

A Literature Review: Efforts to Overcome Student's Mathematical Literacy

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ABSTRACT

Mathematics is closely related to everyday life, by using mathematics we can solve problems of everyday life related to mathematics. The purpose of learning mathematics and mathematical abilities is contained in mathematical literacy. Mathematical literacy is a person's ability to formulate, use and interpret mathematics in a variety of contexts. Therefore, mathematical literacy must be mastered by students. However, in reality the mathematical literacy of Indonesian students is still low. The method used in this research is literature study. The data collected is in the form of research results from various articles, library sources and documents that are in accordance with the theme of the factors causing the low mathematical literacy skills of Indonesian students and efforts to improve them. The results of this study are the low mathematical literacy is caused by several factors including the learning process is still much teacher-centered, the lack of students practicing literacy questions, students have difficulty making mathematical models from real-world problems. These problems must be addressed immediately. The solution offered in this paper is to use contextual learning because literacy is closely related to the real world context, improve mathematical thinking habits, and get students to practice literacy questions or PISA-type questions. This solution is expected to improve students' mathematical literacy skills.

Keywords : *Literature review; Mathematical literacy; Effort to overcome*



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INTRODUCTION

Mathematical literacy is an individual's ability to formulate, identify, understand and apply basic mathematics in various contexts that individuals need in everyday life (Ojose, 2011). Mathematical literacy is important for students' competence in reading, writing, and speaking about mathematics. Literacy skills related to the ability to read, mathematics, and science and their applications in life serve as a benchmark for the extent to which the quality of education, especially for students of compulsory school age in a country (Johar, 2014). Good literacy skills greatly affect the acquisition of various information related to competence in living life, because literacy is able to influence individual thinking in making conclusions, responding to the environment, and fostering a critical culture that gives birth to an intelligent and competitive society (Masfufah &

Afriansyah, 2021).

Based on several opinions about mathematical literacy, it can be concluded that mathematical literacy emphasizes the ability to apply mathematical concepts in solving problems of everyday life. In the problem solving process, relevant mathematical concepts must be chosen to solve the problems encountered in order to obtain the correct solution. So mathematical literacy can be defined as the ability to perform mathematical reasoning, design, apply, and interpret relevant mathematical concepts in various contexts of everyday life problems effectively.

One of the programs that evaluates students' mathematical literacy skills is *The Program for International Student Assessment (PISA)*. PISA is one of the studies developed by several developed countries in the world who are members of the *Organization for Economic*

Cooperation and Development (OECD) in Paris, France. Indonesia has participated in the PISA evaluation program since 2000, this international program is held every 3 years with the aim of measuring reading, math and science literacy achievement. The involvement of the Indonesian people in the PISA study is to measure the literacy skills of Indonesian students, which is still far from satisfactory when compared to other countries (Noviana & Murtiyasa, 2020).

The results of the PISA survey regarding the level of mathematical literacy of Indonesian students are in fact still far from expectations. Indonesian students' mathematical literacy is still below the average, which means that Indonesian students' mathematical literacy is still low. This is one of the problems that Indonesia is currently facing. In the 2015 PISA, the mathematical literacy of Indonesian students was ranked 63 of the 70 survey participating countries. Relatively similar results were also obtained at PISA the following year, namely in 2018 the mathematical literacy of Indonesian students was ranked 72 out of 78 survey participating countries (OECD, 2019).

Many studies show that the mathematical literacy of Indonesian students is still relatively low. Based on the research results Rusmining et al. (2014) which provides information that the mathematical literacy ability of students who are the subject of research is low, namely at a level below 3. In line with this, the results of Masfufah & Afriansyah's (2021).

