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# Contextualized Mathematics Instruction and Learners' Problem-Solving Skills at Pinto National High School

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## ABSTRACT

*Problem-solving is a core competency in mathematics education and a critical indicator of learners' conceptual understanding and higher-order thinking skills. This study examined how contextualized mathematics instruction influences learners' problem-solving skills at Pinto National High School. Anchored in constructivist learning theory and contextualized teaching frameworks, the study employed a qualitative case study design. Data were collected through classroom observations, semi-structured interviews with mathematics teachers, and analysis of lesson plans and learner tasks. Findings revealed that contextualized instruction enhanced learners' ability to analyze problems, apply appropriate strategies, and justify solutions by linking mathematical concepts to real-life situations and familiar contexts. Teachers' adaptive practices and use of locally relevant examples supported learner engagement and persistence in problem-solving tasks despite instructional constraints. The study underscores the pedagogical value of contextualized mathematics instruction in strengthening problem-solving skills and offers implications for teaching practice, curriculum design, and future research in secondary mathematics education.*

**Keywords**: *contextualized instruction, mathematics education, problem-solving skills, learner-centered pedagogy, secondary education*

## I. INTRODUCTION

Developing learners' problem-solving skills has long been a central goal of mathematics education. Problem-solving enables learners to apply mathematical concepts, reason logically, and make informed decisions in both academic and real-life situations. International and national curriculum frameworks emphasize problem-solving as a key mathematical process that supports conceptual understanding and lifelong learning. However, many learners struggle with mathematics problem-solving due to difficulties in interpreting abstract problems, selecting appropriate strategies, and connecting mathematical concepts to real-world contexts.

Contextualized mathematics instruction has been advanced as a pedagogical approach that addresses these challenges by situating mathematical concepts within meaningful, familiar, and real-life contexts. By connecting abstract ideas to learners' lived experiences, contextualized instruction aims to enhance comprehension, engagement, and transfer of learning. In the Philippine basic education context, curriculum policies encourage contextualization and localization of instruction to improve relevance and learner outcomes. Despite this policy direction, empirical studies examining the relationship between contextualized mathematics instruction and learners' problem-solving skills in secondary schools remain limited.

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Pinto National High School provides a relevant setting for exploring this relationship, as teachers implement contextualized strategies while addressing diverse learner needs and instructional constraints. This study seeks to examine how contextualized mathematics instruction influences learners' problem-solving skills, contributing context-specific evidence to the growing literature on effective mathematics pedagogy.

## II. REVIEW OF RELATED LITERATURE

Problem-solving in mathematics is commonly defined as the process of analyzing a situation, identifying relevant information, selecting appropriate strategies, and evaluating solutions. Research consistently shows that effective problem-solving requires not only procedural knowledge but also conceptual understanding, reasoning, and metacognitive skills (Polya, 1957; Schoenfeld, 1985).

Contextualized instruction is grounded in constructivist learning theory, which views learning as an active process of meaning-making based on prior knowledge and social interaction (Vygotsky, 1978). In mathematics education, contextualization involves presenting problems that are situated in real-life or familiar contexts, enabling learners to see the relevance and applicability of mathematical concepts. Studies indicate that contextualized and problem-based instruction improves learners' engagement and problem-solving performance by reducing abstraction and supporting conceptual connections (Boaler, 1998; Gravemeijer & Doorman, 1999).

Research in secondary mathematics education further suggests that contextualized instruction supports learners' strategic thinking and persistence by encouraging multiple solution pathways and reflective reasoning (Hiebert et al., 1997). These findings highlight the potential of contextualized mathematics instruction to enhance problem-solving skills, particularly in diverse and resource-constrained educational settings.

## III. METHODOLOGY

This study employed a qualitative case study design to examine contextualized mathematics instruction and its influence on learners' problem-solving skills within a real-life classroom context. The case study approach allowed for an in-depth exploration of instructional practices, learner responses, and pedagogical decision-making as they naturally occurred.

