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# Analysis of Problem-Solving Ability in Mathematics Learning for Grade VI Elementary School Students

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**Abstract**
This study aimed to analyze elementary students' mathematical problem-solving skills through a contextual geometry assessment focused on rectangular shapes. The research involved 36 sixth-grade students who completed five open-ended problem-solving tasks designed to measure four aspects of problem-solving: modeling the problem, identifying relevant information or constraints, reasoning with data, and drawing conclusions. Student responses were evaluated using an analytic rubric with a maximum total score of 15.
The results showed that the average student achievement was 76.67%, indicating a moderate to good level of problem-solving ability. Students demonstrated strong performance in understanding and modeling the problem context, with the highest mean score obtained in this aspect. However, reasoning with data emerged as the weakest area, as many students experienced difficulties in explaining solution procedures clearly and systematically, despite obtaining correct final answers. Students' ability to draw conclusions based on mathematical evidence was adequate but not yet consistent.
In conclusion, the findings suggest that while contextual problems support students' initial understanding, greater instructional emphasis is needed on reasoning processes, procedural explanation, and evidence-based conclusions to strengthen overall mathematical problem-solving skills at the elementary level.
Keywords: Problem Solving Ability, Mathematics Learning, Elementary School

## 1. INTRODUCTION

Developing students' mathematical problem-solving ability has become a central priority in twenty-first-century education, as it represents higher-order thinking skills essential for academic achievement and real-life decision-making. In primary education, particularly at the sixth-grade level, problem solving is not only a key competency emphasized in national curricula but also a crucial foundation for students' transition to more advanced mathematical concepts at the secondary level. Despite its importance, many elementary students continue to experience difficulties in analyzing problems, selecting appropriate strategies, and clearly communicating their reasoning. This condition highlights the urgency of evaluating students' current levels of mathematical problem-solving ability

(Yunansah et.al., 2022; Wahid et.al., 2023; Wahid & Asrina, 2024).

Previous studies consistently indicate that elementary students demonstrate limited proficiency across the four fundamental dimensions of problem solving: understanding the problem, planning a solution, implementing the plan, and evaluating the solution. Research conducted over the past decade reveals that students frequently misinterpret problem statements (Nurdin et al., 2020), exhibit weak strategic reasoning (Permatasari & Retnawati, 2019), and encounter challenges in justifying their solutions (Wijaya et al., 2018). International studies similarly report that primary school students struggle to connect mathematical concepts with problem-solving tasks due to underdeveloped reasoning skills and insufficient instructional support (Chen & Huang, 2021; Kapur, 2016).

However, a critical review of the existing literature reveals a notable gap. Most prior research has focused on general mathematical competencies or specific instructional strategies, while relatively few studies have examined a comprehensive profile of students' problem-solving ability encompassing all four aspects within authentic classroom contexts at the end of primary education (Herlambang, 2021; Herlambang & Abidin, 2022; Permana et.al., 2024). In addition, many assessments relied heavily on multiple-choice tests, which provide limited insight into students' reasoning processes. This gap underscores the need for analyses based on essay-type problem-solving tasks that can capture deeper evidence of students' conceptual understanding and strategic thinking.

Within this research context, the present study seeks to extend and strengthen existing findings by providing a detailed quantitative and qualitative description of students' performance across each aspect of mathematical problem solving. Rather than contradicting earlier studies, this research reinforces previous evidence regarding students' difficulties, while contributing a more comprehensive and curriculum-aligned analysis focused on sixth-grade mathematics learning.

The novelty of this study lies in its application of structured analytic scoring to essay-based problem-solving items for assessing the four essential components of mathematical problem solving among sixth-grade students in an Indonesian primary school. This approach enables a more authentic evaluation of students' reasoning abilities and procedural fluency compared to the objective testing formats commonly employed in earlier research.

Accordingly, the purpose of this study is to analyze the mathematical problem-solving ability of sixth-grade students by examining their performance across four key aspects—problem understanding, planning, implementation, and evaluation—using an essay-based assessment designed to reflect real curricular demands., while simultaneously fostering students' capacity to actively construct their own knowledge." To support the implementation of PBL, a PBL-based teaching module is designed as an interactive, systematic, and student-centered learning guide.

