Development of Contextualized Teaching Through Problem-Solving (TTP) Lesson Plan in Measurement

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Abstract

The lack of contextualized Teaching Through Problem-Solving (TTP) lesson plans hinders the effective use of problem-solving as a teaching strategy. This study developed and evaluated contextualized TTP lesson plans in measurement for Grade 7 students in Northern Mindanao using the ADDIE model. Analysis, design, and development were guided by teacher insights and reviewed by TTP practitioners using a table of specifications, with three iterative cycles yielding positive feedback aligned with contextualization, the TTP framework, and the Most Essential Learning Competencies (MELCs). The implementation revealed limited student progress, underscoring the significance of lesson refinement. Thematic analysis of student experiences and focus group discussions with teachers indicated that the lesson plans fostered engagement, collaboration, and critical thinking, but challenges with reading comprehension, time management, and unequal participation were noted. These findings suggest that integrating mathematical problems into locally relevant contexts enhances TTP effectiveness, but careful alignment with core TTP components is essential for optimal learning outcomes.

Keywords: teaching through problem-solving, lesson study, contextualization

1. Introduction

Problem-solving is a cornerstone of mathematics, fostering students' ability to think critically, reason logically, and apply knowledge to real-life contexts. Research consistently emphasizes that problem-solving should not be treated as an isolated, end-of-chapter exercise but rather integrated throughout the curriculum as a central aspect of mathematics teaching and learning (Hourigan & Leavy, 2022). In this regard, teachers play a pivotal role in cultivating students as mathematical problem solvers, and lesson designs that adopt the Teaching Through Problem-Solving (TTP) approach provide a pathway to achieve this goal.

Teaching Through Problem-Solving, also referred to as the Japanese teaching approach, is grounded in constructivist principles, where students actively build

mathematical understanding through tackling unfamiliar problems, exploring multiple strategies, and reflecting on solutions. DOST-SEI introduced TTP in the Philippines through Project Science Teacher Academy for the Regions (STAR), as cited by Isoda (2010). The model is interdisciplinary and emphasizes contextualization, aligning with the view that authentic, context-based tasks deepen conceptual learning. From a theoretical standpoint, TTP is informed by a problem-based learning framework that positions learners as active agents in knowledge construction and by socio-constructivist perspectives that highlight dialogue, collaboration, and reflection as essential to learning.

Despite strong international evidence of TTP's benefits, such as enhancing students' creativity, communication, and reasoning abilities (Tambunan, 2019; Albay, 2019; Behlol et al., 2018), research in the Philippine context remains limited. Buan et al. (2021) noted that local studies have not sufficiently established the effectiveness of TTP nor examined its contextualized implementation. Teachers in Northern Mindanao, Philippines, also report reluctance to adopt the approach due to constraints of time, curricular pressures, and insufficient support (Hourigan & Leavy, 2022). This gap demonstrates the importance of localized instructional resources that can help teachers integrate TTP in ways that are both feasible and responsive to students' needs.

In response, this study focuses on the development of a contextualized TTP lesson plan for Grade 7 mathematics. Specifically, it seeks to (1) describe the process of developing the contextualized lesson plan; (2) validate the lesson plans with the help of TTP practitioners and teacher evaluators in terms of content, objectives, and contextualization. The study also aims to evaluate the lesson plans according to (3) students' diagnostic and posttest scores following the implementation of the lesson plan and (4) insights of both students and teachers regarding the use and effectiveness of the contextualized TTP lesson plan.

2. Methodology

This paper constitutes a developmental research endeavor employing the ADDIE model of instructional design, which unfolds in five distinct phases: analysis, design, development, implementation, and evaluation (DeBell, 2020). Quantitative data were collected using an evaluation rubric for the lesson plan and students' diagnostic and post-test scores, while qualitative data were gathered through interviews and Focus Group Discussions (FGD). Rather than aiming to generalize findings, this dual approach is intended to document the developmental process in detail and provide rich, contextualized data that may guide other educators and researchers in designing and adapting Teaching Through Problem-Solving (TTP) lesson plans. In this way, the study examines both the validity and acceptability of the developed TTP lesson plan while also clarifying its potential effectiveness and practical implications for classroom use.