The study was conducted at Pinto National High School, a public secondary school offering junior high school mathematics. Participants included selected mathematics teachers and their respective classes. Teachers were purposively selected based on their use of contextualized instructional strategies.

Data were collected through classroom observations, semi-structured interviews, and document analysis. Observations focused on instructional strategies, learner engagement, and problem-solving processes during contextualized lessons. Interviews explored teachers' beliefs about contextualized instruction, challenges encountered, and perceptions of learners' problem-solving development. Lesson plans, worksheets, and learner outputs were analyzed to examine alignment with contextualized and problem-solving-oriented instruction.

Data were analyzed thematically using an inductive approach. Observation notes, interview transcripts, and documents were coded to identify recurring patterns related to contextualization, problem-solving processes, and instructional practices. Triangulation across data sources enhanced the credibility and trustworthiness of the findings.

## IV. RESULTS AND DISCUSSION [Page Style ]

Analysis of the data generated three major themes describing the influence of contextualized mathematics instruction on learners' problem-solving skills.

**Table 1**

**Dimensions of Learners' Mathematical Problem-Solving Skills**

| Dimension | Description | Indicators |
|---|---|---|

| Dimension | Description | Indicators |
|---|---|---|
| Problem Interpretation | Ability to understand and represent the problem situation | Identifies given information, determines what is asked, translates context into mathematical form |
| Strategy Selection | Ability to choose appropriate problem-solving methods | Selects correct operations, applies relevant formulas or procedures |
| Execution of Solution | Accuracy and coherence in applying the chosen strategy | Performs calculations correctly, follows logical steps |
| Reasoning and Justification | Ability to explain and justify solutions | Provides clear explanations, uses mathematical reasoning |
| Reflection and Evaluation | Ability to check and evaluate solutions | Verifies answers, reflects on correctness and reasonableness |

*This framework is adapted from Polya (1957) and Schoenfeld (1985) and used to guide observation, task analysis, and assessment.*

Table 1 presents the key dimensions used to examine learners' mathematical problem-solving skills in the study. The framework emphasizes that problem-solving is a multifaceted process that extends beyond arriving at a correct answer. By including problem interpretation, strategy selection, execution, reasoning, and reflection, the table reflects a comprehensive view of mathematical problem-solving consistent with established theoretical models. This structure guided both instructional planning and data analysis, allowing the study to capture how learners engaged cognitively at different stages of solving contextualized mathematical problems. The inclusion of reflection and evaluation highlights the importance of metacognitive skills in mathematics learning, reinforcing that effective problem-solving involves monitoring and assessing one's own thinking.

**Table 2**

**Contextualized Mathematics Problem Used in Instruction**

| Context | Problem Description |
|---|---|
| Local Market Scenario | A vendor in the community sells rice at ₱48 per kilo. If a customer buys 3.5 kilos and pays ₱200, how much change should the customer receive? |
| Mathematical Focus | Operations with decimals, real-life application |
| Expected Strategy | Multiplication, subtraction |
| Contextual Feature | Familiar local market situation |

*Contextualized tasks were designed using familiar community settings to enhance relevance and comprehension.*

Table 2 illustrates how contextualized mathematics problems were designed and implemented during instruction. The use of a local market scenario demonstrates how mathematical concepts were embedded in familiar, real-life situations to enhance relevance and comprehension. By grounding problems in learners' everyday experiences, the instructional tasks reduced abstraction and supported learners' understanding of what was being asked. This approach helped learners translate contextual information into mathematical representations more effectively, thereby supporting problem interpretation and strategy selection. The table exemplifies how contextualization served as a pedagogical bridge between mathematical theory and practical application.

