
PROBLEM SOLVING ABILITY ANALYSIS: SYSTEMATIC LITERATURE REVIEW

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Abstrak: Kemampuan problem solving adalah kapasitas siswa dalam melakukan penyelesaian soal-soal atau yang lazim disebut pertanyaan. Kemampuan problem solving adalah komponen penting dalam penyelesaian masalah siswa dalam menjawab pertanyaan-pertanyaan yang diberikan guru. Dalam penelitian ini, dianalisis kajian kualitatif tentang kemampuan problem solving siswa pada tingkat SD, SMP, dan SMA antara tahun 1999 dan 2022. Systematic Literature Review (SLR) yang merupakan metodologi kajian mengumpulkan data primer yang telah dipublikasikan di jurnal yang terindeks oleh Sinta dan Scopus. Terkumpul 24 artikel hasil ekstraksi data yang disesuaikan dengan kriteria seleksi. Metode kualitatif digunakan dalam analisis data. Data dikelompokkan menurut tahun publikasi, tingkat pendidikan, demografi, pengindeks jurnal, bahan kajian, dan temuan kajian. Temuan penelitian menunjukkan bahwa penelitian tentang kemampuan problem solving merupakan tren utama di bidang aritmatika sosial dari tahun 1999 hingga 2022. Banyak penelitian tentang kemampuan problem solving telah dilakukan di tingkat sekolah dasar di wilayah Jawa Namun, di semua tingkat sekolah, kemampuan memecahkan masalah matematika masih sangat rendah. Mencari solusi yang tepat adalah bagian tersulit bagi siswa untuk dikuasai dalam proses penyelesaian masalah. Salah satu faktornya adalah siswa tidak sepenuhnya memahami materi. Hal ini menjadi tantangan para peneliti dan pendidik yang melakukan penelitian tentang kemampuan problem solving siswa, khususnya di bidang-bidang yang masalah-masalahnya masih jarang diselidiki

Kata Kunci: *Probleng Solving, Systematic Literature Review*

Abstract: Problem solving ability is a student's capacity in solving questions or commonly called questions. Problem solving ability is an important component in solving student problems in answering questions given by the teacher. In this study, qualitative studies were analyzed on students' problem solving abilities at the elementary, junior high and high school levels between 1999 and 2022. Systematic Literature Review (SLR) which is a study methodology collects primary data that has been published in journals indexed by Sinta and Scopus. Collected 24 articles of data extraction results adjusted to the selection criteria. Qualitative methods were used in data analysis. Data are grouped according to year of publication, level of education, demography, journal indexer, study material, and study findings. The research findings show that research on problem solving skills is a major trend in the field of social arithmetic from 1999 to 2022. Many studies on problem solving skills have been conducted at the elementary school level in the Java region. However, at all school levels, the ability to solve math problems is still very low. Finding the right solution is the most difficult part for students to master in the problem solving process. One of the factors is that students do not fully understand the material. This is a challenge for researchers and educators who conduct research on students' problem solving abilities, especially in fields where problems are rarely investigated.

Keywords: *Problem Solving, Systematic Literature Review.*

INTRODUCTION

Each individual is expected to be able to solve or solve problems, including in student education. Students are expected to be able to solve problems while carrying out education according to their level. This is in line with the mandate (Katon & Arigiyati, 2018) that students have the ability to solve problems which include the ability to understand problems, design mathematical models, complete models, and interpret the solutions obtained. According to (Widodo & Widayanti, 2014) in his research which said that problem solving is important to instill in students. By solving mathematical problems, students will not lose meaning in learning mathematics because a concept or principle will be meaningful if the concept can be applied in solving problems.

What is important to do is how students are able to understand mathematical problems and be able to provide solutions. This is in line with (Haryati et al., 2016) which says that the competencies that students must have in solving word problems are 1) verbal ability, namely the ability to understand the problem and interpret it so that it can turn it into a mathematical model and 2) algorithmic ability, namely the ability to students to determine the right algorithm in solving problems, the accuracy of calculations and the ability of students to draw conclusions from the results of calculations that students do and relate them to the initial problem to be solved. Meanwhile, according to Polya (1973: 5-19) also states that solving mathematical problems can be done in four steps, namely (1) understand the problem, (2) make a plan, (3) implement the plan, and (4) check the answers again. But at this time there are still some students who are constrained in solving problems. According to (Wang & Chiew, 2010) the obstacles are the ability to think, learn, and understand is still not optimal, while according to (Suarsana et al., 2019) students' constraints in problem solving are reasoning and student creativity in solving real context problems which are still low and students are not yet familiar with real content models so according to (Hidayatullah & Csíkos, 2022) students are able to find more specific belief structures that describe students' conceptions comprehensively.

