

SYSTEMATIC LITERATURE REVIEW: STUDENTS' MATH COMPREHENSION SKILLS IN HANDLING MATH PROBLEMS

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ABSTRACT

This study aims to conduct a literature review on students' ability to understand mathematical concepts when solving mathematical problems from primary to tertiary education levels. The method used was Systematic Literature Review (SLR), which reviewed 53 examples of research on students' ability to understand mathematical concepts. The sample consisted of indexed journals published between 2015 and 2022. Data were collected by documenting all articles related to students' understanding of mathematical concepts, including the year of the study, education level, sample size, and type of study. The results showed that in the last eight years, articles highlighting student characteristics and learning styles dominated, while articles on gender differences and learning media tended to be less popular among researchers. The majority of studies were conducted at the junior secondary level with sample sizes generally less than 30.

Keywords: Concept Understanding Ability, Literature Study

INTRODUCTION

Concepts refer to ideas or thoughts expressed in a definition, forming a body of knowledge in the form of principles, laws, or theories. Concepts are obtained through generalization and abstraction from facts, events, and experiences. Concepts can change along with new knowledge or facts, and their function is to explain and predict (Sagala, 2003). Bloom defines understanding as a person's ability to take meaning from the material or information learned. This includes students' ability to receive, absorb, and understand the material delivered by the teacher, as well as understand what they read, see, experience, and feel (Susanto, 2013).

The ability to understand concepts is an important foundation for students in understanding subject matter (Farida et al., 2019). In the context of solving math problems, concept understanding is key. However, many students still have inadequate concept understanding, as seen from the results and problem-solving process. Not understanding the concept of the material can make students confused and hinder them in solving the questions given by the teacher.

Basically, concept understanding in mathematics learning is an important element. It is the foundation for students to be able to think effectively in solving mathematical problems and everyday problems. The importance of concept understanding has been recognized by various

researchers and mathematics education experts. This concept understanding can be classified into several levels, ranging from mechanical understanding to intuitive understanding, which indicates the level of depth of students' understanding of mathematical material. In addition, there are two types of understanding, namely instrumental understanding and rational understanding, where rational understanding allows students to not only solve problems correctly but also explain the process used. Thus, the understanding of mathematical concepts plays a crucial role in students' ability to succeed in mathematics lessons and everyday life.

According to Wulansari (2021), Pollastek categorizes understanding into two types, namely computational understanding and functional understanding. Computational understanding is the ability to apply mathematical formulas in simple calculations and perform calculations algorithmically, which is a lower level of understanding. Functional comprehension, on the other hand, is a higher-level ability, where a person can connect mathematical concepts or principles with one another, as well as understand each process performed.

In Cahani's research (2021), it is explained that there are several indicators of the ability to understand mathematical concepts, such as explaining a concept, applying concepts in various situations, and developing implications of a concept. Students with a high learning concentration category were able to fulfill all of these indicators. Students with moderate learning concentration category can only fulfill two indicators, namely explaining a concept and applying concepts in various situations. Meanwhile, students with low learning concentration category can only fulfill one indicator, namely applying concepts in various situations.

Systematic Literature Review (SLR) is a review method that aims to explore information that has been known from previous research on a particular phenomenon, subject, or topic (Van Klaveren & De Wolf, 2019). The objectives of SLR research include identifying, reviewing, evaluating, and interpreting all research relevant to the topic of interest and specific research questions (Triandini et al., 2019). Given the importance of students' mathematical concept understanding in the learning process, researchers are interested in conducting a literature review on students' mathematical concept understanding ability in solving mathematical problems. This is expected to provide guidance for researchers related to students' mathematical understanding and enable further research.

The purpose of this study is to conduct a literature review related to students' mathematical concept understanding ability, taking into account the year of research, level of education, sample size, and type of research.

METHODS

The method applied in this research is Systematic Literature Review (SLR). This method involves identifying, reviewing, evaluating, and interpreting all relevant research related to the chosen topic. In accordance with the research of Triandini et al. (2019), this method is carried out by going through the stages of systematic review and identification of journals, following predetermined steps.

