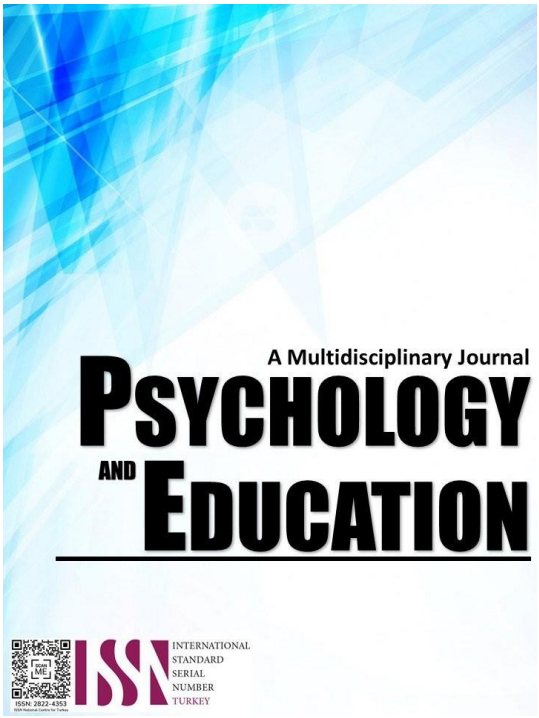
EFFECTIVENESS OF AGONSA CHART IN IMPROVING STUDENT MATHEMATICAL PROBLEM-SOLVING SKILLS



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Research Article

Effectiveness of Agonsa Chart in Improving Student Mathematical Problem-Solving Skills

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Abstract

The purpose of this research is to determine how well the AGONSA pocket chart works as an intervention approach to improve learners in Grade 6's ability to solve mathematical word problems. Forty-five students from elementary school took part in the activity, and at first, their proficiency in solving mathematical puzzles varied. Pre- and post-test assessments were used in the study to look at how the AGONSA chart affected the skills of the participants. The pretest results showed that a large percentage of students had difficulty solving arithmetic word problems prior to the intervention, with the majority of answers falling into the "Unsatisfactory" and "Poor" categories. The posttest results showed some improvement in the "Satisfactory" and "Very Satisfactory" categories, indicating some development. Even so, a large portion continued to fall into the "Unsatisfactory" category, suggesting persistent difficulties with problem-solving abilities. The pretest and posttest mean scores differed significantly, according to statistical analysis using t-tests, indicating that the intervention significantly increased proficiency. This statistical significance demonstrated how well the AGONSA chart works as a tool to improve grade six students' ability to solve mathematical problems. The results indicate that although the intervention resulted in some progress, more work is still needed to address enduring difficulties in solving mathematical word problems. In order to further improve students' proficiency in this crucial skill area, it highlights the significance of focused interventions and structured methods to problem-solving. The study demonstrates how the AGONSA chart can be an effective teaching tool that supports students' understanding and implementation of mathematical problem-solving techniques, leading to improved academic achievement in mathematics.

Keywords: *agonsa, mathematical word problems, intervention, effective*

Introduction

Word problems in mathematics often pose a challenge because they require the students to read and comprehend the text of the problem. It also identifies the question and creates and solves a numerical equation. Many students may have difficulty reading and understanding the written content in a word problem. For this reason, students should learn key terminology before attempting to solve mathematical word problems. The technique of using Agonsa Chart in solving problems. It develops the fluency, flexibility and reading comprehension of students to become adept at mathematical thinking and reasoning. It also fosters and facilitates creative thinking. It also makes students do step by-step processes they use as they solve problems.

Word Problem-solving is a dominant mathematical competency in the 21st century. It plays a vital role in the process of teaching and learning of mathematics. Educators strive hard to seek appropriate methods that may help students to become better problem solvers in real-world situations. Until now, many researchers continue to investigate suitable methods in improving the abilities of students. For students to feel comfortable with the process of solving a worded problem, mathematics teachers provide many problem- solving experiences in their classes. Letting students engage in this activity may develop their mathematical thinking and reasoning. According to Laguda (2007), problem-solving is the process of interpreting a situation mathematically that usually engages several repetitive cycles of expressing, testing, and revising mathematical interpretation.

