Journal of Honai Math, 8(2), 309-320, August 2025
https:/doi.org/10.30862/jhm.v8i2.828

Students' and teacher's difficulties in dealing with real-context problem: A case study

Dini Kinati Fardah[1] *, Yaya Sukjaya Kusumah[1]

[1] Universitas Pendidikan Indonesia, West Java, Indonesia)
* Correspondence: dinifardah@upi.edu)

Received: 17 March 2025 | Revised: 23 July 2025 | Accepted: 23 August 2025 | Published: 30 August 2025

Abstract

The data obtained from the results of the International Assessment (PISA) and the studies of researchers lately show that the mathematical literacy of Indonesian students is lacking. Various obstacles may be the factor that causes this. This article aims to describe the difficulties of students in solving real-world context problems and explore the teacher's difficulties in activating real contexts in the mathematics class. This study gives an attempt to provide a picture of the relationship between student mathematical literacy and the obstacles faced by the teacher, which has not been studied much. This is a case study in a private school in Bandung, Indonesia. Eighteen students were given a test consisting three real context problems in social arithmetic topic accompanying by the scale of confidence in answering the questions, while their mathematics teacher were given structured and unstructured questionnaires. The test and questionnaires were then analyzed qualitatively. The results showed that students had difficulty understanding problems, especially non-routine problems that related to real-world contexts, even though they claimed to be familiar with the context given. In addition, students also had difficulty with the prerequisite material to solve the contextual problems given. Facing problems that they were unfamiliar with caused their confidence in solving problems to decrease when compared to their initial level of confidence. Meanwhile, for the teacher, students' low reading interest, low reading comprehension, and low reasoning ability were problems for them. Designing a series of activities brought from real-world contexts in open-ended problem types that require reasoning and higher-order thinking skills can be a tool for students to develop mathematical literacy and can help teachers to implement it in their classrooms.

Keywords: problem solving; mathematical literacy; students' difficulties; teacher's difficulties; real context problem

Introduction

Problem solving is one of 21st century learning required skills in the domain of learning and innovations that must be prepared for students (P21 Partnership For 21st Century Learning, 2007). Scott (2015) suggests that learning offers students the best opportunities to acquire 21st-century skills, one of which is designing learning activities relevant to the real world. To face and solve everyday problems, a person's literacy is very necessary. Mathematics is applied in a wide range of everyday situations, causing mathematical literacy essential for everyone to effectively address common issues, particularly those that involve mathematical concepts to solve. This is supported by the opinion of Ojose (2011) who states that "Mathematics literacy is needed both in the workplace and in everyday life". However, in fact, Indonesian students' mathematical literacy is still very low. Based on the 2018 PISA results, the mathematics score of Indonesian students is 379 which is in the level 1 category. This score is still far below the average score of students in the world (489) which is in the level 3 category (Schleicher, 2019). This is reinforced by the results of PISA 2022 (366), which have not shown an increase in the mathematics achievement of students in Indonesia in general (Schleicher, 2023)

One important aspect that required to build 21st century skills, especially in learning and innovation skills, is mathematical literacy (Rizki & Priatna, 2019). Mathematical literacy has many related concepts and is often referred to by other terms, such as numeracy and quantitative literacy. In US, quantitative literacy and mathematical literacy are more commonly used, but numeracy is more commonly used in UK, Australia, New Zealand and in Indonesia. According to Ojose (2011) someone who has good mathematical literacy will be able to perform data estimation and interpretation, daily life problem-solving, reasoning in numerical, graphical and geometric situations, also communication using mathematics.

There are three components that need to be considered in measuring mathematical literacy, including: 1) The situation or context in which the problem arises; 2) Mathematical content used to solve problems, organized by certain overarching ideas, and most importantly, and; 3) Competencies that must be activated to connect the real world, where problems are built, with mathematics, and then to solve these problems. From those components, one of the important aspects, which is also iconic keywords in the previous definition of mathematical literacy is "real-world context", which gives us the view that it is very important to convey problems based on real-world situations to improve students' mathematical literacy. According to (De Lange, 2003), mathematics in schools is focused on substantive content, while mathematical literacy is focused on how to use mathematics in real life. The use of context in mathematics learning is more interesting and involves students (Abadi & Fardah, 2018). However, which context to choose and how to empower students to identify mathematical content in contextual problems need to be carefully considered when developing students' mathematical literacy (Kolar & Hodnik, 2021). Hence, to activate students' mathematical literacy, the choice of context in learning, activities and assignments is a crucial thing to pay attention to.

