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Systematic Literature Review: Students' Mathematical Literacy Ability in Solving PISA Questions

Fitri Wulandari[1], Meliasari[2], Flavia Aurelia Hidajat[3]
[1,2,3]State University of Jakarta
Email: fitriwulandari.fwd0@gmail.com

ABSTRACT

This study aims to review the literature related to students' mathematical literacy skills in solving PISA questions from gender and learning methods carried out from elementary school to tertiary education. This study uses the Systematic Literature Review (SLR) research method with research data found as many as 16 national and international articles published in the period 2018 – 2024. Data collection was carried out by documenting the relevant articles reviewed from the year of research, level of education, sample size in the study, and the type of research used. Based on the results of the study, it can be seen that articles on students' mathematical literacy skills in solving PISA questions have been reviewed from a learning method that has dominated in the last seven years. Meanwhile, research on students' mathematical literacy skills reviewed from a gender perspective still lacks interest in researchers. The majority of researchers conducted research at the junior high and high school education levels with a sample of less than 30. While the type of research that is often used is a qualitative research method with a descriptive approach.

Keywords: *Mathematical Literacy Ability, PISA, Literature Studies.*

1. INTRODUCTION

The progress of a country can be seen from the quality of education in the country. Students' ability to solve problems related to mathematics, reading and science related to daily life is an indicator of a country's quality assessment. Therefore, mathematical skills are one of the aspects that continue to be improved in the world of education [1]. Mathematics is taught at all levels of education, from the most basic to the highest education. The learning provided to students is expected to improve students' reasoning skills in solving mathematical problems. [2].

Mathematical literacy ability is one of the important aspects that can affect students' ability to face life's challenges. Mathematical literacy is defined as the ability of students to interpret, formulate, and implement mathematics in various contexts [3]. Students' poor mathematical literacy skills will result in students' ability to argue, create, and reason not developing, making it difficult for students to solve mathematical problems in daily life [4].

In a global context, students' mathematical literacy skills are measured through PISA results PISA *(Programme for International Student Assessment)* results [5]. PISA is an international study coordinated by the OECD (*Organisation for Cooperation and Development*) located in Paris, France since 2000. PISA is conducted every three years periodically to measure the literacy, science, and mathematics achievements of 15-year-old students [6]. In general, there are three main PISA studies, including: reading literacy, mathematical literacy, and science literacy [7].

The benefits that Indonesia gets as a member of PISA are to find out the level of literacy achievement of Indonesian students when compared to other countries, as well as the factors that affect it. So that it can be used as an evaluation and input in the formulation of policies to improve the quality of education in Indonesia [8]. However, in reality, Indonesia has a low ranking in PISA. In 2015 Indonesia was ranked 62nd out of 72 countries participating in the PISA test with a score of

386 [2]. The low PISA results prove that students' mathematical literacy skills in Indonesia are still very low compared to other countries [3].

Kurniawati & Kurniasari [1] stated that mathematical literacy in the context of PISA can be interpreted as students' ability to compile and interpret mathematics in everyday life, for example students' ability to carry out mathematical reasoning and use mathematical concepts, procedures, and facts to explain and predict phenomena. Dewantara [8] in his research stated that mathematics problems with the PISA model in the enrichment program provided in the form of non-routine questions to students are expected to optimize students' mathematical literacy skills, so that they can help students in developing student skills optimally. So that students need to be accustomed to working on PISA type questions that aim to broadly open students' minds [7].

Seeing the importance of students' literacy skills in everyday life and PISA which is used as a reference to measure students' literacy skills, researchers are interested in conducting a literature review on students' literacy skills in working on PISA questions. The results of this study are expected to be a guideline for further research. *Systematic literature review* (SLR) aims to identify, examine, evaluate, and interpret studies related to the topic or phenomenon of interest, with a focus on answering specific and relevant research questions [9].

This study aims to conduct a literature review related to students' literacy skills in solving PISA questions based on education level, number of samples and type of research method using the systematic literature review (SLR) method. An important stage that must be carried out before starting this research is data collection in the form of previous research on students' mathematical literacy skills in solving PISA questions in their supporting aspects.

