**ISSN 2502-5872 (Print)**
**ISSN 2622-3627 (Elektronik)**

Volume 10 Number 1, February 2025, 179-192

# ANALYSIS OF MATHEMATICS TEACHER'S PEDAGOGICAL COMPETENCY AND STUDENTS'S NUMERACY IN SOLVING NUMERACY PROBLEMS

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***ABSTRACT***

This study aims to analyze the pedagogical competence of mathematics teachers and students' numeracy level in solving numeracy problems. The research was conducted in one junior high school in Bandung using a qualitative approach and case study design. The subjects of this research were 16 students in grade VIII and one math teacher at a junior high school in Bandung. Data were collected through observation, numeracy tests, and interviews. The numeracy test results showed that four students had a low numeracy level, six were medium, and six were high, with an average numeracy score of 70.625, which was in the medium category based on the indicator scale. Observations and interviews revealed that teachers have good pedagogical competence. Teachers can design learning according to the curriculum, use methods that actively involve students, and provide constructive feedback. However, test results show variations in students' numeracy levels that require adaptive learning strategies significantly to help students with low numeracy. This research emphasizes the importance of problem-based and differentiated learning approaches to improve students' overall numeracy ability. In addition, further evaluation of other factors, such as motivation and learning environment, which may affect students' numeracy ability, is needed.

**Keywords :** Case study, numeracy, pedagogical competency, numeracy problems.

**How to Cite:** Epran., Kusumah, Y. S., & Herman, T. (2023). Analysis Of Mathematics Teacher's Pedagogical Competency and Students's Numeracy In Solving Numeracy Problems. *Mathline: Jurnal Matematika dan Pendidikan Matematika*, *10*(1), 179-192. http://doi.org/10.31943/mathline.v10i1.796

## PRELIMINARY

The teacher is an essential element in the continuity of the teaching and learning process, with their primary role being to provide the best education to the students. According to KEMENDIKBUD Number 15/2018, teachers have several main tasks: providing education, teaching, and evaluating students. Several factors may influence the teaching process, but the role of the teacher remains very significant in the teaching context (Wulandari & Iriani, 2018). In addition, teachers also play an essential role in learning process, and need to be equipped with necessary ability to empower students (Ayu et al., 2021; Islami et al., 2022). The core competency standards regulated by the Minister of National Education Regulation No. 16/2007 include pedagogical, professional, social, and personality competency dimensions. In this context, aspects of teachers' pedagogical

competency are considered more efficient in running and implementing the learning process (Pardi, 2021).

A teacher's pedagogical competency involves abilities in managing the student learning process, including deep understanding of student needs, planning and implementing optimal learning, assessing learning achievement, utilizing technology in the learning process, and proactive initiatives in developing students' potential to actualize their various talents and abilities (Rahmayani et al., 2022; Santoso & Julie, 2023). Teachers and students must have good competencies or abilities for the continuity of the learning process (Dwijayanti et al., 2021). This is important because teachers' pedagogical competence influences learning strategies to improve students' numeracy ability, especially for low ability students. This helps to find practical approaches to support all levels of student numeracy.

It is typical for students to struggle with mathematical problems (Agustin et al., 2024; Vitaloka et al., 2020). This difficulty can also arise from a lack of ability to interpret the problem correctly, especially when the problem is in the form of a story problem or requires complex solution steps. Learning mathematics can train students to link one concept to another in solving problems logically, analytically, and systematically. One of the challenges pupils face is resolving numeracy issues (Annisa et al., 2024; Waluyo & Nuraini, 2021). To solve problems related to mathematics, students must have good numeracy. According to the Education Assessment Center, numeracy is the ability of everyone to apply number concepts and number operations in everyday life (Pusat Asesmen Pendidikan, 2023). Numeracy is the ability to solve math problems at school and is necessary for various types of work (Mukuka et al., 2023; Westwood, 2022). This ability must be possessed by every student, because numeracy is a basic mathematical ability that can be an indicator in determining human resources (Pujadas-Mora & Pérez-Artés, 2023) and requires a high level of understanding and reasoning to complete (Chan & Scalise, 2022; Sari et al., 2021). A person is said to have numeracy if they have the ability to apply basic concepts and mathematical processes to everyday life situations, such as interpreting and using information from diagrams, tables, or other problems presented (Anderha & Maskar, 2021; Nasrullah et al., 2022). So, based on the above explanation, numeracy is an individual's ability to apply basic mathematical concepts and operations in everyday life.

