Opportunities and Challenges of Using a Problem-Solving Approach in form Three Students' Learning of Mathematics in Hwange District, Zimbabwe

***Henry Mudenda**

Lecturer at Zimbabwe Open University, Faculty of Education, Department of Teacher Development, Zimbabwe

***Corresponding Author**

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ABSTRACT

Mathematics is widely recognised as a cornerstone of scientific advancement, technological innovation, and socio-economic development. Despite its importance, learners in many developing countries continue to experience persistent difficulties in mathematical problem-solving, resulting in low achievement and reduced interest in the subject. This study investigated the opportunities and challenges associated with the use of a problem-solving approach in the teaching and learning of mathematics among Form Three students in selected secondary schools in Hwange District, Zimbabwe. The study was guided by a pragmatic research paradigm and employed a convergent mixed-methods research design. Data were collected from mathematics teachers, Heads of Department, and Form Three learners using questionnaires, semi-structured interviews, classroom observations, and document analysis. Quantitative data were analysed using descriptive statistics, while qualitative data were analysed thematically.

The findings revealed that teachers generally acknowledged the pedagogical value of problem-solving in promoting conceptual understanding, critical thinking, mathematical reasoning, learner engagement, and independent learning. However, classroom observations indicated that traditional teacher-centred instructional practices remained dominant, with limited implementation of authentic problem-solving pedagogy. Major challenges included inadequate teacher preparation, insufficient instructional time, examination-oriented teaching practices, inadequate teaching and learning resources, and learners' dependence on procedural instruction. The study further established that continuous professional development, learner-centred pedagogies, curriculum support, and collaborative learning environments could significantly enhance the implementation of problem-solving instruction in mathematics.

The study concludes that successful implementation of problem-solving instruction requires systemic support involving teachers, schools, teacher education institutions, curriculum developers, and educational policymakers. It recommends sustained professional development programmes, curriculum reforms that prioritise mathematical reasoning, and increased investment in instructional resources to improve mathematics learning outcomes in Zimbabwean secondary schools.

Keywords: Mathematics**,** Mathematics education, problem-solving approach, learner-centred pedagogy, mathematics teaching

INTRODUCTION

Mathematics occupies a central position within contemporary education systems because it equips learners with analytical reasoning, logical thinking, creativity, and decision-making competencies that extend beyond classroom learning into everyday life. Across the globe, educational systems increasingly recognise mathematical problem-solving as one of the essential competencies required for success in the twenty-first century. According to the Organisation for Economic Co-operation and Development, learners are expected not only to master mathematical procedures but also to apply mathematical knowledge flexibly to unfamiliar and authentic situations. Similarly, UNESCO (2021) identifies critical thinking, creativity, collaboration, and problem-solving as indispensable competencies for preparing learners to participate effectively in modern knowledge societies.

The shift from procedural instruction towards inquiry-based and problem-solving pedagogies reflects broader international reforms in mathematics education. Rather than viewing mathematics as a collection of formulas to memorise, modern curricula emphasise mathematical reasoning, conceptual understanding, communication, and the ability to solve complex problems (National Council of Teachers of Mathematics [NCTM], 2000). Consequently, mathematics classrooms are increasingly expected to provide learners with opportunities to explore, investigate, justify, and communicate mathematical ideas through meaningful problem-solving experiences.

Problem-solving has therefore become both an instructional strategy and a learning outcome within mathematics education. As George Pólya (1957) famously argued, solving mathematical problems enables learners to develop habits of logical inquiry, reflective thinking, and intellectual independence. Likewise, Alan H. Schoenfeld (1985) contended that effective mathematical learning occurs when learners actively construct solution strategies, monitor their thinking processes, and evaluate alternative approaches rather than merely reproducing teacher demonstrations. These perspectives continue to shape mathematics education reforms worldwide.

Within Zimbabwe, mathematics remains a compulsory subject at secondary school level because of its recognised contribution to science, technology, engineering, and mathematics (STEM) education. The Zimbabwean Curriculum Framework encourages learner-centred pedagogies that promote inquiry, creativity, innovation, collaboration, and critical thinking (Ministry of Primary and Secondary Education [MoPSE], 2015). Consequently, mathematics teachers are expected to facilitate learning experiences that encourage learners to construct mathematical understanding through exploration, discussion, and problem-solving instead of relying exclusively on teacher exposition.

Despite these curriculum expectations, evidence from both national examination reports and classroom research suggests that mathematics performance among secondary school learners remains unsatisfactory. Numerous learners continue to struggle when required to interpret mathematical situations, formulate solution strategies, justify reasoning, and apply concepts in unfamiliar contexts (Tambychik & Meerah, 2010). Similar observations have been reported across many developing countries, where mathematics instruction frequently remains examination-driven and teacher-centred, limiting opportunities for conceptual understanding and higher-order thinking (Boaler, 2016).

The persistence of procedural teaching practices has attracted considerable scholarly attention. According to Hiebert and Carpenter (1992), meaningful mathematical learning occurs when learners establish conceptual connections between ideas rather than memorising isolated procedures. Likewise, Boaler (2016) argues that classrooms characterised by exploration, discussion, and multiple solution pathways promote deeper mathematical understanding than environments dominated by repetitive exercises. Such learner-centred classrooms encourage learners to view mathematics as a discipline of reasoning and sense-making rather than simply obtaining correct answers.

Constructivist learning theories similarly emphasise that knowledge is actively constructed through meaningful interaction with learning experiences. Jean Piaget maintained that learners develop increasingly sophisticated cognitive structures through active exploration of their environment, while Lev Vygotsky highlighted the importance of social interaction, dialogue, and scaffolding within learners' Zone of Proximal Development. These theoretical perspectives provide strong justification for problem-solving approaches that position learners as active participants in mathematical knowledge construction rather than passive recipients of information.

Problem-solving instruction also contributes significantly to learners' broader educational development. Research consistently demonstrates that learners engaged in authentic mathematical problem-solving develop improved reasoning abilities, communication skills, creativity, persistence, and metacognitive awareness (Schoenfeld, 2007). Furthermore, collaborative problem-solving promotes teamwork, argumentation, reflection, and the ability to justify mathematical thinking, competencies increasingly valued within contemporary education systems.

However, implementing learner-centred mathematics instruction remains challenging. Studies conducted across Africa and other developing contexts have identified numerous barriers, including inadequate teacher preparation, overcrowded classrooms, limited instructional resources, curriculum overload, examination pressure, insufficient professional development, and learners' preference for teacher-directed instruction (Anthony & Walshaw, 2007; Panaoura, 2012). These contextual realities often constrain teachers' ability to facilitate meaningful mathematical inquiry despite recognising its educational benefits.