This study aims to analyze the usability of a PBL-based teaching module for procedural text material in elementary schools. The usability evaluation includes effectiveness, efficiency, and user satisfaction, involving both students and teachers in using the module. The findings of this study are expected to provide insights for the development of innovative and applicable teaching modules and to support the creation of high-quality learning processes in elementary schools.

## 2. METHOD

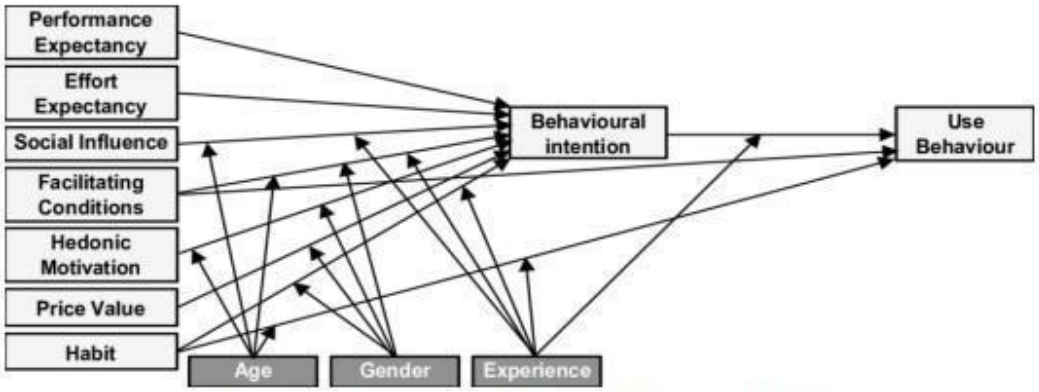
This study employs a quantitative research approach using a survey method with questionnaires. Survey-based research

is a familiar activity within the general public, and many researchers possess the competence to apply this research method, which has developed into a distinct research approach (Adiyanta, 2019). Although survey

research using questionnaires is limited to collecting data on demographic characteristics, social conditions, community activities, as well as opinions and attitudes, it remains a widely used method (Abdullah, 2015).

The study was conducted with 100 elementary school teachers using Google Forms distributed to teachers. Elementary school teachers were selected as research subjects because elementary education serves as the foundational stage for students in acquiring knowledge. Therefore, teachers are required to adopt instructional strategies that enhance student motivation and make learning meaningful. Along with technological advancements, elementary school teachers are expected to adapt by integrating technology-based media into their instructional practices.

**Figure 1.** UTAUT2 Model Thinking Framework




## 3. RESULT AND DISCUSSION

### Result

Analysis results against 36 students show that average achievement solution problem is in the category moderate – good , with average score of 11.5 out of score maximum 15 (76.67%) . This is indicates that in a way general student has capable follow channel solution problem based context get up flat , especially rectangle long , but Still show variation sufficient achievement significant between aspects .

Findings This in line with view OECD (2017) states that that ability solution problem mathematical student school base often not develop in a way evenly distributed across all stages of the thinking process , especially when move from understanding problem going to data processing and reasoning procedural .

Assessment solution problem mathematical based context rectangle long followed by 36 students grade VI with 5 questions description , each worth maximum 3 , so that score maximum overall is 15 .

**Table 1. Statistics Descriptive Total Student Score**

| Statistics | Mark |
|---|---|
| Maximum Score | 15 |
| Minimum Score | 6 |
| Average | 11.50 |
| Average Percentage | 76.67% |
| Standard Deviation | ±2.6 ( variation currently ) |

The average is 76.67% show that in a way general student has reach category good , but existence range sufficient score width (6–15) indicates inequality mastery between students , especially in the aspect think level tall .

Findings This consistent with report OECD (2019) which states that variation ability solution problems at the level school base generally tall when questio,.;;ll,kv c n demand reasoning and justification .

C. **Aspects Modeling Problem : Students' Core Strengths**

Aspect modeling problem (Question 1) obtaining average score highest (2.83 out of 3 or 94.4%) . Most of student capable identify source problem main , namely limitations around fence (48 meters) and goal For get wide field as big as Possible .

