WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

PROBLEM SOLVING ABILITY IN SCHOOL EDUCATION: A REVIEW OF EMPIRICAL STUDIES

Renu Sharma[1], Dr. Shelly[2]

[1] Research Scholar, IIMT University
Email ID:justrenu1356@gmail.com
[2] Associate Professor, IIMT University
Email ID:shellyrana1981@gmail.com

ABSTRACT :

A problem solving skill plays a vital role in successful education as it helps learners utilize information, understand new problems, analyze options for resolution purposes. This paper is a research article that summarizes some national and international studies on developing skills for solving problems by children at schools. The review considers empirical studies, theoretical contributions, intervention research, meta-analyses, and large-scale educational assessments. Problem solving is an integral part of education which involves developing skills such as critical thinking, reasoning abilities, self-regulation strategies for effective learning through reading comprehension and writing proficiency while also being influenced by motivation levels among students' attitudes towards schoolwork. Research on Indian students' problem solving abilities is related to their academic performance level of parents education history cognition behavior patterns gender environment factors within schools but results vary among them. International research provides comparatively strong evidence for the effectiveness of metacognitive instruction, schema-based approaches, collaborative problem-solving, problem-posing activities, and structured interventions for mathematical word problems. This paper also highlights an issue regarding lack of authenticity and novelty to problems faced by students at schools within India; there is a requirement for better contextualized tests as well as more effective interventions studies. In general, problem solving is an inter-disciplinary subject that can be taught like any other discipline instead of being limited by its mathematical nature. Problem solving skills of students; Metacognitive abilities among pupils for mathematics problems based on problem-solving strategies; Higher order thinking through education intervention programs.

I. INTRODUCTION

The problem solving skill is about understanding problems, analyzing data for solution possibilities and selecting best approach among them. Generally it includes identifying problems, analyzing them from various angles; formulating solutions through planning methods; implementing those plans effectively while evaluating results against goals achieved. Learners should apply what they already know instead of relying solely upon rote learning or previous practice skills.

Problem solving plays a vital role for kids' education as well as their daily life activities. Problem-solving skills of students are developed through math problem solving tasks, science experiments lab work assignment writing papers reading comprehension tests decision-making exercises etc. For example, when you solve an algebraic equation it means that they need knowledge about what is going on first so as to choose appropriate operations for them. In this way, students might need to analyze why there was an unexpected result of an experiment before they revise their hypotheses. These examples show how good solutions are achieved through proper use of information, logic and decision making skills.

Transferring knowledge between similar problems and different contexts is an essential part of solving them effectively. A student might know about an idea and be able to answer it easily, but he/she may have difficulty applying that knowledge on another situation. It implies there is a relationship between having knowledge and using it effectively as separate components to learn something. Thus developing problem solving skills would enable students to be better self-directed learners that are able to handle new coursework problems effectively and solve real-life issues efficiently.

Also problem solving includes some advanced cognitive abilities like analysis, logic reasoning, critical thinking, decision making and choice between options. If you are having trouble with something, it might be helpful for you to find out what is important about that problem; relate various pieces of data together; think about possible solutions before trying again. They help students go from being a receiver of knowledge rather than an active participant towards engagement with it during their studies. Creativity and independent thinking can be fostered through these means as they allow for exploration of various approaches towards finding an answer.

Another aspect to consider for developing problem solving skills would be metacognition. This is about students' knowledge of themselves as thinkers and ability for self-regulation while performing an activity. Students who monitor their understanding, recognize their mistakes, assess the usefulness of a strategy, and review their final answers may be better prepared to manage challenging problems. Students may be encouraged through questions such as "How did you get your answer?", "What was difficult about it?", and "Would there be a better way of doing this?". However, there is a difference among them due to factors such as student's background knowledge, type of problem solving activity, instructional method employed by teachers and ways of evaluating these skills.