Within Zimbabwe, relatively few empirical studies have investigated how these contextual factors specifically influence the implementation of problem-solving instruction at the Form Three level. Form Three represents a particularly important stage because learners encounter increasingly abstract mathematical concepts while simultaneously preparing for Ordinary Level examinations. The effectiveness of instructional approaches adopted during this stage may substantially influence learners' subsequent mathematical achievement, confidence, and progression into STEM-related careers.

The present study therefore sought to investigate the opportunities created by mathematics teachers when using a problem-solving approach, examine the challenges affecting its implementation, and identify practical strategies for strengthening learner-centred mathematics instruction in Hwange District secondary schools. By combining quantitative and qualitative evidence, the study contributes to a more comprehensive understanding of mathematics teaching practices within rural Zimbabwean contexts and provides evidence that may inform teacher education, curriculum implementation, and educational policy.

Beyond its local significance, the study contributes to the growing international discourse surrounding equitable mathematics education in resource-constrained environments. Improving learners' mathematical problem-solving competencies is increasingly recognised as essential for achieving quality education under the United Nations Sustainable Development Goal 4, which advocates inclusive and equitable quality education for all. Consequently, understanding both the opportunities and obstacles surrounding problem-solving pedagogy has implications not only for Zimbabwe but also for comparable educational settings across Sub-Saharan Africa.

Statement of the Problem

Despite the recognition of problem-solving as a fundamental component of mathematics education, many secondary school learners continue to perform poorly in mathematical problem-solving tasks. In Zimbabwe, mathematics teaching remains predominantly teacher-centred, with instructional practices emphasizing procedural fluency and examination preparation rather than conceptual understanding and authentic problem-solving experiences (Jaji, 1990; National Council of Teachers of Mathematics [NCTM], 2000). Consequently, many learners experience difficulties in interpreting mathematical problems, selecting appropriate solution strategies, and applying mathematical knowledge to unfamiliar situations.

Although the national mathematics curriculum advocates learner-centred pedagogies and problem-solving approaches, classroom implementation appears inconsistent, particularly in rural secondary schools. Teachers often encounter challenges such as limited instructional time, inadequate professional preparation, insufficient teaching resources, and learners' dependence on teacher-directed instruction. While these issues have been documented in broader educational contexts, there is limited empirical evidence regarding how they specifically influence the teaching and learning of mathematics through problem-solving among Form 3 learners in Hwange District. This study therefore sought to investigate both the opportunities created by teachers and the challenges encountered in implementing problem-solving approaches in Form 3 mathematics classrooms.

Research Objectives

The study was guided by the following objectives:

General Objective

To investigate the opportunities and challenges associated with the use of a problem-solving approach in teaching and learning mathematics among Form 3 learners in Hwange District secondary schools.

Specific Objectives

1. To examine mathematics teachers' perceptions of using a problem-solving approach in teaching mathematics.
2. To identify the opportunities created by teachers to promote mathematical problem-solving among Form 3 learners.
3. To determine the challenges experienced by mathematics teachers when implementing a problem-solving approach.
4. To explore possible strategies for improving the implementation of problem-solving approaches in secondary school mathematics classrooms.

Research Questions

The study sought to answer the following research questions:

1. What are mathematics teachers' perceptions regarding the use of a problem-solving approach in teaching mathematics?
2. What opportunities do teachers create for learners to engage in mathematical problem-solving?
3. What challenges do mathematics teachers experience when implementing a problem-solving approach?
4. What strategies can improve the effective implementation of problem-solving approaches in Form 3 mathematics classrooms?

Significance of the Study

The findings of this study are expected to contribute to both educational theory and classroom practice by providing empirical evidence on the opportunities and challenges associated with implementing a problem-solving approach in the teaching and learning of mathematics at the secondary school level. As mathematics continues to be recognised as a cornerstone of scientific and technological advancement, improving learners' problem-solving competencies remains a national and global educational priority (National Council of Teachers of Mathematics [NCTM], 2000; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2021).

For mathematics teachers, the study provides practical insights into instructional practices that promote learner-centred classrooms, critical thinking, and conceptual understanding. The findings may encourage teachers to reflect on their pedagogical approaches and adopt instructional strategies that actively engage learners in mathematical reasoning and problem-solving rather than relying primarily on procedural teaching methods (Schoenfeld, 1985).

For school administrators and Heads of Mathematics Departments, the findings provide evidence that may guide the planning of professional development programmes, mentoring initiatives, and collaborative lesson study activities aimed at strengthening teachers' capacity to implement problem-solving approaches effectively.

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The study is also significant for teacher education institutions, as it highlights competencies that should be emphasised during pre-service and in-service teacher preparation programmes. The findings may assist universities and colleges in reviewing mathematics education curricula to ensure that future teachers develop the pedagogical knowledge and confidence required to facilitate mathematical problem-solving effectively (Shulman, 1987).

For the Ministry of Primary and Secondary Education (MoPSE) and curriculum developers, the study provides context-specific evidence from rural secondary schools that may inform curriculum implementation, teacher support systems, and mathematics education policy. The findings may also contribute to the development of targeted interventions designed to improve mathematics achievement through learner-centred instructional practices consistent with Zimbabwe's competence-based curriculum.

The study further benefits learners by identifying classroom practices that foster deeper conceptual understanding, mathematical reasoning, collaboration, creativity, and independent thinking. Effective implementation of problem-solving approaches has the potential to improve learners' confidence, motivation, and achievement in mathematics while equipping them with transferable skills required for lifelong learning and participation in science, technology, engineering, and mathematics (STEM) disciplines (OECD, 2019; NCTM, 2000).

Finally, the study contributes to the existing body of literature on mathematics education by addressing the limited empirical evidence on problem-solving instruction within rural Zimbabwean secondary schools. By focusing specifically on Form 3 learners in Hwange District, the research provides context-specific findings that may serve as a reference for future studies investigating learner-centred mathematics instruction in comparable educational settings across Zimbabwe and other developing countries.

Research Gap

A review of existing scholarship indicates that mathematical problem-solving has received substantial attention within international mathematics education research. Seminal contributions by Pólya (1957), Schoenfeld (1985), Hiebert and Carpenter (1992), and the National Council of Teachers of Mathematics (2000) established problem-solving as a central component of effective mathematics instruction. More recent empirical studies have similarly demonstrated that learner-centred problem-solving approaches improve conceptual understanding, mathematical reasoning, learner motivation, and academic achievement (Boaler, 2016; Hattie, 2023).

