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Teachers' Perspectives and Practices in Implementing Mathematical Literacy-Oriented Learning

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ABSTRACT

Teachers' understanding and implementation of mathematical literacy-oriented learning are crucial for enhancing students' mathematical literacy. A growing body of research has been conducted to improve students' mathematical literacy, with a particular focus on understanding students' obstacles and addressing the associated issues. On the other hand, there have been limited studies concerned on understanding teachers' role in promoting students' mathematical literacy. This study aims to analyze teachers' perspectives and practices in designing and implementing instructional strategies for enhancing students' mathematical literacy. A qualitative method with a case study is carried out in this research. Subjects in this research consist of 6 mathematics teachers (2 junior high school teachers and 4 senior high school teachers) at Kupang, East Nusa Tenggara Province, Indonesia. Data were collected through interviews, observations, and document analysis. The results were then analyzed qualitatively using techniques of data reduction, display, and conclusion drawing or verification. The results indicate that while teachers believe they have a good understanding of mathematical literacy and claim to design and implement literacy-oriented learning effectively, analysis of documents, observations, and interviews reveals that their skills require further improvement. This is mainly reflected in students' worksheets which lack of mathematical literacy-oriented activities and teachers' inability to conduct effective in-class learning activities to foster mathematical literacy. These findings suggest that stakeholders should develop targeted professional development programs and curriculum supports that emphasize content knowledge while equipping teachers with practical and student-centered strategies to enhance mathematical literacy. Furthermore, this study pinpoints deficiencies in teacher practices and provides a basis for future interventions to enhance mathematical literacy through more effective instruction.

Keywords: Learning Design, Mathematical Literacy, Mathematics Learning, Teacher Perception, Teacher Practice

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Introduction

Mathematical literacy is considered as a fundamental and critical skill for success in the 21st century. It encompasses the ability to identify, understand, and solve problems in various contexts using mathematical knowledge and reasoning (Sáenz, 2009; Tariq et al., 2013). Developing strong mathematical literacy in students empowers them to make informed decisions, analyze data, and navigate a world increasingly reliant on quantitative information (OECD, 2023a). In Indonesia, achieving national educational goals emphasizes the importance of fostering mathematical literacy competencies among students (Ministry of Education and Culture of Indonesia, 2019).

The PISA 2022 results showed that the mathematical literacy scores of Indonesian students decreased compared to the result of PISA 2018 (OECD, 2019, 2023b). Although the decline in the score is still better than the average decline in the international PISA score and in terms of ranking Indonesia rose 5 ranks (Ministry of Education, Culture, Research, 2023). In addition, the mathematical literacy achievements of Indonesian students in general have not achieved optimal results where most students still have difficulty in solving mathematical literacy problems particularly high-level problems (Hapsari et al., 2022; Susanta et al., 2022; Udil & Samo, 2023). This needs to be a common concern for the government, schools, and teachers to seek appropriate actions to improve students' mathematical literacy skills.

The low mathematical literacy achievement of students is influenced by various factors both from the student side and from the side of the teacher who facilitates students to learn in the classroom. Some factors include students who are not familiar with mathematical literacy problems (Novitasari et al., 2020; Vitantri & Syafrudin, 2022) and the quality of learning implementation that is not optimal (Udil et al., 2024). Concerning the quality of learning, it is found that many teachers are not familiar with mathematical literacy problems, lack of knowledge about mathematical literacy, and lack of ability to design and implement mathematical literacy-oriented learning (Jupri & Rosjanuardi, 2020; Umbara & Suryadi, 2019). In other words, the low mathematical literacy skills of students are also caused by didactical obstacles that stem from the limited ability of teachers to design and implement mathematical literacy-oriented learning (Rayhan & Juandi, 2023). If left unaddressed, these issues may have long-term consequences, such as impairing students' ability to solve real-world problems, make informed decisions, and adapt to the demands of the modern workplace (Gustiningsi et al., 2024; Risdiyanti et al., 2024), where mathematical reasoning and critical thinking are increasingly essential.