Research show that students' mathematical literacy skills are still low, this can be seen from the results of students' work in solving PISA model problems which are classified at the basic level, namely level 1 and 2. Students still have difficulties, especially in applying the formulas they already know. The results of the research by Buyung & Dwijanto (2017) also show that the mathematical literacy of Indonesian students is still low. The literacy skills of students who are research subjects are not good enough overall, especially at the modeling and reasoning stages to solve problems related to everyday life. The low mathematical literacy of students, of course, there are factors that influence it.

According to Diyarko & Waluyo (2016) there are many factors that cause students to have difficulty in solving mathematical literacy problems, in addition to the absence of habituation

from teachers with mathematical literacy questions, the method and media factors used do not support learning. In line with this, Khotimah et al. (2018) states that students' mathematical literacy skills are low because in the learning process students only listen to what is conveyed by the teacher and very rarely do questions and answers to check students' understanding so that learning is only teacher-centered which causes students to be less active during the teaching and learning process at school. Students only receive passive learning, and do not understand the material presented, so students feel confused, bored and have no enthusiasm in participating in ongoing learning. These problems must be immediately found a solution, so that the mathematical literacy of Indonesian students can increase.

METHODS

This research is a literature study. The type of data collected is in the form of research results from various articles, library sources and documents that are in accordance with the theme of the factors causing the low mathematical literacy ability of Indonesian students and efforts to improve them. In literature study research, literature search is not only the first step in creating a *research design* but also using library sources to obtain research data. The data obtained, then collected, compiled, studied, analyzed, and concluded so as to get a new idea about a topic of study.

The steps taken by the researcher in this study were collecting data, reviewing and discussing research that has been done by other researchers. Researchers conducted reviews of various articles both national and international and systematically identified appropriate articles with predetermined steps. The selected articles are articles published in the last ten years.

In this study, the researcher conducted a data search process using a search engine (Google Chrome) with the site address <http://garuda.ristekdikti.go.id/> and by searching on Google Scholar and <https://eric.ed.gov/>. Next, the researcher analyzes, summarizes the articles that have been selected, and develops the ideas obtained. The results of the research are then used as a discussion in this article.

RESULTS AND DISCUSSION

The data from the search results for articles and their summaries are presented in the following table 1

Table 1. Summary Results of Reviewed Articles

Title	Journal	Researcher (year)	Result
Pelatihan Soal Matematika Berbasis Literasi Numerasi pada Siswa SMA IT Fitrah Insani	J. Pengabdian Masyarakat MIPA dan Pendidikan MIPA	Nicky Dwi Puspaningtyas, Marchamah Ulfa (2020)	The provision of numerical literacy-based question training has a significant influence on student learning outcomes. The implementation of mathematical numeracy literacy-based problem training was carried out well and can be declared successful.
Melatih Literasi Matematika Siswa dengan Soal PISA	Prisma, Prosiding Seminar Nasional Matematika	Nabilah Mansur (2018)	To overcome the low mathematical literacy of students, it can be trained by giving PISA questions on a regular basis. The compatibility and understanding between mathematical literacy and PISA makes PISA questions can be used to practice mathematical literacy. Because what is assessed in the PISA study includes mathematical literacy. To make it happen, habituation is done to work on PISA type questions.
Analisis Kemampuan Literasi Matematis Siswa melalui Soal PISA	Mosharafa: Jurnal Pendidikan Matematika	Risma Masfufah, Ekasatya Aldila Afriansyah (2021)	Students' mathematical literacy skills are still low, this can be seen from the results of students' work on solving the problems given, in this case various types of PISA questions. Therefore, in practice, students need to get used to being given questions with the PISA type so that students can open their minds broadly.
Efektivitas Pendekatan Kontekstual Berbasis Karakter dan Budaya Lokal Terhadap Kemampuan Literasi Matematis Siswa SMP	WILANGAN: Jurnal Inovasi dan Riset Pendidikan Matematika	Ayu Wahyuningtyas, Hepsi Nindiasari, Abdul Fatah (2020)	The result of this study showed that: (1) mathematical literacy skills of students who get a contextual approach based on character and local culture with LKPD are better than students who get expository learning, (2) increase in mathematical literacy skills of students who get a contextual approach based on character and local culture with LKPD is better than students who get expository learning, and (3) students give a positive response to mathematics lessons with a contextual approach based on character and local culture with LKPD.
Penerapan pendekatan kontekstual sebagai upaya meningkatkan hasil belajar	Jurnal Pembelajaran Matematika Inovatif	Heni Tusdia, Tina Rosyana (2021)	Students' mathematical literacy skills are still low, this can be seen from the results of students' work on solving the problems given, in this case various types of PISA

