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Learning Difficulties in Solving Problems in Mathematics at Tertiary Level

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ABSTRACT

This paper examined a conceptual review of learning difficulties in solving mathematical problems at the tertiary level. Problem-solving is pivotal to learning mathematics at all educational levels as it fosters in-depth mathematical understanding and transfer of mathematical knowledge to both known and unknown situations. It is quite unfortunate that solving mathematical problems remains a challenge for students at tertiary levels despite its significance. Many students are still confronted with difficulties at each stage of the general problem-solving procedure prescribed by Polya. These difficulties include: lack of understanding of the problem statement; inability to devise a plan, inability to execute an appropriate plan and inability to check for corrections. Nine contributory factors to these difficulties in problem-solving were identified, which are weak foundational knowledge, anxiety, ineffective teaching methods, language barriers, poor strategies, inadequate practice, overcrowded classrooms, socio-economic hardship, and limited technology access. It is therefore recommended that educators take into consideration these difficulties and factors contributing to them to proffer better ways of overcoming such challenges to learners, such as better teaching strategies, supportive institutional policies, improved resources, and explicit instruction in problem-solving skills like those of George Polya and others. This will enable teachers and students to be good problem-solvers.

Keywords: Learning difficulties, Mathematics, Problem, Problem-solving, Mathematical problem-solving, Tertiary level.

Introduction

Mathematics is widely recognised as a foundational discipline that supports scientific advancement, technological innovation, economic development, and logical reasoning. At the tertiary level, mathematics becomes more specialized and abstract, serving as a compulsory or supportive subject in fields such as engineering, economics, computer science, statistics, and education. Despite its importance, many students in higher institutions experience persistent learning difficulties in solving mathematical problems. Problem-solving is a central objective of mathematics education because it enables learners to apply concepts, analyze situations, reason critically, and develop solutions to unfamiliar tasks. However, reports from universities and colleges across many countries indicate that a substantial number of students struggle with mathematical problem-solving, leading to poor academic performance, course repetition, anxiety, and attrition from mathematics-related programmes (Saha et al., 2024).

Learning difficulties in mathematics at the tertiary level often stem from weak foundations laid in primary and secondary schooling. Many students enter universities with an inadequate grasp of arithmetic operations, algebraic manipulation, fractions, equations, graphs, and mathematical language. These deficiencies become more apparent when students encounter advanced topics such as calculus, linear algebra, differential equations, probability, and statistics. Research shows that learning gaps accumulated during earlier schooling stages significantly affect students' readiness for higher education, especially in numeracy-based disciplines. Where prior knowledge is weak, students often rely on memorisation rather than conceptual understanding, making it difficult to solve non-routine problems.

Another major source of difficulty is the abstract nature of tertiary mathematics. Unlike lower levels, where mathematics may involve concrete examples and routine exercises, university mathematics requires formal reasoning, proofs, symbolic manipulation, and interpretation of theoretical models. Students who are accustomed to procedural learning frequently struggle to transition into the conceptual and analytical thinking required in higher education. Research has shown that many undergraduates can perform routine computations but fail when asked to justify methods, interpret results, or solve unfamiliar problems requiring higher-order reasoning (Jablonka, 2020). This suggests that tertiary mathematics demands cognitive skills beyond mere formula application.

Problem-solving difficulties are also associated with poor mathematical language and communication skills. Mathematics has its own vocabulary, symbols, structures, and representations. Students may understand a concept partially but fail to interpret word problems, mathematical statements, or symbolic expressions correctly. For instance, misunderstanding terms such as "evaluate," "differentiate," "approximate," or "prove" can lead to incorrect approaches. In multilingual contexts such as Nigeria, language barriers may further complicate comprehension where students learn mathematics in English but think primarily in indigenous languages. Studies have noted that language proficiency significantly influences students' ability to decode and solve mathematical tasks in tertiary institutions (McLachlan & Essien, 2022).

Also, affective factors such as mathematics anxiety, fear of failure, low self-confidence, and negative attitudes contribute greatly to learning difficulties in problem-solving. Many students develop anxiety from previous negative experiences in mathematics classrooms, harsh assessment methods, or societal beliefs that mathematics is only for exceptionally gifted learners. At tertiary level, such anxiety may intensify due to increased workload and competitive environments. Students experiencing mathematics anxiety often avoid practice, panic during tests, and demonstrate reduced working memory during problem-solving tasks. Palestro & Jameson (2020) observed that mathematics anxiety can significantly impair performance even when students possess the necessary knowledge.

