

## The Effectiveness of Learning Problem Solving Model for Improving the Ability to Solve Mathematics Questions in Story Form in Autistic Students

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### Abstract

*This study sought to investigate the efficacy of a problem-solving learning paradigm in enhancing autistic kids' capacity to solve Math problems in the form of tales. This study focuses on a single subject. The research used the A-B-A' design. The baseline-1 (A) phase consisted of administering a test three times to establish the subject's initial ability to solve Story Form Math Problems. Math Problems in the form of Stories were solved using the problem-solving learning approach during the Intervention phase (B). The baseline-2 (A') phase consisted of administering a test three times to assess the subject's ability to complete Story Form Math Problems after receiving an intervention. The findings of this research suggest a shift in the direction of the trend, with the effect growing with a (+) effect in phase A, increasing with a (+) effect in phase B, and decreasing with a (=) effect in phase A'. The stability trend is steady during all three periods. The level difference between phases A and B is +32.5%, whereas the level change between phases B and A' is +5%. In each step, the fraction of overlapping data is 0%. A problem-solving learning paradigm has been shown to improve autistic pupils' ability to solve arithmetic problems in the form of tales.*

**Keywords:** Problem Solving, Children with ASD, Mathematics.

## **Introduction**

One of the most important functional skills that autistic children need to develop is the capacity to problem-solve, particularly in circumstances that include the management of financial affairs (Lora et al., 2020; Chou, 2020). This is owing to the fact that the capacity to solve issues is a requirement for the life of all persons, and the task of efficiently managing one's financial resources is closely related to the existence of humanity. Consequently, the reason for this phenomenon is as follows: In addition, the use of mathematical problems that are given to students in the form of tales about daily obstacles is one of the entry points that may be used in the process of teaching students how to find solutions to problems.

Students have a better chance of effectively resolving issues that occur in the real world if they have better analytical abilities (Jiménez-Munguía et al., 2012). One way to strengthen students' analytical skills is to have them work on mathematical problems presented in the form of tales. In addition, mathematical problems presented to autistic persons in the form of tales might be helpful in the process of fostering the development of their language abilities (Barnett & Cleary, 2015).

Children with autism have difficulty processing large amounts of verbal information at once (Oswald et al., 2016), and as a result, they are unable to understand mathematical concepts that are presented in the form of narratives (Bae, 2013). Autism is a spectrum disorder that affects a person's ability to communicate and socialize. In order to address this issue, a learning model is required that is capable of assisting autistic children in comprehending mathematical problems that are presented in the form of stories and identifying the stages for problem-solving, thereby increasing their capability to solve mathematical problems that are presented in the form of narrative.

One of the many different learning models that may be utilized, the problem-solving learning model is one of the options available to children with ASD (Beverdors et al., 2008). The use of a problem-solving paradigm that is widely regarded as being of very high quality contributes to the growth of students' ability to find solutions to a variety of challenges. In order for students to effectively solve the problem, there is a total of four (four) work that needs to be done before the problem can be considered solved. The first phase in this process is to get an understanding of the problem at hand, the second step is to design a solution, the third step is to put that plan into action, and the fourth step is to do an additional check on the answers that have been established.

It is believed that a learning problem solving model can improve autistic children's ability to solve mathematical problems presented in the form of stories (See for example: Rockwell et al., 2011; Schaefer Whitby, 2013; Root & Browder, 2019; Cox & Root, 2020; Root et al., 2021). This is due to the fact that through this learning, students are trained to find the essence of the problem, then simplify the sentence of the story by writing known and asked data (Beverdors et al., 2008). Consequently, it is believed that this learning can help autistic children. This is one of the reasons why it is believed that this kind of learning has the potential to enhance autistic children's ability to work through mathematical challenges. By

writing down the information that is already known and then asking questions about it, it is feasible to bridge the gap in the students' grasp of the subject. This is due to the fact that the inquiry's language gets simpler to understand. Because of this, it is essential that additional study be conducted into the usefulness of learning problem-solving models to boost autistic students' ability to solve mathematical questions that are given in the form of stories.