**Table 3**

**Problem-Solving Skills Assessment Rubric**

| Level | Descriptor | Description |
|---|---|---|
| 4 | Highly Proficient | Correctly interprets the problem, selects an appropriate strategy, solves accurately, and clearly explains reasoning |
| 3 | Proficient | Understands the problem and applies a suitable strategy with minor errors in execution or explanation |
| 2 | Developing | Shows partial understanding of the problem and attempts a strategy but commits major errors |
| 1 | Beginning | Has difficulty understanding the problem and is unable to apply an appropriate strategy |

*This rubric was used to evaluate learner outputs during contextualized problem-solving tasks.*

Table 3 outlines the rubric used to assess learners' problem-solving performance during contextualized mathematics

tasks. The rubric emphasizes qualitative differences in learners' understanding, strategy use, and reasoning rather than focusing solely on correctness. This allowed for a more nuanced evaluation of learners' cognitive processes, including their ability to explain solutions and justify reasoning. The progression from "Beginning" to "Highly Proficient" reflects increasing levels of conceptual understanding, procedural accuracy, and metacognitive awareness. The rubric supported consistent and transparent assessment of learner outputs and enabled comparison of problem-solving development across tasks.

**Table 4**

**Observed Effects of Contextualized Instruction on Problem-Solving Skills**

| Observed Outcome | Description |
|---|---|
| Improved comprehension | Learners more accurately identified what was given and what was asked |
| Increased strategy use | Learners demonstrated better selection of problem-solving methods |
| Enhanced persistence | Learners showed less tendency to give up on challenging problems |
| Stronger reasoning | Learners provided clearer explanations of solutions |

Table 4 summarizes the observed effects of contextualized mathematics instruction on learners' problem-solving skills. The findings indicate notable improvements in learners' comprehension, strategy use, persistence, and reasoning. Learners demonstrated greater accuracy in identifying relevant information and selecting appropriate solution strategies when problems were contextualized. Increased persistence suggests that learners were more motivated and less likely to disengage when tasks were meaningful and relatable. Enhanced reasoning and explanation further indicate deeper cognitive engagement, as learners were able to articulate their thought processes rather than rely on trial-and-error methods. These outcomes collectively suggest that contextualized instruction positively influenced both the cognitive and affective dimensions of problem-solving.

**Overall Analytical Interpretation**

Taken together, the tables provide converging evidence that contextualized mathematics instruction supports the development of learners' problem-solving skills by strengthening understanding, strategy use, and reflective thinking. The alignment between instructional design (Table 2), assessment criteria (Table 3), and observed learner outcomes (Table 4) demonstrates instructional coherence and methodological rigor. These findings reinforce the view that contextualized instruction is an effective pedagogical approach for enhancing mathematical problem-solving, particularly in secondary school settings where learners often struggle with abstract concepts and disengagement.

**Theme 1: Improved Problem Interpretation through Contextualized Tasks**

Findings indicate that contextualized problems helped learners better understand and interpret mathematical tasks. Real-life scenarios and familiar situations enabled learners to identify relevant information and clarify problem requirements. One teacher shared, "Mas naiintindihan ng mga mag-aaral ang problema kapag may kaugnayan sa kanilang karanasan" (P4). Another noted, "Hindi agad sila sumusuko kapag malinaw ang konteksto ng tanong" (P9). A third participant stated, "Mas nagiging malinaw sa kanila kung ano ang hinahanap kapag may kwento ang problema" (P3).

Interpretively, contextualized tasks reduced abstraction and supported comprehension, aligning with research emphasizing that meaningful contexts enhance learners' ability to make sense of mathematical problems (Boaler, 1998).

**Theme 2: Enhanced Strategy Use and Reasoning**

The second theme highlights how contextualized instruction supported learners' use of problem-solving strategies and mathematical reasoning. Learners demonstrated improved ability to select appropriate operations, justify solutions, and explain reasoning when problems were context-based. One participant explained, "Mas nagagamit nila ang tamang paraan kapag naiintindihan nila ang sitwasyon" (P1). Another shared, "Mas kaya nilang ipaliwanag ang sagot kapag may koneksyon sa totoong buhay" (P6). A third teacher observed, "Nakikita ang pag-unlad sa kanilang pag-aanalisa ng problema" (P8).