Many researches utilized specific contexts to help students gaining good mathematical literacy. For examples, Mhakure (2020) use the context of Cape Town, South Africa, population

that bring from a newspaper there, Yansen et al. (2019) use the context of Asian Games football context, Runtu et al. (2023) use the ethnomathematics context of North Sulawesi Indonesia, and Ozkale & Ozdemir Erdogan (2022) use the context of financial. In summary, context selection that familiar to the students is crucial and it will facilitate the students' mathematical literacy.

A literature review from Aisyah & Juandi (2022) provides the results that Indonesian students still in the low level of mathematical literacy in various level of education. However, this research did not give explanation what caused these problems in terms of students-teacher relationship. The difficulties of students may be related to the teacher's difficulties in bringing literacy into the classroom. The absence of real contexts in the classroom in mathematics learning may make students unaccustomed to dealing with flexible mathematics that requires problem-solving skills. It seems that teacher's difficulties are also need to be explored. In addition to studying students' difficulties in solving mathematical problems based on real contexts, this article also reveals teacher's difficulties in presenting contexts in the mathematics classroom.

Methods

This is case-study research that aims to describe the difficulties of students to solve real context problem and their teacher's difficulties in activating mathematical literacy in her class. A test of real context problems in the financial context was given to 18 eighth grade students in a private school in Bandung, Indonesia. A test was designed to unpack students' ability in solving real context problems according to mathematical literacy process framework (formulate, employ, and interpret). Three non-routine real context problems were given to the students after being validated by expert. Embedded in the test, apart of having to solve the 3 non-routine problems given, students also asked to give: 1) their confidence level of their ability in dealing with mathematics problem, task, course, and test all this time; 2) their confidence level of the solution they obtained; and 3) the familiarity of the context given in the problem in a differential semantic scale between 0.0 (not confidence/familiar at all) to 5.0 (very confidence/familiar). The data then analyzed descriptively to support the data of students' mathematical literacy. An interview conducted to mathematics teacher who teach students to explore what has become the difficulties of teacher involving students in activities that deal with mathematical literacy. The twelve items of the questionnaire include the aspect of teacher's perception on student ability, learning resources, and teacher's perception on the effect of mathematical literacy tasks or activities implementation. The data obtained from the test and teacher interview were then analyzed qualitatively. The 3 problems of social arithmetic given to students have the characteristics as shown in Table 1. Problem 1 and 3 are developed by the researchers, meanwhile problem number 2 is adapted from Mason et al. (2010).

Tabel 1. Problem framework

Problem no.	Type of problem	Problem framework
Problem 1	Routine problem	A trader buys 25 kg of Cianjur rice at a price of Rp 325,000.00. In sending the rice to his house, he is charged a shipping fee of Rp 35,000.00. If the trader

		wants a 10% profit from his sales, what is the selling price of the rice per kilogram that he should set?
Problem 2	Non-routine problem	In a mall that is having a warehouse sale, buyers are entitled to a 20% discount, but they also have to pay a 15% purchase tax. Ani and Ali as managers are considering a policy that does not harm buyers. Ani says that it is better to calculate the discount first and then the tax so that buyers will benefit more, but Ali says the opposite. Which one is correct? Give reasons.
Problem 3	Non-routine problem	There are two vouchers that apply to Dias when he shops for food through the Shapee Food application. The first voucher gives a 15% discount with a maximum price reduction of Rp35,000.00, while the second voucher gives a 35% discount with a maximum price reduction of Rp15,000.00. For what amount of purchase do both vouchers provide the same amount of spending? Which voucher provides more benefits?

Results and Discussion

The result is divided into three main parts, namely students' difficulties in solving real context problems, students' confidence in their competency, and teacher's difficulties in dealing with mathematical literacy.

