Mathematics Education And Application Journal (META)
Volume 7, No. 2, December 2025, pp. 83-92

ELEMENTARY SCHOOL TEACHERS' BELIEFS ABOUT MATHEMATICAL PROBLEM-SOLVING: A CASE STUDY IN PINRANG REGENCY

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Received: 1 December 2025 / Revised: 19 December 2025 / Accepted: 19 December 2025 /
Published online: 31 December 2025

Abstract
Teachers' beliefs about students' mathematical problem-solving abilities substantially influence the nature of problem-solving instruction provided in classrooms. This study aims to describe elementary school teachers' beliefs about mathematical problem-solving, focusing on their understanding of the nature of problem-solving, its importance, and how it should be taught. Six elementary school teachers with diverse teaching experiences and grade levels participated in the study through semi-structured and in-depth interviews. The findings reveal four significant insights: (1) Teachers generally define problem-solving as solving calculation-based tasks using specific procedures grounded in students' mathematical knowledge; (2) Most teachers perceive mathematical problem-solving tasks merely as "difficult problems" for students, without recognizing their non-routine characteristics; (3) Teachers believe the primary difficulties students face involve understanding problems and determining appropriate procedures; and (4) Classroom instruction tends to emphasize providing examples of correct solution procedures as fixed models students must follow. Overall, the analysis shows that although teachers acknowledge the importance of problem-solving, their understanding remains limited regarding diverse problem-solving strategies and the deeper conceptual meaning of "problem" in mathematical problem-solving.

Keywords: Teachers' Beliefs, Mathematical Problem-Solving, Elementary School

Abstrak
Pentingnya keyakinan guru mengenai kemampuan pemecahan masalah matematika sangat berdampak bagi pembelajaran pemecahan masalah yang mereka lakukan di kelas. Penelitian ini bertujuan untuk mendeskripsikan keyakinan guru Sekolah Dasar tentang kemampuan pemecahan masalah matematika yang menyangkut sifat pemecahan masalah matematika, pentingnya pemecahan masalah, dan pengajaran pemecahan masalah matematika. Penelitian ini diikuti oleh 6 orang guru SD dengan pengalaman mengajar dan tingkatan kelas yang berbeda dengan melakukan wawancara semi terstruktur dan mendalam. Hasil penelitian menunjukkan empat temuan utama: (1) Para guru mengartikan pemecahan masalah adalah menyelesaikan soal perhitungan dengan prosedur tertentu menggunakan pengetahuan matematika yang dimiliki siswa, (2) Sebagian besar guru memandang soal pemecahan masalah matematika adalah soal yang sulit dikerjakan oleh siswa tanpa menyebutkan kriteria non rutin, (3) Guru meyakini bahwa kesulitan utama siswa terletak pada aspek memahami masalah dan menentukan prosedur yang tepat, dan (4) Pengajaran pemecahan masalah di kelas cenderung terfokus pada pemberian contoh prosedur penyelesaian yang benar sebagai acuan yang harus diikuti oleh siswa dalam pemecahan masalah. Analisis keseluruhan menunjukkan bahwa guru meyakini pentingnya pemecahan masalah matematika, meskipun demikian pemahaman mereka masih terbatas tentang strategi pemecahan masalah yang variatif dan makna mendalam tentang arti masalah dalam pemecahan masalah matematika.

Kata kunci: *Keyakinan Guru, Pemecahan Masalah Matematika, Sekolah Dasar.*

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INTRODUCTION

Problem-solving is defined as a behavioral process that involves generating alternative responses to problematic situations and increasing the likelihood of selecting the most effective responses among these alternatives (D'Zurilla & Goldfried, 1971). Problem-solving is typically associated with tasks whose solution methods are not immediately known. It is a crucial life skill (Karatas & Baki, 2013) that involves finding appropriate responses to unique and unfamiliar situations. The problem-solving process begins with the initial encounter with a problem and ends when a solution is reached based on the information provided (Olatide, 2015). In a similar, (Schoenfeld, 1982) contribution to the field conceptualizes problem-solving as the "art" of dealing with non-routine tasks whose solution strategies are not readily known, but which offer learners the opportunity to develop new techniques.