matematika siswa SMP kelas VII pada materi aritmetika sosial			questions. Therefore, in practice, students need to get used to being given questions with the PISA type so that students can open their minds broadly.
Efektifitas Pendekatan CTL dan PBL dengan Setting Kooperatif Tipe STAD Ditinjau dari Kemampuan Literasi Matematis Siswa	Cahaya Pendidikan	Muhammad Arif Wicaksono, Nina Agustyaningrum (2018)	In hypotheses 1 and 2, it is concluded that the CTL and PBL approaches with each STAD cooperative setting is effective in terms of mathematical literacy skills student. In the results of testing the third hypothesis, it was concluded that there was no difference the effectiveness of the CTL and PBL approaches with the STAD type cooperative setting in terms of students' mathematical literacy skills.
Corresponding Habits of Mind and Mathematical Ability	IOP Conf. Series: Journal of Physics: Conf. Series 895	G Dwirahayu, D Kustiawati and I Bidari (2017)	The results of the analysis showed that the learning process of mathematics of the students' habits of mind are less developed in the learning process. Without any treatment given to the habits of mind. The result shown that impact of habits of mind toward mathematical ability is 40%. If teachers can develop their students' knowledge, attitude and skills holistically, as expectation, then the potential of students to acquire knowledge in mathematics will be higher or better.
Faktor Mathematical Habits Of Mind dan Kemampuan Literasi Matematis Siswa SMP di Kabupaten Bandung Barat	Jurnal Mercumatika : Jurnal Penelitian Matematika dan Pendidikan Matematika	Putri Eka Indah Nuurjannah, Heris Hendriana, Aflich Yusnita Fitrianna (2018)	There is significant relationship between mathematical habits of mind and literacy skills mathematics of junior high school students in West Bandung Regency, with the influence of mathematical habits of mind on students' mathematical literacy abilities of 39.8% and the rest is influenced by other factors not measured in this study. Have the mathematical habits of mind high in students, will provide a good increase in mathematical literacy skills.
Kontribusi Habits of Mind Terhadap Kemampuan Literasi Matematika Siswa pada Materi Geometri	Jurnal Pendidikan Matematika (Kudus)	Putri Nur Malasari, Tatang Herman, Al Jupri (2019)	Students have the ten categories of habits of mind which serve as indicators in this research. Habits of mind have influence positive effect on students' mathematical literacy skills in solving problems flat sided space problem. The size of the contribution is 43.5% while 56.7% was contributed by other factors not measured in this research.

Based on several literatures that have been studied by researchers, the researcher offers several solutions or efforts to overcome the low

mathematical literacy of Indonesian students, including:

1. Using Contextual Learning

Context in literacy assessment is important, because context brings students' mindsets to recall the concepts they have learned, relate them to existing problems in the context, then formulate a solution that is appropriate to the given context (Rahmawati & Mahdiansyah, 2014). The use of context in learning mathematics makes abstract concepts understandable based on the understanding formed from certain real situations that are well known to students. Based on this, it can be seen that in order to support students' mathematical literacy, it is important to link the material, and the learning process with real-life contexts. Therefore, one of the lessons that can support students' mathematical literacy skills is contextual learning.