Nevertheless, important gaps remain within the existing body of knowledge. First, much of the available literature originates from developed countries whose educational environments differ considerably from those of many developing nations. Consequently, findings generated within well-resourced educational systems cannot automatically be generalised to rural Zimbabwean secondary schools, where contextual challenges such as limited instructional resources, large class sizes, examination pressures, and inadequate teacher support may influence classroom implementation differently.

Second, although several Zimbabwean studies have examined mathematics performance and curriculum implementation, relatively few have specifically investigated how mathematics teachers create opportunities for learner-centred problem-solving while simultaneously negotiating the practical constraints encountered during classroom instruction. Existing research has frequently concentrated on learners' examination performance rather than exploring teachers' instructional experiences, classroom practices, and pedagogical decision-making processes.

Third, previous studies have rarely focused specifically on Form Three learners. This learner group occupies a critical transitional stage characterised by increasing mathematical complexity and preparation for high-stakes Ordinary Level examinations. Understanding instructional practices at this level therefore provides valuable insights into how mathematical reasoning and problem-solving competencies develop before learners reach examination classes.

Finally, there is limited empirical evidence integrating both quantitative and qualitative perspectives to provide a comprehensive understanding of opportunities and challenges associated with problem-solving instruction in rural Zimbabwean mathematics classrooms. Many previous investigations have adopted either survey methods or qualitative case studies independently, limiting the depth of understanding that can be achieved through methodological triangulation.

The present study addresses these gaps by employing a convergent mixed-methods approach to investigate teachers' perceptions, observed classroom practices, opportunities created for learners, implementation challenges, and possible interventions for strengthening problem-solving instruction among Form Three learners in Hwange District. In doing so, the study contributes context-specific evidence capable of informing teacher education programmes, curriculum implementation strategies, and mathematics education policy within Zimbabwe and comparable educational settings.

LITERATURE REVIEW

Conceptualising Mathematical Problem-Solving

Mathematical problem-solving occupies a central position in contemporary mathematics education because it enables learners to construct conceptual understanding while simultaneously developing reasoning, communication, and analytical competencies. Although mathematics has traditionally been associated with procedural fluency and computational accuracy, recent educational reforms increasingly emphasise learners' ability to apply mathematical knowledge in unfamiliar contexts, justify their reasoning, and develop multiple solution strategies (National Council of Teachers of Mathematics [NCTM], 2000). Consequently, problem-solving has evolved from being viewed merely as an instructional topic to becoming both the primary objective and the principal vehicle through which mathematical learning occurs.

Scholars have offered diverse but complementary definitions of mathematical problem-solving. According to George Pólya (1957), a mathematical problem exists whenever an individual seeks a solution but lacks an immediately obvious procedure for obtaining it. This definition distinguishes genuine mathematical problems from routine exercises, which require only the application of memorised algorithms. Similarly, Wilson (2004) argues that mathematical problems require learners to interpret information, formulate strategies, evaluate possible approaches, and justify solutions rather than simply reproduce previously demonstrated procedures.

The distinction between exercises and authentic mathematical problems is particularly significant within mathematics education. Routine exercises generally assess learners' procedural competence, whereas authentic problems require conceptual understanding, flexible thinking, creativity, and mathematical reasoning (Hiebert & Carpenter, 1992). As Carpenter et al. (1999) observe, learners who repeatedly encounter meaningful mathematical problems develop deeper conceptual knowledge because they continuously establish connections among mathematical ideas instead of memorising isolated procedures.

The evolution of mathematics education has increasingly positioned problem-solving as an essential component of curriculum reform. The National Council of Teachers of Mathematics (2000) identifies problem-solving as one of the five fundamental process standards that underpin effective mathematics learning. Likewise, the Organisation for Economic Co-operation and Development incorporates mathematical problem-solving within international assessments because it reflects learners' capacity to apply mathematical knowledge in authentic situations rather than merely recall factual information.

Constructivist perspectives provide further theoretical justification for emphasising problem-solving within mathematics instruction. According to Jean Piaget (1972), learners actively construct knowledge by interacting with their environment and reorganising existing cognitive structures. Rather than passively receiving information, learners interpret experiences through exploration, experimentation, and reflection. Problem-solving activities therefore provide meaningful opportunities for learners to integrate new mathematical concepts with prior knowledge, resulting in increasingly sophisticated cognitive development.

Similarly, Lev Vygotsky (1978) argued that learning occurs most effectively through social interaction within the Zone of Proximal Development. During collaborative mathematical problem-solving, learners negotiate meaning, exchange ideas, defend arguments, and receive instructional support from teachers and peers. Such interactions facilitate conceptual growth while simultaneously strengthening learners' mathematical communication skills and confidence.

Contemporary mathematics education researchers continue to reinforce these theoretical perspectives. According to Boaler (2016), classrooms characterised by exploration, discussion, and multiple solution pathways encourage learners to perceive mathematics as a coherent system of reasoning rather than a collection of disconnected formulas. Likewise, Schoenfeld (2007) maintains that successful mathematical problem-solvers continuously monitor their thinking, evaluate alternative strategies, and reflect upon their reasoning throughout the solution process. These metacognitive behaviours distinguish expert mathematical thinkers from learners who rely exclusively on memorised procedures.

Within Zimbabwe, curriculum reforms similarly recognise the importance of mathematical problem-solving. The Ministry of Primary and Secondary Education (MoPSE, 2015) advocates learner-centred pedagogies that develop creativity, innovation, collaboration, communication, and critical thinking. Consequently, mathematics teachers are expected to facilitate classroom environments where learners actively investigate mathematical relationships instead of merely reproducing teacher demonstrations. However, despite these curriculum aspirations, numerous classroom studies continue to report widespread reliance on procedural instruction, suggesting that the intended curriculum has not yet been fully realised in classroom practice (Jaji, 1990).

Collectively, the literature demonstrates that mathematical problem-solving extends beyond obtaining correct numerical answers. Instead, it represents a dynamic cognitive process through which learners interpret situations, formulate strategies, justify reasoning, communicate ideas, and construct increasingly sophisticated mathematical understanding. This broader conceptualisation provides the foundation upon which learner-centred mathematics instruction is built.

Problem-Solving as a Learner-Centred Pedagogical Approach

The growing emphasis on learner-centred education has fundamentally transformed conceptions of effective mathematics teaching. Traditional instructional approaches typically position teachers as transmitters of knowledge while learners assume relatively passive roles. In contrast, learner-centred pedagogies encourage learners to construct mathematical understanding through exploration, inquiry, discussion, and reflection (Anthony & Walshaw, 2007). Within this paradigm, problem-solving serves as one of the most effective instructional approaches for facilitating meaningful mathematical learning.