The most common problems students have to solve are problems in the form of questions, of course math problems. The math problems solved by students are in the form of questions or math problems that students must complete. From the results of the study (Rohmah & Sutiarto, 2018) stated that the types of errors experienced by students in mathematical word problems with systems of linear equations were reading errors, comprehension errors, transformation errors, process skill errors and encoding errors. According to (Sri Adi Widodo, 2015) which says that a math problem can become a math problem if students don't have an idea to solve it, but these students want to solve the math problem.

Based on the description above, in terms of concluding several studies, it is necessary to understand representatively from the articles that have been observed related to this topic to see problem

solving research in mathematics learning. Efforts to think in solving problems and are an important aspect in helping improve students' problem solving abilities (Pebrianti et al., 2022) . Therefore it is considered important to carry out a *Systematic Literature Review* (SLR).

Systematic Literature Review (SLR) is a term used to refer to a particular research or research methodology and the development carried out to collect and evaluate related research on a particular focus topic. SLR research is conducted for various purposes, including to identify, review, evaluate, and interpret all available research on interesting topical phenomena, with specific relevant research questions. SLRs are also often needed to determine research agendas, as part of a dissertation or thesis, and as part of completing research grant applications (Triandini et al., 2019) . The SLR method uses an *evidence-based approach* to search for relevant studies with several predefined research questions by selecting, assessing, and synthesizing findings to answer research questions and SLRs also a research technique for analyzing *state-of-the-art* in a particular field of knowledge by formally defining problem statements, sources of information, *strings search*, the inclusion and exclusion criteria of the papers found in). search, quantitative analysis to be carried out (if necessary), and templates for finding information collected from papers and a research technique used to study or find issues contained in software engineering (Wahyudin & Rahayu, 2020) .

Data collection related to research on *problem solving skills* is summarized based on several questions such as year of publication, level of study, demography, indexing of journals, analytical techniques, materials, and results contained in articles. Through the data obtained, the researcher asked the following related questions: (1) How is the description of the research findings related to students' *problem solving abilities* based on the year of publication? (2) How is the description of research findings related to students' *problem solving abilities* based on study level? (3) How is the description of research findings related to students' *problem solving abilities* based on the journal index? (4) How is the description of research findings related to students' *problem solving abilities* based on research locations? (5) How is the description of research findings related to students' *problem solving abilities* based on mathematics topics? (6) How is the description of research findings related to students' *problem solving abilities* based on the results contained in the article?

RESEARCH METHODS

Systematic Literature Review

This research method is *Systematic Literature Review* (SLR). By using the SLR method, it is possible to systematically review and identify journals which in each process follow the steps or protocols that have been set. In addition, the SLR method can avoid identification that is subjective and

it is hoped that the results of the identification can add to the literature on the use of the SLR method in identifying journals, it is hoped that this method will be carried out by synthesizing the results of scientific studies to answer certain research questions in a transparent and reproducible way (Triandini et al. al., 2019) . In this study, filtering of journals was carried out as a data base in the form of research results that focused on students' *problem solving abilities* . This study went through 3 stages, namely: 1. Searching databases based on keywords in abstract titles, searching academic databases (WoS, Scopus, Google scholar, and other databases), search for publications based on previous research articles and timeframes. 2. Re-examine the found research articles by eliminating duplicate documents, and eliminating unrelated research articles. 3. Analyze the contents of research articles by coding and synthesizing (Ekawati et al., 2021)

The inclusion criteria are intended to obtain articles that are in accordance with the research objectives. Exclusion criteria can be used to eliminate irrelevant studies from selected studies (Pebrianti et al., 2022) . The inclusion criteria specified in this study were as follows: (1) The research was conducted in the field of mathematics; (2) The research conducted analyzed students' reversible abilities; (3) The research was conducted on students at the elementary, middle and high levels; (4) The study was published within the last 20 years, namely from 2002 to 2022; (5) Studies published in indexed journals Sinta and Scopus; (6) Research must include the approach or method used.

Population and Sample

The population in this study is all research on students' *problem solving abilities* . The collected studies totaled 35 studies. Furthermore, various articles with qualitative, quantitative approaches and articles not indexed by Scopus or Sinta, and several articles with inappropriate years of publication were deleted. Articles were selected based on inclusion criteria so that 24 articles were obtained.

Data collection technique

Information collected in the form of primary research about students' *problem solving abilities* has been published in Sinta indexed national journals and Scopus indexed international journals by search engines such as Google Scholar, Semantic Scholar, and ERIC.