Curricular reforms in Indonesia have incorporated mathematical literacy concepts (Ministry of Education and Culture of Indonesia, 2020), but effectively implementing these changes requires well-equipped teachers who understand and can translate theoretical frameworks into practical classroom strategies (Jupri & Rosjanuardi, 2020). In other words, it is the teachers' responsibility to think, design, and implement instructional activities to enhance students' mathematical literacy (Adelia et al., 2024). Teachers' knowledge and pedagogical practices are essential factors that support student learning outcomes related to mathematical literacy (Genc & Erbas, 2019; Siswono et al., 2018).

A growing body of research has been conducted to improve students' mathematical literacy, including studies that analyze students' difficulties in solving mathematical literacy problems, develop instructional interventions or learning media, and implement various classroom-based strategies (Dewi & Maulida, 2023; Ekaputri & Simanjorang, 2022; Farhan et al., 2021; Udil & Samo, 2023; Wardani & Siregar, 2023). These studies primarily focus on student-related factors, such as cognitive challenges, problem-solving skills, and responses to instructional strategies. For example, Udil and Samo (2023) described students' low levels of mathematical literacy without analyzing potential contributing factors from the teacher's perspective. In addition, a systematic literature review conducted by Udil et al. (2025) examined learning obstacles in solving mathematical literacy problems, but did not address the extent to which teachers may contribute to these challenges. Dewi and Maulida (2023) developed STEM-nuanced mathematics teaching materials to enhance students' mathematical literacy. While the study successfully produced feasible and effective instructional materials, it lacked an in-depth examination of the teacher's role in designing and implementing the developed product. Similarly, Farhan et al. (2021) examined the effectiveness of the Problem-Based Learning (PBL) model in enhancing students' mathematical literacy. While the findings demonstrated that PBL was more effective than conventional instructional models, the study did not further explore the teacher's role in designing and implementing the instructional strategies.

In contrast, research examining the role of teachers, particularly how they interpret mathematical literacy concepts embedded in the curriculum and translate them into classroom practices, remains scarce. Only a limited number of studies have explored teacher-related factors such as pedagogical content knowledge, design of literacy-oriented lessons, or classroom implementation strategies in relation to mathematical literacy. Risdiyanti et al. (2024) responded to the low levels of students' mathematical literacy by proposing a framework for a mathematical literacy learning environment that integrates coursework, social media, and community engagement. This framework aims to serve as a comprehensive reference for enhancing teachers' capacity to teach and assess students' mathematical literacy in a more holistic manner. Nevertheless, the study specifically focused on teachers working in inclusive school settings, which may limit the generalizability of its findings to broader educational contexts. Meanwhile, Kintoko et al. (2024) explored the perspectives of junior secondary school teachers regarding the concept of mathematical literacy. The study highlighted that teachers acknowledged the importance of reasoning mapping, group discussions, and active learning as instructional practices that foster critical thinking and promote mathematical literacy among students. However, the study was limited to uncovering teachers' conceptual understanding and perceptions of how mathematical literacy is implemented in the classroom, without examining their actual teaching practices. The existing literature predominantly addresses student-centric factors and instructional strategies, with limited attention given to the role of teachers in this process. This gap is critical because teachers play a central role in bridging curriculum reforms with classroom realities, and their understanding significantly influences students' learning outcomes. By highlighting this underexplored dimension, the present study aims to contribute original insights into teacher practices as a key factor in developing students' mathematical literacy.

Understanding teachers' perspectives and practices on designing and implementing instructional strategies specifically to support mathematical literacy development is essential for promoting effective educational practices in Indonesia. Therefore, this study aims to analyze teachers' perspectives and practices in designing and implementing instructional strategies for enhancing students' mathematical literacy. Specifically, it explores how teachers understand the mathematical literacy in the curriculum, translate it to the learning design, and execute it to the mathematical literacy-oriented learning in the classrooms.

Methods

This study employed a qualitative approach using a case study design. Qualitative research aims to explore and understand the meaning of the phenomenon in natural settings (Fraenkel & Wallen, 2009). Frey (2022) mentioned that a case study involves a detailed investigation of an entity (research subject or object), in which the researcher examines relevant issues or reveals phenomena by examining the entity in its social and cultural context. In this study, the phenomenon concerns teachers' perspective and practice in designing and implementing mathematical literacy-oriented learning.