Contextual learning engages students in important activities that help them relate academic lessons to the real-world contexts they encounter. By linking the two, students can see meaning in school assignments. When students compose assignments or find interesting problems, when students make choices and accept responsibility, seek information, and draw conclusions, when actively select, organize, organize, touch, plan, investigate, question, and make decisions, they connect the academic side, with context in life situations, and in this way they find meaning.

Contextual learning is a learning and teaching concept that facilitates teachers in connecting the concepts presented to students' real world situations and stimulates students to relate previously mastered knowledge to its use in everyday life (Tusdia & Rosyana, 2021). With contextual learning, students will be more active in learning because students feel close to the problems given in the learning process. Contextual learning prioritizes the process rather than the results, so it is hoped that the learning outcomes will be more meaningful and the learning process will take place naturally. Contextual learning prioritizes full student activity in discovering the concepts being studied and relating them to real-life circumstances so as to trigger students to be able to apply them in everyday life (Fendrik, 2017).

Many studies show that contextual learning has a positive impact in improving the skills needed in students' mathematical literacy skills. Based on the results of Tusdia & Rosyana (2021) research, it shows that the learning outcomes of students who receive contextual

learning improve by paying attention to the characteristics and essence of the contextual approach, namely how the subject matter is associated with students' daily activities in the real world as students, family members and society. While the research results Wahyuningtyas et al. (2020) provides information if the mathematical literacy skills of students who receive a contextual approach are better than students who receive expository learning. The results of research by Nurfadilah et al. (2021) showed that the mathematical understanding ability of students who used a realistic approach was better than students who used a scientific approach. Based on the results of these studies, contextual learning can support students' literacy skills. Teachers can also use student-centered learning models in implementing contextual learning, such as *Problem Based Learning*, *Inquiry Based Learning*, *Discovery Learning*, and so on.

Contextual learning emphasizes the process of full student involvement to be able to find the material being studied and relate it to real life situations so as to encourage students to be able to apply it in everyday life. The mathematization process brings students to change from contextual problems from the real world to the mathematical world needed to solve these problems. Mathematization brings students in interpreting and evaluating problems and reflecting on solutions to ensure that the solutions found are in accordance with the real situation that caused the problem so that it can be solved by students through contextual learning. Whereas in literacy questions, it is closely related to the context of daily life, so that with the teacher applying contextual learning, students will be accustomed to solving problems of daily life and in the end students will be able to solve literacy problems well.

2. Improving Mathematical Habits of Mind

One of the affective abilities that every student must possess and improve in learning mathematics is *Mathematical Habits of Mind (MHM)* or mathematical thinking habits (Nuurjannah et al., 2018). Meanwhile, according to Dwirahayu et al. (2017) teaching mathematics is not only to make students good in cognitive but they must be good in thinking habits, so that students can apply mathematical concepts to problems of daily life.

By getting students used to thinking, students will be more enthusiastic and active in the learning process. In line with this, Suwaibah et al. (2020) revealed that one approach that can make students independent and make students active during the learning process in the classroom is the *MHM approach*.

Habits of Mind (HM) is the tendency of students to behave intellectually or intelligently when students are faced with problems, especially problems for which the solution is not immediately known (Dwirahayu et al., 2017). *HM* is a behavior that requires mind discipline that must be trained, so that a habit is formed to always try to do something or act better and smarter. Meanwhile, according to Miliyawati, (2014) *MHM* is a development of thinking skills through habituation or cultivation of mathematical thinking. From some of these opinions it can be concluded that *MHM* is a habit of thinking done by students in solving a problem by connecting it to mathematical concepts. *HM* has a role in learning mathematics, namely exploring mathematical ideas, reflecting on the suitability of solutions or problem solving strategies, generalizing, formulating questions, and constructing examples.