From an Indian education perspective, studies were conducted on student problem solving skills related to various factors such as personality traits, cognition level of children's parents' relationship statuses etc. Academic performance, sex of students' parents education level; knowledge acquisition process and thought patterns; intelligence traits; self-awareness about cognition; pedagogical techniques are some examples here. These studies help us understand more about why there are variations among student achievement levels. However, there is no consistency among these results from various research papers. For instance, studies on gender disparities yield different findings which indicate that conclusions need to be made based upon specific students' groups, schools of education and research techniques used for them.

Also international studies have looked at ways to improve problem solving skills via structured programs of education. Research has looked at methods like metacognition teaching techniques, cooperative education programs, schematic pedagogy for solving problems through questions of knowledge theory; problem posing exercises to improve working memory skills while studying mathematics. While these techniques have different goals and methodologies, there is a common goal of assisting students to solve issues through organizing data, choosing suitable tactics for solving them as well as evaluating those solutions. The effectiveness might depend upon learner's age, difficulty level of tasks, length of time spent on teaching sessions, and how well those learned skills are applicable for future use.

This study is important because it recognizes that a student's problem solving skill cannot just be considered as an immutable trait to them alone. While there may be differences among students' previous knowledge base, experience level and skill set; proper teaching methods are available for improving logical reasoning abilities as well as problem-solving strategies of pupils. Through providing interesting questions, asking students about their logic behind answers; exploring other approaches available at hand; teaching errors are valuable lessons rather than failures of performance. Question-based teaching methods such as discussions, reflections on problems solved through inquiry-based learning can increase student self-confidence and skills for tackling new challenges.

From this point of view, our current research paper is an analysis based on some books about solving problems by schools' children today. This paper aims at identifying major themes of earlier studies on this topic; analyzing factors related to student's problem solving abilities; and examining teaching methods which might help them develop better skills. By bringing together findings from different educational contexts, the review aims to provide a clearer understanding of the current state of research and highlight areas that require further investigation. The study may also offer useful insights for teachers, researchers, and educational planners interested in promoting meaningful learning and strengthening problem-solving competence among school students.

II. Approach

This study is based on literature reviews rather than collecting any information directly from school children. The previous studies on this topic as well as related academic papers have been analyzed for developing a comprehensive knowledge.

Literature includes papers on empirically conducted experiments, interventions; systematic review of scientific literature for this is a particular topic such as "student problem solving". There is a focus on research of primary level children, junior high schools and senior secondary levels Level 2-3.

The literature for this study is classified as either a national or an international research project. The study of problem-solving (general), math problems, word problems for mathematics, meta-cognitive skills like learning style and collaboration between learners were included as part of this research on teaching methods.

These papers are analyzed based on their purpose of study; subjects involved; variable in, variables studied; results obtained from them and its significance for education. Instead of just listing them out by date orderly manner for analysis purposes purposesitez are analyzed so as to find commonalities among these papers; similarities between some articles and differences from others; discrepancies within certain sections or chapters;

and a lack thereof elsewhere.

This paper is not an exhaustive study but just a selection of studies for purposes like this. Thus, these findings are to be taken for granted by way as a summary from all relevant studies instead of being an exhaustive statistic on global research data collection efforts.

III. REVIEW OF RELATED LITERATURE

Research has shown that there is a relationship between student demographics and academic achievement levels among them. Kishore [1] studied problem solving skills of senior secondary school students based on variables like district, locality and gender. There was no statistical significance between them according to this result. There was an equal level of performance by both, rural and urban students; there are no major distinctions between those who live in a particular district versus another boy/girl. The results show that demographics alone are insufficient to explain differences among individuals' abilities for solving problems. Also they highlight its significance for studying other or as a factor outside school environment like class experience teaching methods previous knowledge engagement through solving problems effectively. From an educational standpoint, student achievement might be influenced by factors such as their education history and access to resources like teachers or materials.