Students' difficulties in solving real context problems

From the data obtained, it is shown that most students have difficulties in solving the problem given. In detail, in terms of the number of students who passed the three aspects of mathematical literacy, namely the process of formulating, employing, and interpreting is shown in Table 2.

Table 2. Number of students succeeding in each mathematical literacy process

Problem 1			**Problem 2**			**Problem 3**		
Formulate	Employ	interpret	Formulate	Employ	interpret	Formulate	Employ	interpret
15	15	15	3	2	0	1	0	0

It can be seen in Table 2 that students found difficulties in problem 2 and problem 3, while they easily solve problem 1. It is reasonable since problem 1 is a routine problem and it is well-structured problem as they usually found in their mathematics class. In problem 1 students do not find any difficulties in those three aspects of formulate, employ, and interpret. Meanwhile, for problem 2 and problem 3, students find difficulties since the stage of formulate.

In problem 2, a non-routine problem, students were given information of two managers of a store who want to give big sales to customers. They argue which should be counted first so that the customer will get maximum benefit, the discount of 20% or the tax of 15%. Students are asked to give solutions along with the argument. In the process of working for the second problem, some students asked whether the problem missed some information or not. Several students stated that they cannot find any amount of money in those problems. Problem 2 can be classified as an ill-structured problem, where the components of the problem are not clearly defined, and their characteristics may be ambiguous (Jonassen, 1997).

In addition, in the exercise session on the topic of social arithmetic that is often found in mathematics textbooks in Indonesia, for example in Figure 1a for the discount context (Susanto et al., 2022) and Figure 1b for the tax context (Maulida et al., 2022), the information given is clearly stated: the percentage of discounts or taxes, accompanied by a certain amount of money. Meanwhile, in Problem 2 it is not found a certain amount of money accompanying the percentage of tax and discount given in the problem. This makes students confused about how to solve the problem.

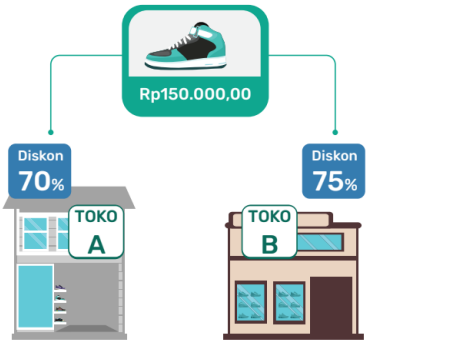

Figure 1a. A relevant sample to problem 2 in Indonesian textbook about discount context

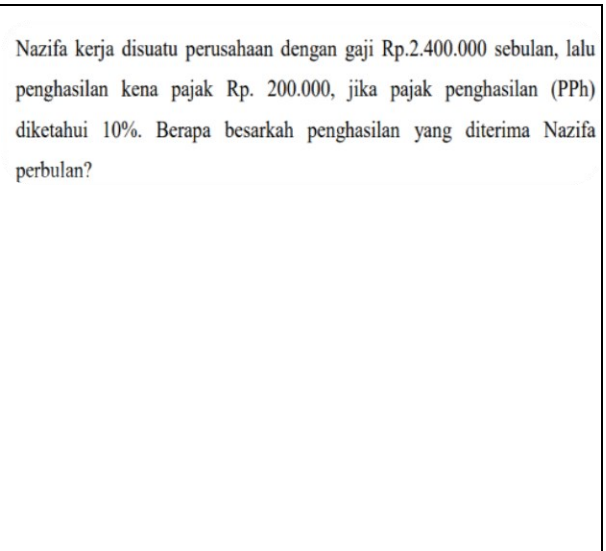

Figure 1b. A relevant sample to problem 2 in Indonesian textbook about tax context

Related to mathematical literacy, students fail to formulate problems that is to understand that information related to the amount of money can vary, can be supposed to with certain variables, or students can try with several numbers that he thinks are easy to calculate. This causes many students who just answer questions without a clear justification as seen in Figure 2. This also leads to the temporary conclusion that students are not used to encountering unstructured questions, and this makes it difficult for students to understand the problems given. Majority of the students end up in giving a solution that are not based on argument and data.