Teaching methods used in tertiary institutions also influence students' success in mathematical problem-solving. In many universities, mathematics is still taught predominantly through lecture methods where instructors focus on derivations and examples while students passively take notes.

This teacher-centred approach may not adequately develop inquiry, collaboration, or problem-solving competence. Large class sizes, limited contact hours, insufficient tutorial sessions, and inadequate feedback further worsen the situation. Active learning strategies such as guided discovery, cooperative learning, and technology-supported instruction have been recommended to improve engagement and understanding (Xu et al., 2025). Where such approaches are absent, students may continue to struggle with independent problem-solving.

Technological factors have become increasingly relevant in contemporary mathematics learning. Digital tools such as graphing software, computer algebra systems, online tutorials, and interactive simulations can support visualization and conceptual understanding. However, unequal access to devices, unstable internet connectivity, and low digital literacy may hinder effective use of these resources, particularly in developing countries. During and after the COVID-19 pandemic, many tertiary institutions adopted blended and online learning systems, exposing disparities in students' readiness for digital mathematics learning (Adeniyi & Awofala, 2023; Akinoso, Agoro, & Alabi, 2020; Akinoso & Akinoso, 2022). According to Rahiem (2020), students with limited access to educational technology faced greater learning losses in quantitative subjects.

Socio-economic conditions also play an important role in learning difficulties. Students from disadvantaged backgrounds may experience financial stress, inadequate study materials, poor accommodation, hunger, or the need to combine studies with part-time work. These conditions reduce concentration, attendance, and time available for practice, which is essential in mathematics mastery. Since mathematical competence develops through consistent engagement, irregular study patterns can significantly impair problem-solving performance. Tertiary students dealing with economic hardship may therefore underperform despite intellectual potential (Saha et al., 2024).

Similarly, the issue of large enrolment in tertiary institutions often results in overcrowded classrooms and limited lecturer-student interaction. Mathematics learning requires questioning, clarification, guided practice, and immediate correction of misconceptions. In overcrowded settings, lecturers may find it difficult to identify individual learning needs or provide personalized support. Students who are shy or confused may remain silent, allowing misconceptions to persist until examinations. This structural challenge is common in many public tertiary institutions in Africa and has implications for students' problem-solving development (Drape et al., 2016).

At the cognitive level, students differ in reasoning ability, working memory capacity, spatial visualization, and metacognitive skills. Successful mathematical problem-solving requires planning, monitoring progress, evaluating solutions, and choosing appropriate strategies. Students lacking metacognitive awareness may jump into calculations without understanding the problem, fail to check answers, or persist with ineffective methods. Sun (2022) emphasized that expert problem solvers differ from novices not only in knowledge but also in strategic control and self-regulation. Therefore, learning difficulties may arise when students have not been trained in how to think about problems systematically.

In the Nigerian context, persistent poor performance in general studies mathematics, statistics, engineering mathematics, and other quantitative courses has raised concern among educators and policymakers. Examination reports and institutional records often reveal high failure rates in first-year mathematics-related courses. This trend may be linked to inadequate secondary preparation, teacher quality issues, overcrowding, poor infrastructure, and students' weak study habits. Researchers in Nigeria have repeatedly identified mathematics as one of the subjects with high rates of failure and withdrawal at tertiary level (Awofala et al., 2024).

These realities justify the need for investigation into the specific learning difficulties students face in solving mathematical problems. Thus, the following are considered in this paper as the research objectives.

Research Objectives

This paper would examine the;

1. Context of problem in mathematics
2. Context of mathematical problem-solving
3. Mathematical problem-solving process
4. Factors contributing to students' difficulties in mathematical problem-solving

Methods

This paper adopted a conceptual review. Articles available online were included in this paper using search terms such as problem in mathematics, mathematical problem-solving, mathematical problem-solving process, and learning difficulties in mathematical problem-solving. Next, research articles and topics specifically related to the topic under study were examined. As regards the inclusion criteria set for this paper, the articles relating to mathematical problem-solving published online between 2016 and 2026 were included in the paper. The search was conducted across three major databases: Scopus, Web of Science, and Google scholar. After searching for the studies and specifying the ones to be analyzed in line with the inclusion criteria, eight hundred and fifty-six studies were included.