Research consistently demonstrates that teaching through problem-solving differs substantially from teaching for problem-solving. Teaching for problem-solving often involves explaining mathematical procedures before allowing learners to apply them to routine exercises. Conversely, teaching through problem-solving introduces learners to carefully designed mathematical tasks that require investigation before formal procedures are presented (Schoenfeld, 1985). Learning therefore emerges naturally from learners' attempts to solve authentic mathematical challenges.

According to Cockcroft (1982), mathematics derives its educational value largely from its applicability to solving practical problems. Learners become increasingly motivated when mathematical concepts are introduced within meaningful contexts that reflect real-world situations. Similarly, Evans (1994) argues that effective problem-solving instruction encourages rich interactions among learners, promotes mathematical dialogue, and enables learners to justify and evaluate alternative solution strategies. Such classrooms foster intellectual curiosity while simultaneously strengthening learners' conceptual understanding.

The learner-centred nature of problem-solving aligns closely with inquiry-based learning philosophies. During inquiry-oriented mathematics instruction, teachers facilitate rather than dominate learning by posing challenging questions, encouraging exploration, and guiding learners towards conceptual discoveries (Artzt et al., 2008). Rather than providing immediate solutions, teachers scaffold learners' thinking through carefully structured questioning and feedback. This instructional approach encourages learners to assume greater responsibility for constructing mathematical knowledge.

One important characteristic of learner-centred mathematics instruction is its emphasis on multiple solution pathways. As Pólya (1957) observed, authentic mathematical problems rarely possess only one acceptable solution method. Allowing learners to develop and compare alternative strategies promotes flexibility, creativity, and deeper conceptual understanding. Boaler (2016) similarly contends that classrooms encouraging multiple representations and diverse solution strategies cultivate mathematical confidence while reducing learners' anxiety towards mathematics.

Another distinguishing feature involves the central role of mathematical discourse. Vygotskian perspectives emphasise that meaningful learning occurs through dialogue, negotiation, and collaborative knowledge construction (Vygotsky, 1978). Accordingly, effective mathematics classrooms encourage learners to explain reasoning, critique peers' arguments, justify conclusions, and collectively evaluate alternative mathematical ideas. Hiebert (1997) argues that such discourse enables teachers to identify learners' misconceptions while providing opportunities for conceptual refinement.

Learner-centred problem-solving also enhances learner motivation. Traditional mathematics instruction often emphasises procedural accuracy and memorisation, leading many learners to perceive mathematics as abstract and disconnected from everyday experiences. In contrast, contextualised mathematical problems demonstrate the practical relevance of mathematical concepts, thereby increasing learner engagement and persistence (Resnick, 1987). When learners successfully solve meaningful problems independently or collaboratively, they develop greater confidence in their mathematical abilities.

However, implementing learner-centred pedagogies requires substantial pedagogical expertise. Teachers must possess sufficient content knowledge to anticipate learners' misconceptions, design appropriate tasks, facilitate productive discussions, and provide effective scaffolding without reducing the cognitive demand of mathematical problems (Ball et al., 2008). Consequently, successful implementation depends not only upon curriculum intentions but also upon teachers' professional knowledge, beliefs, and instructional competence.

Evidence from developing countries nevertheless suggests that learner-centred mathematics instruction remains difficult to implement consistently. Examination-oriented education systems frequently encourage procedural teaching because teachers perceive algorithmic instruction as more efficient for preparing learners for standardised assessments (Tambychik & Meerah, 2010). Consequently, many classrooms continue to prioritise procedural fluency at the expense of conceptual understanding despite curriculum reforms advocating learner-centred approaches.

Overall, existing literature strongly supports problem-solving as an effective learner-centred instructional approach capable of improving mathematical understanding, learner engagement, reasoning, and independent thinking. Nevertheless, successful implementation requires favourable instructional conditions, adequate teacher preparation, and supportive educational policies.

Competencies Developed Through Mathematical Problem-Solving

Beyond improving academic achievement, mathematical problem-solving contributes significantly to learners' cognitive, affective, and social development. Contemporary educational frameworks increasingly recognise that mathematics education should cultivate transferable competencies applicable across diverse academic, professional, and everyday contexts (OECD, 2022). Consequently, problem-solving has become an essential mechanism for developing higher-order thinking skills required within knowledge-based economies.

Perhaps the most widely recognised competency developed through mathematical problem-solving is critical thinking. According to Schoenfeld (1985), learners engaged in authentic mathematical inquiry continuously analyse information, evaluate evidence, formulate hypotheses, monitor progress, and revise solution strategies. These cognitive processes strengthen learners' capacity for logical reasoning while promoting intellectual

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independence. Likewise, Baroody (1998) argues that learners who regularly engage in mathematical investigations develop increasingly sophisticated analytical skills that extend beyond mathematics itself.

Problem-solving similarly promotes conceptual understanding by encouraging learners to establish meaningful connections among mathematical ideas. Hiebert and Carpenter (1992) contend that conceptual understanding emerges when learners relate new knowledge to existing cognitive structures instead of memorising isolated procedures. Because authentic mathematical problems require learners to interpret situations rather than recall formulas mechanically, conceptual learning becomes both deeper and more durable.

Metacognitive competence represents another important outcome of mathematical problem-solving. Successful learners continually monitor their own thinking, evaluate the effectiveness of solution strategies, identify errors, and regulate subsequent learning behaviours (Schoenfeld, 2007). Such self-regulatory skills enable learners to become increasingly autonomous, reflective, and resilient when confronted with unfamiliar mathematical situations.

Communication and collaboration also feature prominently among competencies fostered through problem-solving instruction. Vygotsky (1978) emphasised that social interaction plays a fundamental role in cognitive development. Collaborative mathematical investigations therefore encourage learners to articulate ideas, defend arguments, negotiate meaning, and appreciate diverse perspectives. Anthony and Walshaw (2007) similarly report that classroom discussions centred upon mathematical reasoning substantially enhance learners' communication skills and conceptual understanding.

Furthermore, mathematical problem-solving nurtures creativity and innovation. Unlike routine exercises that require predetermined procedures, authentic mathematical problems encourage learners to generate multiple solution pathways, experiment with representations, and evaluate alternative approaches (Boaler, 2016). These experiences cultivate intellectual flexibility while encouraging learners to perceive mistakes as valuable learning opportunities rather than indicators of failure.

Finally, mathematical problem-solving contributes positively to learners' attitudes towards mathematics. Research consistently indicates that learners experiencing meaningful mathematical success develop stronger self-efficacy, increased motivation, and greater persistence when facing challenging tasks (Hattie, 2023). Such affective outcomes are particularly important because positive mathematical dispositions frequently influence long-term participation in STEM-related education and careers.