### **Methods**

This study is an example of single subject research, which is a kind of quantitative research that only involves one participant in the experiment. The primary methodology used in SSR research is observing people in a state for which they are not receiving therapy, after which they are given treatment, and the researchers evaluate how the treatment affects the people's capabilities. In this research, the link between the use of problem-solving learning models and the capacity of children with autism spectrum disorder (ASD) to solve mathematical problems presented in the form of tales will be investigated.

This investigation makes use of a design known as the A-B-A' design, which is broken down into three distinct stages: The Baseline-1 (A), intervention (B), and Baseline-2 (A') phases. The A-B-A design will demonstrate that there is a causal connection between the variable that is being dependently examined and the variable that is being investigated independently. In the current investigation, the use of the A-B-A design serves the objective of determining how much of an impact the learning of problem-solving models has on the capability of children with ASD to solve mathematical problems presented in the form of tales.

The learning problem solving approach that was used in this investigation was a problem-based learning model that was developed to teach autistic kids how to obtain information from a mathematical problem that was presented in the form of a storyline. Developing methods for addressing problems by assembling mathematical phrases based on the information that is already available. Putting into action techniques for problem solving that have been developed, which involves conducting mathematical operations in accordance with mathematical phrases that have been produced by students, and then re-examining by analysing the appropriateness between the solutions and the queries.

For the purpose of this investigation, the researchers used several methods of data gathering, including learning outcome exams. A test is a series of questions or exercises designed to evaluate the level of knowledge, intellect, abilities, or qualities held by a person or group of people. A learning outcome test will be used as the method of evaluation in this study. The purpose of this test is to collect quantitative data regarding the subject's capability to solve mathematical problems presented in the form of stories before, during, and after receiving an intervention. The data will be gathered using the subject's performance on the test. The quantitative data that was gathered as a consequence, presented in the form of the subject's rate of providing accurate answers.

## Results

### Baseline 1

The Baseline-1 procedure was carried out over the course of three sessions, with each session lasting for a duration of thirty minutes. During each session of baseline-1, the subject was given ten questions to measure his or her knowledge and the researcher observed the subject as they worked through the problems. The set of ten questions consists of three mathematical problems presented in the form of addition stories, three mathematical problems presented in the form of subtraction stories, and four mathematical problems presented in the form of mixed arithmetic operations involving addition and subtraction.

The data that were collected during the third session of baseline-1 demonstrated stability, which allowed the baseline-1 phase to be terminated. The subject was able to solve 2 of the 10 questions presented in the first and second sessions on their own, 1 item with assistance from the researcher when doing calculations, and 7 items did not work despite the fact that the subject had received assistance from the researcher. Therefore, the achievement value for the first and second sessions is 45%. The subject was able to successfully complete 3 questions on their own during the third session, whereas 7 questions were not successfully finished despite the fact that the subject had gotten support from the researcher. Therefore, the accomplishment value was calculated to be 47.5%. When the subject was working on the test questions throughout the three baseline-1 sessions, the subject made the mistake of adding up all of the numbers that were included in the question. This was an error. In order to provide more clarity about the statistics concerning the percentage of subject accomplishment in the process of solving mathematical problems presented in the form of tales collected from the baseline-1 phase.

Table 1. Baseline Results-1 Percentage of Achievement of Ability to Solve Math Problems in The Form of Stories

Session	Score	Category	Achievement
Session 1	18	45%	Very lacking
Session 2	18	45%	Very lacking
Session 3	19	47,5%	Very lacking
<b>Total</b>	<b>18,33</b>	<b>46%</b>	<b>Very lacking</b>

As can be seen in the table that is located above, the subject's ability to solve mathematical problems that are told in the form of stories is not even close to being satisfactory. This is shown by the fact that the subject's achievement score is still less than 54%. This may be seen by taking a look at the subject's achievement score in baseline-1 for the job of solving mathematical problems that are told to them in the style of stories. In the first session, this accounts for 45% of the total, in the second session it accounts for 45% of the total, and in the third session it accounts for 47.5% of the total. The achievement of the subject in the process of solving mathematical problems that were provided in the form of stories obtained a score of 46% on average.