The initial database search yielded 54,600 records across the three databases, 1,900 from Scopus, 1,200 from Web of Science, and 51,500 from Google Scholar. After removing duplicates, 53,595 records remained for screening. Following title and abstract screening, 45,750 records were excluded for reasons including lack of mathematics focus, non-empirical design, or wrong publication type. The remaining 7,845 full-text articles were assessed for eligibility, resulting in the exclusion of 6,989 articles due to absence of original data, wrong publication type, or insufficient methodological data. The final sample included 856 studies for review and synthesis.

Context of Problem in Mathematics

The context of problem in mathematics refers to the surrounding conditions, circumstances, and real-life situations within which mathematical problems are presented, interpreted, and solved. In mathematics education, context gives meaning to abstract symbols, formulas, and procedures by linking them to practical experiences or realistic scenarios. Rather than presenting mathematics as isolated computations, contextualized problems enable learners to see how mathematical ideas apply to everyday life, professional tasks, and societal issues. Almuna (2017) emphasized that students understand mathematical concepts more effectively when problems are embedded in familiar and meaningful contexts. At the tertiary level, where mathematical tasks become increasingly abstract, context becomes important in helping students connect theory with application. Mathematical problems can exist in pure, semi-realistic, or real-life contexts. Pure mathematical contexts involve symbolic manipulation with little or no reference to external situations, such as solving equations or proving theorems. Semi-realistic contexts may involve hypothetical situations designed for teaching purposes, such as sharing objects, calculating speed, or estimating population growth. Real-life contexts involve authentic data and practical decision-making situations drawn from economics, engineering, health sciences, business, or technology. According to Munaji et al (2025), exposing students to multiple forms of context improves mathematical modelling skills and flexible reasoning. This is particularly relevant in tertiary institutions where students are expected to apply mathematics to professional disciplines. One important aspect of context in mathematics is that it enhances problem comprehension. Many students fail in mathematical problem-solving not because they lack computational ability, but because they cannot interpret what the problem is asking (Awofala, Fatade, & Olaoluwa, 2013; Awofala, Balogun, & Olagunju, 2011; Awofala, 2011). Word problems, modelling tasks, and application-based questions require students to identify variables, relationships, constraints, and objectives before selecting solution strategies. Context helps learners visualize situations and organize relevant information. Research has shown that students perform better when they understand the situational meaning of a problem rather than merely manipulating symbols mechanically (Romberg, 2016). Understanding of context enhances learners' acquisition of 21st century skills (Awofala et al., 2019).

At the tertiary level, context is especially important in disciplines such as engineering, economics, computer science, medicine, and statistics, where mathematics serves as a tool for solving professional problems. For example, calculus may be applied to optimization in business, differential equations to population dynamics, matrices to computer graphics, and statistics to data analysis. When lecturers teach mathematical concepts without relating them to disciplinary contexts, students may perceive mathematics as irrelevant and difficult. This often reduces motivation and engagement. Studies indicate that students are more interested in mathematics when they recognize its usefulness in their chosen careers (Leyva et al., 2022). However, contextual problems can also create difficulties for students if the context is unfamiliar, culturally distant, or linguistically complex. A student may understand the mathematics involved in a problem but still fail because the scenario uses unfamiliar vocabulary, foreign measurement systems, or situations outside the learner's experience. For instance, problems based on snow, baseball statistics, or foreign currencies may disadvantage students in African contexts. Parker & Flood (2016) noted that language and cultural relevance significantly influence students' access to mathematical meaning. Therefore, effective contextualization requires sensitivity to learners' backgrounds and experiences.

Context of Mathematical Problem Solving

One major context of mathematical problem solving is the educational or classroom context. This includes teaching methods, classroom interaction, instructional materials, lecturer support, assessment style, and opportunities for guided practice. In classrooms where instruction is teacher-centered and focused mainly on memorization of formulas, students often develop weak problem-solving abilities. Conversely, classrooms that encourage questioning, exploration, collaboration, and multiple solution methods tend to produce stronger mathematical thinkers. Lugosi & Uribe (2022) found that active learning approaches significantly improve students' achievement and engagement in science and mathematics courses. Thus, the classroom context can either promote or hinder mathematical problem solving. Another important context is the real-life or application context. Many mathematical problems are solved more effectively when learners understand their practical relevance. Contextual problems related to finance, engineering, health sciences, agriculture, business, or technology help students connect abstract mathematics to everyday life and professional practice. For instance, optimization problems may be linked to profit maximization, while statistics may be connected to medical data analysis. Students are more motivated when they perceive mathematics as useful and meaningful. Research indicates that application-based tasks improve students' interest and transfer of learning across disciplines (Shurygin et al, 2024).