This research was conducted in April-May 2024. The procedures are illustrated in Figure 1. The flowchart visually represents the sequential steps of the research process. The subsequent paragraphs describe and illustrate how each procedure is linked to specific outcomes.

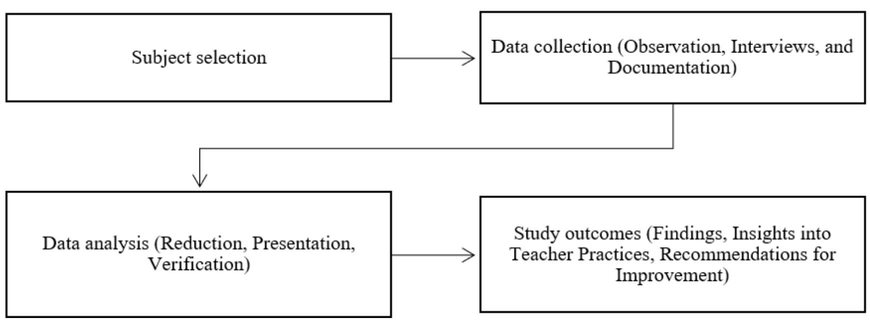


Figure 1. *The research procedure*

The research subjects were six mathematics teachers at public schools in Kupang, East Nusa Tenggara Province, consisting of four senior high school teachers and two junior high school teachers. Subjects were selected using a purposive sampling technique with several considerations, including the respondent's time availability, the implementation of the *Merdeka* curriculum in the school, and the implementation of the Minimum Competence Assessment in the school. This step ensures that the study focuses on teachers who are directly involved in implementing mathematical literacy-oriented learning, thus providing relevant and context-specific insights.

Data collection techniques in this study were conducted using observation, documentation, and interviews. All respondents were informed about the purpose and procedures of the study and voluntarily agreed to participate by signing an informed consent form. They were assured of the confidentiality of their responses and were given the right to withdraw from the study at any time without any negative consequences. The observation was conducted to observe the learning activities carried out by respondents with a focus on observing the implementation of mathematical literacy-oriented lesson plans. Observation data capture the actual classroom practices and provide evidence of how instructional strategies are implemented in real time.

Interviews were conducted to explore respondents' knowledge and experience in designing and implementing mathematical literacy-oriented learning. In this case, it covered aspects of respondents' knowledge related to mathematical literacy, respondents' experience in designing mathematical literacy-oriented learning, and respondents' experience related to mathematical literacy-oriented learning practices. Interview responses yield in-depth insights into teachers' perspectives, rationales behind their instructional choices, and their perceived gaps between theory and practice.

Documentation was conducted to analyze the learning tools designed by respondents, especially lesson plans and students' worksheets. Document analysis provides concrete examples of instructional design and highlights specific areas where the design either aligns with or deviates from the intended mathematical literacy objectives.

To ensure the validity of this research, a triangulation approach was employed, combining both source and technique triangulation (Creswell, 2013). Source triangulation involved collecting data from 6 different teachers from both junior and senior high school. This allowed cross-verification of findings and provided a more comprehensive understanding of teachers' perspectives and practices. Technique triangulation further enhanced validity by using diverse methods of collecting data, including interviews with teachers, classroom observations, and documentary analysis of lesson plans and worksheets. It captures different dimensions of the phenomenon under study. By converging data from varied sources and methods, the study minimizes potential biases and strengthens the credibility and reliability of its findings (Cohen et al., 2007).

The data were analyzed qualitatively based on the data obtained from the research instruments. The analysis of learning tools, observation results, and interviews was carried out to describe completely and comprehensively related to teachers' knowledge and skills in designing and implementing mathematical literacy-oriented learning. Data analysis consisted of three main stages of reducing data, presenting data, and concluding/ verification (Miles & Huberman, 1994).

Results and Discussion

To provide a comprehensive picture aligned with the study objectives, the findings are organized to first present teachers' perspectives on mathematical literacy, followed by an analysis of their documented instructional designs (lesson plan and students worksheet) and observed classroom practices. Interviews with teachers revealed a general awareness of the importance of mathematical literacy. Teachers consistently expressed that mathematical literacy is essential for helping students apply mathematical concepts in real-life situations. In addition, teachers expressed their confidence in designing mathematical literacy-oriented instruction. This was confirmed from the interview conducted with teacher A.