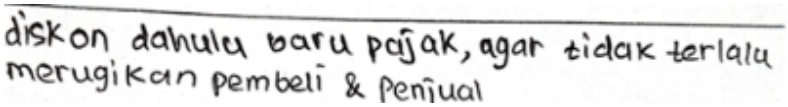

Figure 2. incomplete student's answer for problem 2

The student understood the context but they found difficulties in formulating the problem into mathematical model. It is also possible for student to try some numbers as a price if the student can formulate the problem well. But, as we seen in Figure 2, student just give the conclusion without any arguments accompanied. This is inline with the result of Cho & Kim

(2020) study, that students may experience difficulties in identifying and defining problems due to the large space when encountering ill-structured problems.

Among the student who do not give complete answer or argument, and do not elaborate the process of finding the conclusion, there are also some students who pass the aspect of formulate and employ. Yet, the students do not evaluate the answer for the general conclusion he made. He took an example if he spent Rp 100.000,00 and explain the illustration. The process of the student finding the answer is as seen in Figure 3.

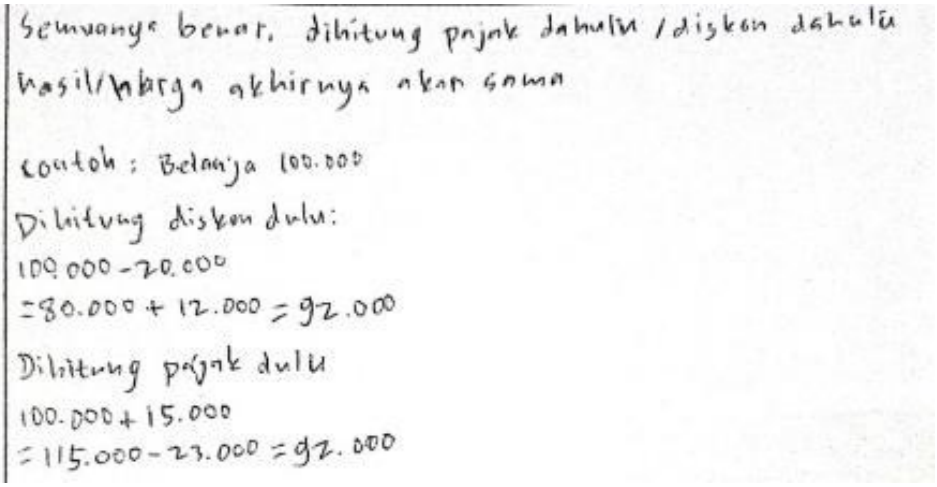

Figure 3. Students process of making conclusion in Problem 2

It can be seen in Figure 3 that the student inductively found the conclusion. He did not give up on this non-routine problem and he tried to simplify it by using 100.000 as the price that will be counted. In four steps of inductive thinking suggested by (Isoda & Katagiri, 2012), the student has already achieved the conclusion but still misses the verification step. It will be complete if he can find the generalization of the conclusion for any price or he can also try for some price and verify for the new price which has not been tried. It is also in line with SOLO Taxonomy, that students in this stage of developmental age (13-15 years old) have not reached the extended abstract stage which possible for them to work in abstract world and do deduction thinking (Biggs & Collis, 1982). They are still in the relational stage, so solving the problem above inductively is a normal process for the student at this age. For the students who were still not in the stage of formal age, to achieve the generalization as asked in this problem, students can be supported by some tools such as a calculator, Ms. Excel software, graphing calculator, or dynamical geometric software (DGS) so that the exploration of inductive thinking to support the conclusion will be richer.

In problem 3, given information on two different vouchers provided by an online shop. Students are asked to conclude when the vouchers will be equal, and when those will have higher benefits over the other. This problem also needs students to make generalization which divided into two main conditions. But, none of the students give the complete generalization. The most logic answer yet still lack of support and argument is as seen in Figure 4.