Previous research argues that, "This indicates that students' improved ability to reason mathematically results in increased sense-making and conceptual understanding." (Mukuka et al., 2023; Troutman & Lichtenberg, 1982). Better conceptual understanding,

reasoning ability, and the practical application of mathematical knowledge in real-world contexts are all outcomes of improved students' mathematical reasoning.

The use of the numeracy context aims to introduce the role of mathematics in daily activities (Alda & Wahidin, 2021; Gunawan et al., 2023). Good numeracy enables students to solve various mathematical problems by utilizing a variety of numbers and symbols associated with fundamental mathematical ideas (Alfarisi et al., 2023). In addition, students with good numeracy will be more effective in solving various math problems (Chan & Scalise, 2022). This makes learning mathematics more useful, especially for students' personal development. This is because students with strong numeracy have an advantage in solving daily life problems, including in the context of careers in various fields such as science, technology, engineering, and economics.

Previous research revealed a significant relationship between teachers' pedagogical ability and students' numeracy. The research indicates that students' numeracy can improve along with the enhancement of teachers' pedagogical competency (Kasipahu et al., 2022). Thus, an in-depth analysis of teachers' pedagogical competency and students' ability to solve numeracy problems is necessary. By identifying and analyzing, teachers can take appropriate corrective measures to help students better understand mathematics, especially in solving numeracy problems.

## METHODS

This research adopts a descriptive qualitative approach with a case study research design that aims to analyze the pedagogical competence of mathematics teachers and students' numeracy ability in solving numeracy problems. This approach allows researchers to get a clear and in-depth picture of the interaction between teachers' pedagogical competence and students' numeracy ability in the context of mathematics learning. The case study design is very appropriate because it allows researchers to explore students' behavior in more detail in solving numeracy problems and the cognitive challenges they face. With this approach, researchers can capture phenomena that may be missed in a broader research approach and provide more precise insights into the factors influencing students' success in solving math problems. The research subjects were 16 grade VIII students from one of the junior high schools in Bandung City who were selected through a purposive sampling technique. This technique allows researchers to select subjects with specific characteristics to the research objectives, such as variations in students' numeracy abilities so that interviews can provide more relevant and in-depth

information. Data triangulation techniques were applied by collecting data through various methods, namely observation, numeracy tests, and interviews, to ensure data accuracy and validity. With this method, researchers can process and organize data more systematically and objectively to make the research results more comprehensive and reliable.

In this study, the first step was to observe the learning process carried out by the teacher. This observation aims to analyze the teacher's pedagogical competence in explaining mathematics material, especially related to the approach used, delivery strategies, and interactions with students. Observations were conducted directly in the classroom with a focus on how the teacher gave explanations, the use of learning media, and the teacher's ability to manage the classroom. In addition, the observations also recorded how the teacher facilitated students' understanding of mathematical concepts and students' involvement in the learning process, especially in the context of numeracy. The data from this observation is used to evaluate the extent to which teachers' pedagogical competence affects students' numeracy ability in solving math problems. The researcher used a structured observation sheet covering aspects such as lesson planning, teaching and learning activities implementation, and how the teacher gave feedback and managed the class.