Triandini (2019) explains the steps in SLR as follows: (1) Setting research questions based on the chosen topic. (2) Conduct a search process to get answers to research questions through relevant sources. The search process can use search engines such as Google Chrome with specific sites for primary and secondary data. (3) Establish inclusion and exclusion criteria to determine the relevance of the data used. (4) Assessing the quality of the data found based on certain criteria. (5) Collecting data from relevant research. And (6) Analyzing the data to find the results of the research questions and draw conclusions.

This research begins with data collection through documentation of all research related to students' understanding of mathematical concepts, followed by data analysis of articles and drawing conclusions. The articles used in this study amounted to 53 national research articles that had been indexed in Sinta 1 to 5 and Garuda, which were obtained from Google Scholar and published in the span of 2015 to 2022. These steps ensured that the research was conducted in a structured and systematic manner.

RESULT AND DISCUSSION

The results of the research data presented in this literature review include an analysis and summary of the documented research on mathematical concept understanding skills. This data is classified based on four moderating variables, including year of study, level of education, sample size and type of study. In addition, the studies were also analyzed based on characteristics, learning methods, learning media, and descriptions of students' understanding of the subject matter.

Student characteristics include learning style, cognitive style, gender, confidence level, and motivation to learn. In terms of learning methods, there are variations of learning models,

approaches, and learning methods, as well as evaluation of students' critical thinking skills. Common learning media used in this literature study include Google Classroom, Geogebra-based learning videos, and Schoology media.

Table 1 Analysis Results.

Criteria		Mathematical Concept Understanding based on -			
		Characteristic	Method	Media	Description
YEAR OF STUDY	2015 - 2017	2	3	1	1
	2018 - 2020	11	8	2	9
	2021 - 2022	9	6	0	4
Education level	Elementary School	1	6	0	1
	Junior High School	9	8	1	9
	Senior High School	7	2	2	3
	Higher Education	2	1	0	1
Sample Size	< 30	7	10	3	6
	>= 30	12	7	0	8
Research Type	Qualitative	13	9	2	14
	Quantitative	5	7	1	0
	Mixed Method	1	1	0	0
Total		22	15	3	14

According to the data in Table 1, it can be seen that during the last eight-year period, articles analyzing students' mathematical understanding ability related to characteristics dominate with a total of 19 research articles. This shows the high interest of researchers in the study of student characteristics in understanding mathematical concepts. Meanwhile, research related to learning methods and description of subject matter also attracted researchers' interest, with 18 articles and 14 articles respectively. However, research related to learning media is still lacking, perhaps due to the limited technology in some areas.

The technology limitation factor can be overcome with a solution for teachers to use conventional learning media in the learning process so that students can easily understand the material being taught. Learning media plays an important role in learning, and its use can indirectly affect students' enthusiasm and interest in learning. Therefore, each factor will be described based on the predetermined criteria.

Over the past eight years (2015-2022), research data on students' mathematical concept understanding ability has been collected and presented in Figure 1. From the data, it can be seen

that research related to student characteristics shows an increasing trend in 2018 and 2020, with a slight decrease in 2019 and 2021, before increasing again in 2022. Meanwhile, research on learning methods showed an increase in 2017-2019 and 2021, but decreased in 2020, and there was no research in 2022. Similarly, research on the description of subject matter showed an increase in 2017-2019 and 2021, but no research in 2020 and 2022.

However, research on learning media shows a smaller number, with only one study each year from 2019 to 2021, and no studies in 2022. This suggests that the topic of learning media is still under-explored in the context of students' mathematical concept understanding ability.