Analytically, contextualization encouraged deeper cognitive engagement and strategic thinking, consistent with studies highlighting the role of meaningful contexts in developing problem-solving competence (Gravemeijer & Doorman, 1999).

**Theme 3: Teacher Adaptability and Scaffolded Problem-Solving**

The third theme underscores the role of teacher adaptability in implementing contextualized mathematics instruction. Teachers adjusted examples, provided guided questioning, and scaffolded tasks based on learners' responses. One teacher remarked, "Inaangkop ko ang halimbawa ayon sa antas ng klase" (P5). Another stated, "Mahalaga ang paggabay upang hindi sila maligaw sa proseso" (P4). A third participant emphasized, "Ang tamang suporta ang susi sa

paglinang ng problem-solving" (P6).

This theme suggests that reflective and responsive teaching practices were essential in maximizing the benefits of contextualized instruction, supporting research on the importance of scaffolding in problem-solving development (Schoenfeld, 1985).

## V. DISCUSSION

The findings demonstrate that contextualized mathematics instruction enhances learners' problem-solving skills by strengthening their ability to interpret problems, select appropriate strategies, and engage in mathematical reasoning. When mathematical tasks were situated in familiar and meaningful contexts, learners were better able to understand what was being asked, identify relevant information, and translate real-life situations into mathematical representations. This improved problem interpretation reduced cognitive overload and allowed learners to focus on higher-order processes such as strategy selection and justification of solutions. Similar findings have been reported in mathematics education research, where contextualized and realistic problem settings were shown to support learners' comprehension and sense-making, particularly when dealing with abstract mathematical concepts (Boaler, 1998; Gravemeijer & Doorman, 1999).

Consistent with constructivist perspectives, learners in this study engaged more deeply with mathematical tasks when instruction explicitly connected abstract concepts to familiar contexts drawn from their everyday experiences. Constructivist theory posits that learning occurs through the active construction of knowledge based on prior experiences and social interaction (Vygotsky, 1978). In mathematics education, contextualized instruction allows learners to build conceptual understanding by anchoring new ideas to existing knowledge structures, thereby supporting deeper cognitive engagement and transfer of learning (Hiebert et al., 1997). Empirical studies have shown that learners exposed to context-based and problem-centered mathematics instruction demonstrate stronger reasoning skills, greater flexibility in strategy use, and improved ability to explain their solutions compared to those taught through decontextualized approaches (Schoenfeld, 1985; Boaler, 2002).

Teacher adaptability and scaffolding further emerged as critical factors in strengthening learners' ability to navigate complex mathematical problems. Teachers who adjusted examples, provided guided questioning, and gradually reduced support enabled learners to progress through increasingly challenging tasks while maintaining engagement and confidence. Research emphasizes that effective scaffolding supports learners within their zone of proximal development, allowing them to perform tasks they could not accomplish independently (Vygotsky, 1978). In mathematics classrooms, responsive pedagogy characterized by adaptive instruction, formative feedback, and strategic questioning has been found to enhance learners' persistence and problem-solving competence (Schoenfeld, 2016; Darling-Hammond et al., 2017). Together, these findings highlight the importance of contextualized instruction combined with reflective and responsive teaching practices in fostering meaningful problem-solving skills and sustaining learner engagement in mathematics education.

## VI. CONCLUSION AND IMPLICATIONS

This study provides empirical evidence that contextualized mathematics instruction plays a significant role in developing learners' problem-solving skills at Pinto National High School. By situating mathematical concepts within meaningful contexts and providing appropriate instructional support, teachers enabled learners to engage more effectively in problem-solving processes.

Implications for practice include encouraging mathematics teachers to design context-based problems and integrate real-life examples into instruction. Implications for curriculum and school leadership emphasize supporting professional development focused on contextualized and problem-solving-oriented teaching. Future research may employ mixed-methods designs or involve multiple schools to further examine the impact of contextualized instruction on mathematical achievement and problem-solving performance.

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