Research has focused on gender disparities amonger, but results vary from study to study regarding this topic. Kaur and Rai [2] studied how metacognitive skills relate to problem solving abilities and self esteem among high school students. The results showed no significant difference between males and females for solving problems but there was some variation among them regarding another variable. On the other hand, Selvaganapathy and Rajendran [3] studied problem solving skills of 120 students from Tamil Nadu schools to find out that there are some differences between boys' and girls', as well as an overall higher rate of problem-solving ability among them. There is a difference among males and this shows that we cannot generalize about it based on gender alone because there are other factors such as age group or education level to consider while doing so. Kaur and Rai [2] found no statistical correlation between metacognition and problem solving skills. It should be noted CORBYB as it relates to planning, monitoring and evaluation of thoughts by people.Awareness of one's own thoughts does not necessarily mean better problem solving skills. Learners might need practice of metacognitive techniques for certain assignments.

Success rates of problem-solving are a topic which requires more research. Nazir [4] states that there is a correlation among these variables of secondary school students from Central Kashmir. This indicates a relationship between good problem-solving ability and high academic achievement. Such a relationship is reasonable as it helps students read comprehension skills, apply their knowledge while solving problems analytically and drawing logical conclusions about those issues. However, nonetheless, academic achievement and problem-solving abilities are different things. Although students may perform well in tests through rote learning of information and copying previous methods, they could have difficulty answering unseen problems since these require applying what has been learned to new situations independently. Thus, information on academic achievement doesn't always indicate an individual's ability to solve problems effectively. Home environment and family related factors might be responsible for variations among students' educational experiences. According to Vishwanatham [5], there was an investigation on mathematical problem solving skills of 600 students from secondary schools located within Mahabubnagar district, Telangana by their parents' education level. There was an important effect of parents' education on this research finding. One possible explanation for this phenomenon could be parental education level affecting child's academic guidance, access to study materials and intellectual support from their family members at home. Supportive educational environment of a child can be an opportunity to discuss questions and think independently. However, parent education levels are not an all-encompassing measure for measuring a child's skill at solving problems. This relationship might be due to various factors such as family background, availability of educational facilities at schools, teacher effectiveness and student's personal learning needs. Arora [6] extends this research to examine problem-solving skills among students from different subjects at government high schools. These comparisons matter as they help students from various courses have access to diverse subjects for practicing analytical, numerical, scientific and conceptual thinking skills. The study shows that we should take into account an individual's environment while analyzing variations among individuals' abilities for solving problems.

Besides demographics and family issues, studies also looked at how people learn individually and think about things. Mohanta and Tali [7] researched problem solving skills of senior high school students' learning behavior patterns. The research is part of a larger conversation about learner behavior towards learning activities, processing data, and choosing methods to solve problems. There are differences among students regarding how they organize data, identify connections between concepts, compare options for solving problems, and answer difficult questions. Knowledge of such distinctions would allow teachers to offer diverse teaching methods instead of relying solely upon one type of instruction. Sharma and Kharbanda [8] studied cognitive styles of students' academic performance and problem-solving skills from a sample of 210 high schoolers at Agra. Also, this study highlights how student information processing affects their grades. Collectively they show that problem solving is an intricate skill which may not

always be attributed to any single aspect of psychology. Knowledge of prior experience, cognition process, preference for learning style, motivation and classroom background can influence how students tackle issues.

Studies about teaching methods provide more information for developing problem solving skills. Jeena [9] studied how cooperative learning can improve emotional intelligence, problem solving skills and scientific creativity among secondary school students. There was an increase of problem solving skills due to this cooperative learning program. Through collaboration, students have chances of explaining why they chose a particular solution; considering alternative perspectives; comparing various options available at hand; learning about other people's methods used in solving problems together. These experiences can help students to have more knowledge about problems instead of relying upon one technique alone. Nevertheless, its effectiveness as an educational tool is determined by what kind of task it involves; whether they're fun or boring. Placing students together doesn't guarantee effective teamwork among them. Xu, Wang, and Wang [10] found that there was an overall positive correlation between collaborative problem solving and critical thinking but also some differences among various situations. Duration of intervention, group size, subject area, and teacher support are some factors that might affect results. This study shows that purposeful tasks for students to do actively are important as well as good teachers' help during group work sessions.