Several factors influence students' mathematical problem-solving ability, including attitudes toward mathematics, self-esteem, teaching approaches, student motivation, confidence, and self-efficacy (Luthfiyah et al., 2024; Memnun & Akkaya, 2012; Pimta et al., 2009). Guven & Cabakcor (2013) identified a significant relationship between students' academic achievement and their problem-solving ability. Students' difficulties in problem-solving are also influenced by teachers, primarily when teachers focus on following textbook examples rather than examining underlying principles, and when instruction is delivered without considering cognitive processes (Phonapichat et al., 2014). Teachers also experience challenges when implementing problem-solving strategies in the classroom (Siswono et al., 2017), Although teachers recognize the benefits of problem-solving for students (Yavuz & Erbay, 2015), they tend to emphasize rote memorization of facts and concepts, partly because they lack sufficient knowledge of how to teach problem-solving effectively (Palraj et al., 2017).

A substantial body of research demonstrates that teachers' beliefs strongly shape their instructional practices (Siswono et al., 2016, 2017; Xenofontos & Andrews, 2012, 2014; Yavuz & Erbay, 2015). Teachers' beliefs, knowledge, judgments, thinking, and decisions profoundly affect how they teach and how students learn (Hiebert et al., 1996). Therefore, meaningful changes in teaching require significant changes in teachers' beliefs and knowledge. According to Richardson (1996), beliefs are psychological understandings, premises, or propositions accepted as accurate. That belief influences the implementation of teaching and the teacher's teaching style (Arikan, 2016). This is because a person's belief is a key element that guides their behavior, especially in problem-solving learning.

Problem-solving ability is one of the essential skills that must be mastered in mathematics learning (Komariah et al., 2024). Given this, teachers' beliefs about mathematical problem-solving play a crucial role in shaping their problem-solving instruction. This study aims to describe elementary school teachers' beliefs about students' mathematical problem-solving abilities. Specifically, it focuses on three aspects: teachers' beliefs about the nature of mathematical problem-solving, its importance, and how problem-solving should be taught and learned in the classroom.

METODE

This study employed a qualitative research approach to explore elementary school teachers' beliefs about mathematical problem-solving. A phenomenological design was adopted as the primary research framework. Phenomenology examines lived experiences and how individuals interpret those experiences to construct meaning (Marshall & Rossman, 2016). Since the purpose of this study was to explore teachers' beliefs about mathematical problem-solving, a qualitative phenomenological approach provided rich and in-depth insights into the phenomenon.

The study involved six elementary school teachers (Teachers A–F) working in public schools in Pinrang Regency during the 2024/2025 academic year. Their teaching experience ranged from 2 to 20 years. General participant information is provided in Table 1.

Data were collected through semi-structured and in-depth interviews. The interview questions were developed based on belief components from the Indiana Mathematics Belief Scales (Kloosterman & Stage, 1992), *Mathematics Belief Instrument* (Hart, 2002), *Mathematical Beliefs Related System* (Op 't Eynde & De Corte, 2003) and *Teacher Beliefs About Mathematical Problem-Solving* (Ford, 1994). They were adapted for the present study, yielding three categories and six guiding questions (Table 2).

Tabel 1
General Participant Information

Participant	Gender	Years of Teaching Experience	Grade Level Taught
A	Female	5	Grade 5
B	Female	20	Grade 3
C	Female	18	Grade 4
D	Female	8	Grade 5
E	Female	12	Grade 4
F	Female	2	Grade 6

Tabel 2
Categories of Question

No.	Category	Questions
1	Nature of Problem-Solving	What is mathematical problem-solving? Can you provide an example of a mathematical problem-solving task?
2	Importance of Mathematical Problem-Solving	Is mathematical problem-solving essential to teach? What difficulties do students face in mathematical problem-solving?
3	Teaching and Learning of Problem-Solving	How do you teach problem-solving to your students? Is it necessary to teach the correct procedures in mathematical problem-solving?