Many studies have shown that *MHM* has a positive effect on the mathematical abilities needed in mathematical literacy. The results of Sumartini's research (2022) show that there is an influence *HM* on mathematical creative thinking skills through improving learning. Students feel happy and motivated to take part in mathematics learning with *HM* (Hasanah & Purwasih, 2022). While the research results of Suwaibah et al. (2020) showed that the literacy ability of students who received learning with the *MHM* was better than students who did not receive *MHM*, students gave a good response to the *MHM*. This is in line with the research results of Nuurjannah et al. (2018) which shows that *MHM* can improve mathematical literacy skills because it can make it easier to build knowledge or strategic concepts for students to solve problems.

HM or thinking habits must be developed in the learning process because when students are faced with problems and anxiety occurs, a certain pattern of intelligence will be formed to encourage success in solving problems. In mathematics, the teacher must teach content as a basis in mathematics, then the teacher trains students to use

their thinking skills with new problems, the teacher expands to cognitive tasks that require thinking skills, and at a high level the teacher guides students in thinking habits (Dwirahayu et al., 2017). The habit of positive thinking in learning mathematics provides fluency for students to find new ideas. *MHM* can encourage students to find connections between

mathematical ideas (Nuurjannah et al., 2018). The consequences or results obtained from the habits of thinking carried out will show students in taking action when facing problems, forming certain intellectual behavior patterns that can encourage student success in solving a problem.

The evaluation process in the content of the mathematical literacy process can be supported by a thorough and diligent attitude which is a characteristic of *HM*. In addition, in formulating problems into mathematical models and applying mathematical concepts, procedures, and facts, it requires a careful attitude in solving problems, flexible thinking, applying previous knowledge, and thinking and having clear and precise mathematical communication. These attitudes are characteristic of intelligent thinking habits (*HM*). This shows that *HM* is one of the abilities that can help students to improve their mathematical literacy skills. Therefore, *HM* or this habit of thinking needs to be considered by teachers in implementing mathematics learning.

3. Familiarizing Students Practice with Literacy Problems

Mathematical literacy requires students to master mathematical concepts and apply them to solve problems of everyday life related to mathematics. Teachers have an important role to train and improve students' mathematical literacy skills. One way that can be done by the teacher is that the teacher must often provide literacy questions in the mathematics learning process. This is in line with the results of Puspaningtyas & Ulfa (2020) research which explains that the provision of literacy-based question training has a significant influence on student learning outcomes. Students begin to recognize and get used to numerical literacy-based questions so that they can work on questions well and can answer questions more precisely than before. Students are also more enthusiastic in learning and solving numerical literacy-based questions because their application

is close to everyday life. Meanwhile, according to Hapsari (2019) mathematical literacy problems require students to think and use their knowledge in depth. Therefore, to help realize the goals of learning mathematics, teachers need to provide mathematical literacy questions to students and familiarize students with solving them.

Teachers can also use PISA-type questions in the learning process. If we compare the meaning of mathematical literacy with the goals of PISA, it can be seen that there is a match and harmony between the two. Mathematical literacy is defined as a person's ability to formulate, use and interpret in various contexts, while the purpose of PISA is to measure the extent to which students' mathematical literacy skills are. For this reason, to train students' mathematical literacy skills, argumentation-based questions are needed, namely through PISA questions. According to Mansur (2018), to overcome the low mathematical literacy of students, it can be trained by giving PISA questions on a regular basis. The compatibility and understanding between mathematical literacy and PISA makes PISA questions can be used to practice mathematical literacy. Because what is assessed in the PISA study includes mathematical literacy.

CONCLUSION

Mathematical literacy is a person's ability to formulate, use and interpret mathematics in a variety of contexts. Indonesia has low mathematical literacy skills. The low level of mathematical literacy is caused by several factors including the learning method is still teacher-centered, the lack of students practicing literacy questions, students have difficulty making mathematical models from real-world problems. This problem must be addressed immediately. The solution offered in this paper is to use contextual learning because literacy is closely related to the real world context, improve mathematical thinking habits, and familiarize students with practicing literacy questions or PISA-type questions. This solution is expected to improve students' mathematical literacy skills.

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