**Table 2 percentage of ratedpect**

| Question | Rated aspect | Average Score ( max 3) | Percentage |
|---|---|---|---|
| **Question 1** | Modeling problem | **2.83** | **94.4%** |
| **Question 2** | Barriers / information addition | **2.42** | **80.6%** |
| **Question 3** | Think with data | **1.61** | **53.7%** |
| **Question 4** | Conclusion & reasoning | **2.14** | **71.3%** |
| **Question 5** | Solution problem intact | **2.50** | **83.3%** |

In addition , the findings This consistent with results study Verschaffel et al. (2020) who stated that student school base tend more successful at the stage understanding problem when question served in close context with life they , like development facility village or school .

Aspect modeling problem get highest average score ( 2.83 or 94.4% ). Almost all over student capable identify that source problem main is limitations around fence (48 m) and goal get wide maximum .

The height achievements This show that student has own ability understand

context problem real with good , especially when problem served in form a close story with life daily .

Findings This support theory Polya (1957) that stage understanding the problem relatively more easy achieved compared to stage reasoning and proof . In addition , Verschaffel et al. (2020) confirm that context

The height achievements in aspects This show that student relatively capable understand context problem real and catchy objective mathematics hidden behind story . This is support theory Polya (1957) about stage First solution problem , namely *understanding the problem* , which emphasizes importance understand what is known , what is asked , and the limitations that exist

Each variable is assigned a numerical value or weight, which appears to represent its level of importance or contribution to the Usability (USA) variable. From the diagram, it can be observed that the highest values are associated with user activity related to the learning device in the form of a teaching module, as evaluated by 100 respondents. The four variables with the highest scores are Feedback, Cooperative and Collaborative Learning, Evaluation of Prior Knowledge, and Implementation

authentic help student build representation beginning problem in a way appropriate .

2. Aspects Identifying Barriers and Information Additional : Understanding Good Enough Contextual

In this aspect identify obstacle or information additional (Question 2), students get an average score 2.42 (80.6%) , which is in the category good . Mostly student capable mention information relevant additions , such as land boundaries , functions field , or need society , even though quality reasoning and depth the reasons given Still varies .

Average score aspect This is 2.42 (80.6%) , indicating category good . Mostly student capable mention information addition like limitations land , need public , and function field .

However , only part capable students give reason logical Why information the important .

This data show that student start own awareness to incompleteness information in problem contextual , but ability argumentation based proof Still Not yet consistent .

This matter in line with Jonassen ( 2011) stated that ability identify information addition is characteristics ill-structured problem solving that is not develop in a way automatic without exercise explicit .

NCTM (2020) also emphasizes that reasoning mathematical must accompanied by justification , not just mention information .

Findings This show that student start capable think beyond the explicit data provided , a ability by Jonassen (2011) called as ill-structured problem awareness , ie awareness that problem real often requires information addition before decision can taken .

However however , still found answer students who only mention information addition without explanation Why information the important . This is indicates that ability argumentative and justification logical student Still need reinforced , as confirmed by NCTM (2020) that reasoning mathematical No only includes " what is known ", but also " why" information the relevant ".

3. Aspects Think with Data: Key Challenges in Solution Problem

Aspect think with data (Question 3) shows achievements lowest with an average score 1.61 (53.7%) . Many students experience difficulty in explain procedure calculation in a way coherent , although some of them capable get results true ending .

Aspect think with data get the lowest average score , namely 1.61 (53.7%) .

Findings quantitative show :

Many students Correct use formula around , but

fail explain steps calculation in a way sequentially , or

No linking results with context problem .

This matter indicates that student Still dominant use approach procedural mechanistic , not reasoning conceptual .

Findings this is very consistent with study Hiebert & Grouws (2007 ) stated that learning mathematics often too emphasize memorization formula compared to understanding connection between concept .

In addition , OECD (2019) confirm that weakness main student in PISA is explain how and why , not get answer end .

Findings This confirm that weakness main student lies in reasoning procedural and representational step mathematical , not solely on understanding draft base around rectangle long . Phenomenon This in line with results studies Hiebert & Grouws (2007 ) stated that student often get caught up in the approach mechanistic ( memorizing) formula ) without understanding deep to connection between step calculation .

In addition , OECD (2019) in The PISA report also emphasizes that difficulty the biggest student in solution problem mathematical is explain how and why something solution obtained , not just produce answer numeric .