2.1 Research Participants and Setting

The participants of this study included Grade 7 mathematics teachers, students, and expert validators. During the analysis phase, purposively selected Grade 7 mathematics teachers were interviewed using a researcher-developed questionnaire to identify the least learned topics and instructional challenges. In the development phase, two TTP practitioners served as expert validators, reviewing and evaluating the lesson plans across three iterative cycles. For the implementation phase, one Grade 7 mathematics teacher from a national high school in Iligan City, Northern Mindanao, Philippines acted as the implementer of the developed lesson plans, while three other Grade 7 teachers observed the classroom sessions. The student participants consisted of one intact Grade 7 class, who took part in the diagnostic test, three-day implementation, and post-test. Assent from students and parental consent were secured prior to participation, and confidentiality of responses was maintained through anonymization. In the evaluation phase, the teacher-

implementer and teacher-observers participated in a Focus Group Discussion (FGD), providing insights that guided the refinement of the contextualized TTP lesson plans.

2.2 Research Instruments

The study employed various instruments in alignment with the ADDIE model to ensure the systematic development and evaluation of the contextualized lesson plans.

Analysis Phase. An interview questionnaire was used to gather information from Grade 7 mathematics teachers regarding instructional needs, lesson design considerations, and the least learned topics.

Design and Development Phases. An evaluation form, adapted from Alvernia University and revised to suit a problem-solving framework, was utilized to assess the developed TTP lesson plans. Expert validators, composed of two practitioner teachers, reviewed the lessons for feasibility, validity, practicality, and contextualization, ensuring their accuracy and relevance.

Implementation Phase. A diagnostic test and posttest were administered to evaluate the effectiveness of the developed lesson plans in improving students' learning outcomes. Both assessments were prepared and refined using a Table of Specifications (TOS) to maintain alignment with the learning objectives. The results from these tests provided evidence of the impact of the TTP instructional approach.

Evaluation Phase. Interviews with 10 purposively selected students were conducted to capture their perceptions of the implemented lessons and the TTP approach. Additionally, a focus group discussion (FGD) was conducted with the teacher-implementer and three teacher-observers to reflect on the strengths and weaknesses of the implemented lesson plans. Insights from students and teachers informed further refinement of the instructional materials and supported the continuous improvement of the TTP lesson plans.

2.3 Data Gathering Procedure

The data-gathering process followed the structured framework of the ADDIE model, comprising five phases: Analysis, Design, Development, Implementation, and Evaluation. During the analysis phase (week 1), an interview questionnaire for Grade 7 mathematics teachers was prepared, and its reliability was assessed through expert validation. In Week 2, the revised questionnaire was administered to purposively selected Grade 7 mathematics teachers, who voluntarily participated after giving informed consent. These interviews identified the least learned mathematics topics and the challenges faced in instruction.

In the design phase (week 3), structured lesson plans were created based on the K-12 Curriculum Guide, with emphasis on problem-based learning. The development phase spanned nearly a month and involved iterative refinement of the TTP lesson plans. Three cycles of expert review by TTP practitioners were conducted to evaluate competencies, content, and resources, with revisions incorporated at each stage to ensure accuracy and contextual relevance.

The implementation phase lasted one week and included a diagnostic test, a three-day classroom execution of the lesson plans, and a post-test to measure effectiveness. Student participants were given assent forms, and parental consent was secured prior to participation. To maintain confidentiality, all student responses were anonymized.

Finally, the evaluation phase involved a focus group discussion (FGD) with the teacher-implementer, teacher-observers, and researchers. The FGD was audio-recorded (with consent) and transcribed verbatim, and the findings were validated through member checking. These insights served as the basis for further refinements to the developed TTP lesson plans.

2.4 Data Analysis

A combination of qualitative and quantitative methods was used to analyze the data. In the analysis phase, responses from teacher interviews were categorized according to their familiarity with the TTP approach, such as familiar, occasionally familiar, and unfamiliar, and were further coded to highlight needs for contextualization and alignment with MELCs. During the design and development phases, mean scores from TTP practitioners' evaluation forms were compiled to assess the validity and practicality of the lesson plans. For the implementation phase, students' diagnostic and post-test scores were compared using the Wilcoxon signed-rank test to measure the effectiveness of the developed lessons. Finally, in the evaluation phase, teacher and student responses from open-ended questionnaires and focus group discussions were transcribed, coded, and thematically analyzed, resulting in six themes grouped into five broader dimensions that captured their experiences with the contextualized TTP lesson plans.