The cultural and social context of learners also influences mathematical problem-solving. Students' experiences, language background, beliefs, and societal attitudes toward mathematics affect how they approach problems. In multicultural societies or multilingual classrooms, some students may struggle to interpret mathematical vocabulary or culturally unfamiliar scenarios. For example, a problem framed around foreign sports or unfamiliar currencies may confuse students even if the mathematics is simple. Robertson et al (2020) observed that language proficiency and cultural relevance strongly affect learners' participation and success in mathematics. Therefore, problem-solving tasks should be designed with sensitivity to learners' contexts.

The psychological context is equally significant in mathematical problem solving. Factors such as confidence, motivation, perseverance, anxiety, and attitude toward mathematics determine how students respond to challenging tasks (Lawal & Awofala, 2021; Awofala, Lawani, & Adeyemi, 2020; Awofala, 2023; Awofala, 2017, Adebiyi, Awofala, & Malik, 2024). Learners who believe they can succeed are more likely to persist through difficult problems, while those with negative beliefs may give up quickly. Mathematics anxiety, in particular, has been identified as a serious barrier to performance because it reduces concentration and working memory capacity during problem solving. Passolunghi, et al (2016) noted that anxious students may underperform even when they possess the required mathematical knowledge. This shows that emotional context matters greatly in mathematics learning. At the tertiary level, the academic context of mathematical problem-solving becomes more complex (Malasari & Awofala, 2022) because students encounter advanced topics such as calculus, linear algebra, probability, statistics, and differential equations. These areas require abstract reasoning, proof, modelling, and independent learning. Students who previously relied on rote memorization may find it difficult to adapt to the demands of university mathematics. Borji, et al (2021) explained that tertiary mathematics requires a shift from procedural thinking to formal and conceptual reasoning. Therefore, the academic context of higher education often exposes students' earlier learning gaps and weak problem-solving habits.

The technological context has also transformed mathematical problem solving in recent years. Students now use calculators, graphing tools, spreadsheets, computer algebra systems, coding platforms, and online simulations to solve problems. These tools can improve visualization, speed, and conceptual understanding when used appropriately. For example, graphing software can help students explore functions, while statistical software supports data analysis. However, lack of digital skills or unequal access to technology may create new barriers. Xiao (2019) emphasized that modern mathematical literacy increasingly involves solving problems in technology-rich environments. Another context is the assessment context, which refers to how mathematical ability is evaluated. If examinations emphasize memorization of formulas and routine procedures, students may focus on cramming rather than genuine understanding. On the other hand, assessments that include open-ended tasks, reasoning questions, modelling activities, and multiple-step problems encourage deeper learning and stronger problem-solving skills. Nilimaa (2023) argued that assessment practices significantly shape the quality of students' learning experiences. Thus, how mathematics is tested can determine how students prepare to solve problems. In Nigeria and many developing countries, the context of mathematical problem solving is affected by structural challenges such as overcrowded classrooms, limited instructional resources, inadequate tutorial support, and poor educational infrastructure. Many tertiary students learn mathematics in large lecture halls with little opportunity for individual guidance. Such conditions make it difficult for lecturers to identify misconceptions or provide personalized support. George, et al, (2020) reported that institutional factors continue to influence mathematics achievement among undergraduates in Nigeria. This indicates that improving mathematical problem solving requires both pedagogical and systemic reforms.

Mathematical Problem-Solving Process

Steps in Problem Solving

A situation presents a problem because you do not have a clear idea how to start. In mathematics classes, a problem arises for various reasons which include:

1. understanding the wording of the problem;
2. getting started because there is no obvious strategy to use;
3. inability to relate the problem to a previous mathematics the student is familiar with;
4. inability to use the right strategy correctly to solve the problem.

In order to overcome these problems, Polya (1945) cited in Ajao & Awofala (2024) identifies four steps/strategies in problem solving especially word or practical problems in mathematics. The four steps are:

1. understanding the problem;
2. devising a plan;
3. carrying out the plan, and
4. checking for correctness or look back.

These steps are discussed in more detail to help you in teaching mathematics in the schools.

Understanding the Problem

Understanding the problem involves reading and re-reading the problem carefully to find all the clues and determine what the question is all about. Students are stymied in their effort to solve mathematical problems simply because they cannot understand the problem fully or even in part. In order to overcome this obstacle, Polya suggests that students should ask some simple questions like

a. What am I asked to find?

b. Can I restate the problem in my own words?

c. Can I draw a picture or a diagram that can help my under-standing?

d. What is the information provided and is it enough to find a solution?

