
Review of Mathematica's Problem Solving Implementation in Elementary School

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ABSTRACT

Problem solving is the ability of students to solve problems through a systematic thinking process. This research is focused on the implementation of problem solving, especially in elementary schools. This review summarizes the findings of literature studies on problem solving in elementary schools that were published from 2016-2022. Researchers use systematic. First of all the researcher formulates a research problem, then proceeds to explore relevant articles related to problem solving in elementary schools for analysis. Articles were searched using Scopus, Science Direct. From the search results obtained 142 articles related to problem solving. The results of the review revealed that 51% of the articles were the implementation of problem solving in elementary schools and 40 relevant articles were obtained.

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1. INTRODUCTION

The condition of the Covid-19 pandemic has had various impacts on students, especially in elementary schools. One of the impacts experienced by elementary school students is on the problem solving aspect. During the pandemic, learning activities were carried out online so that phenomena emerged that were the impact of online learning that had been implemented so far. Students experience difficulties in understanding and solving problems, especially mathematics in learning activities. In addition, problem solving is a competency developed to face the challenges of the 21st century. Problem solving is considered important because it combines real life with the surrounding environment. In line with the opinion of Jonasse, et al., 2023 states that Problem Solving is an important learning activity in the implementation of formal learning because it involves all levels starting from education at the elementary school level to tertiary institutions. Student involvement in problem-solving activities will help students develop attitudes to think, creativity, flexibility, productivity which are very important in relation to real life.

Rulik and Rudnik (1995: 4) define problem solving as a thought process: "Problem solving is the mean by which an individual uses previously acquired knowledge, skill, and understanding to satisfy the demand of an unfamiliar situation". This understanding means that problem solving is an effort made by individuals (students) using their knowledge, skills and understanding to find solutions or ways of an existing problem. Meanwhile, Ilhan Karatas & Adnan Baki explained "Problem solving is recognized as an important life skill involving a range of processes including analyzing, interpreting, reasoning, predicting, evaluating and reflecting", namely problem solving is an important life skill because it involves the process of analyzing problem, interpret, reason,

Problem Solving is a problem-solving model used by educators in the process of teaching and learning activities. Educators have a role in providing a problem/problem to students and providing opportunities for students to express their opinions so as to build new knowledge. Problem Solving is an effort made to build a scientific thinking process through understanding, analyzing, evaluating and generating new knowledge. Problem Solving according to Polya (1973)[1] is divided into 4 stages, namely: 1) Understanding the problem (understanding problem). At this stage students are able to understand the problems given by the teacher. 2) Planning problem solving (devising a plan). At this stage students are able to determine and create an appropriate model, determine the strategy or method to be used. Students are able to write down the steps in solving problem solving questions. 3) Carry out the problem solving plan (carrying out the plan). At this stage students carry out plans that have been determined at the stage of planning problem solving. At this stage students are able to understand the substance of the material and skills in problem solving. 4) Re-checking the solutions obtained (looking back).

At this stage students reflect by checking again, retesting the predetermined solutions or looking for other alternative answers. In line with the Problem Solving steps developed by J. Dewey, namely: 1) Formulating the problem, knowing and formulating the problem clearly; 2) Examine the problem, use detailed knowledge to analyze the problem from various angles; 3) Formulate hypotheses, imagine and appreciate the scope, causes and alternative solutions; 4) Collecting data and classifying data as material for proving hypotheses, skills in finding and compiling data presenting data in the form of diagrams, pictures and tables; 5) Verifying hypotheses, skills in analyzing and discussing data, skills in connecting and calculating, skills in making decisions and conclusions. Factors that influence student problem solving in learning: 1) internal factors, external factors, and the approach strategy used. Internal factors are factors that come from within the learner. While external factors are factors that come from outside the student. 4) Collecting data and classifying data as material for proving hypotheses, skills in finding and compiling data presenting data in the form of diagrams, pictures and tables; 5) Verifying hypotheses, skills in analyzing and discussing data, skills in connecting and calculating, skills in making decisions and conclusions.

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The purpose of this review is to: review the implementation of Problem Solving in schools for the last seven years in elementary schools?; What types of research are used in problem solving research?; What indicators influence problem solving in elementary schools?