Data analysis technique

This study uses descriptive qualitative data analysis

RESULTS AND DISCUSSION

1. Studies by Year of Publication

The data presented in Figure 1 below is a *problem ability study solving* for the last twenty five years, from 1999 to 2022

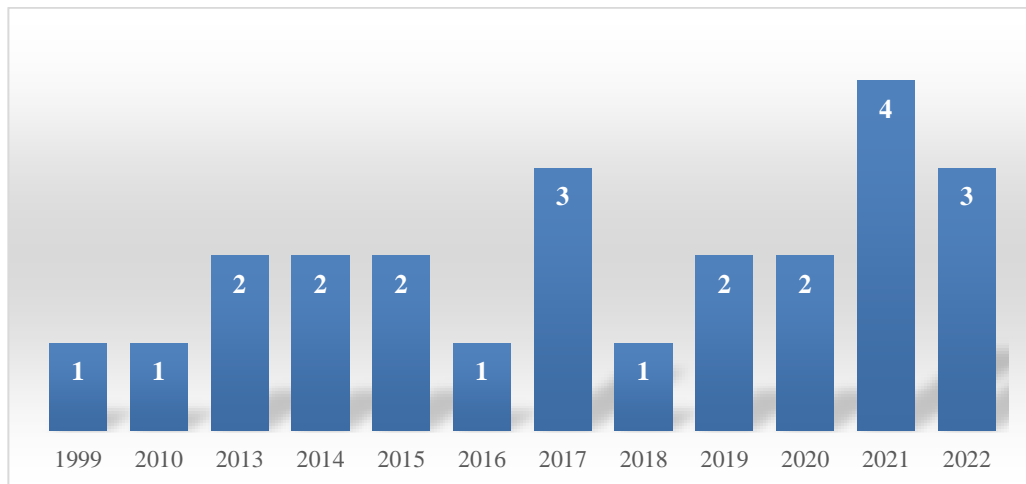


Figure 1. Graph of problem solving abilities by year of publication

Figure 1 shows that studies related to problem solving abilities in recent years have become a concern for researchers. Since studies related to problem solving abilities have started to become a research theme. In 2017 there was a significant increase compared to the previous year. Because of the urgency of problem solving abilities in solving student problems. This can be a new object for researchers to conduct more specific studies in the analysis of students' problem solving abilities.

2. Studies by Education Level

Studies related to students' problem solving abilities at all levels of education, starting from elementary, junior high, high school and tertiary institutions, from the results of a literature study and the distribution of data in Figure 2 below

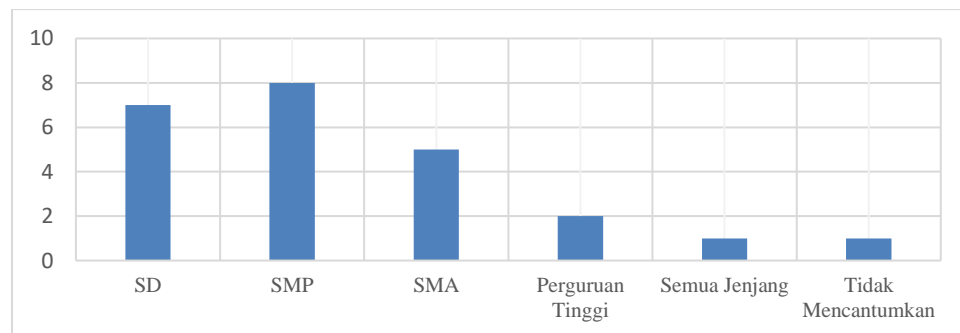


Figure 2. Diagram of problem solving abilities according to educational level

Based on Figure 2, most research related to problem solving abilities is carried out at the junior high school level than at other study levels. However, this does not mean that the levels of other studies

are not important for analysis. There is one study that conducts research related to problem solving at all levels and one research that does not include education levels.

3. Studies Based on Journal Indexers

Figure 3 below visualizes the distribution of studies based on journal indexes starting from Scopus indexed journals from Q1 to Q 3 and indexed by Sinta dari Sinta. Based on data from Scopus indexed journals, the most widely published data distribution is in indexed journals from Q1. Meanwhile, nationally, many studies related to problem solving skills are published in journals with an Sinta 2 index.