Furthermore, word Problem-solving is a form of inquiry learning that requires the application of existing knowledge to the unfamiliar with innovative situations to gain new knowledge (Edwards, 2008). It also refers to a vehicle for learners to evaluate, construct, and refine their own beliefs and theories about mathematics as it relates to the beliefs and theories of others. Schoenfeld, (1992) mentioned that engaging in problem-solving involves finding an answer for a particular problem and encouraging learners to develop their ability to think mathematically. The processes involve the use of content knowledge, procedures, strategies, language, and reflections.

The main focus of this study is to explore whether AGONSA chart can help students in solving worded problems. Specifically, it aimed to determine the students' feelings about solving math problems, AGONSA pocket chart strategy provides some advantages to the students in solving mathematical word problem. First, the students think creatively, critically, and logically, secondly their ability to structure and organize, thirdly their ability to process information. Fourthly, their enjoyment of an intellectual challenge and lastly their skills to solve word problems that help them to investigate and understand the world.

Research Questions

This study sought to answer the following questions:

1. What are the pretest scores of the Grade six Learners before using the AGONSA chart?
2. What are the posttest scores of the Grade six after using the AGONSA chart?
3. Is there a significant difference in the pretest and posttest results before and after using the AGONSA chart?

Literature Review

"I hate math!" and "I hate word problems!" are common remarks heard in math classes when students are tasked with solving word problems. Many learners struggle to understand these problems or hesitate to apply their knowledge to real-world scenarios. This challenge often stems from traditional teaching approaches that emphasize rote learning and algorithms over independent thinking and practical application. Unfortunately, this hinders the development of critical problem-solving skills necessary for navigating real-life situations.

The aspiration of every Filipino is to improve their quality of life and contribute to national development. Achieving this requires equipping students with essential skills, including numerical literacy. As technological advancements reshape society, the ability to think logically and apply mathematical concepts has become a crucial aspect of quantitative literacy, moving beyond simple calculations (Olayvar, 2019). Despite this, many students perceive math as a difficult and tedious subject, which can lead to avoidance and disengagement, even at higher academic levels.

Problem-solving plays a pivotal role in mathematics education (Wilson, Fernandez, & Hadaway, 2011). The ultimate goal of teaching mathematical problem-solving is to empower students to handle real-world challenges effectively, fostering critical thinking, reasoning, and a deep understanding of mathematical concepts (Schoenfeld, 1992; Schoen & Charles, 2003). However, problem-solving is among the most challenging topics to teach, as it requires a diverse set of skills, including procedural knowledge, logical reasoning, and conceptual understanding (Dendane, 2009). Students often struggle with these skills, leading to frustration and underachievement in the subject.

Reys et al. (2001) highlight that mathematical problem-solving not only helps students solve real-life problems but also enhances their ability to work collaboratively, think critically, and reason effectively. Yet, students frequently express difficulty in solving word problems, citing fears, misunderstandings, and procedural flaws. Rosario (2015) noted that these challenges often result in low performance in mathematics, particularly in problem-solving tasks. Overcoming these obstacles requires implementing effective teaching strategies that help students build confidence and proficiency.

The Philippines' performance in mathematics education remains concerning. In the Trends in International Mathematics and Science Study (TIMSS), the Philippines ranked poorly compared to other countries, reflecting deficiencies in math and science education (Bulac, 2018). Such findings underscore the need for innovative approaches to improve learning outcomes. Teachers are encouraged to adopt strategies such as journaling and reflective practices, which allow students to articulate their problem-solving processes and learn from their mistakes (Taban & Cadorna, 2019). Unfortunately, these methods are not yet common in most math classrooms, which continue to rely on traditional problem-solving exercises.

Incorporating modern teaching approaches such as cooperative learning, project-based learning, and mathematical modeling can significantly enhance students' understanding of real-life applications (Özturan Sağırlı, 2010; Blum, 2011). Mathematical modeling, for instance, encourages critical thinking and reasoning, enabling students to connect abstract concepts with tangible problems. As Seyed Alian and Salehi (2021) noted, many students struggle with math due to traditional teaching methods, which often fail to engage them meaningfully. Exploring technology-based approaches and differentiated instruction can address these challenges and make learning math more accessible and enjoyable.