Data analysis followed phenomenological procedures described Creswell & Poth (2016) including: (1) Data managing; (2) Reading and memoing; (3) Describing, classifying, and interpreting; and (4) Representing and visualizing. After transcription, interview data were organized according to thematic categories, coded, and grouped to identify meaningful themes. These themes were then represented narratively, accompanied by verbatim participant quotes.

RESULTS AND DISCUSSION

Result

The findings of this study are organized into six themes: (1) teachers' fundamental beliefs about mathematical problem-solving, (2) the perceived importance of problem-solving, (3) teachers' interpretations of mathematical problem-solving tasks, (4) students' difficulties in mathematical problem-solving, (5) instructional practices used to teach problem-solving, and (6) teachers' views on the role of correct procedures in mathematical problem-solving.

Teachers' Fundamental Beliefs About the Nature of Mathematical Problem-Solving

The interviews revealed varied perspectives regarding the meaning of mathematical problem-solving. Responses from the six participants demonstrated notable diversity in conceptual understanding. The following Table 3 summarizes each teacher's viewpoint.

Analysis of the six responses produced three conceptual categories. The first held by Participants A and F defines problem-solving as contextual and non-routine, reflecting a higher-order cognitive process beyond routine exercises. The second category, represented solely by Participant D, views problem-solving primarily as working through word problems that bridge routine tasks and real-world contexts. The third category held by Participants B, C, and E treats problem-solving as routine and procedural, involving the application of known algorithms to standard mathematical exercises.

Tabel 3
Teachers' Views on the Nature of Mathematical Problem-Solving

Participant	Response
A	"Problem-solving means using mathematical concepts to solve real-life problems."
B	"Solving tasks related to mathematics, such as addition and subtraction."
C	"Answering questions based on the mathematical knowledge students already have."
D	"Solving mathematical problems that involve word problems."
E	"Using mathematical knowledge to solve questions."
F	"Problem-solving involves tackling unfamiliar mathematical problems that require reasoning to understand and solve."

Importance of Mathematical Problem-Solving
Teachers expressed differing rationales regarding the importance of mathematical problem-solving skills. Their responses are summarized below.

Tabel 4
Perceived Importance of Mathematical Problem-Solving

Partisipant	Response
A	"Students need to become accustomed to using mathematical concepts to solve real problems they encounter, rather than simply memorizing formulas."
B	"This ability is important as a foundation for working on mathematics problems, especially basic arithmetic operations that students will continue to use at subsequent levels of education."
C	"The main point is to help students become accustomed to reasoning. Not answering randomly, but understanding the sequence of the process. That is the most valuable skill."
D	"It is important because if students regularly engage in problem-solving, they will not struggle with long and complex word problems such as those in the National Assessment."
E	"It is important to train students to use their mathematical knowledge to solve various types of problems they encounter, both in school and in everyday life."
F	"What matters most is training students to deal with unfamiliar problems that require reasoning, because in life they will not always encounter neatly structured problems. Therefore, this ability becomes an essential asset aligned with curriculum expectations."

Based on the statements of the six participants, three main perspectives regarding the importance of mathematical problem-solving can be identified. The first group views problem-solving as an essential life skill. Participants A, E, and F emphasize this ability as fundamental preparation for dealing with real-world challenges. Participant A highlights the importance of applying mathematical concepts in everyday situations, Participant E underscores its relevance both in academic settings and practical life contexts, while Participant F stresses the need to develop reasoning skills to address unstructured problems encountered in real-life situations.

The second group considers problem-solving as a fundamental academic competency. Participants B and D interpret this ability primarily in relation to academic readiness. Participant B focuses on mastery of basic arithmetic operations as a foundation for subsequent levels of education, whereas Participant D emphasizes its importance particularly for tackling complex word problems found in the National Assessment.