Problem solving skills can be improved by intervention based research. Cornoldi et al., 2015 [11], is an educational intervention that involved 135 primary school children aged three to five years old for developing their metacognitive skills and working memory abilities. Improvement of solving problems was observed after this treatment. It is relevant to this study since it investigates how people solve problems by means of training and experience instead of considering them solely innate traits. Activities which promote self-monitoring of thought processes by students for managing information and evaluating strategies can be useful in dealing better with difficult problems. Problem solving research provides a different view about developing it. The study of a three-level meta-analysis from 2024 [12] found that problem-posing instructional interventions had positive impacts on both cognitive and non-cognitive learning outcomes. Problem posing is an activity where students are asked to ask questions as well as create new ones, change old ones, and investigate connections between given data sets. These activities can help them understand better about problems' structure and increase participation level towards learning. Also they offer a way for students to develop critical thinking skills through self-directed study.

The mathematical aspect to solve problems is an important part of studying problem-solving skills. Kapoor [13] discussed various methods for solving math word problems. The student should know how to read questions correctly; find out which details are important for them; detect connections among numbers; figure out what they need to do next stepwise mathematically. Thus, difficulties might occur due to language understanding or interpreting problems despite having adequate knowledge about computers' functions. This distinction has practical implications for classroom assessment. If you get wrong answers from students then they should be analyzed for their logic and understanding instead of just looking at what was given as an answer by them alone. This method can be useful for finding out where a problem comes from so that you could provide better teaching assistance if needed. Vessonen et al., 2024[14], studied characteristics of word problems related to elementary student performance via a systematic review. They are concerned about aspects like language, numbers data structures and format for presenting information. The difficulty faced by students can be due to both the complexity of a problem and how it is phrased. Differentiating among them will allow for better-designed tests by teachers to give students a more specific type of assistance they need.

Structured methods for solving math problems have been studied by means of a literature review. According to Peltier and Vannest [15], there is an effect from schema based instruction towards elementary school students' problem solving skills. The teaching method helps students understand problems by identifying their core components rather than just knowing common terms or superficial aspects. Through identification of relationships and organization by an appropriate scheme for data, students will be more effective at choosing suitable approaches towards problems that appear unfamiliar. The research is concerned about problems faced by pupils having difficulty with math. Lein, Jitendra, and Harwell [16] reviewed interventions for improving word problem-solving skills of students with learning disabilities and math difficulties. The study found that there are benefits to using a systematic method of teaching. Like Myers et al., 2022 [17], this paper also studied intervention programs of elementary school children who had difficulty learning math via a meta analysis. Together they show that there is a need for clear teaching methods, good planning techniques, proper representation models, effective training sessions, and chances to use knowledge on various tasks. Persistent difficulties should not necessarily mean a lack of problem-solving skills; some students might need better instruction that is well organized.

A broader synthesis is needed to understand better what influences math problems solving. Vessonen et al., 2025a [18], performed a systematic review and meta-analysis on math problem solving intervention for elementary school children. There were 115 papers reviewed by over 20,000 students. The results showed that they were effective for improving word problem solving skills but there was variation due to different levels of intervention intensity and test administration conditions. The effectiveness of this method depends not just upon its selection but also on delivery methods used for

teaching purposes along with quantity given to students as well as evaluation techniques applied towards achieving desired educational goals. Through its Programme for International Student Assessment (PISA) by the Organisation for Economic Co-operation and Development [19], it also studied creativity of problem solving among 15-year olds as per their 2014 report. This paper focuses on issues that are relevant to real-world settings where learners need to analyze problems, identify limitations of existing methods, think creatively about alternatives before implementing them instead of just copying what they've learned from textbooks or lectures. It is an example that shows how problems can be solved through flexible application of knowledge when faced with new situations. Finally, Vessonen et al. (2025b) [20] synthesized research on individual characteristics associated with mathematical word-problem solving among elementary school children. The research found some important aspects like math ability, calculation skill, cognition power of mind for languages and motivation levels among them. The results support this idea that effective problem solving is based on an integration between knowledge acquisition skills, logical thinking abilities, understanding of languages as well as cognitive capabilities and learners' traits or attributes.