Every Filipino dreams of elevating the nation’s development and living standards. Achieving this goal requires fostering numeracy and problem-solving skills among learners. Effective teaching methodologies and targeted interventions are essential to enhance students’ proficiency and ensure that they are equipped to meet the demands of an ever-evolving world. By addressing the barriers to math education and adopting innovative strategies, educators can help students overcome their fear of math and prepare for a brighter future.

Methodology

Research Design

The study utilized experimental in one-group. In this design, the dependent variable is measured once before the treatment is implemented and once after it is implemented. Hence, the study will determine the relationship between used of the performance of the respondents before and after the treatment of Agonsa pocket chart in improving students mathematical problem-solving skills. Moreover, the one-group posttest-only design, also known as the one-shot case study, is the form of quasi-experimental that is most vulnerable to internal validity challenges. The one-group posttest-only design requires a researcher to measure a dependent variable for one group of participants after a treatment.

Respondents

The researchers randomly selected 45 Grade 6 learners from an elementary school, specifically targeting those who demonstrated lower scores in Mathematics as the study's respondents.

Instrument

The primary instrument utilized in this study was the AGONSA pocket chart, designed to provide a simpler and faster method for

understanding and solving mathematical word problems. The researchers also incorporated ten adopted word problems as part of the study. AGONSA, an acronym for Asked, Given, Operation, Numbers, Solution, and Answer, serves as a step-by-step guide to solving mathematical word problems effectively.

The Innovation of AGONSA

Word problem-solving holds significant importance in mathematics education (Wilson, Fernandez, & Hadaway, 2011), as it helps students develop the ability to solve real-life problems and apply mathematics in everyday situations. It also deepens understanding of mathematical concepts. However, successful problem- solving involves various skills, making it one of the most complex topics to teach (Dendane, 2009). Mathematics is essential for quantifying and solving both natural and man-made problems, contributing to advancements in social, economic, and technological fields (Dendane, 2009).

To make problem-solving easier and more accessible, the researchers utilized the AGONSA method, which stands for Asked, Given, Operation, Numbers, Solution, and Answer. AGONSA charts are designed to engage and motivate students, improving their comprehension and problem-solving abilities. Repetition through the process helps students master solving mathematical word problems. This method fosters mathematical thinking and reasoning while providing a hands-on, repetitive approach to solving problems.

The study primarily explores how AGONSA can help students improve their mathematical problem- solving skills, aiming to gauge students' attitudes toward solving math problems. Word problem-solving is crucial in the 21st century, and educators are continuously seeking methods to improve students' problem- solving abilities. AGONSA, as a classroom tool, is engaging and durable, offering a practical approach to enhancing students' skills through repetition and critical thinking. As an educational strategy, AGONSA has gained attention for its ability to make mathematics more engaging and applicable, while promoting collaborative learning and problem-solving in real-world scenarios.

Procedure

The researchers personally administered a pretest consisting of 10 word problems to the Grade 6 learners. During the scheduled session, the researchers provided instructions and guided the students in analyzing and comprehending the given questions. The pretest results were recorded for analysis. Following this, the researchers introduced the AGONSA method to the participants, discussing its purpose and application in solving mathematical word problems.

Subsequently, the researchers presented a customized AGONSA chart to the Grade 6 learners. The chart featured various colors, each corresponding to a specific step in the problem-solving process: red for Asked, orange for Given, yellow for Operation, green for Numbers, blue for Solution, and violet for Answer. Each step included a "mystery question" to guide the learners through the process. The AGONSA method was designed as a step-by-step guide to enhance students' understanding and ability to solve mathematical word problems.

Afterward, a posttest was administered using the same set of word problems. The posttest results were recorded and compared to the pretest scores to determine any improvement in the learners' performance.

The study employed an experimental research design, specifically the pretest-posttest two-group method. For data analysis, the researchers used the T-test statistical tool to evaluate the significant difference between the pretest and posttest scores of the respondents, providing insights into the effectiveness of the AGONSA method.

Data Analysis

To address the first two research questions, descriptive statistics were employed. Specifically, the mean and standard deviation were calculated to analyze the pretest and posttest scores, providing a summary of the learners' performance before and after the intervention.

For the third research question, a T-test was conducted to examine the relationship between students' mathematical problem-solving skills before and after the implementation of the AGONSA chart. This statistical test was utilized to determine whether the observed differences in scores were statistically significant.