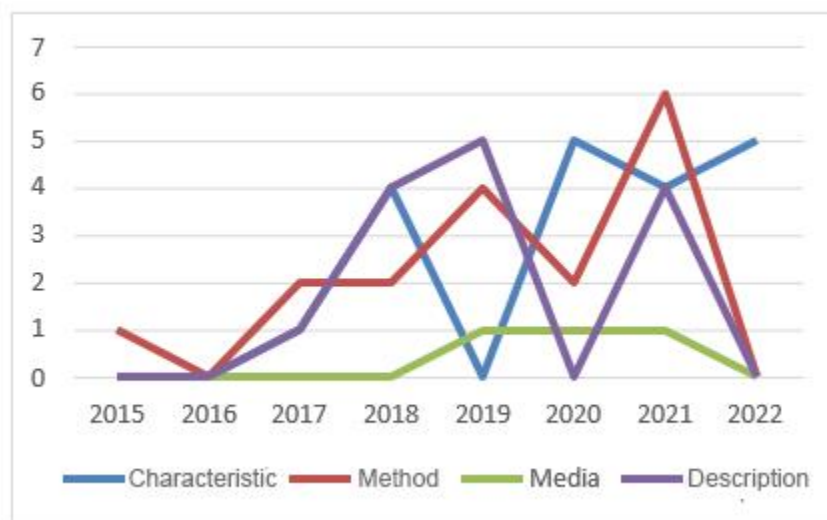


Figure 1. Data based on year of research.

Next is the classification based on Education Level, divided into four categories, namely Elementary School, Junior High School, Senior High School, and College. Data on the number of studies based on Education Level are presented in the following graph.

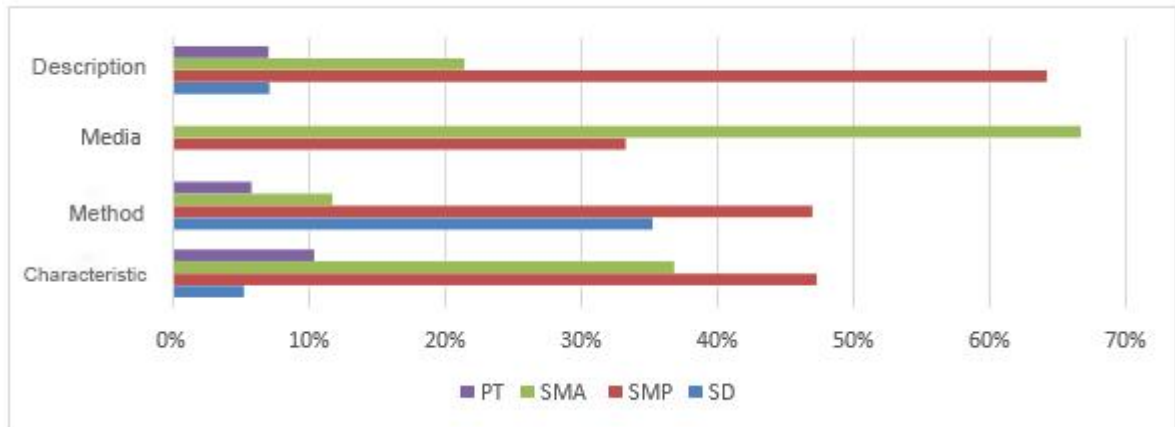


Figure 2. Data based on education level.

Figure 2 shows the distribution of research on students' mathematical concept understanding ability based on Education Level. It can be seen that research related to characteristics, learning methods, and description of dominant subjects is mainly conducted at the Junior High School level. However, research on learning media is limited to Junior High School and Senior High School, with no studies conducted at the Elementary School and College levels. This indicates a lack of use of learning media in mathematics education, thus limiting the number of studies conducted in this context. Therefore, it is important for researchers to pay more attention to and conduct research on various Education Levels to improve this situation.

In addition, it is important to note that mathematical concept understanding should be taught early, especially at the Elementary School level, as students are still in an important developmental stage and have the ability to absorb knowledge well. Awareness of the importance of early mathematical concept understanding will help in preparing a strong foundation for students for more complex mathematics learning at higher levels.

Then the classification based on sample size is divided into two categories, namely samples with less than 30 and samples with 30 or more. This data is presented in the graph below.