In general terms, this paper discusses how problem solving skills are an integral part of student achievement which depends upon various personal, familial, psychological and teaching influences. Studies on demographics show conflicting results about gender; however, research into academic performance, cognition styles and educational experience reveals some correlations among them. Further research shows that interventions are effective for improving student performance through appropriate teaching methods such as group work, cognitive skills development activities like solving problems based on schemas or mathematics programs of study. Also, there are variations among studies due to different methodologies used by researchers; students' demographics vary from one study to another; assessments differ between them; and they occur within various schools/schools of education systems. Overall it means there are other factors involved in developing problem solving skills besides just teaching content to students. This is an environment where students are able to ask questions, analyze problems through experiments on various approaches; they also have opportunities of explaining why things work this way by mistake while applying knowledge towards new challenges. Therefore, a systematic review of national and international studies would be helpful to understand major factors affecting problem solving skills and find ways to improve it among students at schools.

IV. SYNTHESIS

National and international literature provides some information about student problem solving skills and factors contributing towards their development.

Problem solving skills are an important aspect of education that is affected by various elements. Reviewed research shows that there are no explanations for this phenomenon based on intelligence level, educational attainment by sex/gender; also not due to metacognition skills alone. A student's academic achievement is influenced by factors such as prior knowledge, reasoning abilities, language proficiency, motivation levels, past educational background and resources provided at school. Thus an overall knowledge about solving problems should include personal traits as well as environmental factors that affect learning process.

Also, there are studies that show how to improve problem solving skills by means of proper education programs. Studies of metacognition teaching methods such as cooperative learning, problem posing tasks for solving problems based upon schemas or math word puzzles show benefits to learners through organized educational experiences. They help students learn about issues, organizing data; exploring various techniques for solving them; assessing how well they work out results. This study shows that we should give students more chances for practicing problems solving instead of assuming they will learn it naturally from knowing about a topic.

Also thirdly, it affects student achievement due to its characteristics or way of being presented. The way a question is phrased, its organization of data points, their numerical relationships and context for performing tasks can influence student interpretation and approach to them. An incorrect answer by a student doesn't always mean they don't understand concepts; it could be due to confusion about the question or choosing an unsuitable approach. Therefore it would be more beneficial if we studied how they solve a problem instead of just judging them based upon whether or not their answer was right or wrong.

Fourthly, Metacognition may play an important part of solving problems; however it is not necessarily automatic nor universal to all people. Planning strategies for implementation monitoring effectiveness identifying mistakes evaluation of solutions is needed good at teaching skills. Nevertheless, they should know what techniques work best on specific problems before using them properly. According to this study, raising awareness about one's own thoughts can be more effective if there are also clear instructions for learning them through guidance and practice on various kinds of problems.

Finally, cooperative education provides chances for improving student's problem solving abilities through well designed activities that are relevant to them. Collaborating with others helps students to compare concepts, discuss arguments for them, explore other solutions towards solving problems better. However, it depends upon how well students interact with each other through their interactions as a whole while being guided by an educator. Activity groups work better for teaching if all students participate actively and there is meaningful conversation about ideas, reasoning skills, and in order to make decisions together as a group member.

The sixth point is that there were inconsistencies between these results regarding demographics and context for each study of India. Studies of sex differences between rural areas and cities; education level by parents' schooling statuses and intellectual styles for, etc have yielded different findings. The differences show that there is a correlation between background characteristics and problem solving skills which might vary due to factors such as study group size, school environment, and testing techniques. More studies on various groups of students, well-defined variables and proper measurement tools will be needed to understand themly this relationship between factors.