2. RESEARCH METHODS

The researcher conducted a literature review using the PRISMA guidelines for systematic reviews and looking for evidence of a problem. Online articles were searched by searching using the Scopus database related to Problem Solving. We determined the research questions, the search process, the implementation of problem solving in elementary schools, the factors influencing learning problem solving in schools, followed by an analysis of the literature review.

The search process was carried out using the Scopus and Science Direct databases. A search of articles published for the 2016 – 2022 period, obtained 142 articles relevant to problem solving. From a search using the keywords "Problem Solving" and "Elementary School" several relevant articles were obtained, then articles that met the criteria for "Problem Solving" were selected. The literature search involved 2 stages, namely the initial stage and the 2nd stage related to sorting relevant articles based on the aspects studied. In the first stage, the researcher conducted an initial search, reviewed the abstract, and concluded. The initial article search yielded 142 relevant articles related to problem solving in elementary schools. The second stage, the researcher read and screened articles that were relevant to problem solving.

3. RESULT AND DISCUSSION

RESULT

The results of the initial search and study selection obtained 142 articles, each article was identified and 40 relevant articles were obtained. Furthermore, 102 articles were deleted because they were not relevant to the topic "problem solving in elementary schools." The results of research by tracing Scopus and Science Direct obtained 142 articles from online journals. The search for articles covers issues from 2016 to 2022. The keywords used in the search are "Problem Solving", "Elementary school".