Researcher	:	Currently, what curriculum is used at school and what is your reference for preparing learning tools?
Teacher A	:	The school still uses the 2013 curriculum for grade XII students and the Merdeka Curriculum for grade X and XI students. So, because I teach grade X1, I refer to the Merdeka Curriculum.
Researcher	:	When developing the teaching module (lesson plan), did you consider the mathematical literacy aspect?
Teacher A	:	There is a literacy aspect in the teaching modules created, especially for designing problems and examples of problems.
Researcher	:	What about the selection of the instructional strategy?
Teacher A	:	I chose Problem-Based Learning (PBL). Incidentally, I know the Discovery Learning, Problem-Based Learning, and Project Based Learning models, but what I think is suitable for students' abilities and characteristics is PBL. Because students are still not optimizing the basic concepts.

From the interview excerpt, teacher A acknowledged that aspects of literacy had been included in the teaching modules, especially in problem design. The interview revealed that teacher A believed the instructional tools developed were aligned with the *Merdeka* Curriculum and adequately supported the cultivation of students' mathematical literacy. This belief was particularly grounded in the inclusion of contextual learning activities, problem-based tasks, and illustrative examples, which the teacher viewed as evidence of mathematical literacy-oriented instruction. However, when further linked to the selection of the instructional strategies, teacher A stated that the selection of the PBL model considered the students' low understanding of basic concepts and did not specifically mention its relationship with efforts to develop mathematical literacy. In other words, the selection of the PBL model by the teacher was not fully based on the consideration that the model could facilitate the development of mathematical literacy.

Teacher B also emphasized that mathematical literacy allows students to understand and solve real-world problems, as indicated from the interview expert. However, in the process of developing learning tools, teachers tend not to consider aspects of mathematical literacy in choosing the right instructional strategies. Although it can be understood that the selection of the PBL model by both teacher A and teacher B is certainly relevant to the efforts to develop students' mathematical literacy. However, neither teacher A nor teacher B in the process realized or did not consider aspects of mathematical literacy in the selection of the PBL model. In addition, teacher B also stated that in the design of the learning tools, the aspect of mathematical literacy had not been fully integrated into the activities, sample problems, and assessment of students' learning processes and outcomes.

Researcher	:	How do you understand the importance of improving literacy skills in planning learning activities?

Teacher B	:	In my opinion, improving mathematical literacy skills is very important. Because, with this ability, students can understand and apply mathematical concepts in everyday life and real-world challenges.
Researcher	:	Does this mean that when choosing an instructional strategy, you consider efforts to improve mathematical literacy?
Teacher B	:	I chose an instructional strategy using the Problem-Based Learning model with methods including group discussion, question and answer, lecture, and group presentation. I think it is good for students.
Researcher	:	Does that mean you design mathematical literacy-oriented learning?
Teacher B	:	This learning activity did not focus on improving students' mathematical literacy skills, because the characteristics of the mathematical literacy learning design were not visible, such as using word problems based on contextual problems.
Researcher	:	Then how do you design the assessment?
Teacher B	:	The design of assessment of learning processes and outcomes is not yet fully linked to students' mathematical literacy skills.

Based on the results of the interview with teacher C, the respondent highlighted the importance of contextual activities and real-life application in learning design. In addition, Teacher C believed that the use of worksheets and accompanying students to conduct group discussions served as a means to support students' learning and development of mathematical literacy. This shows that the teacher views the provision of the worksheet, which contains activities that students must do, as representing a mathematical literacy-oriented process.

Researcher	:	How do you implement mathematical literacy-oriented learning?
Teacher C	:	I gave students the worksheet to solve the problem through group discussion, and gave immediate feedback on students' progress.
Researcher	:	Are there any shortcomings that you feel from the learning process that has been carried out?
Teacher C	:	In the future, there is still a need to design lessons that focus more on improving students' mathematical literacy skills. This could include integrating more contextual activities.
Researcher	:	What does that mean?
Teacher C	:	In my opinion, the activities designed still need to be adapted to contextual problems including the steps. In addition, sample problems also need to be directed in the form of mathematical literacy problems.