**Table 1. Observation Sheet**

| Number | Statement |
|---|---|
| 1 | Teachers use media that makes students active in learning |
| 2 | Teachers use learning media that are in accordance with basic competencies |
| 3 | Teachers develop developmentally appropriate learning scenarios |
| 4 | Teachers develop learning scenarios according to the learning materials |
| 5 | The teacher conveys the competencies to be achieved to the students |
| 6 | The teacher makes apperceptions that are in accordance with the learning material |
| 7 | Teachers prioritize student involvement in the utilization of learning media |
| 8 | The teacher uses correct and fluent spoken language |
| 9 | The teacher conducts the final evaluation according to the students' competencies |
| 10 | Teacher gives follow-up enrichment assignment |

Subsequently, a test was administered using numeracy problems comprising three related questions the teacher had validated. This test aims to evaluate the extent of students' ability in solving numeracy problems. The data collected are divided into three categories: students with high, medium, and low ability.

**Table 2. Students' Numeracy Ability Category Scale**

| Scale | Category |
|---|---|
| $0 \leq V \leq 60$ | Low |
| $60 < V \leq 80$ | Medium |
| $80 < V \leq 100$ | High |

Note: V (The grades obtained by the students)

Source: (Rahmawati & Maryono, 2018)

The test results were analyzed to assess students' ability when solving the numeracy questions given. The analysis was done based on the indicators of numeracy.

**Table 3. Indicators of Numeracy**

| No | Indicators |
|---|---|
| 1 | Able to solve daily problems by applying a variety of numbers or symbols linked to fundamental mathematical ideas. |
| 2 | Able to analyze data shown in various ways, including tables, charts, graphs, and diagrams. |
| 3 | Able to interpret results |
| 4 | Able to make conclusions |

Source: (Yusuf & Ratnaningsih, 2022)

Furthermore, after the test results were obtained, interviews were conducted by the researcher (Sugiyono, 2018). The interview was conducted with multiple students to verify the responses provided in their written answers. In addition, interviews were also addressed to teachers who aimed to analyze the relationship between teacher competency abilities and student numeracy ability and identify areas where improvements could be implemented (Mukhibin et al., 2023; Nasrullah et al., 2022). The teacher competency that are analyzed in this study is pedagogical competency.

**Table 4. Indicators of Teacher Pedagogical Competency**

| **INDICATOR** | **RESEARCH QUESTION** |
|---|---|
| Preparation Stage | 1. Do you use approaches in the learning process?<br>2. Do you always prepare lesson plans before teaching?<br>3. What learning resources do you use in teaching? |
| Implementation Stage | 4. Do you always use media in the learning process?<br>5. Do you always use teaching aids in the learning process?<br>6. Do you always give conclusions about the material taught at the end of the lesson?<br>7. Do you always give students exercises on the material taught?<br>8. How do you develop the learning materials delivered in class? |
| Assesment Stage | 9. Do you always provide evaluation questions for students at the end of each learning activity?<br>10. Are there any obstacles that you feel in assessing students? |

The type of interview is unstructured. The interview guideline contains a summary of the questions to be asked (Dalyono, 2012) and focused on the teachers' opinions and the

implementation of the most effective teaching methods (Lestari & Yudhanegara, 2017). This information can provide an overview of how teachers conduct a learning process, particularly in numeracy materials.

## RESULT AND DISCUSSION

This research began with observing the implementation of learning in the classroom. Observations were carried out in grade VIII. The observation was conducted when the teacher explained the concepts of The System of Linear Equations in Two Variables. The observation shows that learning begins with praying together, led by one of the students, greeting the students, and introducing the material to be taught. During the introduction, the teacher presented examples of real-life applications of the System of Two-Variable Linear Equations and reminded students about the prerequisite material, which is the Single-Variable Linear Equation. After that, the teacher prepared learning media in the form of a PowerPoint presentation to explain the material to the students. The teacher also involved the students in the learning process through a question-and-answer session. The teacher asked students to come to the front of the classroom to share their opinions and answer the questions. At the end of the lesson, the teacher provided an evaluation and summary of the material that had been covered. Occasionally, the teacher encouraged the students to keep studying and practising problems related to the material taught with enthusiasm and diligence. Thus, this observation stage showed that the teacher had carried out the learning process well.