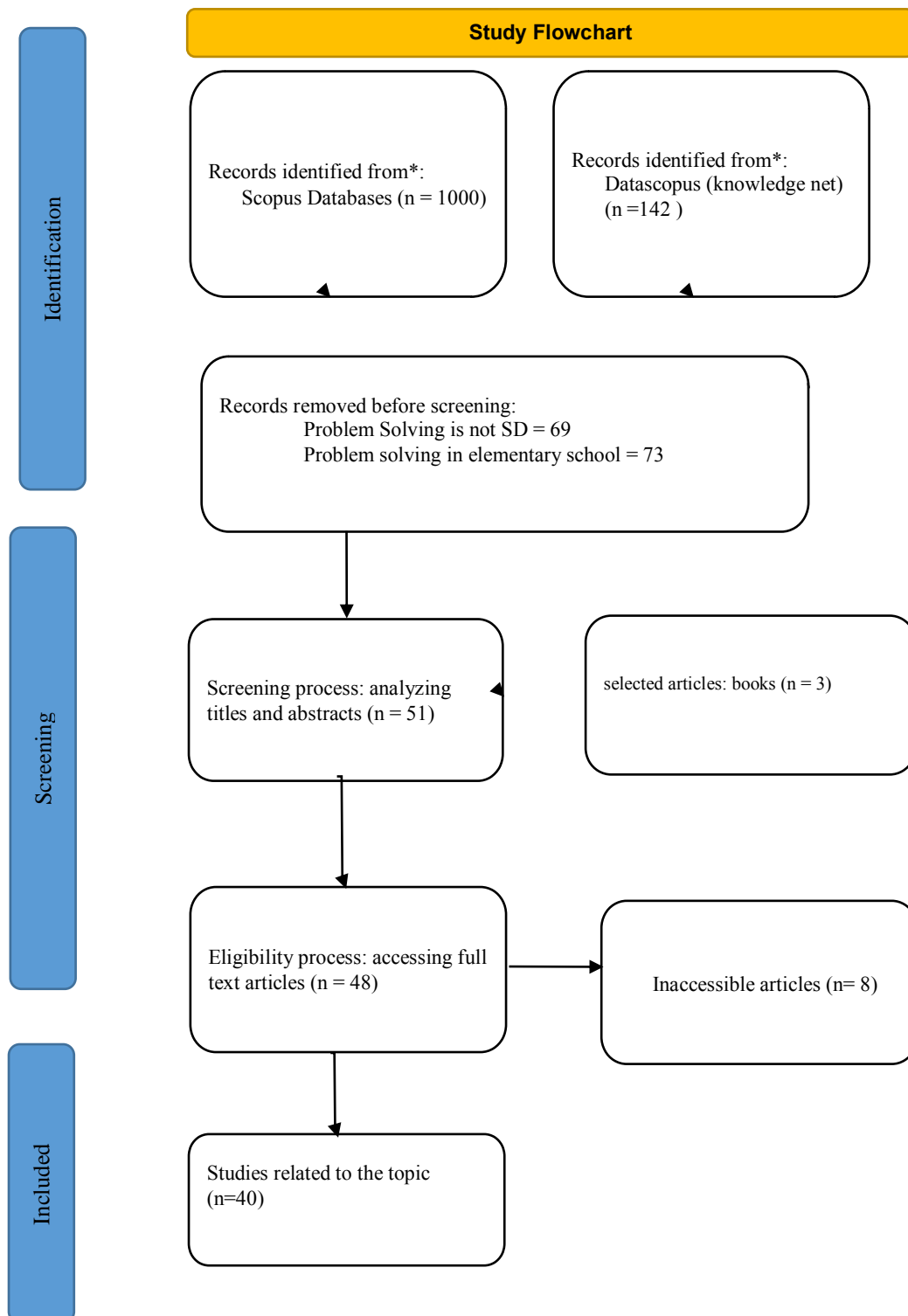




Diagram 1. Problem Solving in Elementary Schools

Table 1. Types of research

Types of research	Frequency	Percentage (%)
Quantitative	8	35.00 %
Qualitative	14	35.00 %
R&D	2	5.00 %
Experiment	9	22.50 %
Case study	7	17.50%
	40	100%

The results showed that the analysis of the problem solving article review was more focused on experimental research. Experimental research related to problem solving is 22.50%, while development research is 5.00%, which means that not much development research related to problem solving has been conducted in elementary schools.

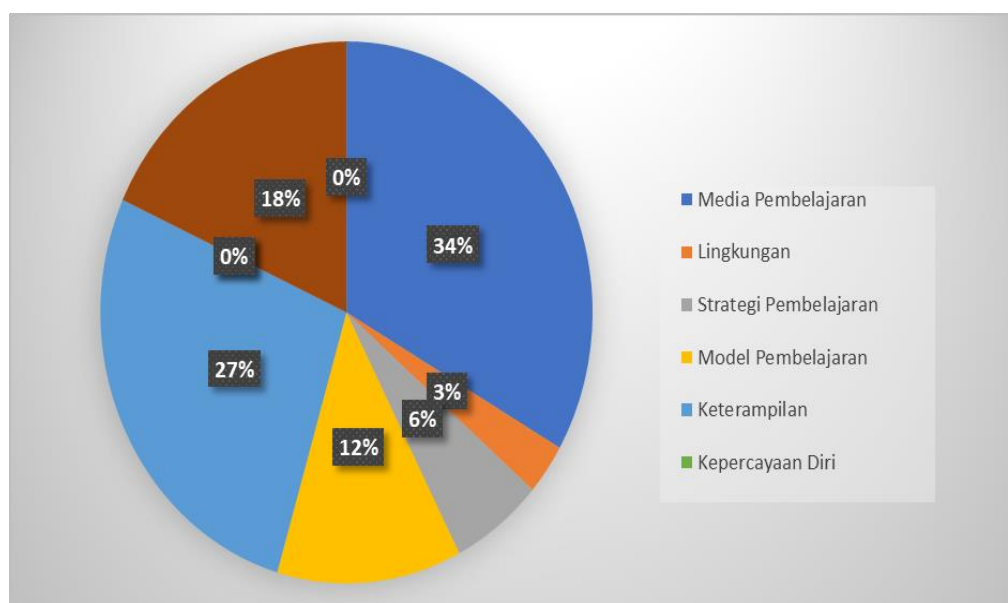


Diagram 2. Aspects that influence Problem Solving in Elementary Schools

Search results using the data base obtained as many as 142 articles. The articles were analyzed by looking at the implementation of problem solving in elementary schools and there were 26 articles that were linear with the topic. The results of diagram 1 explain 51% of the articles applied at the elementary school level. In addition, table 1 shows that the 26 articles were obtained with a percentage of 27% qualitative research, 23% quantitative research, 15% development research and 35% experimental research.