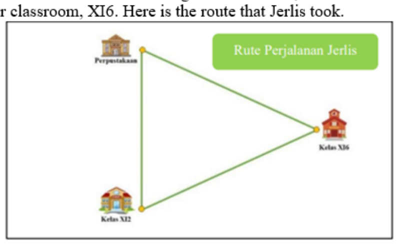
Despite these stated perspectives, further probing revealed that teachers' understanding of mathematical literacy was often limited to surface-level interpretations. Teacher A noted the inclusion of literacy aspects in the form of problems and examples, but did not explicitly align the selection of the Problem-Based Learning (PBL) model with the goal of developing mathematical literacy. Instead, the choice was driven more by the perceived suitability of the model for students who were still struggling with basic concepts. Similarly, Teacher B, while acknowledging the importance of mathematical literacy, admitted that their learning activities did not explicitly aim to enhance literacy skills. The problems used were not deeply contextual, and assessments were not directly tied to literacy competencies. Teacher C also recognized the need for improvement, stating that future learning designs should include more contextualized tasks and literacy-oriented sample problems. These interview findings suggest a gap between teachers' perceived understanding and their ability to systematically translate this understanding into effective instructional planning.

CORE COMPETENCE	
Learning outcomes	By the end of the F+ phase, learners can express trigonometric functions using the unit circle, model periodic phenomena with trigonometric functions, prove and apply trigonometric identities as well as the cosine and sine rules.
Learning objectives	Through learning activities using the Problem Based Learning (PBL) model combined with the Teaching at the Right Level (TaRL) approach as well as discussion, question and answer, and presentation methods, students are able to cooperate, independently, critically reason, and creatively prove the sine rule properly and correctly.

Figure 2. *The formulation of learning objectives in the lesson plan*

To explore how these perspectives were manifested in actual teaching practices, document analysis and classroom observations were conducted. Document analysis of one teacher's learning tools (teacher A) shows that the development of learning tools has indeed referred to the "*Merdeka*" Curriculum. It means the lesson plan is mathematical literacy-oriented. However, in the learning objectives formulated by the teacher, there is no specific intention to achieve mathematical literacy and tends to focus on mastering formal mathematical knowledge and skills (Figure 2).

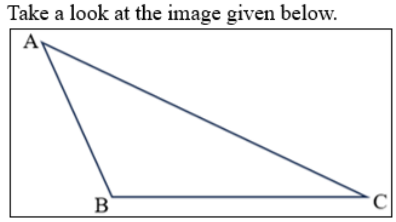
Problem 1.
Jerlis is a student in class XI6 of SMA Negeri 7 Kupang. One day, she walked to the school library to borrow a book. After she finished borrowing the book, Jerlis decided to go to class XI2 to meet her friend. After meeting with her friend, Jerlis returned to her classroom, XI6. Here is the route that Jerlis took.



If we know that the angles formed in Class XI6 and the Library are 120° and 30° respectively, and the distance between the Library and Class XI2 is 6 meters. Find the distance between Class XI2 and XI6.

a

Take a look at the image given below.



It is known that the magnitude of $\angle ABC = 120°$, $\angle BAC = 30°$, and the length of $AC = 6$ m. Determine the length of BC.

b

Figure 3. *Snippet of problem 1 in students' worksheet (a) and another form of the problem without context (b)*

In addition, the design of the students' worksheets also contains some interesting things. In general, the problem and activities of the worksheet have indeed used contextual and relevant problems for students. However, it can be seen in Figure 3(a) that the illustrations presented do not match the information in the problem. It is known that one of the angles is 120°, but all the angles in the picture are obtuse. In addition, the problems given also tend to only change routine problems in story form. Compare problem 1 in Figure 3(a) with the problem presented in Figure 3(b). Both forms of problems have the same content and cognitive processes and only differ in terms of the context presented. The results of the document analysis show that teachers are still not optimal in designing mathematical literacy-oriented learning. In particular, teachers' skills in designing problems with mathematical literacy aspect still need to be improved.