Collectively, the literature demonstrates that mathematical problem-solving develops a comprehensive range of competencies extending well beyond computational proficiency. These competencies, including critical thinking, conceptual understanding, metacognition, communication, collaboration, creativity, resilience, and self-confidence, reflect the broader educational goals of twenty-first-century mathematics education and provide compelling justification for integrating problem-solving more fully into secondary school mathematics classrooms.

Theoretical Framework

This study is anchored in Constructivist Learning Theory, primarily drawing on the works of Piaget (1970) and Vygotsky (1978), while integrating Pólya's (1957) mathematical problem-solving model and Schoenfeld's (1985) cognitive framework for mathematical problem-solving. Collectively, these theories explain how learners develop mathematical understanding through active engagement in meaningful problem-solving activities rather than through passive reception of information.

Constructivism posits that learners actively construct knowledge as they interact with their environment and build upon prior experiences. According to Piaget (1970), learning occurs when individuals assimilate new experiences into existing cognitive structures or accommodate those structures to incorporate new knowledge. Within mathematics education, this implies that learners develop conceptual understanding by exploring mathematical ideas, testing hypotheses, and reflecting on their reasoning rather than memorising formulas or procedures. Similarly, Bruner (1966) argues that discovery learning enables learners to construct deeper conceptual knowledge through active exploration, making mathematics more meaningful and transferable to real-life contexts.

The social dimension of constructivism is further explained by Vygotsky (1978), who emphasised that learning is fundamentally a social process. His concept of the Zone of Proximal Development (ZPD) suggests that learners achieve higher levels of understanding when supported by teachers or more knowledgeable peers. Consequently, effective mathematics instruction requires teachers to scaffold learners' thinking through questioning, collaborative learning, guided inquiry, and classroom discussion. As Hiebert et al. (1997**)** observe, meaningful classroom discourse enables learners to articulate mathematical ideas, justify their reasoning, and refine their understanding through interaction with others.

The study also adopts Pólya's (1957) classical framework for mathematical problem-solving. Pólya proposed four sequential stages of problem-solving: understanding the problem, devising a plan, carrying out the plan, and looking back to evaluate the solution. These stages encourage learners to think systematically while promoting analytical reasoning, reflection, and strategic thinking. According to Pólya (1957), successful problem-solvers continually monitor their progress and evaluate the effectiveness of the strategies they employ rather than merely seeking correct answers.

Complementing Pólya's model is Schoenfeld's (1985) theory of mathematical problem-solving, which argues that successful problem-solving depends on four interrelated components: mathematical resources, heuristic strategies, metacognitive control, and learners' belief systems. Schoenfeld maintained that possessing mathematical knowledge alone does not guarantee successful problem-solving. Instead, learners must also regulate their thinking, monitor their progress, select appropriate strategies, and maintain positive beliefs regarding their mathematical capabilities. Later, Schoenfeld (1992**)** further argued that metacognition and self-regulation distinguish expert mathematical problem-solvers from novices.

The theoretical assumptions adopted in this study are consistent with the recommendations of the National Council of Teachers of Mathematics (2000), which advocates learner-centred classrooms where mathematical understanding is developed through inquiry, reasoning, communication, and authentic problem-solving. Likewise, Anthony and Walshaw (2009**)** contend that effective mathematics instruction should encourage learners to investigate mathematical relationships, justify their reasoning, and collaborate in solving meaningful problems rather than relying solely on procedural instruction.

Taken together, Constructivist Learning Theory, Pólya's problem-solving framework, and Schoenfeld's cognitive model provide an appropriate theoretical lens for examining the opportunities and challenges associated with implementing problem-solving approaches in Form 3 mathematics classrooms. These theories explain how instructional practices, classroom interactions, teacher competence, and learner engagement collectively influence the development of mathematical reasoning, conceptual understanding, and problem-solving competence.

Conceptual Framework

The conceptual framework for this study was developed from the principles of constructivist learning and contemporary literature on mathematics problem-solving. It illustrates the relationships among teacher-related factors, classroom practices, contextual conditions, learner engagement, and mathematics learning outcomes.

The framework assumes that the successful implementation of a problem-solving approach depends largely on teachers' pedagogical knowledge, beliefs about mathematics teaching, professional competence, and access to adequate instructional resources. According to Shulman (1987), effective teaching requires not only mastery of subject content but also pedagogical content knowledge that enables teachers to transform mathematical concepts into meaningful learning experiences. Similarly, Ball, Thames, and Phelps (2008) argue that mathematics teachers require specialised knowledge that allows them to anticipate learners' misconceptions and facilitate conceptual understanding through appropriate instructional strategies.

The framework further recognises that classroom implementation is influenced by contextual factors such as instructional time, class size, availability of teaching materials, school leadership support, curriculum demands, and opportunities for professional development. Research has consistently shown that these contextual variables significantly influence teachers' ability to implement learner-centred instructional approaches effectively (Anthony & Walshaw, 2009; Tambychik & Meerah, 2010).

When teachers successfully implement problem-solving strategies, learners are provided with opportunities to engage actively in mathematical thinking through classroom discussion, collaborative learning, inquiry, exploration, and reflective reasoning. Such learner-centred environments promote deeper conceptual understanding because learners construct mathematical knowledge through interaction with tasks, peers, and teachers (Vygotsky, 1978; Hiebert et al., 1997).

Active learner engagement subsequently contributes to improved mathematical reasoning, critical thinking, problem-solving competence, conceptual understanding, learner confidence, and overall academic achievement. According to the National Council of Teachers of Mathematics (2000), meaningful engagement in authentic mathematical tasks enables learners to develop flexible thinking and transferable problem-solving skills required both within and beyond the classroom.

However, the framework also acknowledges that barriers such as limited instructional time, inadequate teacher preparation, insufficient teaching resources, negative learner attitudes, and examination-oriented teaching practices may constrain the effective implementation of problem-solving approaches (Buschman, 2004; Hiebert & Carpenter, 1992). These constraints reduce opportunities for learner participation and often result in teacher-centred instruction that emphasises procedural fluency at the expense of conceptual understanding.

The conceptual framework therefore proposes that teacher competence and supportive classroom conditions positively influence the implementation of problem-solving instruction, which, in turn, enhances learner engagement and ultimately improves mathematics learning outcomes. Conversely, contextual challenges weaken instructional implementation and reduce opportunities for learners to develop higher-order mathematical thinking skills.

The conceptual relationships investigated in this study are summarised below.