The mathematics teacher should encourage the students to ask the type of sampled questions as it is appropriate for the level of the students and problem at hand. Doyle (2005) notes that students who have poor literacy skills invariably have poor problem-solving skills when a problem requires reading and interpreting texts because these students cannot gain sufficient meaning from the text. Textually-based mathematical problem requires students to discriminate between relevant and irrelevant information to solve the problem.

Devising a Plan

Once the problem is understood, the student has many reasonable ways to solve it based on the students' past experiences. The following questions will help in this second stage of devising a plan, thus,

a. Do I know a related problem?

b. How did I solve the related problem?

Activities and strategies that can be carried out in this planning stage include:

a. making a list;

b. looking at a pattern;

c. drawing a picture;

d. using a formula, etc.

Carrying out the Plan

The third step is usually easier. In this third stage, you need to be careful and continue with the plan you have chosen. However, if your plan fails after you have carefully checked for errors in calculation and steps, then discard the plan and try another one.

Checking for Correctness or Looking Back

Once you have found a solution, it is important you go back to the problem and see if your answer or solution satisfies the conditions of the problem. This fourth step develops confidence in students as constant looking back helps them predict the strategy to use in future problems thereby increasing their confidence and interest in mathematics. In conclusion, the mathematical problem-solving process is a structured yet flexible pathway through which learners move from understanding a problem to planning, executing, and evaluating a solution. It requires conceptual knowledge, procedural fluency, strategic thinking, metacognition, and persistence. At the tertiary level, where mathematical tasks are more abstract and discipline-based, mastery of the problem-solving process is essential for academic success.

Factors Contributing to Students' Difficulties in Mathematical Problem-Solving

Students' difficulties in mathematical problem-solving arise from a combination of cognitive, instructional, emotional, linguistic, environmental, and socio-economic factors. Mathematical problem-solving is not limited to obtaining answers; it involves understanding the problem, selecting strategies, carrying out procedures, and evaluating solutions (Akinsola & Awofala, 2009; Akinsola & Awofala, 2008). When students experience weakness in any of these stages, their performance is affected. Empirical studies across different educational contexts have shown that poor achievement in mathematics is often linked to multiple interacting variables rather than a single cause (Wodtke & Parbst 2017). At the tertiary level, these difficulties become more visible because students are expected to solve abstract, non-routine, and discipline-based problems independently. Thus, the following factors are analyzed:

1. Poor Foundational Knowledge and Conceptual Gaps

One of the most significant factors contributing to students' difficulties is weak background knowledge from earlier schooling. Many students progress to tertiary institutions without mastering basic arithmetic, algebra, fractions, graphs, equations, and mathematical language. Since advanced mathematics builds on prior knowledge, deficiencies at lower levels make higher-level topics difficult to understand. Empirical evidence by Chinn (2020) showed that students with weak numeracy foundations consistently perform poorly in advanced quantitative tasks. For example, a student who does not understand factorization may struggle to solve quadratic equations such as $x^2 - 5x + 6 = 0$ because solving it requires prior algebraic knowledge. Similarly, a student weak in fractions may find calculus limits and probability concepts confusing.

2. Mathematics Anxiety and Negative Attitudes

Mathematics anxiety is another major contributor to poor problem-solving performance. Anxiety creates fear, tension, and mental blocks whenever students encounter mathematical tasks (Awofala & Akinoso, 2017; Awofala & Ogunsanya, 2025; Awofala, 2020). It reduces concentration, confidence, and working memory, making it difficult to reason through multistep problems. Awofala, et al. (2024) found that anxious students often underperform even when they possess the necessary mathematical skills. For instance, a student may understand how to solve simultaneous equations in class but panic during an examination and forget the steps. This directly affects the context of mathematical problem solving, where emotional conditions influence how learners approach tasks. Negative beliefs such as “mathematics is only for gifted people” also discourage persistence.

3. Ineffective Teaching Methods

Teaching methods strongly influence students’ mathematical understanding. In many institutions, mathematics is taught mainly through lectures, memorization of formulas, and teacher demonstrations, with little student participation. Such approaches may develop procedural imitation but not deep understanding or strategic thinking (Awofala, Fatade, & Ola-Oluwa, 2012). For example, students who only memorize the quadratic formula may fail to understand when or why it should be used: $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ When faced with unfamiliar quadratic problems, they become confused. This links with the heading context of problem in mathematics, because classroom context shapes students’ opportunities to reason, discuss, and practice solving problems.