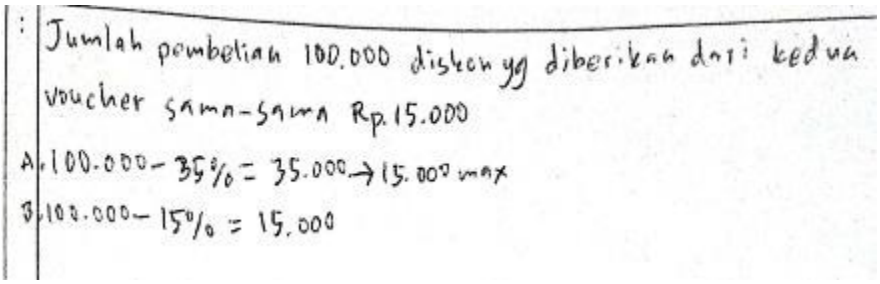

Figure 4. Student's answer in problem 3

As seen in Figure 4, student just answer for the first question, that is when the vouchers will be equal. He can find Rp 100.000,00 by trial-and-error method. Unfortunately, there is no explanation about the second question, that is about when those will have higher benefits over the other. If following Polya's problem-solving phase (Polya, 2004), then students have understood the problem, devised and carried out the plan using a strategy (guess and check), but students have not performed the looking back phase. There are several things that the student missed, including: 1) He did not check that there was a second question asking him to conclude which voucher provided more benefits; 2) He did not check what about purchases below or above IDR 100,000.00; 3) He did not check whether there were other strategies, for the example using a graph or by using a mathematical model. However, the majority of the students did not understand the problem given. They cannot formulate the problem into mathematics model or even just retell the problem given using other words. They just answer the straight point without accompanied by complete argument or explanation such seen in Figure 4.

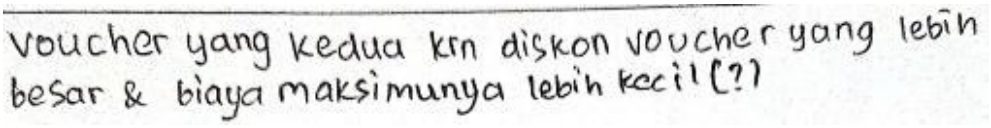

Figure 5. Student's answer in problem 3

Summarizing in the results above, students were difficult to solve non-routine problem as it was unfamiliar type of test they dealt with. Students were difficult to formulate and analyze the problem in to the simpler form, so that the employ and interpret stage do not occurred. It is in line with the result of Anggraini et al. (2023) research that research that research that students have difficulty in investigating information in non-routine problem so that they failed to develop the problem-solving strategies. It may be also caused by the mathematical ability of the students was in low level. As referred to Ozrecberoglu et al. (2022) research result that the scores of the students in basic mathematics knowledge and concept skills affect the scores they obtain from non-routine problems. Hendrayanto et al. (2022) also report that students' difficulties in solving non-routine problems stemmed from the immaturity of the concepts that

students have that should be used in solving the problems. Teachers can build a scaffolding to help students gaining their literacy by give them non-routine problems, ill-structured problems, problematic problem step by step so that students familiar with the type of problem. Teaching problem solving heuristics also can be one alternative ways.

Students' level of confidence in their competence

There are three data of students' level of confidence obtained from the students, by considering; 1) their ability to deal with a mathematics problem, task, course, and test all this time (C1); 2) their ability to solve the contextual problem given (C2). For the first result, it is obtained that the average of the student's confidence level of their ability in dealing with mathematics problem, task, course, and test all this time is 3.29 in the scale of 0.0-5.0. The comparison of the last two results is shown in Table 3.