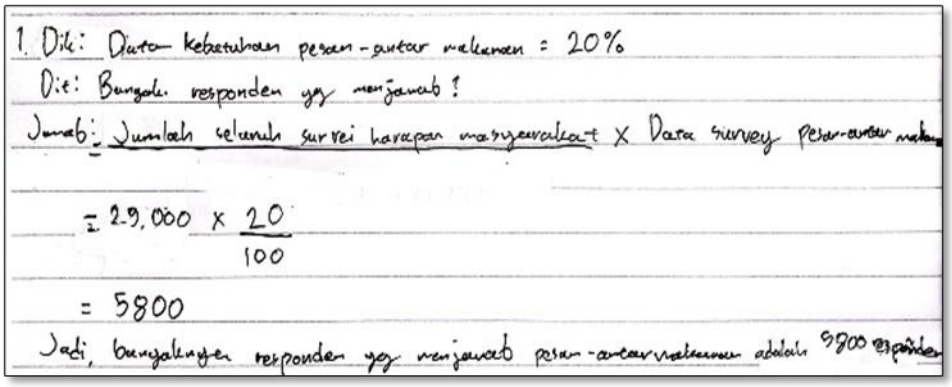
**Table 5. Student Numeracy Scores**

| Rating Scale | Level | The Number of Students | Percentage (%) |
|---|---|---|---|
| $0 \leq V \leq 60$ | Low | 4 | 25 |
| $60 < V \leq 80$ | Medium | 6 | 37.5 |
| $80 < V \leq 100$ | High | 6 | 37.5 |

The numeracy test results show that out of 16 students in class VIII, four students have low numeracy ability, six students are in the medium numeracy category, and six students are in the high numeracy category, with an average overall score of 70.625, which shows that students' numeracy ability are generally in the medium category. Students with low numeracy ability tend to have difficulty understanding basic mathematical concepts, such as interpreting information in story problems, identifying relationships between

variables, and performing mathematical calculations. They need additional guidance and a more personalized learning approach to strengthen their understanding of basic concepts. Students in the moderate numeracy category can understand most problems but still experience problems in more complex problems, especially those that require an in-depth understanding of context and application of logic. Reinforcement in applying concepts and increased rigour can help them improve to a higher level.

Meanwhile, students with high numeracy ability understand numeracy problems well, can analyze relationships between variables and solve problems accurately. Students in this category need more significant challenges, such as complex problem-solving problems, to develop their critical thinking ability. This finding confirms the importance of adaptive learning approaches to accommodate students' different abilities. Teachers need to design appropriate learning strategies to improve the abilities of low-numeracy students while providing more meaningful challenges for high-numeracy students so that their abilities develop more optimally. Strategies such as problem-based learning or real-world contexts can be an alternative to improve students' overall numeracy ability. Here is an example of students' work in solving the given problem:




**Translate**

1. Known : food delivery demand data = 20%
   Asked : how many respondents answered?
   Answered
   = The product of the surveys on community expectations × the data from the food delivery survey.
   $= 29.000 \times \frac{20}{100}$
   = 5.800