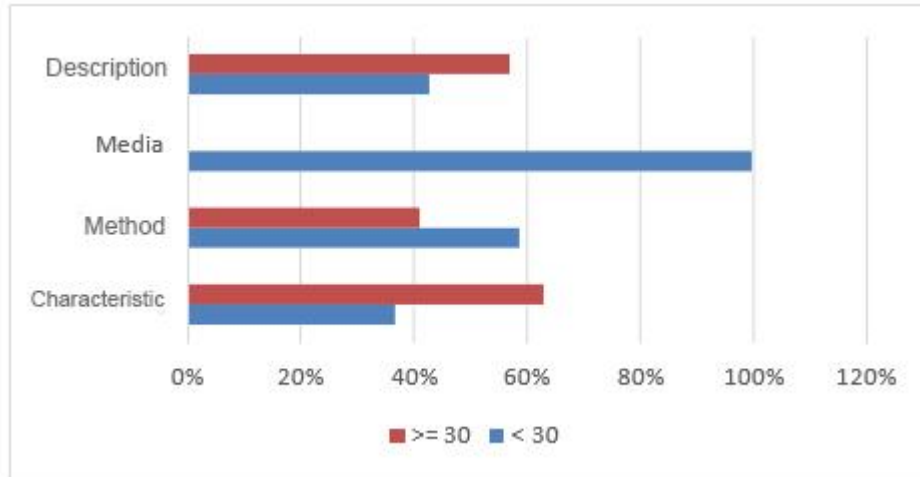


Figure 3. Data based on sample size.

Based on the data in Graph 3, it can be seen that research on students' understanding of mathematical concepts related to teaching methods and media tends to use samples with less than 30 participants, and there is even no research with a large sample size in media learning studies. Meanwhile, in research on the characteristics and description of subject matter, larger samples are used, with 30 or more participants. As explained by Siyoto (2015), a sample is a part of the population that is taken according to certain procedures to represent the entire population, both in terms of quantity and characteristics.

The types of research in this study are categorized based on their types, divided into three categories. In this research, three types of methodologies are used, namely qualitative, quantitative, and mixed-method. Qualitative research is divided into three categories, namely descriptive qualitative research, case studies, and phenomenology. Meanwhile, quantitative research is divided into four categories, namely descriptive quantitative research, experimental, quasi-experimental, and correlational, as listed in the table below.

Table 2. Types of Research

Methodology		Frequency	Percentage	Total
Quantitative	Experimental	3	6%	25%
	Quasi-experimental	7	13%	
	Correlational	2	4%	

	Descriptive	1	2%	
Qualitative	Case Study	4	8%	72%
	Descriptive	34	64%	
Mixed Method		2	4%	4%

In the past eight years, research on students' mathematical concept comprehension abilities has largely used qualitative descriptive methods, which account for 64% of the total research. Qualitative methods allow researchers to investigate the natural conditions of objects using the researcher as the main instrument, purposive and snowball sampling of data, and inductive data analysis. However, research using mixed methods is still less popular, as it requires a deep understanding of qualitative and quantitative research, as well as a significant amount of data, time, and effort. Nevertheless, this does not hinder researchers from using mixed methods in the future.

Graph 4 shows that research on students' mathematical concept comprehension abilities is dominated by qualitative research, especially those related to subject matter descriptions and student characteristics. On the other hand, research using mixed methods is limited, especially in studies that highlight characteristics and teaching methods. This indicates that there is still potential for more research using mixed methods in the future, although it is currently less popular.

CONCLUSION

Based on the previous results and discussions, it can be concluded that research on students' mathematical concept comprehension abilities mainly focuses on student characteristics, while interest in research on learning media is still relatively low, possibly due to limitations in the use of media in the learning process and technological constraints in some regions. The most frequently used subjects to measure students' mathematical concept comprehension abilities are geometry, algebra, and arithmetic. The publication of research on students' mathematical concept comprehension abilities shows an average increase from 2017 to 2019 and 2021, but tends to decrease in 2020 and 2022. Additionally, it was found that the majority of research is conducted at the junior high school level, with most research samples having less than 30 participants.

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