Researchers also conducted classroom observations to explore their skills in implementing mathematical literacy-oriented learning. Observations were carried out while teachers conducted the learning activities they had previously designed, as illustrated in Figure 4. The results indicate that, procedurally, the teacher implemented the learning phases (introductory, main, and closing activities) in a complete and structured manner. The instructional sequence and learning syntax were followed systematically, demonstrating the teacher's familiarity with the chosen pedagogical model.

(a) (b)

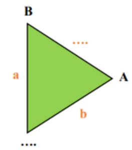
Figure 4. *Learning implementation by teacher A*

However, several critical observations emerged regarding the extent to which the lesson facilitated mathematical literacy. For example, during the initial orientation to the problem, the teacher immediately explained the contextual information and directly identified the mathematical questions within the task. Students were not given the opportunity to individually or collaboratively explore the problem, interpret its context, or formulate the mathematical components on their own. This teacher-centered approach limited student engagement in one of the essential components of mathematical literacy: the ability to make sense of and mathematize real-life situations.

According to the PISA framework (OECD, 2023a), mathematical literacy involves students' capacity to analyze, formulate, and solve problems arising in real-world contexts. The lack of opportunity for students to interpret the problem themselves reduces the potential for developing mathematical reasoning and diminishes students' active role in the learning process. Without this exploratory phase, students are less likely to engage in sense-making, draw connections between mathematical ideas and contextual information, or build the reasoning skills necessary to navigate complex, real-world mathematical situations.

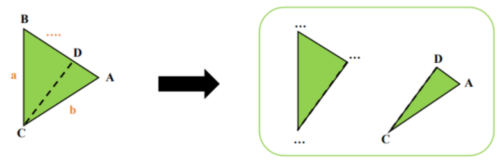
Step 1: Drawing illustration of the problem

If Class XI6 is called point **A**, the Library is point **B**, and Class XI2 is point **C**, with the length of **BC** is ***a*** unit, **AC** is ***b*** unit, and *AB* is ***c*** unit. Then, the illustration that corresponds with the problem is as follows.



Step 2: Making height line from the angle C

If a height line is drawn from angle C to point D on line AB in the triangle, it can be seen that the height line divides ΔABC into 2 .... triangles, namely ΔACD and Δ ... as shown in the following figure.

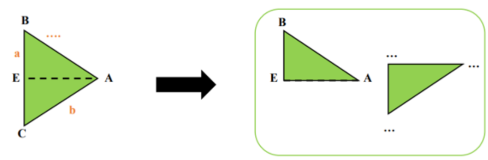


By applying the definition of sine, it can be obtained:

$$\frac{\ldots}{\sin A} = \frac{\ldots}{\ldots}$$

Step 3: Making height line from the angle A

If a height line is drawn from angle A to point E on line BC in the triangle, it can be seen that the height line divides ΔABC into 2 .... triangles, namely Δ… and ΔAEB as shown in the following figure.



By applying the definition of sine, it can be obtained:

$$\frac{\ldots}{\sin B} = \frac{\ldots}{\ldots}$$

Step 4: Determine the sine rule

In steps 2 and 3, you have obtained two final equations. Based on those equations, we get:

$$\frac{\ldots\ldots}{\sin A} = \frac{\ldots\ldots}{\sin B} = \frac{\ldots\ldots}{\ldots\ldots}$$

The equation above is called the .... **Rule.** The sine rule applies to every triangle and used to determine the elements (sides or angle) in another triangle if some of the elements are known. Therefore, it can be concluded that:

Sine Rule is ……………………………………………………………………………………….
………………………………………………………………………………………………..

Figure 5. *Snippet of steps and activities in the worksheet designed by the teacher*

In addition, when working on the worksheet, students are primarily guided through a structured sequence of activities aimed at deriving the sine rule (as shown in Figure 5), rather than solving a real-world or contextual problem using mathematical reasoning. Step 1 begins by introducing a triangle with labeled vertices based on contextual locations (Class XI6, the library, and Class XI2), and prompts students to visualize the triangle based on given side lengths. Step 2 and Step 3 involve constructing height lines from vertices C, and decomposing the triangle into right-angled triangles. These steps are intended to support students in applying the definition of sine and deriving corresponding trigonometric ratios. Finally, in Step 4, students are instructed to equate the expressions obtained from the previous steps to form the sine rule.