2. METHODS

The purpose of this study is to review and identify previous research on students' mathematical literacy skills in solving PISA problems. So that *Systematic Literature Review* (SLR) is the appropriate research method used in this study. *Systematic Literature Review* (SLR) is a research method by conducting *Reviews* and identify journals or previous research in a structured manner and carry out the process *Reviews* based on predetermined steps [9]. There are several stages in research, including formulating problems and research questions, searching for literature, determining research criteria, selecting literature, presenting data, managing data and drawing conclusions.

Data was collected by documenting journal articles from the Google Scholar database and using the Publish or Perish application with the keyword "Students' mathematical literacy skills in solving PISA problems" by limiting articles from 2018 to 2024. So that 16 related articles were found which were used as data in this study. The literature obtained was then selected and analyzed based on research criteria. Then the data was analyzed to produce conclusions.

3. RESULTS AND DISCUSSION

The research data included in the *Systematic Literature Review* (SLR) research is a summary of documented research related to students' mathematical literacy ability in solving PISA questions which are categorized into four moderation variables, namely the year of research, the level of education, the sample size, and the type of research used. The analysis of the research is based on the mathematical literacy ability of students based on gender and the learning methods used. The learning method includes the PISA question model given and the level of student ability.

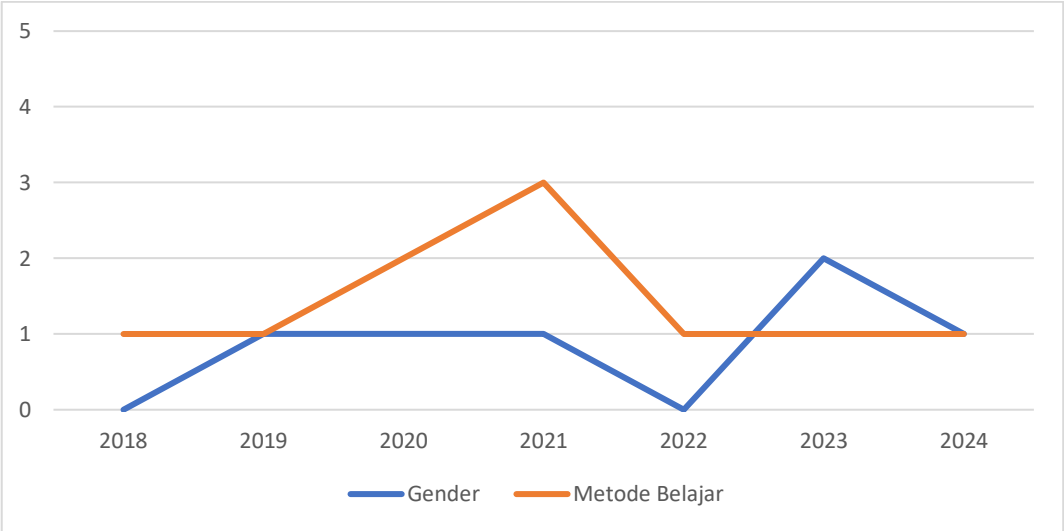
Table 1. Results of Analysis

Criterion		Mathematical literacy skills are measured from-	
		Gender	Learning methods
Year of study	2018 – 2020	2	4
	2021 – 2022	1	4
	2023 – 2024	3	2
Education level	SD	0	0
	JUNIOR	4	3
	SMA	2	6
	College	0	1
Sample size	< 30	2	10
	> = 30	4	0
Type of research	Qualitative	5	6
	Quantitative	1	0
	Design reseach	0	4
Total		**6**	**10**

Based on table 1, it can be seen that over the past 7 years, articles related to students' mathematical literacy skills in solving PISA questions reviewed from the learning methods used have dominated 10 research articles. This shows that articles on students' mathematical literacy skills are quite interesting for further research. Meanwhile, there are only 6 research articles on students' mathematical literacy skills assessed based on gender. Although gender is one of the important factors in knowing students' mathematical literacy skills. However, this topic is not widely discussed in the context of PISA because the focus of research is more on how the learning methods and question models used in the PISA test affect students' overall mathematical literacy skills.