Lastly, it highlights some of those differences between Indian and foreign studies that are covered by our paperwork. Indian research provides valuable information about what affects a student's problem solving skills like academic performance, intelligence is related to cognition traits of parents' backgrounds as well as education history. Nevertheless, many papers are mainly concerned with description and relationship among variables. International studies on this topic include many papers such as reviews, meta-analysis and experimental designs to improve problem solving skills. The paper discusses how more research on interventions would be beneficial for Indian school systems through, such as experiments and quasi-experiments to evaluate various teaching methods' efficacy within diverse environments.

In general, this study shows that enhancing student's problem solving skills needs an effective strategies for addressing their unique requirements such as personalization to each learner; task specificity; and teacher effectiveness within classrooms. It is also necessary that more studies be conducted on this topic so as a better understanding can be gained about how certain teaching methods work well with specific learners at particular times of life where it leads to significant positive change over time.

V. CONCLUSION

This paper discusses how problem solving skills are important for effective education and in schools to achieve better results among pupils' academic performance. Learning is better if students can learn new things as well as usereason about them for solving problems from different perspectives by analyzing data points, choosing suitable methods of action, evaluating alternatives before making decisions on how best to proceed towards achieving goals efficiently. Therefore problem solving is a bridge connecting classroom education to real-world- world applications.

Indian studies show research on problem solving by scholars concerning various factors such as academics performance, parents' education level, learning style and thought process, self-awareness skills; gender differences among students and teaching methods used for instruction purposes are some examples here. Nonetheless, there is inconsistency among them regardinges within this paper on those subjects. It implies that problem solving skill is an intricate attribute which can't be fully described by any specific age group or personality trait alone. The development of this project should be understood as a interplay among student skills, knowledge acquisition process and school settings.

International research shows that a good system can help be used for improving student's ability at solving problems. However, its efficacy might depend upon factors like type of assignment, level of teaching, length of time spent on it by learners and teacher support. The study shows how effective problem solving problems require proper planning techniques, suitable instructional methods to be used by teachers along with time for continuous practice sessions.

One major point from this paper (review) would be that solving problems shouldn't just mean doing lots of drills or getting right on tests. A student should be able transmissible for solving problems by identifying pertinent facts from available data sets; they must also have an aptitude towards analyzing alternatives before coming up with solutions which are logical based upon evidence gathered through research papers written on that topic. The teacher may help be able to facilitate it through asking questions, promoting critical thinking skills within their students' classrooms where they reflect upon what has been learned from making errors rather than simply punishing them.

Furthermore, problem solving problems should not just be taught within mathematics classes but also to other areas of study like science or history. There are some studies done about this topic beforehand but more needs to be researched especially regarding Indian education system. Future research

needs more focus on experiments/quasi-experiments; long-term study design; cultural relevance of tests and problems solving activities. Also, researchers need to study these issues among various ages of students at schools from elementary through high school levels on many subjects for children. These studies can be useful for identifying effective strategies that are beneficial to students' learning outcomes and understanding how certain programs work best on them.

To conclude, developing problem solving skills needs collaboration between educators, school administrators, educational planners and academics. Available research is an important source of information about what influences this skill and how to improve it. Nevertheless, further studies and effective teaching methods need to be conducted for translating them into useful learning results at school level. Ultimately we want our children to learn rather than just memorize facts; they must also develop critical thinking skills so that they can solve problems creatively instead of simply regurgitating what has been taught before them.

REFERENCES

[1] Kishore, N. (2015). Study of problem solving ability among senior secondary school students. Indian Journal of Applied Research, 5(6), 59–61.

[2] Kaur, N., & Rai, M. (2024). Study of metacognition among senior secondary students in relation to their problem-solving ability and self-esteem. Voices of Teachers and Teacher Educators, 13(1), 144–157.

[3] Selvaganapathy, R., & Rajendran, P. (2024). Fostering problem-solving proficiency: A survey of secondary students in Tamil Nadu, India. International Journal of Creative Research Thoughts, 12(3).