### Intervention

In most cases, the researcher will start the class by welcoming the students and then go on to the next phase in the process, which is the implementation of the intervention to solve math problems in the form of a narrative utilizing problem-solving learning models. In addition to questioning the topic of the activities that they participated in throughout the break. In addition, the researcher provided an explanation about the subject matter that was going to be investigated, which was then followed by questions and responses regarding the topic that was brought up in the form of a tale. After that, the researcher provided examples of questions to be asked and then illustrated how to find a solution to the issue using the step-by-step approach to problem solving. Before asking the subject to independently complete 5 practice questions, the researcher assists the subject in completing 2 sample questions and then directs the subject through the completion of those sample questions. At the conclusion of the session, participants will reflect on what they have just learnt.

Table 2. Intervention Results Percentage of Achievement Ability to Solve Math Problems in Story Form

Session	Score	Category	Achievement
Session 1	16	80 %	Good
Session 2	16	80 %	Good
Session 3	18	90 %	Very Good
Session 4	16	80 %	Good
Session 5	18	90 %	Very Good
Session 6	18	90 %	Very Good
Session 7	18	90 %	Very Good
Session 8	19	95%	Very Good
<b>Total</b>	<b>18,33</b>	<b>86%</b>	<b>Very Good</b>

According to the data shown in the table above, the subject's ability to answer mathematical problems disguised as tales over the course of the intervention was excellent, as evidenced by an average accomplishment score that was higher than 86%. This can be seen from the subject's achievement score in solving math problems presented in the form of stories during the intervention, which was 80% during the first session, 80% during the second session, 90% during the third session, 80% during the fourth session, 80% during the fifth session, 90% during the sixth session, 90% during the seventh session, and 95% during the eighth session. As a consequence, an overall score of 86% was achieved.

### Baseline 2

During the baseline-2 phase, the investigators will collect data to determine the subject's ultimate capacity after the intervention has been administered. The final ability that was investigated during the baseline-2 phase was the subject's capacity to solve mathematical problems involving addition, subtraction, and mixed arithmetic operations between addition and subtraction. These types of problems were presented in the form of addition, subtraction, and mixed arithmetic operations. The Baseline-2 procedure was carried out over the course of three sessions, with each session lasting for a duration of thirty minutes. During each session

of the baseline-2 phase, you will give the identical test questions that you did during the baseline-1 phase. These questions will be used to evaluate your progress. The questions that have been provided include three arithmetic problems presented in the form of stories with addition material, three arithmetic problems presented in the form of stories with subtraction material, and four arithmetic problems presented in the form of stories with mixed arithmetic operations that include both addition and subtraction.

The execution of sessions 1, 2, and 3 in baseline-2 proceeded well and as planned. Because the data that were collected during the third session of baseline-2 demonstrated stability, the baseline-2 phase has been terminated. The subject was able to independently answer 10 out of the 10 problems that were provided in the first, second, and third sessions. As a result, the subject received a score of 100 percent for accomplishment in the first, second, and third sessions. When the accomplishment score is more than 86%, it indicates that the subject has a very excellent capacity to solve mathematical problems presented in the form of tales. This can be shown by looking at the subject's accomplishment score in answering arithmetic questions presented in the form of a narrative in baseline-2. More specifically, the subject obtained a score of 100% in achievement during the first, second, and third sessions of the study.

### **Discussion**

According to the findings of the investigation into the circumstances, it is known that the duration of the baseline-1 (A) = 3, the intervention (B) = 8, and the baseline-2 (A') = 3. The outcomes of the tendency toward rising both at baseline-1 and intervention while remaining level at baseline-2 Trend toward stability, with baseline-1 representing stability, intervention representing stability, and baseline-2 representing stability. The data trail has a pattern of increasing, and the level of stability and range for baseline-1 is stable, with a range of 42.5%-49.5%; the level of stability and range for intervention is stable, with a range of 80%-93%; and the level of stability and range for baseline-2 is stable, with a range of 100%-100%. The changes in the level of baseline-1 were (+2.5), which indicates improvement; intervention was (+15), which indicates improvement; and baseline-2 was (=0), which indicates no change.

Calculating the difference in data between the baseline-1 data from the previous session and the intervention data from the first session was what was needed to establish the extent of change that occurred. The value of the difference indicates the degree to which there is a shift in behavior as a direct consequence of the intervention. The change in level that occurred between the baseline-1 and intervention phases of this research was +32.5%, while the change in level that occurred between the intervention and baseline-2 phases was +5.