3. Results and Discussion
3.1 Analysis, Design and Development of Contextualized TTP Lesson Plan

In this study, the researchers employed the ADDIE model, composed of five key stages: Analysis, Design, Development, Implementation, and Evaluation (DeBell, 2020), to guide the development of a contextualized TTP lesson plan. TTP (Teaching Through Problem-Solving) differs from other inquiry-based models, like the 4As (Activity, Analysis, Abstraction, Application), which place an emphasis on general exploration. The first phase of TTP involves students concentrating on a mathematical problem. Second, they try to discover answers to the problem. Third, they talk about the solutions they find. The fourth step involves the teacher making connections between various solutions and summarizing the lessons learned in relation to the lesson objectives, or instructing students to do so (Roorda et al., 2024). This clarification guarantees a proper understanding of the presented design as TTP, not just a generic inquiry lesson.

Analysis. In the study's analysis phase, researchers interviewed five Grade 7 mathematics teachers about their familiarity with the TTP approach. Four teachers were familiar with it, one occasionally used it, and one was unfamiliar. While teachers agreed on TTP's benefits for critical thinking and problem-solving, one expressed concern that TTP wasn't suitable for lower-achieving students, fearing it would lead to spoon-feeding. To address this, researchers implemented remedial measures such as using concrete examples, visual aids, regular supervision, and manageable workloads. Teachers also emphasized the need to contextualize problems to make them relatable and familiar to students, supported by Reyes et al. (2019). The least-learned topics identified included algebra, measurement, simplifying, irrational numbers, the real number system, and sets. For the lesson plan on measurements, teachers recommended using games or group activities and simple language, aligning with findings from Gomez et al. (2020). These insights directly informed the design phase, ensuring that the contextualized TTP lesson plan incorporated teacher-suggested strategies, locally relevant contexts, and scaffolds to address students' varied learning needs.

Design. The design process deliberately incorporated the core features of TTP. The researchers developed a semi-detailed lesson plan to reflect potential solutions vital to teaching concepts. The TTP lesson plans were contextualized based on teacher interview findings, making problems familiar by using context from the research setting. The lesson plans emphasized engaging group activities, and one of these plans particularly utilized DIY cubes to teach the concept of volume. Additionally, researchers maintained strict adherence to the Most Essential Learning Competencies (MELCs). This phase yielded an initial draft, which underwent expert review and iterative refinement during the development phase.

Development. The process of developing the contextualized involves creating the problem in accordance with the standard lesson plan format of the research setting, drafting the lesson plan, and evaluating the contextualized TTP lesson plan.

(i) Drafting the Lesson Plan

The contextualized TTP lesson plan has its specific parts as follows:

a. Technical Details—This section contains the following details: (1) competencies addressed or the objectives; (2) learning content; and (3) learning resources.
b. Learning Strategies—This section contains:
c. Activating Prior Knowledge—This contains the following subsections: (1) drill; (2) reviewing past lessons; and (3) establishing the purpose of the lesson.
d. Presentation and Modeling—This contains the following subsections: (1) Activity/Presentation of the Problem; (2) Analysis, this list possible answers and solutions of students; (3) Abstraction, where concepts are developed; and (4) Application.
e. Closure—Contains the generalization; the learners must generalize, through questioning, the concept and skills addressed in the plan.
f. Evaluation—In the lesson plan, a short assessment is administered to show whether the objectives are achieved.
g. Assignment
h. Remarks
i. Reflection

(ii) Evaluation of the Contextualized TTP Lesson Plans

The results revealed that Lesson Plans 2 and 3 were rated as well-constructed by the evaluators, while for Lesson 1, they were strongly agreed upon. This assessment suggests that the developed lesson plans were considered ready for implementation. Table 1 shows the summary of ratings from the evaluators.