Independent Variables

Teacher Competence

Teacher Beliefs

Instructional Resources

Professional Development

Classroom Environment

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Implementation of Problem-Solving Approach

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Learner Engagement

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• Discussion

• Collaboration

• Exploration

• Critical Thinking

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Learning Outcomes

• Problem-solving Skills

• Conceptual Understanding

• Mathematical Reasoning

• Achievement

The framework also recognises that several moderating factors influence implementation, including:

- time constraints;
- teacher experience;
- class size;
- learner motivation;
- school support;
- availability of teaching materials.

These contextual factors may either facilitate or hinder effective implementation of problem-solving instruction.

METHODOLOGY

Research Approach

This study adopted a mixed methods research approach, combining quantitative and qualitative methods to obtain a comprehensive understanding of the opportunities and challenges associated with using a problem-solving approach in teaching Form Three mathematics. Mixed methods research allows researchers to integrate numerical trends with participants' lived experiences, thereby producing richer and more comprehensive findings than a single methodological approach (Creswell & Plano Clark, 2018). According to Creswell (2014), combining qualitative and quantitative data strengthens the validity of research findings through triangulation.

The quantitative component generated numerical data from questionnaires administered to mathematics teachers, while the qualitative component relied on interviews and classroom observations to gain deeper insights into teachers' instructional practices and perceptions regarding problem-solving instruction.

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Research Design

The study employed a descriptive survey research design supported by qualitative interviews and classroom observations.

Descriptive survey research enables researchers to describe existing conditions without manipulating variables (Cohen et al., 2018). The design was appropriate because the researcher intended to investigate existing classroom practices, identify opportunities created by teachers, and explore the challenges teachers experienced when implementing problem-solving instruction.

Observational methods complemented the survey by allowing the researcher to compare teachers' reported instructional practices with actual classroom implementation.

Population of the Study

The target population comprised mathematics teachers teaching Form Three learners in secondary schools located in Hwange District.

The population included:

- Mathematics teachers
- Heads of Mathematics Departments
- Student teachers teaching mathematics

These participants were selected because they were directly involved in implementing mathematics instruction and therefore possessed relevant knowledge concerning problem-solving pedagogy.

Sample and Sampling Procedures

Three secondary schools were purposively selected from different categories within Hwange District to ensure diversity.

The selected schools represented:

- one boarding secondary school;
- one day high school; and
- one ordinary-level day secondary school.

Purposive sampling ensured that schools with differing learning environments were represented (Etikan et al., 2016).

Within each school, mathematics teachers responsible for Form Three classes were selected using purposive sampling because they possessed the knowledge required to answer the research questions.

The final sample included:

- Mathematics teachers;
- Heads of Departments; and
- Student teachers responsible for teaching mathematics.

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Data Collection Instruments

Three instruments were used.

Questionnaires

Structured questionnaires collected quantitative data regarding teachers' perceptions of problem-solving instruction, challenges encountered, and opportunities created during mathematics teaching.

Questionnaires provide an economical means of collecting information from several respondents simultaneously (Kothari, 2004).

Interviews

Semi-structured interviews enabled teachers to explain their experiences in greater depth.

Interviews generated detailed explanations concerning teachers' understanding of problem-solving, classroom realities, professional preparedness, and suggested improvements.

According to Merriam and Tisdell (2016), interviews provide rich descriptions that cannot easily be obtained through questionnaires.

Classroom Observations

Lesson observations enabled the researcher to witness actual classroom practices.

Observation schedules focused on:

- learner participation;
- teacher questioning;
- collaborative learning;
- mathematical discussions;
- learner independence;
- use of problem-solving activities.

Observation is particularly useful because it records actual behaviour rather than reported behaviour (Cohen et al., 2018).

Validity and Reliability

Instrument validity was established through expert review by experienced education lecturers.

Their comments assisted in refining questionnaire items and interview questions.

Reliability was enhanced through piloting the instruments before the main study.

Triangulation using questionnaires, interviews, and observations improved the trustworthiness of findings (Lincoln & Guba, 1985).

Ethical Considerations

Permission to conduct the research was obtained from relevant educational authorities and participating schools.

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Participants voluntarily participated after receiving information regarding:

- study objectives;
- confidentiality;
- anonymity;
- voluntary participation; and
- the right to withdraw.

No participant names appear in the study.

Ethical principles recommended by the American Educational Research Association (AERA, 2020) guided the research.

RESULTS

Teachers' Views on Problem-Solving

Questionnaire responses revealed overwhelmingly positive perceptions regarding problem-solving instruction.

Most teachers agreed that problem-solving:

- promotes critical thinking;
- improves conceptual understanding;
- enhances learner participation;
- develops mathematical reasoning;
- encourages independent learning.

Interview participants similarly described problem-solving as learner-centred and beneficial for developing higher-order thinking.

One teacher explained:

"Learners understand concepts better when they solve problems themselves instead of simply copying procedures."

Another participant observed that problem-solving allows teachers to identify learners' misconceptions early, before formal instruction begins.

These findings support the observations of the National Council of Teachers of Mathematics (2000), which argues that mathematical understanding develops through meaningful engagement with challenging tasks rather than memorization.

Similarly, Pólya (1957) maintains that problem-solving enables learners to discover mathematical relationships independently.

Opportunities Created by Teachers

Teachers identified several opportunities created through problem-solving instruction.

These included:

Promotion of Critical Thinking

Teachers reported that learners were encouraged to:

- analyse situations;
- compare strategies;
- justify answers;
- evaluate different solution methods.

Such activities encouraged mathematical reasoning, consistent with constructivist learning principles (Piaget, 1970).

Learner Collaboration

Teachers frequently organised learners into groups.

Collaborative discussions allowed learners to:

- exchange ideas;
- explain procedures;
- defend reasoning;
- compare answers.

These findings agree with Vygotsky (1978), who argued that learning develops through social interaction.

Increased Learner Participation

Problem-solving activities encouraged active learner engagement.

Rather than passively listening to explanations, learners participated in:

- investigating problems;
- making conjectures;
- discussing ideas;
- presenting solutions.

This finding aligns with Hiebert et al. (1997), who emphasise learner participation as central to conceptual understanding.

Identification of Prior Knowledge

Teachers reported that problem-solving activities helped determine learners' existing understanding before introducing new concepts.

One participant commented:

"I can easily identify which learners already understand the topic before teaching."

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This diagnostic function supports formative assessment practices (Black & Wiliam, 2009).

Classroom Observation Findings

Despite teachers expressing positive attitudes toward problem-solving, classroom observations revealed a different reality.

Most lessons followed traditional instructional patterns.

Teachers typically:

- explained procedures;
- demonstrated worked examples;
- asked learners to imitate examples;
- assigned routine exercises.