4. Language and Problem Interpretation Difficulties

Many students struggle not with calculations but with understanding what mathematical questions require. Word problems often contain technical vocabulary, symbolic expressions, and hidden relationships that students must interpret correctly. McLachlan & Essien (2022) found that language proficiency significantly predicts mathematics performance, especially in multilingual settings. For example, a student may not distinguish between the terms “differentiate,” “integrate,” “approximate,” or “prove.” In Nigeria and similar contexts, students may think in indigenous languages while learning mathematics in English, causing comprehension barriers. This connects to the context of mathematical problem solving, where language and culture affect understanding.

5. Weak Problem-Solving Strategies and Metacognitive Skills

Some students know mathematical content but do not know how to approach unfamiliar problems strategically. They may begin calculations immediately without analyzing the problem, selecting suitable methods, or checking answers. Ajao & Awofala (2024) emphasized that expert problem solvers use planning, monitoring, and evaluation strategies more effectively than novices. For instance, when asked to solve a system of equations, a student may randomly manipulate numbers rather than choosing elimination, substitution, or matrix methods

$$: 2x + y = 7$$

$$x - y = 2$$

This connects directly with the Mathematical Problem-Solving Process, especially the stages of planning and looking back.

6. Lack of Practice and Poor Study Habits

Mathematics mastery requires repeated practice with varied tasks. Many students study mathematics only during examinations, relying on cramming instead of continuous engagement. Without regular practice, they forget procedures, fail to recognize patterns, and lose fluency. Al-Mutawah, et al (2019) found that consistent problem-solving practice improves conceptual understanding and procedural accuracy. For example, a student who solves only one derivative problem before an exam may struggle with variations such as product rule, quotient rule, or chain rule. This links to the earlier discussion on learning difficulties at tertiary level, where independent study habits are crucial.

7. Large Class Size and Limited Support

Overcrowded classrooms reduce lecturer-student interaction and limit personalized guidance. Mathematics learning often requires immediate clarification of misconceptions, but in large classes many students remain silent and confused. Saha, et al (2024) observed that institutional challenges such as overcrowding and inadequate support contribute to weak mathematics outcomes in higher education. For example, if 300 students attend one calculus lecture, it becomes difficult for the lecturer to address each learner's misunderstanding about limits or integration techniques. This demonstrates how environmental context influences problem-solving development.

8. Socio-Economic Challenges

Students from disadvantaged backgrounds may face hunger, stress, lack of textbooks, unstable electricity, or the need to combine studies with work. These conditions reduce concentration and time available for mathematical practice. Ahn & Davis (2023) reported that socio-economic disadvantage is strongly associated with lower academic outcomes in quantitative subjects. For instance, a student who works late hours to pay fees may have little time to solve tutorial questions or attend extra classes. Even with ability, performance may decline because of environmental pressures.

9. Limited Use of Technology and Learning Resources

Modern mathematical learning benefits from graphing tools, simulations, calculators, online tutorials, and software. Where students lack access to such resources, visualization and practice opportunities are reduced. Technology-rich learning environments improve mathematical literacy when access and skills are available (Xiao et al., 2019; Akinoso, 2017; Akinoso, 2018; Akinoso, 2023). For example, graphing software can help students visualize functions like

$$y = \sin x$$

making concepts clearer than static textbook diagrams. Students without such tools may rely solely on memorization.

Conclusion

Students' difficulties in mathematical problem-solving are caused by interconnected factors including weak foundational knowledge, anxiety, ineffective teaching methods, language barriers, poor strategies, inadequate practice, overcrowded classrooms, socio-economic hardship, and limited technology access. These factors link strongly with the earlier headings on context of problem in mathematics, context of mathematical problem solving, and the mathematical problem-solving process, showing that success depends on both learner ability and learning environment. Addressing these challenges requires better teaching strategies, supportive institutional policies, improved resources, and explicit instruction in problem-solving skills.

Suggestion for further studies

Based on the findings and discussions on students' difficulties in mathematical problem-solving at the tertiary level, the following areas are recommended for further studies:

- Gender Differences in Mathematical Problem-Solving
- Influence of Technology on Problem-Solving Skills
- Mathematics Anxiety and Academic Achievement
- Metacognitive Skills and Problem-Solving Ability

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