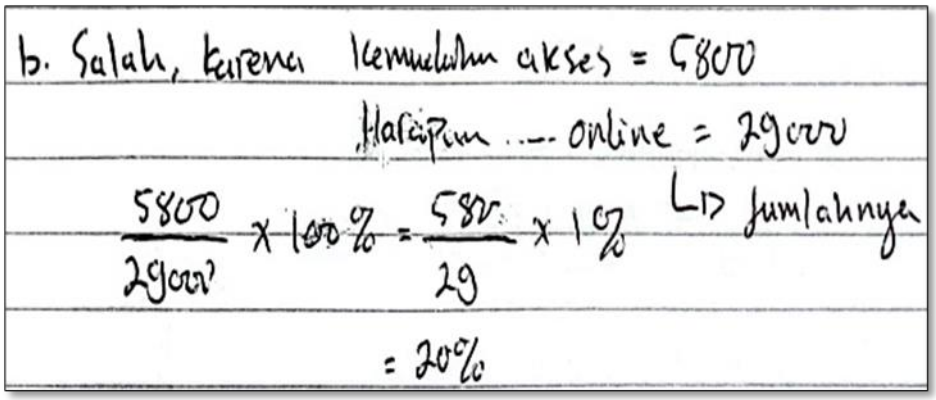
So, the number of respondents who answered food delivery is 5.800 respondents

**Figure 1. NF's Work**

Based on Figure 1, the researcher interviewed students to explore their numeracy. The interview was conducted to delve deeper into students' numeracy. Here is an excerpt from the interview.

> T: "Can you explain where you got the 29.000 respondents?"
> S: "The answer is obtained from adding up all the respondents known from the diagram, sir." (while writing the answer on paper)
> T: "Where did you get the result of 5.800?"
> S: "First, I multiplied 29.000 by 20. Then, I divided the result by 100, sir."

From the students' answers and interviews, it is obvius that the students have been able to analyze information displayed in the form of diagrams and graphs. The students wrote down the known information as a percentage value of 20%, which is obtained from the diagram displayed in the problem. The students were also able to obtain information on the number of respondents, as many as 29.000, obtained from the graph displayed in the problem. Furthermore, the students can interpret the analysis results with the right calculations to obtain answers or conclusions from the questions. Thus, the students have fulfilled various numeracy indicators in solving the given problems.




**Translate**
b. Wrong, because of the ease of access = 5.800
online expectations = 29.000
So,

$$\frac{5800}{29000} \times 100\% = \frac{580}{29} \times 1\%$$
$$= 20\%$$

**Figure 2. AR'S Work**

Based on Figure 2, the researcher interviewed the student. The interview was conducted to delve deeper into students' numeracy. Here is an excerpt from the interview.

> T: "Where did you get the ease of access of 5.800 and online expectation of 29.000?
> S: "I obtained the data from the table and diagram in the question, sir."
> T: "How did you get 20%?"
> S: "I divided the number of respondents by the number of online expectations, then I multiplied it by 100%, sir." (while writing down the answer)

From the students' answers and interviews, it is found that they were able to solve the given problems well. The questions provided were true-or-false choices, but the students had to explain their reasoning. The students can relate the information in the diagram and graph to the problem to answer the questions. As with the students's answer to (2.b), they answered question correctly. The students wrote and related the previous information to solve the problem. From the results of the analysis and calculations the student carried out, he obtained an appropriate answer or conclusion.

The test analysis results indicate that students have good abilities, with an average score of 70.625, when solving numeracy problems. In order to solve the provided problem, the students could use various numbers or symbols associated with fundamental mathematical ideas. The students have also been able to analyze and relate various information in tables, diagrams or graphs into problem solving. In addition, the students have also been able to interpret an analysis and make conclusions from the given problems.

Furthermore, the researchers conducted interviews with mathematics teacher to obtain information related to implementing learning in the classroom. From the results of the interviews conducted, it is found that:

(1) Preparation Stage

At this stage, the teacher has a good understanding of learning theory and the principles of educational learning. He can apply creative learning approaches, strategies, and techniques to teach their subjects. The approach that the teacher always use is scientific approach. At this stage, the teacher also always prepare one-sheet lesson plans and prepare teaching materials before the learning process

takes place. The teaching materials teacher use are not only from school but also taken from other sources as references in teaching.