Although this activity may support conceptual understanding of the derivation process of sine rule, the worksheet does not provide students with opportunities to apply the sine rule to solve the contextual problem initially introduced. There is no follow-up task that requires students to interpret or calculate based on the triangle formed in Step 1 using the derived rule. Consequently, the teacher's instructional design, as reflected in the worksheet, emphasizes procedural derivation over functional application. Thus, while mathematically valid, the worksheet activities do not fully promote the development of students' mathematical literacy, which includes the ability to interpret, formulate, and solve real-world problems using mathematical knowledge.

Furthermore, the teacher has facilitated students to communicate and evaluate the process and the results of solving problems in the worksheet. However, the activity of discussing the results of the worksheet has not facilitated students to answer the problems presented at the beginning. The discussion and reinforcement given by the teacher classically were still limited to explaining the concept of the sine rule. Meanwhile, the solution to the problem presented at the beginning was not discussed or concluded. In other words, the teacher only facilitated students to understand the mathematical concepts and procedures that had been done during solving the problem in the worksheet. The teacher has not facilitated students to interpret the results obtained to answer the initial given problem. This shows that the teacher has not optimally facilitated the mathematical literacy-oriented learning process.

Teachers' knowledge related to mathematical literacy is a crucial factor in developing students' mathematical literacy. A strong understanding allows teachers to design and implement learning experiences that facilitate students' abilities to reason, interpret, and solve real-world mathematical problems. The results of the interview illustrate that teachers believe they have a good grasp of the concept of mathematical literacy and can translate it into lesson design and classroom implementation. These results align with the findings of Siswono et al. (2018), who reported that mathematics teachers were confident in their understanding of mathematical literacy and claimed to frequently implement teaching aligned with literacy-oriented approaches. However, contrasting findings by Adelia et al. (2024) and Umbara & Suryadi (2019) suggest that many teachers lack deep knowledge of mathematical literacy and its PISA-based components, primarily due to limited access to information and professional development opportunities.

These contrasting findings suggest that teacher understanding of mathematical literacy is uneven and has not been optimally developed across educational contexts. While some teachers may possess confidence in their knowledge, this does not always equate to accurate or comprehensive understanding which highlights a gap between perceived and actual competence. The variation in findings also indicates that systemic factors such as unequal access to resources, inconsistent professional training, and differing levels of curriculum support may be contributing to these disparities.

This discrepancy raises a critical question: What explains the gap between teachers' self-reported understanding and their actual classroom practices? One plausible explanation is that while teachers may have a surface-level awareness of the terminology and expectations of the curriculum, they often struggle with operationalizing these concepts into coherent learning designs and instructional strategies. This interpretation is supported by the document analysis of teacher-developed learning tools, which revealed several shortcomings. Although the problems presented in the worksheets were superficially contextual, they often featured inconsistencies between illustrations and problem data and merely reformulated routine exercises into story formats. These findings echo Rurisman & Yerizon (2021), who observed that teachers' worksheets frequently lack contextual relevance, guiding activities, and authentic problem-solving opportunities. Jupri & Rosjanuardi (2020) also found that many teachers possess a limited understanding of what constitutes a mathematical literacy problem, while Siswono et al. (2018) noted teachers' inexperience in designing mathematics tasks grounded in real-world contexts.

Furthermore, the lack of integration in teachers' understanding is mirrored in the classroom implementation. Observational and interview data indicated that instruction remains largely teacher-centered. For instance, rather than encouraging students to engage with, interpret, and mathematize contextual problems independently, teachers often dominated the meaning-making process. This limited student autonomy in exploring the problems and hindered the development of mathematical reasoning. According to the PISA framework (OECD, 2023a), the ability to formulate, employ, and interpret mathematics in various contexts is fundamental to mathematical literacy. When students are not invited to actively analyze and represent contextual problems, their capacity to develop critical reasoning skills is significantly diminished.