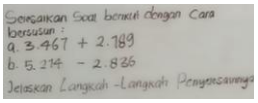
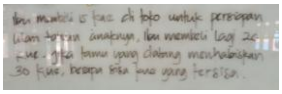
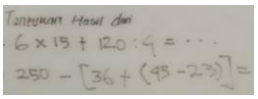
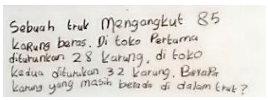
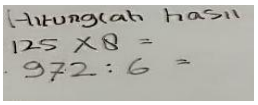
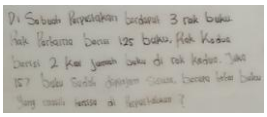
The third group is represented by Participant C, who views problem-solving as a process of developing thinking skills. This perspective highlights the value of systematic reasoning and understanding the steps involved in solving a problem, positioning these processes as valuable forms of intellectual preparation that extend beyond merely obtaining the final answer.

Teachers' Interpretations of Mathematical Problem-Solving Tasks

Teachers provided different examples of what they considered problem-solving tasks. Some presented routine procedural items, while others offered contextualized questions. The following table summarizes these examples.

Tabel 5

Problem-Solving Tasks Proposed by Teachers

Item	Translation	Item	Translation
 (B)	Solve the following problems using the vertical algorithm: *a) 3.647+2.789* *b) 5.274 – 2.836*	 (A)	*"*A mother bought 15 cakes at a shop. To prepare for her child's birthday, she bought an additional 24 cakes. If the guests ate 30 cakes, how many cakes are left?*"*
 (C)	Determine the result of: *a) 6×15 120 : 4=...* *b) 250 –[36 (45-23)]=..*	 (D)	"A truck is transporting 85 sacks of rice. At the first store, 28 sacks are unloaded, and at the second store, 32 sacks are unloaded. How many sacks of rice remain on the truck?"
 (E)	Calculate the result of:. *a) 125 × 8 = ...* *b) 972 : 6 = ...*	 (F)	A library has 3 bookshelves. The first shelf contains 125 books, the second shelf contains 48 more books than the first, and the third shelf contains twice the number of books on the second shelf. If 157 books have been borrowed by students, how many books remain in the library?

Based on the problems submitted by the six participants, their inputs can be grouped into three main perspectives. Participants A and D proposed simple problems with a single solution pathway and relied on direct procedures to solve them. Participants B, C, and E submitted straightforward, non-contextual items presented as direct calculation tasks. Participant F, in contrast, provided a multi-step problem that required analyzing relationships. These findings indicate that teachers hold highly varied understandings of what constitutes a mathematical problem-solving task. Many teachers consider simple story problems to fall under problem-solving (as seen in A and D). Others view direct, decontextualized items involving complex calculations as problem-solving tasks (B, C, and E). Nevertheless, Participant F recognized that mathematical problem-solving tasks are typically non-routine in nature.

Students' Difficulties in Mathematical Problem-Solving

The interview results show that the teachers provided rich and specific responses, revealing various layers of difficulty ranging from cognitive to psychological aspects. To present this qualitative data clearly and systematically, a summary of their responses regarding the specific difficulties students encounter in mathematical problem solving is presented in the following Table 6.

The analysis reveals three significant categories of difficulty. First, students struggle to comprehend problems, including identifying key information (Participant C) and overcoming fixed-mindset reactions (Participant D). Second, they face challenges in determining appropriate strategies,

such as choosing correct operations (Participant A) or developing independent approaches (Participants E and F). Third, students exhibit procedural weaknesses, particularly in basic operations (Participant B). These findings indicate that difficulties span all stages of the problem-solving process: comprehension, strategy formulation, and procedural execution.

Tabel 6
Students' Difficulties in Mathematical Problem-Solving

Partisipant	Response
A	"Students are often confused about selecting the appropriate arithmetic operation to solve a problem, even when they understand the context."
B	"They experience difficulties performing basic mathematical operations, especially when the task involves multiplication and division."
C	"Let alone solving the problem, students are already confused when trying to understand the information and what the question is asking."
D	"In essence, when students encounter a problem-solving task, they often read the question and immediately say 'I can't do this.'"
E	"Their difficulty lies in understanding the problem and determining an appropriate solution strategy; students typically ask, 'What should I do with this, Miss?'"
F	"Students are too accustomed to routine problems, making them struggle when faced with non-routine tasks. They are not trained to develop their own strategies and tend to wait for solution examples from the teacher."