The results of the analysis related to aspects that influence problem solving at the elementary school level, obtained 7 aspects, namely learning media, environment, learning strategies, learning models, skills, self-confidence. The percentage in the learning media aspect is 34%, meaning that there is a lot of research that examines learning media related. The lowest percentage was obtained from the environmental aspect of 3%. The learning media aspect has a role in solving student problems (SY Huang, 2020; Jasmawati, 2021)[2], [3]. Student skills are an influential aspect of problem solving at the elementary school level (HE Rudyanto 2019; SB Gültekin, 2022)[4], [5]. Environmental aspects are factors that influence students in problem solving.

Table 2. Reviews and meta-analyses included in the study

No	Writer	Indonesian title	Year	Types of research	Results/ Benefits
1	M. Suselan [6]	School Type difference Among the Performance of Fourth Grade Students in Rural Malaysia in Solving Math Word Problems Involving Higher Order Thinking Skills.	2022	Case study	Solving Math Word Problems Involving Higher Order Thinking Skills.
2	TT Do [7]	Development and Validation of Interpersonal Problem Solving Inventory for Elementary School Students.	2022	R&D	Interpersonal Problem Solving Inventory of Elementary School Students
3	TT Do [8]	The Interpersonal problem solving inventory: Development and evaluation in a sample of fourth graders.	2022	Experiment	Interpersonal Problem Solving Inventory of Elementary School Students
4	M. Hourigan [9]	Experience of elementary school teachers involved in Teaching Through Problem Solving using Lesson Study.	2022	Experiment	Teaching Through Problem Solving using Lesson Study
5	SB Gültekin[5]	Investigating the Impact of Scientific Process Skills-Based Activities on Problem Solving Skills	2022	Qualitative	Scientific Process Skills to Problem Solving Skills
6	M. Arafik [10]	Utilization of Quipper School Technology in Learning Children's Literature in the Era of the COVID-19 Pandemic to Increase Interest in Reading in Elementary Schools.	2022	Qualitative	Utilization of Quipper School Technology in Learning Children's Literature
7	AS Nur [11]	Construction of the learning trajectory of elementary school students in solving	2022	Case study	Construction of student learning trajectories

integer problems.

8	X. Gao [12]	Towards a 5E-Based Reverse Class Model for Teaching Computational Thinking in Elementary Schools: Its Influence on Students' Computational Thinking and Problem Solving Performance.	2022	Case study	The 5E-Based Reverse Classroom Model for Teaching Computational Thinking in Elementary Schools
9	J.Wu[13]	Integrating spherical video-based virtual reality into elementary students' scientific inquiry instruction: effects on their problem-solving performance	2021	experiment	spherical video-based virtual reality into elementary school students' scientific inquiry instruction
10	CK Nguyen	Development of Social Problem Solving Tests for Elementary School Students	2021	R&D	Social Problem Solving Test for Elementary School Students
11	JL Piñeiro	Pedagogic knowledge of elementary school teacher candidates for solving mathematical problems. Mathematics	2021	quantitative	Pedagogical knowledge of prospective elementary school teachers
12	Riyadi	Profile of students' problem solving abilities seen from Polya's four-step approach and elementary school students.	2021	case study	student problem solving seen from Polya's four-step approach
13	D. Herro	Assessing elementary students' collaborative problem solving in makerspace activities. Information Science and Learning	2021	qualitative	Elementary students collaborative problem solving in makerspace activities
14	S. Sarwi	Implementation of STEM Approach-Based Project-Based Learning to Improve Students' Problem Solving Ability	2021	experiment	STEM approach
15	IF Apriani	How is elementary school teachers mathematics problem solving ability?	2021	qualitative	Elementary school teacher mathematics problem solving
16	JM Fidelis	The Relationship Between Quantitative Reasoning and Word Problem Solving	2021	quantitative	Quantitative Reasoning and Problem Solving