Few lessons involved genuine mathematical inquiry.

Learners rarely:

- formulated strategies independently;
- discussed multiple solutions;
- justified mathematical reasoning.

Instead, teachers dominated classroom discussions.

These observations suggest a disconnect between teachers' beliefs and instructional practices.

Such inconsistencies have also been documented by Hiebert et al. (1997), who found that teachers often support learner-centred instruction theoretically but revert to procedural teaching during classroom practice.

Challenges Encountered by Teachers

Several recurring challenges emerged.

Time Constraints

Time emerged as the most frequently cited challenge.

Teachers believed that problem-solving consumed considerable instructional time.

One participant explained:

"One problem may take the whole lesson."

Consequently, teachers preferred procedural teaching because it enabled syllabus coverage.

These findings correspond with those of Stigler and Hiebert (1999), who noted that teachers frequently abandon inquiry-based teaching due to curriculum pressures.

Learner Dependence

Teachers reported that many learners expected immediate answers from teachers.

Learners were reluctant to struggle independently with unfamiliar problems.

According to interview participants, learners frequently asked:

"*Teacher, what is the formula?",*

instead of exploring possible solution methods.

Such dependency limits mathematical resilience (Schoenfeld, 2016).

Limited Teacher Knowledge

Several teachers acknowledged insufficient preparation for teaching through problem-solving.

Although familiar with procedural mathematics, many lacked confidence in facilitating open-ended investigations. Buschman (2004) similarly observed that many mathematics teachers receive limited preparation for inquiry-oriented instruction.

Resource Constraints

Teachers also reported shortages of:

- instructional materials;
- mathematical manipulatives;
- technological resources;
- reference materials.

Limited resources reduced opportunities for designing authentic mathematical investigations.

Examination Pressure

Teachers believed national examinations encouraged procedural teaching.

Consequently, classroom instruction became examination-driven rather than inquiry-based.

This finding reflects concerns raised by Boaler (2016), who argues that assessment systems often discourage creative mathematical thinking.

DISCUSSION

The findings demonstrate that teachers generally possess positive perceptions regarding problem-solving instruction but experience significant challenges translating these beliefs into classroom practice.

Consistent with constructivist learning theory, participants recognised that learners construct mathematical understanding through active engagement rather than passive reception (Piaget, 1970; Vygotsky, 1978).

Teachers acknowledged that problem-solving develops reasoning, creativity, collaboration, and conceptual understanding.

These findings corroborate earlier studies by Schoenfeld (2016), who argues that successful mathematics instruction develops strategic competence alongside procedural fluency.

However, classroom observations revealed that traditional teacher-centred instruction remained dominant.

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Teachers frequently demonstrated procedures before allowing learners to practise similar exercises. Such practices contradict recommendations by the National Council of Teachers of Mathematics (2000), which advocate learning mathematics through exploration and inquiry.

The discrepancy between teachers' beliefs and classroom practices appears to result primarily from contextual constraints.

Time pressure, examination demands, inadequate instructional resources, and insufficient professional development discouraged teachers from fully implementing learner-centred instruction.

These findings agree with Hiebert et al. (1997), who argue that changing teachers' instructional beliefs alone is insufficient unless institutional conditions also support instructional innovation.

The findings further suggest that professional development remains essential.

Teachers require practical training on designing worthwhile mathematical problems, facilitating mathematical discussions, managing collaborative learning, and assessing problem-solving processes.

This recommendation aligns with the work of Ball, Thames, and Phelps (2008), who emphasise the importance of specialised pedagogical content knowledge in mathematics teaching.

Furthermore, collaborative learning emerged as a major opportunity for enhancing mathematical understanding. Learners benefited from discussing alternative strategies and explaining their reasoning to peers.

These findings reinforce Vygotsky's (1978) concept of the Zone of Proximal Development, whereby learners achieve higher levels of understanding through guided social interaction.

Overall, the study demonstrates that successful implementation of problem-solving pedagogy depends not only on teachers' positive attitudes but also on adequate training, supportive school environments, sufficient instructional time, appropriate resources, and assessment systems that reward mathematical reasoning rather than rote memorisation.

CONCLUSION

This study investigated the opportunities and challenges associated with using a problem-solving approach in teaching Form Three mathematics in selected secondary schools in Hwange District, Zimbabwe. The findings demonstrate that although mathematics teachers generally possess positive attitudes towards problem-solving instruction and recognise its educational value, its implementation remains inconsistent in classroom practice. Teachers acknowledged that problem-solving promotes conceptual understanding, critical thinking, learner participation, mathematical reasoning, and independent learning. These findings are consistent with the constructivist perspectives of Piaget (1970) and Vygotsky (1978), who argue that meaningful learning occurs when learners actively construct knowledge through exploration, collaboration, and reflection.

The study further established that problem-solving creates valuable learning opportunities by encouraging learners to engage in mathematical investigations, discuss alternative solution strategies, justify their reasoning, and apply mathematical concepts to authentic situations. Such learner-centred practices support the development of higher-order thinking skills identified as essential competencies for the twenty-first century (OECD, 2019). These findings also support the recommendations of the National Council of Teachers of Mathematics (2000), which advocates teaching mathematics through meaningful problem-solving experiences rather than through procedural instruction alone.

Despite these opportunities, several barriers continue to hinder effective implementation of problem-solving pedagogy. The most prominent challenges identified were limited instructional time, examination-oriented teaching, inadequate professional preparation, insufficient instructional resources, and learners’ dependence on teachers for procedural guidance. Classroom observations revealed that although teachers expressed favourable

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views regarding problem-solving, many lessons remained predominantly teacher-centred, characterised by demonstration, explanation, and repetitive practice exercises. This discrepancy between teachers' beliefs and classroom practice suggests that positive perceptions alone are insufficient to transform instructional practice without adequate institutional support.

The findings further suggest that successful implementation of problem-solving pedagogy requires more than curriculum reform. Sustainable improvement depends on continuous professional development, supportive school leadership, improved classroom resources, learner-centred assessment systems, and teacher confidence in facilitating mathematical inquiry. Mathematics teachers require opportunities to develop specialised pedagogical knowledge that enables them to design worthwhile mathematical tasks, facilitate productive classroom discussions, assess learners' reasoning, and manage collaborative learning effectively.

Overall, the study concludes that the problem-solving approach has considerable potential to improve mathematics teaching and learning in Zimbabwean secondary schools. However, its effectiveness depends upon deliberate efforts by teachers, school administrators, teacher education institutions, curriculum developers, and policymakers to create enabling environments that support learner-centred mathematics instruction.

RECOMMENDATIONS

Based on the findings of this study, the following recommendations are proposed.