Table 1: Summary of Ratings from Evaluators

Category	Descriptor	Lesson 1	Lesson 2	Lesson 3
Objectives	Lesson objectives are clear & measurable, specifically aligned to the K-12 standards; learning progression is evident.	**4.5** *Strongly Agree*	**5** *Strongly Agree*	**4.5** *Strongly Agree*
Materials	Detailed list of materials are provided for both teacher and students. All handouts, both teacher-created and those from other resources, are referenced in the procedures and attached to the lesson plan.	**4** *Agree*	**2.5** *Disagree*	**4.5** *Strongly Agree*
Introduction	Introduces the lesson by sharing purpose, and relevance; with a clear overview of the student activity.	**4.5** *Strongly Agree*	**3.5** *Agree*	**2.5** *Disagree*
Problem	The problem should be able to fit on the set objectives and should be contextualized problems.	**5** *Strongly Agree*	**3.5** *Agree*	**4.5** *Strongly Agree*
Possible Solutions	Reflect more than 3 solutions/means of solving the problem.	**5** *Strongly Agree*	**3.5** *Agree*	**4.5** *Strongly Agree*
Development of	The development of the concept effectively			

Category	Descriptor	Lesson 1	Lesson 2	Lesson 3
Concept	relates contextualized problems and the anticipated solutions. The students are given more than adequate opportunity to ask questions and are encouraged to interact with their classmates. The teacher often asks higher-order thinking questions.	**5** *Strongly Agree*	**3** *Neutral*	**4.5** *Strongly Agree*
Assessment	Formative and summative assessments are defined, showing a clear relationship to all objectives addressed in the lesson.	**4** *Agree*	**4** *Agree*	**4** *Agree*
Closure and Generalization	Students review the lesson by summarizing and/or sharing what they learned, and the teacher revisits the purpose for the lesson.	**4** *Agree*	**4.5** *Strongly Agree*	**4.5** *Strongly Agree*
	Weighted Means	4.5 *Strongly Agree*	3.6875 *Agree*	4.1875 *Agree*

(iii) Creating the Problem

In this study, the researchers crafted problems to mirror the local setting, aiming to enhance relatability for students. Implementing embedded learning strategies successfully contextualized the learning process, enabling students to grasp mathematical concepts within a real-world framework. Emphasizing active learning proved effective, as students were encouraged to engage in learning through practical application, leading to heightened motivation and improved problem-solving skills. The three rounds of revision, informed by teacher evaluations, played a pivotal role in refining the problems.

Table 2: Summary of Lesson 1 Revisions: Measures of Volume and Capacity

Lesson Component	Before	Comment	Action
Revision 1			
Materials	Rubik's Cube	Instead of a Rubik's cube, use small cubes for students to assemble. - E1 Add water and a graduated cylinder. - E2	Improvised 2 cm cubes were created.
Introduction	With a Drill Activity	Remove the drill. - E1	Drill removed
Problem	The problem utilizes Rubik's cube for volume, no water involved for capacity, just presumption. "If we let each small cube be filled with 1ml of water"	Apply piling up of cubes and allow students to measure water. - E1	Apply assembling cubes for volume and adding measuring water for capacity. "Using a graduated cylinder, what is the capacity in ml can Jona's tupperware be filled with water?
Revision 2			
Materials	No Graduated Cylinder	Use what's available. - E1	Utilized measuring cups

Table 2 summarizes the changes and revisions recommended to enhance the drafted Lesson Plan 1. Key suggestions included using improvised small cubes instead of Rubik's cubes. The proposed activity envisioned students building or assembling small cubes to create larger figures, thereby visually presenting the concept of volume. E1 recommended removing the drill, deeming it redundant. Furthermore, incorporating students' interaction with water and measuring cups was suggested to enhance their personal experience in measuring capacity, consequently improving the overall effectiveness of the lesson plan.

Table 3 offers an in-depth review of the changes and revisions recommended to enhance the drafted Lesson Plan 2. The primary suggestion focuses on the problem-solving aspect, proposing that students measure their temperature. This adjustment aims to contextualize the problem, providing students with a personal connection. Consistent with the previous recommendation by E1, the removal of the drill was advised.
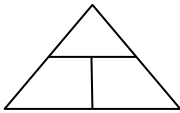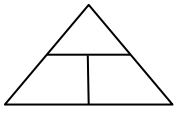
Table 3: Summary of Lesson 2 Revisions: Measures of Temperature