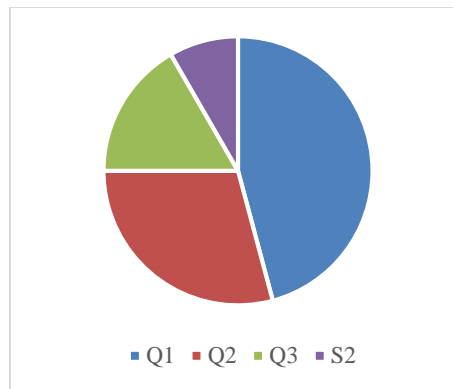


Figure 3. Graph of problem solving abilities based on journal indexers

Based on the presentation of the journal publications above, this provides a great opportunity for authors to be able to publish their articles in Scopus indexed journals.

4. Demographic Based Studies

Details of the study distribution based on demography will be presented into 2 types, namely the demographic distribution of various countries and cities in Indonesia which are presented in the following two figures:

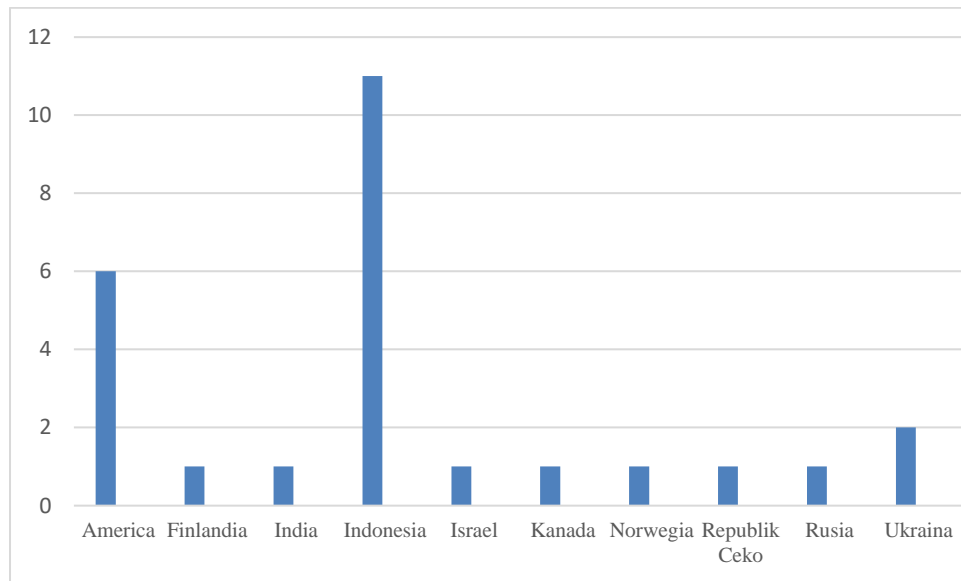


Figure 4. Graph of problem solving ability based on cross-country distribution

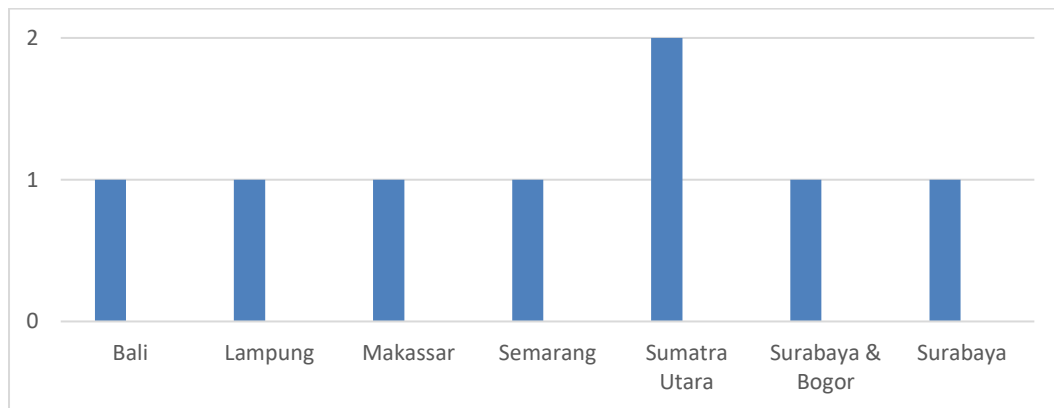


Figure 5. Graph of problem solving abilities based on the distribution of cities in Indonesia

The last few years have become a trend in research conducted by researchers in America . Furthermore, for Figure 5, for Scopus and Sinta indexed articles that conduct studies in regions in Indonesia, the distribution is mostly in Java. Looking at research in the east Indonesia is still low. The results of this study can be used as an opportunity by researchers to improve students' reversible abilities to conduct related research in eastern Indonesia

1. Material Based Study

Topics in mathematics are divided into several fields, including: Algebra, Arithmetic Social,

Integer, Geometry, Mathematical Functions Social, Mathematics Fractions, Linear Equations, and there is one study that does not include mathematical material which is the topic of discussion in the research. Figure 6 below presents the distribution of studies based on the topic of mathematics.