Teaching and Learning of Mathematical Problem-Solving
The research findings on mathematics problem-solving instruction, as conducted by the six teachers, revealed no significant differences. Generally, the teachers concluded that teaching problem-solving means providing a procedural example first before students work on similar problems. Below are the respective responses from each teacher.

Tabel 7
Teachers' Approaches to Teaching Mathematical Problem-Solving

Partisipant	Response
A	"I provide an example first, and only then do I ask students to solve a similar problem."
B	"I demonstrate the solution method, then I change the numbers in the problem for students to work on."
C	"I explain the procedure first, and then I give the students a problem."
D	"I give the explanation first, then ask the students to work on the problem."
E	"I explain the steps first and then provide an example, because without doing so, students are unable to complete the task."
F	"I once gave a problem at the beginning of the lesson and asked students to solve it, but they were confused. So I provided an example of how to solve it first, and then gave them the same problem."

Based on the responses of the six participants, two instructional patterns in teaching mathematical problem-solving were identified. The first group consists of Participants A, B, C, D, and E, who consistently employ a conventional, teacher-centered approach. This group holds the belief that students require concrete examples, fixed procedures, or demonstrated steps before attempting to solve problems independently. Participant E explicitly stated that without the provision of an example beforehand, students would struggle to complete the task.

The second group is represented by Participant F, who demonstrates a degree of variability in instructional practice. This participant had previously attempted an innovative approach by presenting a problem at the beginning of the lesson; however, challenges arose when students expressed confusion. Based on this experience, Participant F subsequently adjusted their strategy by returning to a conventional approach, providing a model solution before asking students to work on the problem.

Overall, it can be concluded that all participants, in practice, tend to employ teacher-centered approaches with differing levels of scaffolding. This pattern indicates a preference for structured and controlled instructional methods, alongside concerns about students' ability to engage with mathematical problems independently when not provided with sufficient initial guidance.

Teaching Correct Procedures in Problem-Solving

The findings indicate that the six participating teachers believe that students must be taught the correct procedures for solving mathematical problems. The following section presents each teacher's response.

Tabel 8

Teaching the Correct Procedures in Mathematical Problem-Solving

Partisipant	Responses
A	"Students need to be taught the correct steps so they can solve problems accurately."
B	"Yes, because without being taught the procedures, students will not be able to work on the problems."
C	"With the correct steps, students learn to solve problems in an orderly manner."
D	"Clear solution steps help students organize information and select an appropriate method of solving."
E	"If the steps are correct, the mathematical knowledge they have learned can be applied properly."
F	"Although I encourage students to be creative in problem-solving, correct procedures remain important as exemplars. Procedures provide foundational guidance that can be developed into more innovative strategies."

Based on the responses of the six participants, it can be concluded that all teachers agreed on the importance of teaching correct procedures in mathematical problem-solving, although they emphasized this principle in different ways. Participants A, B, and E viewed procedures as essential foundations that students must master in order to solve problems accurately. Participants C and D regarded procedures not only as tools for solving tasks but also as mechanisms for cultivating systematic and structured ways of thinking. Meanwhile, Participant F offered a more dynamic perspective, considering procedures as a foundational guide that can be expanded into more creative and innovative problem-solving strategies. Overall, these responses reveal a gradient of understanding from an instrumental orientation to an integrated view that connects procedural discipline with the development of creative thinking.