Table 3. Students' average level of confidence after problem solving

Problem 1	Problem 2	Problem 3	Average
2.44	2.57	2.53	2.51

It can be compared that students' confidence in their ability in math overall this time is an average of 3.29. But, after reading each of the 3 problems given, the average of their confidence to be able to solve the problem dropped (2.51). This confidence that students feel about their performance about their ability to solve the tasks is more commonly referred to as self-efficacy, which is very affected by the success or failure of the previous tasks. Hiller et al. (2022) stated that self-efficacy affect the students' performance in mathematics, mathematical literacy in specific. Meanwhile, there are four factors contribute to the student's self-efficacy namely past performance, vicarious experiences (observing others perform), verbal persuasion, and physiological cues (Ormrod et al., 2019). It means that when the students are not familiar with the type of test or the context or they have never been solving similar problems given, their confidence may be influenced. In this case, students are not familiar with the type of the problem: ill-structured problem. The 'missing information' in the problem translated by the students that there is something wrong with the question. Many factors such as mathematics conceptual understanding and reading ability of students may also become the factors that influenced this result. However, the other factors may influenced need further study.

Teacher's difficulties in dealing with the mathematical literacy

A written interview and a questionnaire were given to the teacher to explore whether the teacher found any difficulties in emphasizing mathematical literacy in their classes or not. The results of the written interview show that the teacher has some difficulties, indeed. There are several points mentioned by the teacher. First, the teacher feels that when they give problems or tasks that emphasize mathematical literacy, the students do not show interest. Reading seems to be the one main problem. Students disliked reading the long passage and they did not know how

to start. The teacher feels that the students have a low understanding of reading. It causes the student to find it difficult to understand the problem and so to solve the problem. Third, teacher feels that the students have a low reasoning ability. In fact, mathematical literacy problems really require reasoning and high-ordered thinking skills (OECD, 2023). Finally, teacher feels that students also have difficulties in finding the mathematics concept hidden in the real-context problem. The students need to be guided so that they can find the mathematics concept that will bring them into the solutions. Students are not familiar with real-world context problems so they find difficulties in how to start and end these tasks. Because students are difficult to solve this kind of problem, teacher feels that this is an obstacle to implementing or emphasizing mathematical literacy in class. The result of the questionnaire is as shown in the table below.

Table 4. Teacher's response of the difficulties on activating mathematical literacy

No.	Questionnaire Item	Score given by teacher
1.	My students have low reading literacy skills, which creates obstacles to implementing mathematical literacy in the classroom	4
2.	My students have low reasoning abilities, which creates obstacles to implementing mathematical literacy in the classroom	3
3.	My students find it difficult to solve word problems, which creates obstacles to implementing mathematical literacy in the classroom	3
4.	My students have low interest word problems which creates obstacles to implementing mathematical literacy in the classroom.	4
5.	I have a few references regarding how to compose mathematical literacy questions	4
6.	I have a few references regarding how to design learning activities that emphasize mathematical literacy	4
7.	I had difficulty finding real-world context regarding the material being taught in class	1
8.	I'm worried that the students won't understand the mathematical literacy questions that I wrote	3
9.	I'm worried that the learning that emphasizes mathematical literacy that I designed will not produce results or be in vain	2
10.	I am worried that student learning outcomes will be low if they are given real-context problems both in learning and in exams	1
11.	I'm worried that the material won't be completed according to curriculum demands if I focus too much on students' mathematical literacy	2
12.	I am worried that students' interest in learning mathematics will decrease if I focus too much on students' mathematical literacy	2

Note: 4 = strongly agree, 1=strongly disagree

Items 1-4 talk about the teacher's perception of students' low performance as an obstacle to mathematical literacy. We can see from the items that the teacher has a perception that what makes it difficult to implement the learning that emphasizes mathematical literacy is her students' lack of reading skills, reasoning abilities, and interest in word problems. The fact is in PISA, it is not only in mathematics that Indonesian students have low score, but also in reading

(OECD, 2023). However, the teacher is also suggested to build her belief that their students have opportunity to gain their mathematical literacy. Giving the real context problem step by step along with teaching the problem-solving heuristics are options that can be choose by the teacher.

From items 5-7, we can see that the teacher does not have difficulties to find and bring real-world context regarding the topic studied in the class. Still, they do lack references on how to compose and design activities or tasks that emphasize mathematical literacy in class. This is partially in line with the result of Pulungan et al. (2024) research that designing learning in the framework of mathematical literacy and the lack of availability of supporting facilities and infrastructure for mathematical literacy learning are problems for teachers.