Lesson Component	Before	Comment	Action
Revision 1			
Materials	Only manipulation from the given data	Let students use digital thermometers. - *E1* and *E2*	Utilized digital thermometers
Introduction	With a Drill Activity	Remove the drill.	Drill removed
Problem	Data was provided.	Allow students to use the thermometer, measuring their own body temperature. - *E1*	The problem was revised giving students an opportunity to measure temperature.
Revision 2			
Objectives	1. approximate measures of temperature	Technical error - *E2*	Edited to: 1. approximate measures of temperature
Assessment	"If Juan's fever kept increasing at the same level every 30 minutes, how high would his fever be at 3 p.m.?"	Complete the given, add an increasing rate of 0.5 degrees Celsius. - *E2*	Edited to: "If Juan's fever kept increasing 0.5 degrees Celsius at the same level every 30 minutes, how high would his fever be at 3 p.m.?"

Table 4 offers an in-depth review of the changes and revisions recommended to enhance the drafted Lesson Plan 3. A primary suggestion emerged, emphasizing the importance of ensuring the accuracy of the given data in the problem. Additionally, a proposal was made to include locations that students are familiar with, such as bus terminal names, in the research setting to better contextualize the problem. This adjustment aims to make the problem more relatable and relevant to the students' local context. Following E1's recommendation, the drill was proactively removed to avoid redundancy and maximize the effective use of time.

Table 4: Summary of Lesson 3 Revisions: Measures of Rate

Lesson Component	Before	Comment	Action
Revision 1			
Materials	No map	Show a map of Iligan City.	A map was added.
Introduction	With a Drill Activity	Remove the drill. - E1	Drill removed
Problem	A bus bound for Iligan City Terminal took off from the Bayugan City Terminal at 11:15 a.m. Its estimated time of arrival in Iligan City is 15:55 hrs. The distance from Bayugan City to Iligan City is 305 km.	Verify if the time traveled from Bayugan City to Iligan City is only 4 hours. - E1	The starting place was changed from Bayugan City Terminal to Cagayan de Oro Terminal.
Problem	A bus bound for Iligan City Terminal took off from the Bayugan City Terminal at 11:15 a.m. Its estimated time of arrival in Iligan City is 15:55 hrs. The distance from Bayugan City to Iligan City is 305 km.	Verify if the time traveled from Bayugan City to Iligan City is only 4 hours. - E1	The starting place was changed from Bayugan City Terminal to Cagayan de Oro Terminal.
Development of Concept	(triangle diagram)	Change the speed to rate.	Edited to: (triangle diagram)
Revision 2			
Development of Concept	Guide Questions: 2. How long is the trip? Convert it into hours. 3. How fast does the bus travel through the distance?	Revise - E1	Edited to: 2. What time is the bus supposed to arrive in Iligan city 3. How fast does the bus travel through the distance?

During the development phase, contextualized TTP lesson plans were created and assessed using the research setting's standard format. Every plan included evaluation, reflection, learning strategies, and technical details. To increase relevance, problems were contextualized using well-known locations and experiences. The plans were rated as well-constructed or strongly agreed upon by the evaluators after three rounds of revisions, indicating that they were ready for implementation. Key refinements included using improvised cubes, integrating water activities, measuring temperature, and removing redundant drills. Following these verified enhancements, the lesson plans proceeded to the implementation stage for evaluation in the classroom.

3.2 Implementation of Contextualized TTP Lesson Plan

During a week-long implementation phase, teachers observed, conducted diagnostic tests, and administered post-tests to assess the contextualized TTP lesson plans. The process began with a diagnostic test to establish a knowledge baseline, followed by three

days of teaching the TTP lesson plans, and concluded with a post-test to measure learning outcomes.

Students' Performance. During implementation, the students engaged actively but had many questions, as they were unfamiliar with the TTP approach and the flow of classroom discussions and activities. These conditions necessitated the teacher to frequently address their queries. Students showed interest in the contextualized problems, finding them relevant. They particularly enjoyed the hands-on activities. However, despite the teacher's reminders, some students still participated minimally.

Table 5 employed the Wilcoxon signed-rank test to assess potential differences between paired samples—diagnostic test and post-test scores in the study. Based on the test, the null hypothesis, "There is no significant difference between the mean diagnostic test and posttest scores of the average-level Grade 7 students," was not rejected. The test statistic (W) calculated as 0.956 resulted in a p-value of 0.0805. Since the p-value exceeded the predetermined significance level ($\alpha = 0.05$), there was insufficient evidence to reject the null hypothesis, indicating a non-significant difference between the diagnostic test and post-test scores. The effect size ($Z = 1.7475; r = 0.2913$) suggested a small effect.