This result shows that teachers have practiced learning that departs from the real situation of students (Umbara & Suryadi, 2019). However, the activities designed for students primarily revolved around understanding mathematical procedures rather than applying them in authentic contexts. Although students were given worksheets, their engagement focused on formal mathematics tasks with limited relevance to real-life scenarios. Despite incorporating mathematical literacy content, teachers' skills in organizing these learning experiences remain insufficient (Adelia et al., 2024; Shaumiwaty et al., 2020), which highlights a critical gap in the effective implementation of mathematical literacy-oriented learning. As a result, while the mathematical content was addressed, the broader goal of fostering mathematical literacy, particularly the ability to connect mathematical reasoning with real-world problem-solving, was not achieved. This confirms the assertion by Bolstad (2020) that teachers' attempts to integrate mathematical literacy often result in fragmented rather than cohesive experiences. The study's findings reveal a persistent theory-to-practice divide. Despite expressing familiarity with mathematical literacy and integrating some contextual elements into their teaching, most teachers struggle to deliver coherent, literacy-oriented learning experiences. This situation may be influenced by structural challenges (Genc & Erbas, 2020), such as high teaching loads, insufficient curriculum training, inadequate institutional support (Hamdiyanti et al., 2024; Hidayat & Chao, 2025), or the limitation of textbooks as learning resources to enhance mathematical literacy (Nurgabyl et al., 2023). These systemic issues can limit teachers' capacity to critically reflect on and improve their instructional practices.

One of the main challenges faced by teachers and needs to be improved is how to teach mathematics by utilizing contexts that are close to students. In Indonesia, several research proposed various instructional strategies to overcome this challenge (Ekaputri & Simanjorang, 2022; Farhan et al., 2021; Junianto & Wijaya, 2019; Maryani & Widjajanti, 2020; Yuliana et al., 2023). International studies have similarly noted and highlighted different pedagogical strategies for translating mathematical literacy goals into the classroom practice (Haara et al., 2017; Kolar & Hodnik, 2021; Mulaudzi, 2024). However, teachers tend to prioritize the provision of mathematical procedures and formulas in mathematics learning (Machaba, 2018). Teachers usually cite several reasons for this, such as students' low understanding of basic concepts, students' low curiosity about new problems (Lestari et al., 2017), time constraints in mathematics classes (Machaba, 2018), teachers' heavy workload (Adelia et al., 2024), content-intensive curriculum demands, and so on. This confirms that teachers' skills in implementing mathematical literacy-oriented learning still need further habituation and improvement. In addition, these factors imply that to effectively foster mathematical literacy, there must be systematic improvements in teacher training and instructional design (Genc & Erbas, 2020; Haara et al., 2017). The implications of these findings are significant for educational stakeholders to develop targeted professional development programs and curricular supports that not only emphasize content knowledge but also equip teachers with practical strategies for integrating contextualized, student-centered learning activities. This research contributes to filling the existing gap by highlighting the specific areas where teacher practices fall short and by providing a basis for future interventions aimed at enhancing mathematical literacy through improved instructional practices.

Conclusion

The development of students' mathematical literacy is strongly influenced by the role of teachers, particularly their understanding of mathematical literacy and their ability to translate that understanding into meaningful instructional practices. While this study found that teachers believe they possess adequate knowledge and claim to implement literacy-oriented learning, further analysis of lesson plans, classroom observations, and interviews revealed significant gaps in practice. Specifically, the design of learning tools (such as lesson plan and student worksheets) lacked authentic, context-based mathematical tasks, and classroom activities fell short in supporting the development of students' mathematical reasoning and problem-solving skills.

These findings underscore the disconnect between teachers perceived and actual competencies in delivering mathematical literacy-oriented instruction. This study contributes to the theoretical discourse by exposing the persistent gap between curriculum ideals and classroom realities, reinforcing the importance of aligning pedagogical understanding with effective instructional enactment.

To address these challenges, educational stakeholders must prioritize sustained, practice-based professional development that equips teachers with both conceptual clarity and applied strategies for designing and implementing contextualized learning. Future research should adopt design-based approaches to develop and evaluate innovative instructional models that bridge this gap and more effectively promote students' mathematical literacy in diverse educational contexts.

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