From items 8-12, we can see that the teacher does not worry if the students' learning outcomes will be low, that their efforts will be in vain, that the material will not be completed according to curriculum demands, or that student's interest in learning mathematics will decrease if she gives emphasize the learning on mathematical literacy. Meanwhile, the teacher worried that their students did not understand the problem she constructed. It means that teacher lacks confidence with the activity or problem that she constructed that oriented to mathematical literacy.

It can be concluded that teacher's perception of students' low performance such as reading skills, reasoning abilities, interest in word problems, and her difficulties in finding guidance or reference on how to design tasks or activities emphasizing mathematical literacy are the main problems for teacher in activate mathematical literacy in class. The correlation between those factors needs to be studied further.

Conclusion

From the results and discussion above, we can conclude that mathematical literacy is still a big problem for students and teacher. As for students, the real-world context that served as a rather long passage is a problem for them. They do not know how to start, understand the problem, solve, and interpret the solution. The difficulties also come from the type of problem given, non-routine problems, open-ended, or ill-structured problems. Students do not seem familiar with this kind of problem. As for teacher, the perception of students' low performance is an obstacle for teacher. The teacher feels that students' low interest in reading, low understanding, and low reasoning ability are big obstacles to solving real-context problems. Another obstacle for teacher is finding the reference for designing activities or tasks emphasizing mathematical literacy. For future research, we suggest designing activities that are brought from real-world contexts that are routine and non-routine problems and require reasoning and higher-order thinking skills that are designed as scaffolding for students to gain mathematical literacy. This also suggested that mathematics teachers should be provided with some training and sources on how to design learning that activates the students' mathematical literacy.

Acknowledgment

I would like to thank the Indonesia Endowment Fund for Education Agency (LPDP) of the Ministry of Finance for sponsoring the research funding.

Conflicts of Interest

The authors declare no conflict of interest.

References

Abadi, & Fardah, D. K. (2018). Students' activities for understanding function shifting by using GeoGebra. *Journal of Physics: Conference Series*, *1108*(1). https://doi.org/10.1088/1742-6596/1108/1/012014

Aisyah, A., & Juandi, D. (2022). The description of Indonesian student mathematics literacy in the last decade. *International Journal of Trends in Mathematics Education Research*, *5*(1), 105–110. https://doi.org/10.33122/ijtmer.v5i1.114

Anggraini, D., Suryadi, D., & Albania, I. N. (2023). *The analysis of students' difficulties in solving non-routine mathematical problems*. 090035. https://doi.org/10.1063/5.0175692

Biggs, J. B., & Collis, K. F. (1982). *Evaluating the Quality of Learning*. Academic Press. https://doi.org/10.1016/C2013-0-10375-3

Cho, M. K., & Kim, M. K. (2020). Investigating Elementary Students' Problem Solving and Teacher Scaffolding in Solving an Ill-Structured Problem. *International Journal of Education in Mathematics, Science and Technology (IJEMST)*, *8*(4). www.ijemst.com

De Lange, J. (2003). Mathematics for Literacy. In B. L. Madison & L. A. Steen (Eds.), *Quantitative literacy: Why Numeracy Matters for Schools and Colleges* (pp. 75–89). Princeton.

Hendrayanto, D. N., Riyadi, R., & Indriati, D. (2022). Dominant Factor were Caused Eight Grade Students Errors in Solving on Cartesian Coordinate Multistep Routine and Non-Routine Modification Story Problems. *JTAM (Jurnal Teori Dan Aplikasi Matematika)*, *6*(2), 354. https://doi.org/10.31764/jtam.v6i2.7313

Hiller, S. E., Kitsantas, A., Cheema, J. E., & Poulou, M. (2022). Mathematics anxiety and self-efficacy as predictors of mathematics literacy. *International Journal of Mathematical Education in Science and Technology*, *53*(8), 2133–2151. https://doi.org/10.1080/0020739X.2020.1868589

Isoda, M., & Katagiri, S. (2012). *Mathematical Thinking: How to Develop it in the classroom* (Vol. 1). World Scientific Publishing Co. Pte. Ltd.