Table 5: Wilcoxon signed-rank test on mean diagnostic test and posttest scores

Paired Variables	Wilcoxon					
	N	*Mdn*	*W*	*Z-value*	*r-value*	*p-value*
Diagnostic Test - Post-Test	45	8	0.956	1.7475	0.2913	0.0805

Source: Introducing JASP 0.18.2 Software and SPSS Software

These results pointed out the need for further reflection and feedback from both teachers and students, leading to the evaluation phase, where the strengths and challenges of the contextualized TTP lessons were systematically examined.

3.3 Evaluation of Contextualized TTP Lesson Plan

The evaluation of the implemented contextualized TTP (Teaching Through Problem-Solving) lesson plans was conducted using feedback from students and teachers. Ten (10) students answered open-ended questions aligned with the dimensions of the Teaching for Robust Understanding (TRU) framework (Schoenfeld, 2016), while a Focus Group Discussion (FGD) with four teachers offered additional details about lesson effectiveness and challenges.

Open-Ended Questions (OEQ) Results on Student Interview. Ten (10) students responded to ten (10) open-ended questions aimed at assessing their understanding, engagement, and satisfaction with the lessons. Their responses showcased diverse perspectives on the teaching approach, with some expressing appreciation for its structured delivery and interactive elements, while others identified areas for improvement. Despite variations in satisfaction levels and occasional challenges during discussions, four students expressed appreciation for the opportunity to develop their own solutions, although the recognition of their ideas varied. Furthermore, six students endorsed the approach, emphasizing its effectiveness in promoting active learning and nurturing critical thinking.

Simultaneously, they offered constructive feedback to improve and enrich the learning experience.

Figure 1. illustrates the themes utilized in the study, encompassing six emergent themes categorized under five overarching dimensions. These dimensions encapsulate the experiences and insights of the students derived from their engagement with the contextualized TTP lesson plan, as extracted from the open-ended interviews. The identified themes include learning through teachers and peers, interest and engagement, learning challenges, building confidence and self-esteem, critical thinking skills and problem-solving skills, and facilitated collective learning and enriching experience.
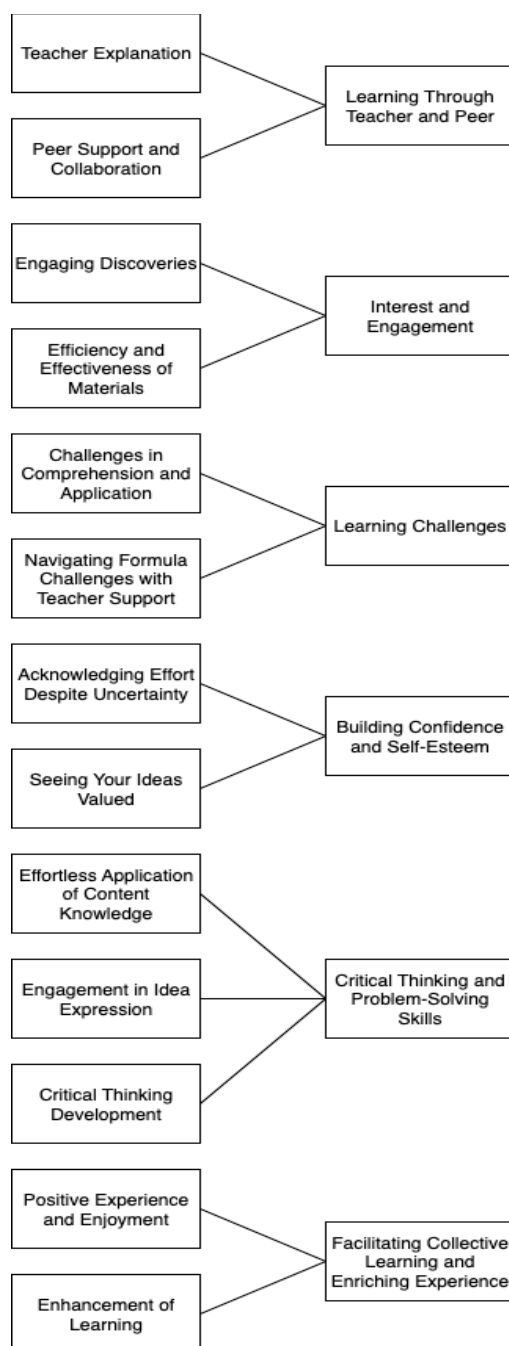