(2) Implementation Stage

At this stage, the teacher has also succeeded in carrying out an educative learning process, which includes understanding the principles of educational learning design. The teacher also always prepares learning media in the form of power point, and not infrequently, the teacher also prepare media in the form of props to make it easier to explain the material to students. Not seldom does the teacher also utilize technology to explain a concept to students; for example, in the metric of building space, the teacher utilizes the geogebra application to explain a concept to students. In addition, the teacher also uses various learning media and learning resources based on the characteristics of students and the subject matter being taught, aiming to achieve overall learning objectives. One example of learning media the teacher use is Kometika (Arithmetic Box), aimed at the seven- grade students for social arithmetic material.

(3) Assessment Stage

At this stage, the teacher has also organized the assessment and evaluation of the learning process and results. The teacher always reflects on the material that has been given. In addition, the teacher also always provides evaluations and conclusions at the end of the lesson.

Mathematics teacher at school has good pedagogical competency based on the findings of interviews with them regarding various pedagogical competency-related topics. Teachers' pedagogical competency includes a set of ability and knowledge that are essential for designing and implementing effective learning (Gultom & Mampouw, 2019).

A teacher with good pedagogical competency can identify students' individual needs, develop lesson plans that are in line with curriculum objectives, and adjust teaching methods to suit students' learning styles. A deep understanding of the subject matter and the ability to deliver it in an interesting and meaningful way are at the core of pedagogical competency (Nur'aini, K.D & Pagiling, 2020). Teachers are also expected to integrate technology and other educational resources into the learning process to enhance student engagement and understanding. In addition, careful evaluation of student's learning progress and the ability to provide constructive feedback is also part of pedagogical competency. Pedagogically proficient teachers can also create a classroom environment that supports collaborative and creative learning.

Thus, students' numeracy development depends not only on the subject matter presented but also on teachers' teaching ability and approaches that focus on the comprehensive development of each student. This aligns with previous research that revealed that teachers' pedagogical competency affects students' numeracy ability. Teachers' pedagogical competency is central in shaping students' numeracy ability. Pedagogical competency includes teachers' ability to teach numeracy concepts effectively, use learning methods that suit students' learning styles, and provide support to overcome individual difficulties.

## RECOMMENDATION

Increased teacher involvement in developing teaching strategies emphasizing the understanding of mathematical concepts and the application of numeracy to everyday life is recommended based on the findings of the analysis of mathematics teachers' competencies and students' numeracy in solving numeracy problems. Additional training for teachers in integrating contextual approaches and innovative learning methods should be organized as it can improve students' understanding and numeracy ability. In addition, there is a need to develop learning resources that support the understanding of mathematics and numeracy concepts, such as textbooks, technology-based learning materials, and extracurricular activities that can enrich students' learning experiences. The implementation of teacher and student competency improvement programs, should be carried out on an ongoing basis to ensure significant improvements in mathematics and numeracy learning outcomes in the educational environment.

## CONCLUSION

This study shows that the pedagogical competence of mathematics teachers has an important role in supporting students' numeracy ability. Based on the results of observations and interviews, the mathematics teachers who were the research subjects had good pedagogical competencies, including the ability to design lessons, manage classes, provide clear explanations, and use various learning methods that support student understanding. Teachers can also provide relevant feedback to help students improve their abilities. From the numeracy test results, the average ability of class VIII students is in the medium category, scoring 70.625. A total of 4 students were classified as low numeracy, six were medium numeracy, and six were high numeracy, indicating a variation in ability among students. Good teacher pedagogical competence contributes positively to student

achievement, especially for those in the medium and high categories. However, low numeracy students needed more specific approaches, such as targeted learning, engaging media, and individualized guidance, to improve their abilities. This study concludes that although teachers' pedagogical competence has supported students' numeracy achievement, additional efforts are needed to bridge the gap. A more personalized learning approach and strengthened learning strategies are key to equally improving students' numeracy ability. In contrast, the continuous development of teachers' pedagogical competence can positively impact students' learning outcomes.

## ACKNOWLEDGMENT

Thank you to the research subjects: Students and teachers who have helped with this research, supervisors who have validated the research documents, and all related parties.

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