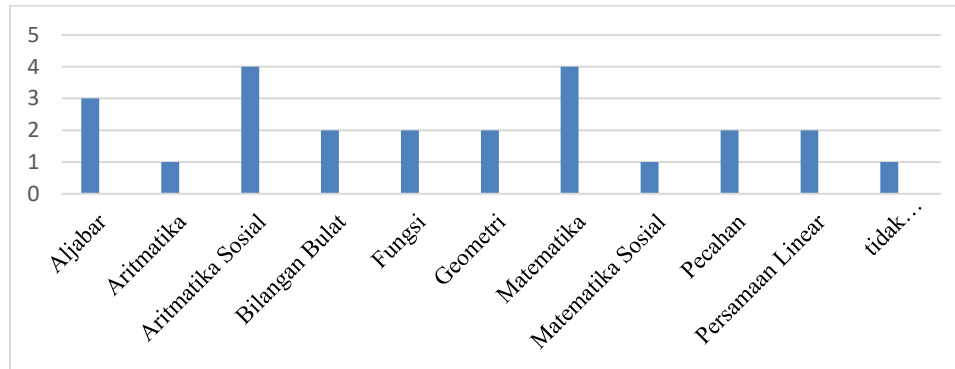


Figure 6. Graph of Problem Solving Ability Based on Material

Figure 6 above shows that the topic that is widely used by researchers in research is social arithmetic because this is another supporting material for mathematical topics related to the daily lives of students from the problems of their lives .

2. Outcome-Based Studies

Reasoning and creativity in solving real context problems is still low and students are not yet familiar with real content models because there is an influence of abstract problems in student problem solving problem solving abilities of students because of the results of the tests that demand students to solve math problems. Students still have difficulty translating the meaning of the question in question. This is because students do not construct knowledge as a whole. Developing students' problem solving skills continues to be a major dilemma. This is partly due to the lack of specialized knowledge of mathematics and the expectation that students will continue to be a major dilemma. This is partly due to a lack of specialized knowledge of mathematics to most levels of complexity (Peranginangin & Surya, 2017) .

In addition, other factors that cause students' low problem solving abilities are caused by students not being able to make connections between concepts, procedures and principles. This happens because mathematics is presented in a form that is less attractive and seems difficult for students to learn; As a result, students often feel bored and do not respond well to lessons. In addition, the learning methods used by the teacher are less varied and tend to limit students from being creative when learning to express their thoughts (Rohmah & Sutiarmo, 2018).

In addition to analyzing students' problem solving abilities, they also look at the offers of

effective learning models. By training students in working on non-routine questions that aim to improve students' mathematical problem-solving skills (Peranginangin & Surya, 2017). On the other hand, the solution offers from articles that provide the most solutions can be done by building interactions between procedural knowledge, conceptual knowledge, and metacognitive processes in solving mathematical problems so that students are able to absorb information well, students understand what is called problem transformation, students understand the material thoroughly, the prerequisite concepts possessed by students are met, the student's experience in working on the questions is very supportive and the students are careful and thorough in the process.

By training students' cognitive abilities, a student who has cognitive flexibility will have various alternative choices when facing certain situations or problems in his life (Rahayuningsih et al., 2020). Why is this problem solving ability so important? To analyze the problem solving abilities of students at school. Solving mathematical problems is so important that the general purpose of teaching mathematics, even as the heart of mathematics, takes precedence over the process and consequently the focus of school mathematics and aims to help develop mathematical thinking. It would be better if the teacher saw the process of building by introducing and receiving knowledge monitor ongoing activities, and correct conflicting interpretations, as the main activity of a student.

CONCLUSION

In recent years, studies related to students' problem solving skills have become a research trend because of the urgency of solving math problems for students. Compared to other levels of education, the study of reversible problem solving processes is more dominantly carried out in junior high schools with social arithmetic material because this material is a support for other mathematics and is also very closely related to solving everyday life problems related to mathematics, so that it has a high urgency to be taught at every level of formal education. Studies with Scopus indexed publications have been carried out in many countries in America. As for Indonesia itself, most of the research was conducted in Java. In addition, it was also found that students' problem solving abilities at all levels were still low, this was because students did not yet have a complete concept. This can be a concern for researchers to develop effective learning designs in improving problem solving abilities. Based on the importance of mathematical problem solving abilities, it is suggested for educators or researchers to conduct research related to students' problem solving abilities at the secondary school level outside Java Island not only focusing on social arithmetic material.

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