Between the baseline-1 phase and the intervention phase, as well as between the baseline-1 phase and the baseline-2 phase, the trend of stability changed from stable to stable. When compared to the subject's performance in the final session of the baseline-1 phase, the subject's performance in the first session of the intervention phase showed a 32.5% improvement in their ability to answer mathematical problems using addition, subtraction,

and mixed arithmetic operations. This indicates that the situation improved or became better after the intervention phase was carried out, as shown by the plus sign. The data from the baseline-1 phase do not overlap with those from the intervention phase in any way. According to these findings, it demonstrates that administering the intervention phase has an effect on the behaviour that is being targeted; more specifically, the application of problem-solving model learning has an effect on the subject's ability to improve their ability to solve mathematical problems presented in the form of stories.

The application of problem-solving model learning can help the subject's difficulties in solving mathematical problems presented in the form of stories, particularly in analysing and understanding problems and in determining the steps for solving problems (Polo Blanco et al., 2022; Browder et al., 2017). This is because problem-solving models are designed to help learners determine how to approach and solve problems (Bae et al., 2015). This is because the participant in the research will be directed to discover the core of the issue and then will be asked to summarize it using data that is both known and gathered. Students may have an easier time grasping the issue if they write down the data that is known and questioned about it. This makes the language of the question more straightforward. The subject may decide the kind of arithmetic operation that should be used to solve the issue by looking at the data that is known and that has been requested for.

This research was conducted with the intention of determining whether or not the use of problem-solving learning models may effectively increase a subject's capacity to answer mathematical problems presented in the form of tales. A measure of something's effectiveness is one that indicates how close it is to being able to accomplish the goal. If a subject is able to solve mathematical problems in the form of stories, addition, subtraction, and mixed arithmetic operations optimally while meeting the minimum completeness criteria established by the school, which is 70%, then the application of the problem-solving learning model can be said to be effective. This ability is demonstrated by the subject's capacity to comprehend and recognize data in mathematical problems presented in the form of narratives, to formulate solutions to problems in the form of mathematical sentences, to carry out calculations based on mathematical sentences that have been compiled, to re-examine the appropriateness of the data in the questions in relation to the results discovered, and to write conclusions.

The total number of sessions that comprised the intervention that was carried out in this research was eight. The eight meetings were broken down as follows: one meeting covered material for addition in the form of story form math problems, two meetings covered material for subtraction in the form of story form math problems, three meetings covered material for identifying addition and subtraction in the form of story form math problems, and the final two meetings covered material for operations. arithmetic questions sometimes take the shape of tales, and you'll need to solve them using a combination of addition and subtraction.

The intervention data revealed that the subject's accomplishment score in the process of solving mathematical problems presented in the form of tales kept rising from the first meeting all the way through the third meeting. The subject's accomplishment score dropped

from 90% to 80% after the fourth meeting with the material to identify addition and subtraction in narrative form math problems. This was due to the fact that the score had previously been 90%. This demonstrates that the subject has not really been able to figure out the processes for solving mathematical problems presented in the form of tales from the first meeting up to the third meeting (Browder et al., 2017).

### **Conclusion**

It is possible to draw the conclusion, in light of the research that has been conducted, that the implementation of the problem-solving learning model is both influential and efficient in terms of enhancing the capability of autistic students to solve mathematical problems presented in the form of stories. This is in accordance with the increasing percentage of the subject's ability to solve test questions consisting of math problems in the form of addition, subtraction, and mixed arithmetic operations between addition and subtraction. The test questions consist of math problems in the form of addition, subtraction, and mixed arithmetic operations between addition and subtraction. The accomplishment score for the topic in the baseline-2 phase in terms of answering math problems presented in the form of tales is a perfect 100%. The result is far higher than the school's predetermined benchmark for academic accomplishment, which is 70%. There is no data that overlaps or overlaps in either the baseline-1 phase or the intervention phase's data, which means that overall, it is possible to draw the conclusion that the implementation of problem-solving model learning has a positive effect on improving the subject's ability to solve mathematical problems presented in the form of stories.

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