4. Aspects Summarizing and Decision Making : Good Enough but Not Consistent

In this aspect conclude (Question 4), students get an average score 2.14 (71.3%) . Most of them student capable state that size 10 m × 14 m not yet fulfil " as wide " criteria maybe ", but No all student capable support conclusion the with argument strong mathematics , such as comparison with form rectangle as condition wide maximum .

Aspect conclude obtained an average of 2.14 (71.3%) . The majority student capable state that size 10 m × 14 m not yet as wide as maybe , but only some who support it with argument mathematical strong , such as :

comparison with form rectangle ,

reason mathematical wide maximum

This data show that student capable conclude in a way intuitive , but Not yet fully based reasoning formal mathematics .

According to Stylianides (2018) , ability conclude need integration between calculation , representation , and communication mathematical —what is necessary taught in a way explicit .

This matter show that ability student in linking results calculation with decision

contextual Still nature partial . According to Stylianides (2018) , ability conclude in mathematics need integration between calculation , reasoning , and communication mathematical , which is not in a way automatic develop without learning explicit .

5. Solution Problem In a way Intact : Promising Potential

Question 5, which requires solution problem in a way comprehensive , showing the average score 2.50 (83.3%) . Findings This indicates that when student given chance For see problem in a way whole and flexible , partial big capable construct the correct solution , namely that wide maximum achieved when field shaped square (12 m × 12 m).

This matter support view Lesh & Zawojewski (2007) that learning based pressing issues exploration and reflection can increase quality solution problem students , even when aspect procedural Still Not yet fully ripe .

integrative question (Question 5) obtained an average of 2.50 (83.3%) . Most of the student capable determine that wide maximum obtained when length and width same ( square 12 m × 12 m) .

This matter support view Lesh & Zawojewski (2007) that approach solution problem based modeling can increase quality think mathematical student .

Synthesis Findings

Based on the statistical data and analysis above , it can be concluded that :

Understanding problem (94.4%) ≫ data processing (53.7%)

Student strong in stage early , but weakening at the stage procedural and justification .

Variation score show the need differentiation learning based on the thought process , not results .

## 4. CONCLUSION

This study examined elementary school students' mathematical problem-solving skills through a contextual assessment of plane geometry, with a specific focus on rectangular shapes. The results indicate that, overall, students demonstrated a moderate to high level of problem-solving ability, achieving an average score of 76.67% of the maximum possible score. Students performed particularly well in modeling problems and understanding contextual situations, suggesting that real-life contexts effectively facilitate initial problem comprehension.

Nevertheless, the analysis revealed a significant weakness in students' ability to reason with data and to explain mathematical procedures. Although many students were able to apply appropriate formulas and obtain correct numerical solutions, they often struggled to clearly articulate the steps involved and to justify their reasoning in a coherent and systematic manner. This finding indicates a tendency toward procedural understanding rather than deeper conceptual comprehension of mathematical concepts.

Furthermore, students' ability to draw conclusions and make decisions based on mathematical evidence was found to be adequate but inconsistent. This inconsistency highlights the need for more explicit instructional support aimed at strengthening mathematical reasoning and communication skills. Despite these challenges, students showed promising potential in solving problems holistically, particularly when they were provided with opportunities to explore and reflect on the underlying problem structure.

Overall, the findings suggest that mathematics instruction at the elementary level should place greater emphasis on reasoning with data, explaining solution processes, and drawing evidence-based conclusions, rather than focusing solely on obtaining correct final answers. The use of analytic rubrics that assess problem-solving processes may support more meaningful evaluation and contribute to targeted instructional improvement.

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Challenge main lies in data processing and explanation procedure mathematical .

Learning need more emphasizes on:
mathematical explanation
reasoning with evidence

explicit modeling of thinking processes

Implications This in line with recommendation NCTM (2020) and OECD (2017) emphasize importance learning mathematics that is not only oriented on results , but also on the thinking process.

## 5. ACKNOWLED

Overall, the findings suggest that mathematics instruction at the elementary level should place greater emphasis on reasoning with data, explaining solution processes, and drawing evidence-based conclusions, rather than focusing solely on obtaining correct final answers.

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