Discussion

Overall, this study's analysis reveals that teachers' perceptions and instructional practices in elementary mathematical problem-solving are highly complex. A detailed examination of the qualitative data shows substantial variation in teachers' conceptual understandings. Some teachers construe problem-solving narrowly as computational and procedural skills for completing routine mathematical exercises. In contrast, others adopt a broader view, understanding it as the ability to apply mathematical concepts in authentic real-world contexts. These findings align with studies by Aras et al., (2025) dan Ford (1994), which show that many teachers associate mathematical problem-solving primarily with procedural and computational proficiency. The problem examples provided by teachers in this study further reinforce the pattern that most teachers do not clearly distinguish between *problems* and *problem-solving*. Teachers tended to categorize any item that students found difficult as a "problem-solving" task. This phenomenon is consistent with Xenofontos & Andrews (2014), who reported that many prospective teachers struggle to differentiate between a *problem* and the *process of problem solving*. Similarly, Näveri et al. (2011) found that many teachers equate mathematical problem-solving tasks with word problems. At the classroom level, this study's findings also reveal that teacher-centered, conventional approaches continue to dominate instruction. This situation can occur across many problem-solving activities, not because teachers lack problem-solving ability themselves, but because they find it challenging to implement problem-solving pedagogy in classroom practice (Siswono et al., 2017).

Teachers' beliefs about students' difficulties in mathematical problem-solving reflect a comprehensive and hierarchical perspective. Students' difficulties appear to be multidimensional, beginning with challenges in comprehending the problem context, followed by an inability to formulate a strategy, and culminating in failure to execute basic procedures. These findings are consistent Phonapichat et al. (2014), who noted that students often cannot identify the assumptions or information needed to solve a task. Such results underscore the need to design instructional approaches that simultaneously develop students' problem-interpretation skills, strategic reasoning, and fundamental computational fluency.

The implementation challenges experienced by teachers in this study are likewise multidimensional and complex. Teachers reported difficulties in guiding students to construct a comprehensive understanding of mathematical tasks, particularly in verbal problem contexts. Despite their differing conceptualizations of the essence of problem-solving, all participating teachers agreed on the importance of mastering correct procedures. This aligns with Kayan & Çakiroğlu (2008), who found that teachers often hold traditional beliefs emphasizing computational skills and adherence to predetermined step-by-step procedures. Nonetheless, relying on memorized procedures to solve problems is pedagogically unproductive and risks reinforcing the misconception that problem-solving is a short, formulaic process based on rote learning (Ozturk & Guven, 2016). Although teachers recognize the benefits of problem-solving for students (Yavuz & Erbay, 2015), they still emphasize factual and conceptual memorization ikely because they lack sufficient knowledge or preparation on how to teach problem-solving effectively (Palraj et al., 2017).

CONCLUSION

Based on the analysis of the research data, it can be concluded that elementary teachers hold diverse perspectives regarding mathematical problem-solving. Broadly, their understandings fall into three major orientations: a real-life orientation, an academic procedural orientation, and a thinking-process orientation. In classroom practice, conventional approaches, particularly demonstration- or example-based instruction, remain dominant. The teachers agreed on the importance of problem-solving skills for students. However, they differed in emphasis, ranging from real-world applicability to academic demands to the development of systematic reasoning. The significant challenges identified include students' difficulties in comprehending problems, planning solution strategies, and weaknesses in basic computational skills. All teachers also emphasized the importance of correct procedures in solving problems, with perspectives ranging from viewing procedures as absolute requirements to considering them as foundational structures that can support creativity.

Based on these findings, several recommendations are proposed to enhance the teaching of mathematical problem-solving in elementary schools. First, professional development is needed to broaden teachers' understanding of problem-solving, particularly for non-routine and contextual problems. Second, it is essential to develop practical guidelines that support teachers in implementing structured scaffolding approaches, progressing from highly structured problems to open-ended ones. Third, assessment instruments should be designed to measure students' thinking processes, not merely their final answers. Fourth, a tiered problem-solving item bank should be developed to match students' cognitive levels. Fifth, establishing practitioner communities is recommended to enable teachers to share experiences and collaboratively address student difficulties. Implementing these recommendations is expected to optimize the comprehensive development of mathematical problem-solving skills among elementary students.

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