Results and Discussion

This section presents the analysis and interpretation of the data gathered, addressing the specific research problems outlined in the introduction. It includes explanations of the relationships between variables and the evaluation of hypotheses, supported by concrete evidence from the data.

Table 1 presents the pretest results of the respondents, categorized into performance levels: outstanding, very satisfactory, satisfactory, unsatisfactory, and poor. The data shows that none of the respondents scored in the outstanding range (9–10). Only 3 respondents, representing 6.7%, achieved scores within the very satisfactory range (7–8), while 10 respondents (22.2%) scored in the satisfactory range (5–6). A significant portion, 14 respondents (31.1%), fell into the unsatisfactory range (3–4), and the majority, 18 respondents (40%), scored in the poor range (0–2).

Table 1. *Distribution of Pretest Scores of Grade 6 Learners in Mathematical Problem-Solving without Using AGONSA Chart*

Pretest Scores	*Description*	*F*	*%*
9-10	Outstanding	0	0
7-8	Very Satisfactory Satisfactory	3	6.7
5-6		10	22.2
3-4	Unsatisfactory	14	31.1
0-2	Poor	18	40
Total		45	100.0

Mean 3.49
SD 2.02

This indicates that a high percentage of students performed in the lower categories, highlighting the need for targeted interventions and additional support to strengthen their understanding of fundamental mathematical concepts. As Kilpatrick et al. (2013) noted, teachers may struggle to adequately explain concepts they do not fully grasp themselves, and this can hinder their ability to engage students in exploring multiple approaches to solving problems. Seyed Alian and K. Salehi (2021) emphasized the critical role of mathematics in education, yet students' declining interest in the subject remains a global challenge. Mathematics is often perceived as complex, leading many students to either avoid or struggle with it. Recognizing this difficulty, researchers and educators have focused on identifying factors that influence mathematics learning and exploring innovative teaching approaches.

In the context of the Philippines, improving quantitative literacy is essential to achieving national development goals. As Olayvar (2019) argued, the definition of quantitative literacy has evolved from merely performing simple mathematical calculations to understanding and effectively communicating mathematical concepts through logical thinking. Teachers are encouraged to implement differentiated instructional strategies to address the diverse needs of learners. The findings of this study underscore the urgency of providing targeted support and refining problem-solving strategies to enhance student proficiency in mathematics.

Table 2. *Distribution of Posttest Scores of Grade 6 Learners in Mathematical Problem-Solving Using AGONSA Chart*

Posttest Scores	*Description*	*F*	*%*
9-10	Outstanding	2	4
7-8	Very Satisfactory Satisfactory	6	13.3
5-6		11	24.4
3-4	Unsatisfactory	23	51.1
0-2	Poor	3	6.7
Total		45	100.0

Mean 4.69
SD 1.86

Table 2 presents the results of the posttest, categorized into outstanding, very satisfactory, satisfactory, unsatisfactory, and poor. The data show improvements compared to the pretest scores, indicating progress in students' understanding and application of problem-solving techniques. Specifically, 2 students (4%) scored between 9-10, classified as outstanding, while 6 students (13.3%) scored 7-8, categorized as very satisfactory. Furthermore, 11 students (24.4%) scored between 5-6, classified as satisfactory. However, a significant portion of students, 51.1%, scored between 3-4, which is unsatisfactory, and 3 students (6.7%) scored between 0-2, indicating poor performance.

The high percentage of students in the unsatisfactory category suggests that they may still struggle with key aspects of mathematical problem-solving, such as identifying the given information, applying appropriate operations, and formulating correct number sentences. This highlights the need for continued emphasis on teaching students a systematic approach to problem-solving, involving the components of asking, given, operation, number sentence, solution, and answer. Teachers should guide students through each step, helping them to read and comprehend problems, identify essential information, choose the correct operation, and articulate the final solution clearly.

While the results suggest that some students continue to face challenges, the improvements in the satisfactory and very satisfactory categories indicate that the AGONSA chart had a positive impact on students' ability to solve mathematical word problems. The AGONSA chart's structured approach provides a valuable intervention for developing problem-solving skills, emphasizing a step-by-step method for tackling word problems.

