literature review has highlighted multiple interrelated factors contributing to the non-attainment of expected learning competencies in high school mathematics. These include curriculum overload, insufficient instructional time, lack of access to resources, student disengagement, and ineffective teaching practices. When instruction is unclear or overly procedural, students struggle to form meaningful connections between concepts, resulting in shallow understanding and limited engagement (Boaler, 2016; Hiebert & Grouws, 2007). Instructional ambiguity—such as inconsistent explanations or fragmented delivery—undermines cognitive processing, especially for students with existing foundational gaps. Moreover, passive, lecture-heavy approaches reduce opportunities for students to actively construct knowledge, ask questions, or apply concepts in real-life contexts (Hattie, 2008).

In contrast, research supports the use of active learning strategies—such as collaborative problem-solving, guided discovery, and contextualized tasks—as practical tools for enhancing understanding and motivation (Chen et al., 2023). Equally important is the role of formative assessment and timely, specific feedback, which help students recognize errors, monitor their progress, and stay engaged in the learning process (Leek et al., 2024). When feedback is delayed or vague, students miss opportunities to adjust their thinking and improve.

Addressing these challenges requires an integrated approach: curriculum simplification and contextualization, ongoing teacher professional development focused on learner-centered pedagogy, improved access to learning resources, and equitable use of digital tools. Future studies—particularly quantitative or mixed-methods research—should further investigate how these factors interact and which interventions yield the most measurable improvements in math learning outcomes. Understanding these dynamics is essential for creating policies and practices that support long-term student success in mathematics.

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7.0 Conflict of Interests

The authors declare that there is no conflict of interest.

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