4.1 Year of study

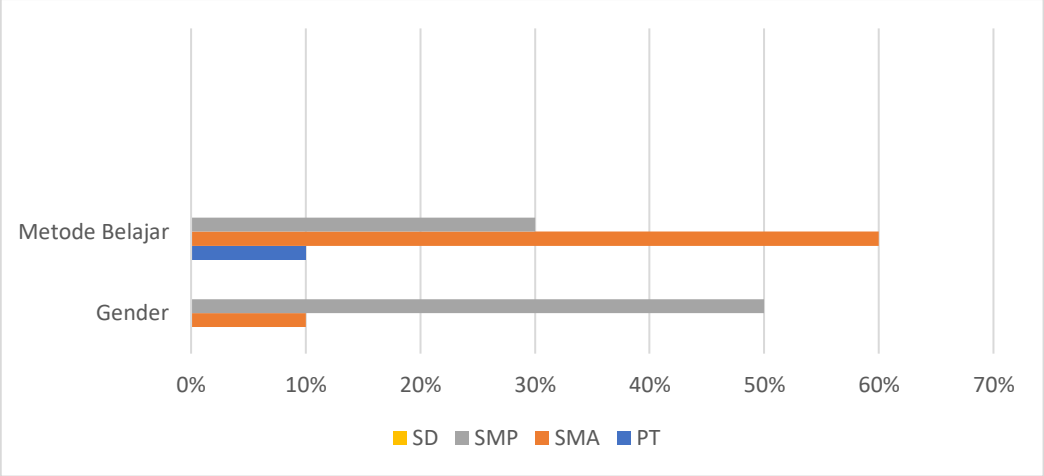
The findings of the data in this literacy study show that in the last 7 years, research on students' mathematical literacy skills in solving PISA questions from a gender perspective has decreased in 2022 and then increased again in 2023-2024. Meanwhile, research on students' mathematical literacy skills in solving PISA questions from a learning method perspective has increased in 2021. However, there has been a decrease in the number of studies in 2022-2024.



Graph 1. Data by Year of Study

4.2 Level of Education

The grouping of education levels in this study is divided into 4 categories, namely Elementary School, Junior High School, Senior High School, and Higher Education. Data based on education level are presented in the following graph.