This aligns with Zimmerman's (2000) description of instructional strategies, where teachers use diverse approaches such as cooperative learning, project-based learning, and problem-solving education to support student growth. Math modeling, as highlighted by Özturan Sağırlı (2010), also enhances critical thinking and reasoning skills, making abstract concepts more tangible. Blum (2011) suggests that integrating real-life problems through mathematical modeling improves students' ability to relate math to everyday situations. In response to these findings, the researcher implemented the AGONSA intervention to further enhance students' problem-solving skills.

Many researchers continue to explore effective methods for improving students' abilities in mathematics. By providing a variety of problem-solving experiences, mathematics teachers can help students become more comfortable with word problems. The AGONSA

chart, designed to be both engaging and durable, is a valuable tool in the classroom for fostering student engagement and reinforcing problem-solving strategies.

As Mayer et al. (1995) note, the process of solving non-routine problems is more significant than simply reaching the correct answer. Students who explore alternative strategies develop critical thinking skills and are better equipped to solve real-life problems. This approach fosters creativity, logic, and problem-solving abilities, essential skills in mathematics and beyond (Bayazıt & Koçyiğit, 2017). Thus, incorporating non-routine problems into teaching not only improves students' problem-solving skills but also cultivates positive attitudes toward mathematics (Koc, Damla & Elci, Aysun, 2022).

Table 3. *Comparison of Pretest and Posttest Scores of Respondents*

Scores	*Respondents*	*Mean*	*SD*	*T-test*	*Decision*
Pretest	45	3.49	2.02	4.34	Reject
Posttest	45	4.64	1.86		

**significant at the 0.05 level*

Table 3 shows the difference between the pretest and posttest scores of the respondents, revealing a significant improvement. The computed t-value of 4.347 is greater than the 0.05 level of significance, leading to the rejection of the null hypothesis. This suggests that the intervention positively impacted the respondents' ability to solve mathematical word problems.

The rejection of the null hypothesis indicates a significant difference between the pretest and posttest scores, confirming that the use of the AGONSA chart intervention improved the respondents' problem-solving skills. The comparison of the pretest and posttest scores, along with the gain scores, demonstrates the level of progress achieved after the intervention. Positive gain scores suggest improvement, while negative scores indicate a decline. In this case, the significant positive change further validates the effectiveness of the AGONSA chart in enhancing mathematical problem-solving abilities.

Rosario (2015) noted that solving mathematical word problems has become a key focus in mathematics education, as many students struggle with them, often resulting in failure. This challenge can stem from factors such as fear of problem-solving, poor comprehension, a lack of subject knowledge, procedural errors, or the complexity of the problems. However, when students employ effective problem-solving strategies, they are more likely to arrive at correct answers. In line with this, Taban and Cadorna (2019) emphasized the importance of strategies like maintaining folders or journals as part of assessment methods to improve students' problem- solving skills.

The researcher used the AGONSA Pocket Chart to support students in solving word problems and enhancing their mathematical problem-solving abilities. Word problem-solving is a critical mathematical competency in the 21st century, and educators are continually seeking methods that can help students become more effective problem solvers in real-world situations.

Conclusions

Based on the findings of the study, the researchers concluded that the use of the AGONSA chart is an effective method for improving students' mathematical problem-solving skills. The AGONSA approach has shown a significant positive impact on enhancing students' abilities to solve mathematical problems. Statistical analysis reveals a notable improvement in mean scores from the pretest to the posttest, supporting the effectiveness of the AGONSA intervention. The low p-value further underscores the statistical significance of this improvement, highlighting the importance of personalized interventions in addressing challenges in solving mathematical word problems.

In light of these conclusions, the following recommendations are made: Educational institutions may consider adopting the AGONSA technique as a remedial strategy to help students strengthen their mathematical problem- solving skills. School administrations should provide support and supervision to teachers in the effective use of the AGONSA technique. Teachers should take proactive steps to continue developing their knowledge and skills in using the AGONSA method, ensuring their effectiveness in fostering lifelong learning. Educators should also explore and implement techniques tailored to address specific challenges in mathematical problem-solving. The findings emphasize the value of customized interventions in enhancing students' competency in particular skill sets. Future researchers may explore studies related to the effectiveness of the AGONSA technique and its potential applications in various educational contexts.

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