Recommendations for Mathematics Teachers

Mathematics teachers should deliberately shift from predominantly teacher-centred instructional methods towards learner-centred approaches that actively engage learners in mathematical inquiry. Rather than demonstrating procedures before practice, teachers should present challenging mathematical problems that encourage learners to investigate, reason, justify, and communicate their mathematical thinking. Regular classroom reflection should become an integral part of instructional practice, enabling teachers to evaluate the effectiveness of their teaching strategies and identify opportunities for continuous improvement.

Teachers should also diversify assessment methods by incorporating authentic problem-solving tasks alongside conventional exercises. Formative assessment strategies, including peer discussions, learner presentations, reflective journals, and classroom questioning, should be used to assess learners' conceptual understanding rather than procedural recall alone.

Recommendations for School Administrators

School administrators should provide institutional support that promotes learner-centred mathematics instruction. Schools should allocate sufficient time for collaborative lesson planning among mathematics teachers to design meaningful problem-solving activities aligned with curriculum objectives.

Administrators should also facilitate regular professional learning communities where teachers share experiences, reflect on instructional practices, observe one another's lessons, and collaboratively develop effective teaching strategies. Classroom supervision should place greater emphasis on learner engagement, mathematical reasoning, and instructional innovation rather than syllabus coverage alone.

Recommendations for Teacher Education Institutions

Universities and teacher training colleges should strengthen pre-service mathematics teacher preparation by incorporating extensive practical training on teaching through problem-solving. Student teachers should experience learner-centred mathematics instruction throughout their training programmes so that they develop confidence in implementing inquiry-based pedagogy.

Teacher education curricula should integrate contemporary theories of mathematics learning, lesson study, classroom discourse, mathematical modelling, formative assessment, and technology-enhanced mathematics instruction. Practical teaching experiences should emphasise designing worthwhile mathematical problems rather than relying solely on procedural teaching approaches.

Recommendations for the Ministry of Primary and Secondary Education

The Ministry of Primary and Secondary Education should strengthen national support for learner-centred mathematics instruction by organising continuous professional development workshops focusing specifically on problem-solving pedagogy. These workshops should provide practical classroom demonstrations rather than theoretical presentations.

Curriculum implementation should be accompanied by adequate teaching resources, including mathematical manipulatives, digital technologies, teacher guides, and learner-centred instructional materials. Furthermore, national assessment systems should increasingly reward conceptual understanding, mathematical reasoning, creativity, and problem-solving competence rather than procedural memorisation.

The Ministry should also strengthen curriculum monitoring mechanisms to ensure that classroom practice aligns with curriculum expectations regarding learner-centred mathematics teaching.

Recommendations for Curriculum Developers

Curriculum developers should provide teachers with comprehensive instructional guides illustrating how mathematical topics can be taught through problem-solving. Curriculum documents should include examples of rich mathematical tasks, assessment rubrics, learner-centred lesson plans, and differentiated instructional strategies suitable for learners with varying mathematical abilities.

Greater alignment should be achieved between curriculum objectives, classroom instruction, instructional materials, and national examinations to encourage consistent implementation of problem-solving pedagogy.

Implications for Policy and Practice

The findings of this study have important implications for mathematics education policy and classroom practice in Zimbabwe and similar developing educational contexts.

First, curriculum reforms alone cannot transform classroom instruction unless accompanied by sustained teacher professional development. Teachers require ongoing opportunities to strengthen both their mathematical content knowledge and pedagogical content knowledge to facilitate inquiry-based learning effectively.

Second, school leadership plays a crucial role in supporting instructional innovation. Administrators should establish supportive professional cultures that encourage collaboration, experimentation, and reflective practice rather than focusing exclusively on examination performance.

Third, assessment policies require reconsideration. High-stakes examinations strongly influence classroom instruction. Unless national examinations reward mathematical reasoning and problem-solving, teachers may continue prioritising procedural teaching to maximise examination success.

Finally, investment in educational resources remains essential. Adequately equipped classrooms create opportunities for meaningful mathematical investigations that foster deeper conceptual understanding among learners.

Study Limitations

Several limitations should be considered when interpreting the findings of this study.

The study was conducted in three secondary schools within Hwange District. Consequently, the findings may not be fully generalisable to all secondary schools in Zimbabwe, particularly urban schools or schools operating under different socio-economic conditions.

The study relied partly on self-reported questionnaire and interview data, which may have been influenced by social desirability bias. Participants may have described instructional practices they considered professionally appropriate rather than those consistently implemented.

The research was conducted during a single academic term. A longitudinal investigation may have provided a more comprehensive understanding of how teachers' instructional practices evolve.

Finally, classroom observations were limited to a relatively small number of lessons and therefore may not have captured the full range of teachers' instructional practices.

Despite these limitations, the mixed-methods approach enhanced the credibility and trustworthiness of the findings through methodological triangulation.

Directions for Future Research

Future studies should expand this investigation by including larger samples drawn from multiple provinces across Zimbabwe to improve generalisability.

Comparative studies examining differences between rural and urban schools would provide valuable insights into contextual influences on mathematics teaching through problem-solving.

Longitudinal research tracking learners' development of problem-solving competence from Form One to Form Four would contribute to understanding how mathematical reasoning develops over time.

Future researchers should also investigate the influence of teacher professional development programmes on classroom implementation of learner-centred mathematics instruction.

Given the increasing integration of educational technology, further research should examine how digital learning platforms, dynamic mathematics software, artificial intelligence applications, and interactive technologies can enhance mathematical problem-solving in Zimbabwean secondary schools.

Finally, future studies should explore relationships between learner motivation, mathematical self-efficacy, classroom discourse, gender, socioeconomic background, and problem-solving achievement to develop a more comprehensive understanding of factors influencing mathematics learning.

Contribution to Knowledge

This study contributes to the growing body of literature advocating learner-centred mathematics education by providing empirical evidence from rural Zimbabwean secondary schools. Its findings demonstrate that problem-solving pedagogy remains a promising instructional approach capable of improving conceptual understanding, mathematical reasoning, learner engagement, and independent thinking. However, successful implementation requires coordinated support from teachers, school leaders, teacher education institutions, curriculum developers, and policymakers.

The study reinforces the view that improving mathematics education extends beyond changing instructional methods. Sustainable educational improvement requires systemic investment in teacher capacity, curriculum alignment, supportive leadership, adequate resources, and assessment systems that value genuine mathematical understanding. By addressing these interconnected factors, Zimbabwe can move towards mathematics classrooms that empower learners to become confident, creative, and competent problem solvers capable of contributing meaningfully to national development and participation in an increasingly knowledge-based global economy.

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