[4] Nazir, U. (2019). Impact of problem solving ability on academic achievement among secondary school students. Think India Journal.

[5] Vishwanatham, J. (2021). Problem solving ability in mathematics among secondary school students with respect to parents' educational qualification. International Journal of Indian Psychology, 9(4), 917–922.

[6] Arora, T. K. (2023). A study on problem solving ability among students of government senior secondary school: A comparative analysis. ShodhKosh: Journal of Visual and Performing Arts, 4(2).

[7] Mohanta, I., & Tali, D. B. (2021). Problem solving ability of senior secondary school students in relation to their style of learning and thinking. International Journal of Creative Research Thoughts, 9(11), a553–a563.

[8] Sharma, A., & Kharbanda, J. (2024). A study of cognitive style in relation to academic achievement and problem solving ability of higher secondary students. International Journal of Indian Psychology, 12(3), 2103–2112.

[9] Jeena, K. G. (2023). Cooperative learning approach for enhancing emotional intelligence, problem solving ability and scientific creativity among secondary school students. Voices of Teachers and Teacher Educators, 12(1), 104–117.

[10] Xu, E., Wang, W., & Wang, Q. (2023). The effectiveness of collaborative problem solving in promoting students' critical thinking: A meta-analysis based on empirical literature. Humanities and Social Sciences Communications, 10, Article 16. https://doi.org/10.1057/s41599-023-01508-1

[11] Cornoldi, C., Carretti, B., Drusi, S., & Tencati, C. (2015). Improving problem solving in primary school students: The effect of a training programme focusing on metacognition and working memory. British Journal of Educational Psychology, 85(3), 424–439. https://doi.org/10.1111/bjep.12083

[12] Effects of problem posing instructional interventions on student learning outcomes: A three-level meta-analysis. (2024). Thinking Skills and Creativity, 53, 101587.

[13] Kapoor, A. (2016). Insights into math word problems: Developing learning cycle for solving word problems. The Primary Teacher, 41(1), 33–40.

[14] Vessonen, T., Dahlberg, M., Hellstrand, H., Widlund, A., Korhonen, J., Aunio, P., & Laine, A. (2024). Task characteristics associated with mathematical word problem-solving performance among elementary school-aged children: A systematic review and meta-analysis. Educational Psychology Review, 36, 117.

[15] Peltier, C., & Vannest, K. J. (2017). A meta-analysis of schema instruction on the problem-solving performance of elementary school students. Review of Educational Research, 87(5). https://doi.org/10.3102/0034654317720163

[16] Lein, A. E., Jitendra, A. K., & Harwell, M. R. (2020). Effectiveness of mathematical word problem solving interventions for students with learning disabilities and/or mathematics difficulties: A meta-analysis. Educational Psychology Review.

[17] Myers, J. A., Witzel, B. S., Powell, S. R., Li, H., Pigott, T. D., Xin, Y. P., & Hughes, E. M. (2022). A meta-analysis of mathematics word-problem solving interventions for elementary students who evidence mathematics difficulties. Review of Educational Research, 92(5), 695–742. https://doi.org/10.3102/00346543211070049

[18] Vessonen, T., Hellstrand, H., Kurkela, M., Aunio, P., & Laine, A. (2025). The effectiveness of mathematical word problem-solving interventions among elementary schoolers: A systematic review and meta-analysis. International Journal of Educational Research, 132, 102642. https://doi.org/10.1016/j.ijer.2025.102642

[19] Organisation for Economic Co-operation and Development. (2014). PISA 2012 results: Creative problem solving: Students' skills in tackling real-life problems (Volume V). OECD Publishing. https://doi.org/10.1787/9789264208070-en

[20] Vessonen, T., Hellstrand, H., Kurkela, M., Aunio, P., & Laine, A. (2025). Individual characteristics associated with elementary school children's mathematical word problem-solving skills: A systematic review and meta-analysis. Review of Education.