Figure 1. Thematic Framework on Open-Ended Questions (OEQ)
Results on Student-Interview

The contextualized TTP lesson plan can be improved with the help of the emergent themes shown in Figure 1. Lesson activities should continue to promote peer discussions and teacher guidance, as evidenced by insights like learning through teachers and peers, facilitated collective learning, and enriching experiences. These insights emphasize the value of social interaction and collaborative strategies. Lessons should incorporate relatable contexts and tasks that enable students to experience success, as indicated by themes such as interest and engagement, as well as the development of confidence and self-esteem. Meanwhile, learning difficulties as well as critical thinking and problem-solving abilities indicate areas in which students need opportunities to practice higher-order thinking and structured scaffolding. Together, these themes guide iterative enhancements by matching classroom interactions, delivery strategies, and lesson content to students' experiences, improving learning outcomes and engagement.

Open-Ended Questions (OEQ) Results for FGD. Following the implementation of three contextualized TTP lesson plans, four Grade 7 teachers participated in a Focus Group Discussion (FGD) to evaluate the plans. Thematic analysis of their feedback revealed several key points. While the lesson plans effectively covered intended content, time management was a significant challenge due to students needing to recall prior knowledge and the time-consuming nature of group activities. Teachers also observed issues with reading comprehension and student engagement, noting that not all students participated equally in group tasks. Despite these challenges, the lesson plans successfully fostered ownership of learning and engagement through practical applications, with students benefiting from real-life contextual experiences. The plans aligned well with the Most Essential Learning Competencies (MELCs), encouraging collaboration and critical thinking. Teachers valued the adaptability of the lesson plans, as they could tailor them to different classroom contexts and student levels. Although the plans were effective overall, they required adjustments to address time constraints and comprehension difficulties.

According to the evaluation, the lesson plans developed demonstrated partial alignment with the core elements of TTP. The contextualized problems provided students with relevant entry points and encouraged active learning, consistent with the TRU framework's dimensions of cognitive demand and access (Schoenfeld, 2016). However, limitations emerged as teachers found it difficult to anticipate students' numerous questions and varied responses and to synthesize their unevenly contributed strategies into shared mathematical concepts. These challenges, observed during the implementation, suggest that the lessons resembled inquiry-based approaches fully embodying TTP design principles. Thus, while the evaluation confirmed the lesson plans' adaptability and motivational impact, further refinement is required to deepen the problem quality, expand anticipation of student responses, and strengthen the consolidation phase to ensure comprehensive mathematical understanding.

4. Conclusion

This study showed how embedding mathematical problems in well-known, locally relevant contexts enhanced students' engagement, promoted critical thinking, and promoted collaborative learning when Teaching Through Problem-Solving (TTP) lesson plans were contextualized. Contextualization in this study meant placing mathematical problems in settings that were familiar and relevant to the students' daily lives. In addition to making the problems relatable, this was done to provide students with easy ways to start interacting with more abstract mathematical ideas. Contextualized problems strengthened learning motivation and ownership, according to findings from teacher feedback and student interviews. However, challenges were evident. Teachers faced challenges in managing their time and helping students transition from tangible contexts to abstract generalizations. Some students participated unevenly in group projects, had trouble understanding what they were reading, or relied too much on their peers. These challenges

demonstrate that, although contextualization can improve access and engagement, it needs to be used in conjunction with the fundamental components of TTP, which include thoughtfully crafted problems, preparation for a range of student perspectives, and organized chances for ideas to be combined into cohesive mathematical concepts. The study concludes that contextualized TTP lessons have potential but need to be improved in order to reach the full potential of the approach. This study contributes to the local discussion on problem-based mathematics instruction as well as the larger discussion on adapting global pedagogical models to particular educational contexts by elucidating and operationalizing the function of contextualization within the larger TTP framework.

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