17	Jusmawati	The Effect of Android-Based Creative Problem Solving Learning Model on Learning Outcomes of Elementary School Students.	2021	experiment	Android Based Creative Problem Solving Learning Model
18	SY Huang	Implementing Digital Escape Room with Science Teaching in Elementary Schools: Learning Achievement, Learning Motivation, and Problem Solving Ability	2020	experiment	Digital Escape Room with Science Teaching in Elementary Schools:
19	MK Cho	Investigating elementary student problem solving and teacher scaffolding in solving unstructured problems. Journal of International Education in Mathematics, Science and Technology	2020	case study	Eementary school student problem solving
20	E. Yayuk	Difficulties for prospective elementary school teachers in solving math problem items: Polya's Steps.	2020	qualitative	Problem solving with Polya
21	E. Ahdhianto	The influence of metacognitive-based contextual learning models on the problem-solving and mathematical communication abilities of fifth grade students.	2020	experiment	Metacognitive-based contextual learning model
22	H. Nurhayanti	Analysis of mathematical problem solving skills in terms of initial abilities and gender differences in primary schools.	2020	quantitative	Mathematical problem solving
23	AR Nisa'	The effectiveness of value clarification techniques (VCT) and problem-based learning (PBL) models on social problem solving skills in terms of emotional intelligence.	2020	experiment	Value clarification technique (VCT) and problem-based learning (PBL) models
24	EM Yeni	Analysis of elementary school students' difficulties in solving mathematical problems in solutions.	2020	qualitative	Mathematical problem solving
25	DH Tong	A case study of developing students' problem-solving skills through solving real-	2020	case study	Students' problem solving

		world problems related to fractions in elementary schools.				skills
26	KC Suryandari	Elementary School Students' Attitudes Toward Science Through Challenging Problem-Solving Tasks during the Covid-19 Pandemic.	2020	qualitative		Solution to problem
27	C. Lee	Precise prompt system based on Polya's method for solving mathematical problems.	2017	quantitative		Polya's method for solving mathematical problems
28	M.Ulu	Errors made by fourth grade elementary school students when modeling word problems and eliminating these errors through scaffolding.	2017	qualitative		Scaffolding
29	Roheni	A Scientific Approach to Improving Students' Mathematics Problem Solving Skills v	2017	case study		Problem Solving Skills
30	D. Zhang	Multiplication Problem Solving Strategic Development: Student Strategy Choice Patterns.	2017	R&D		Strategic Problem Solving
31	C. Sousa	Learning to solve problems in grade 2 SD.	2017	qualitative		Strategic Problem Solving
32	SZ Wasik	Using Creative Problem Solving Competitions to Increase Career Readiness in Elementary Schools.	2017	quantitative		Strategic Creative Problem Solving
33	Z.Ay	Investigate the effect of a problem-solving approach based on metacognitive questions on self-regulation skills. SD Online	2017	qualitative		Strategic Problem Solving
34	G. Ramirez	On the relationship between math anxiety and math achievement in early elementary school: The role of problem-solving strategies.	2016	experiment		The role of problem solving strategies.
35	T. García	Elementary students' metacognitive processes and post-performance calibration on math problem solving	2016	qualitative		Elementary students' metacognitive and post-performance calibration

tasks.

36	J.Tsan	How early did the CS gender gap emerge? A study of collaborative problem solving in 5th grade computer science.	2016	quantitative	Collaborative problem solving studies
37	S. Kingsdorf	An extensive look at the literature on math word problem solving interventions for third graders.	2016	qualitative	Problem solving intervention
38	M.Ulu	Structural equation model to explain the effect of the level of reading fluency, literal comprehension, and inferential understanding of 4th grade elementary school students on problem solving success	2016	quantitative	Inferential understanding
39	AJH Boonen	This isn't math class-we're learning to draw! teacher's use of visual representations in teaching word problem solving in sixth grade elementary school.	2016	qualitative	Solution to problem
40	L. Kashani-Vahid	Creative interpersonal problem solving program: Generating creativity in elementary school students.	2016	Qualitative	Solution to problem

DISCUSSION

Implementation of Problem Solving in elementary schools is related to students' processes in solving problems related to the topic of mathematical problems. Problem solving is student involvement in solving problems related to everyday life or real-world contexts. Teachers use various solutions in solving math problems. The results of the analysis, there are several solutions used by elementary school teachers in solving problems, namely solutions using learning media, using the surrounding environment as learning media, using innovative learning strategies, using learning models, using skills that are able to solve problems, and building self-confidence in student self. Most of the research conducted is related to the use of media in helping students solve problems. Problem Solving research related to student skills can be found in the articles analyzed.

4. CONCLUSIONS

The conclusion in this study is that many studies related to the implementation of mathematical problem solving at the elementary school level have been developed. Suggestions for further research need to be further deepened and developed in studying environmental aspects, motivation, self-confidence, independence, especially at the elementary school level.

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