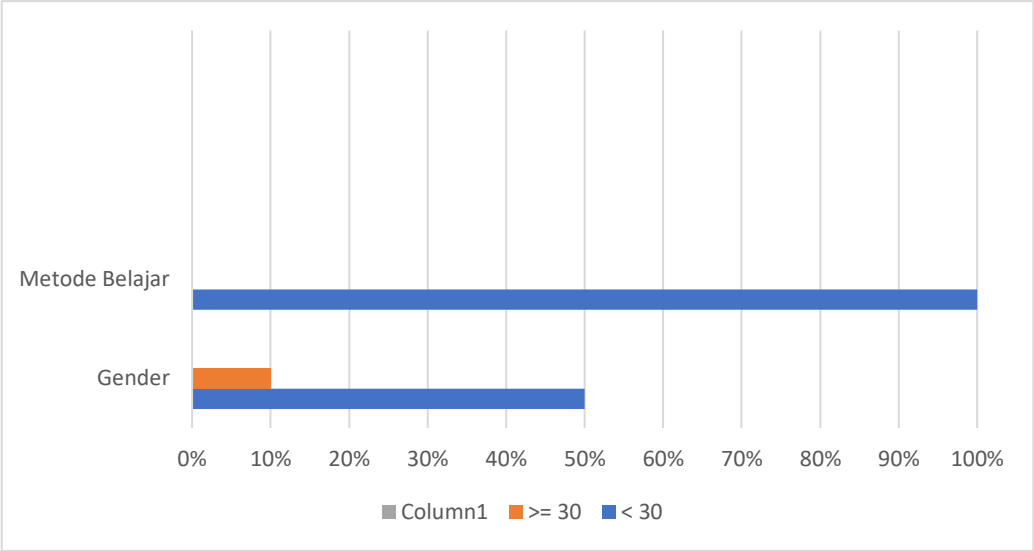
Graph 2. Data by Education Level

Based on graph 2, it can be seen that research on students' mathematical literacy skills in solving PISA questions is reviewed from gender differences, many of which are carried out at the junior high school education level as much as 50% and high school as much as 10%. Meanwhile, judging from the learning method, more is carried out at the high school education level, which is 60%, junior high school as much as 30%, and higher education level as much as 10%. Meanwhile, research on students' mathematical literacy skills in solving PISA questions at the elementary school education level has not yet been found.

The condition of students' mathematical literacy skills in Indonesia is still at a very low classification. This is due to the lack of attention regarding students' mathematical literacy skills, especially on the basic material in mathematics learning [10]. So it is necessary to habituate and introduce PISA model questions from the elementary school education level. This aims to improve the mathematical literacy skills of students in Indonesia. So, in this case, researchers are expected to further research related to students' literacy skills in solving PISA questions at various levels of education, ranging from elementary school to higher education.

Sample Size

The grouping of sample sizes in this literature research is divided into 2 categories, namely samples with a total of less than 30 and samples with a total of 30 or more. Data based on sample size are presented in the following graph.



Graph 3. Data Based on Sample Size

The data in graph 3 shows that research on students' mathematical literacy skills in solving PISA questions, both in terms of gender and learning methods, is dominated by samples with a number of less than 30. In fact, research on students' mathematical literacy skills in solving PISA questions in terms of gender is only 10% and there has been no research with a large number of samples that examines students' mathematical literacy skills in solving PISA questions in terms of learning methods. Most of the research conducted is reviewed from the learning model using the purposive sampling method which only uses samples in one class with a range of 15-26 students. Sugiyono [13] said that the purposive sampling technique aims to obtain in-depth and specific information from a particular phenomenon or group, so that research prioritizes the quality of data samples compared to the quantity of samples.

4.3 Type of Research

The grouping based on the type of research is divided into 3 categories, namely qualitative research, quantitative research, and *design research*. The data is presented in the table below.

Table 2. Data by type of study

Type of Research		Students' mathematical literacy skills were reviewed from - Gender	Learning Methods
Qualitative	Descriptive	4	6
	Exploratory	1	0
Quantitative		1	0
Design Research		0	4
Total		**6**	**10**

Based on table 2, it can be seen that research on students' mathematical literacy ability in solving PISA questions is reviewed from the perspective of gender and learning methods are dominated by descriptive qualitative research types and there is only one study that uses an exploratory approach. The qualitative research method is descriptive research where the data collected is in the form of words or pictures and does not emphasize numbers [11].

Research using quantitative research methods is also found in research on students' mathematical literacy skills in solving PISA questions based on gender. Meanwhile, research with a Design Research approach is widely used in research on students' mathematical literacy skills in solving PISA questions from the perspective of learning methods. The Design Research method is

often used in research to develop theories in certain educational fields from elementary to high levels [12].

CONCLUSION

The purpose of this study was to conduct a literature review on students' mathematical literacy skills in solving PISA questions. Based on the results and discussions that have been presented, it can be concluded that research on students' mathematical literacy skills in solving PISA questions viewed from a learning method is more interesting for researchers. Meanwhile, research on students' mathematical literacy skills in solving PISA questions viewed from a gender perspective is still less popular with researchers. This may occur because linking gender to students' mathematical literacy in the context of PISA may be more limited due to the difficulty of systematically identifying significant differences. Publication of research on students' mathematical literacy skills in solving PISA questions increased in 2021 and decreased in 2022 then increased again in 2023 to 2024. The data review that has been carried out shows that researchers conduct more research at the secondary education level.

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