Jonassen, D. H. (1997). Instructional Design Models for Well-Structured and Ill-Structured Problem-Solving Learning Outcomes. *Educational Technology Research and Development*, *45*(1), 65–94.

Kolar, V. M., & Hodnik, T. (2021). Mathematical literacy from the perspective of solving contextual problems. In *European Journal of Educational Research* (Vol. 10, Issue 1, pp. 467–483). Eurasian Society of Educational Research. https://doi.org/10.12973/EU-JER.10.1.467

Mason, J., Burton, L., & Stacey, K. (2010). *Thinking_Mathematically* (2nd ed.). Pearson.

Maulida, Putra, R. W. Y., & Fadila, A. (2022). *Buku Matematika: Aritmatika Sosial untuk Siswa SMP Kelas VII*. Edupedia Publisher.

Mhakure, D. (2020). Using Mathematical Modelling in the Teaching and Learning of Mathematical Literacy: Perspectives on the South African Context. In *International Perspectives on the Teaching and Learning of Mathematical Modelling* (pp. 467–477). Springer Science and Business Media B.V. https://doi.org/10.1007/978-3-030-37673-4_40

OECD. (2023). *PISA 2022 Results (Volume I)* (PISA). OECD. https://doi.org/10.1787/53f23881-en

Ojose, B. (2011). Mathematics Literacy: Are We Able To Put The Mathematics We Learn Into Everyday Use? In *Journal of Mathematics Education © Education for All* (Vol. 4, Issue 1).

Ormrod, J. E., Anderman, E. M., & Anderman, L. H. (2019). *Educational Psychology: Developing Learners* (10th ed.). Pearson.

Ozkale, A., & Ozdemir Erdogan, E. (2022). An analysis of the interaction between mathematical literacy and financial literacy in PISA*. *International Journal of Mathematical Education in Science and Technology*, *53*(8), 1983–2003. https://doi.org/10.1080/0020739X.2020.1842526

Ozrecberoglu, N., Aydın, S., & Aydın, O. (2022). Students' Skills In Solving Non-Routine Mathematical Problems. *Education Quarterly Reviews*, *5*(2). https://doi.org/10.31014/aior.1993.05.02.504

P21 Partnership For 21st Century Learning. (2007). *Framework for 21st Century Learning*. Polya, G. (2004). *How to Solve it: A New Aspect of Mathematical Method*. Princeton University Press.

Pulungan, D. A., Mila, Y. H., & Harahap, I. H. (2024). Kesulitan Guru Menerapkan Pembelajaran Literasi Matematika di Madrasah Ibtidaiyyah Kota Medan. *Journal of Education Research*, *5*(1), 651–659.

Rizki, L. N., & Priatna, N. (2019). Mathematical literacy as the 21st century skill. *IOP Conf. Series: Journal of Physics: Conf. Series*, *1157*. https://doi.org/10.1088/1742-6596/1157/4/042088

Runtu, P. V. J., Pulukadang, R. J., Mangelep, N. O., Sulistyaningsih, M., & Sambuaga, O. T. (2023). Student's Mathematical Literacy: A Study from The Perspective of Ethnomathematics Context in North Sulawesi Indonesia. *Journal of Higher Education Theory and Practice*, *23*(3), 57–65. https://doi.org/10.33423/jhetp.v23i3.5840

Schleicher, A. (2023). *Programme for International Student Assessment Insights and Interpretations PISA 2022*.

Schleicher, A. (OECD). (2019). *PISA 2018: Insight & Interpretations*.

Scott, C. L. (2015). *The futures of learning 3: what kind of pedagogies for the 21st century?* (15; erf working papers series).

Susanto, D., Sihombing, S., Radjawane, M. M., Wardani, A. K., Kurniawan, T., Candra, Y., & Mulyani, S. (2022). *Matematika untuk SMP/MTs Kelas VII*. Pusat Perbukuan Badan Standar, Kurikulum, dan Asesmen Pendidikan.

Yansen, D., Ilma Indra Putri, R., & Fatimah, S. (2019). Developing pisa-like mathematics problems on uncertainty and data using asian games football context. *Journal on Mathematics Education*, *10*(1), 37–46.