

Problem-Solving Attitudes and Students' Academic Performance in Mathematics: Basis for Intervention Program

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ABSTRACT

This study determined the problem-solving attitudes and academic performance in Mathematics of Grade 4 pupils and examined the relationship between these variables as a basis for an intervention program. A descriptive-correlational design was employed at Annafunan Integrated School, Tuguegarao City, during School Year 2024–2025. From a population of 202 Grade 4 pupils, 133 were selected through simple random sampling using the Raosoft sample-size calculation. Problem-solving attitudes were measured through an adopted questionnaire from Ndlovu (2017), validated by the research adviser and an expert, while academic performance was obtained from pupils' final Mathematics ratings. Weighted mean and descriptive analysis summarized the variables, and Pearson product-moment correlation tested their relationship at the .05 level of

significance. The pupils generally agreed with the positive problem-solving attitude indicators (grand mean = 2.91). Their overall Mathematics performance was very satisfactory (average = 86.2), with 61 pupils (45.86%) classified as very satisfactory, 37 (27.82%) satisfactory, 21 (15.79%) outstanding, 14 (10.53%) fairly satisfactory, and none below expectations. A weak but statistically significant positive relationship was found between problem-solving attitudes and academic performance ($r = .186$, $n = 133$, $p = .033$), leading to rejection of the null hypothesis. The findings indicate that more positive problem-solving attitudes are associated with slightly higher Mathematics performance, although other instructional and contextual factors also matter. The resulting intervention program emphasizes confidence-building, small-group tutoring, teacher sensitivity, parent-teacher collaboration, engaging problem-solving activities, and continuous monitoring.

Keywords: *problem-solving attitudes, Mathematics performance, Grade 4 pupils, mathematics education, intervention program, descriptive-correlational research*

INTRODUCTION

Mathematics education develops reasoning, analysis, and problem-solving capacities that learners use in school and in everyday situations. Philippine basic education likewise emphasizes the development of independent, creative, and critical thinking as part of lifelong learning. Within Mathematics, problem solving is not limited to obtaining a correct numerical answer; it also requires pupils to understand a situation, select or construct a strategy, persist through difficulty, and evaluate the reasonableness of a solution. Difficulties in these processes can become barriers to academic achievement when pupils lack a strong conceptual foundation or struggle to interpret mathematical problems (Phonapichat et al., 2014; Salters, 2019).

Learners' attitudes toward Mathematics are important because confidence, willingness, perseverance, anxiety, and perceived value can influence whether they engage with challenging tasks. Positive learning experiences can strengthen favorable attitudes, whereas repeated difficulty or negative experiences may foster

avoidance and reduced persistence (Giannoukos, 2024). Research on mathematical affect similarly recognizes motivation, engagement, and identity as closely connected with how learners approach mathematical activity (Hannula et al., 2019). In problem-solving contexts, Sturm and Bohndick (2021) showed that attitudes and beliefs can be related to performance and may be addressed through structured training and reflective problem-solving experiences.

At Annafunan Integrated School, teachers observed a continuing need to support pupils in understanding and solving mathematical problems while sustaining productive attitudes toward the subject. Previous studies have reported that attitudes toward Mathematics may be associated with achievement, but the strength and nature of this association can differ across learners, contexts, and instructional conditions (Kele & Sharma, 2014; Sanchal & Sharma, 2017). This makes school-level evidence necessary before designing interventions that focus on confidence, persistence, engagement, or specific problem-solving practices.

Accordingly, this study examined the problem-solving attitudes of Grade 4 pupils, described their academic performance in Mathematics, tested whether the two variables were significantly related, and used the findings as the basis for an intervention program. The study was intended to provide administrators and teachers with a practical basis for targeted Mathematics support, help pupils recognize productive problem-solving dispositions, encourage parents to support learning at home, and provide a reference for future educational research.

Literature Review

Problem-Solving Attitudes in Mathematics

Attitude toward mathematical problem solving includes learners' feelings, beliefs, confidence, willingness, and behavioral tendencies when facing problems. Positive attitudes are reflected in readiness to try, willingness to persist, comfort with challenge, and belief that problem solving is valuable. Russo and Minas (2020) reported that primary learners can respond positively to challenging problem-solving tasks, particularly when the tasks are meaningful and enjoyable. Russo and Hopkins (2019) likewise highlighted the value learners place on challenging tasks when these provide purposeful opportunities for mathematical thinking.

Confidence and perseverance are especially important because problem solving frequently requires sustained effort after an initial strategy fails. Hendriana et al. (2018) connected problem-based learning with mathematical problem-solving ability and self-confidence, while Sturm and Bohndick (2021) emphasized that willingness, perseverance, and self-confidence form important attitudinal dimensions related to problem-solving performance. These findings support classroom practices that develop constructive attitudes while providing pupils with strategies for understanding, representing, solving, and checking mathematical problems.

Academic Performance and Mathematics Learning

Academic performance in Mathematics reflects the extent to which pupils demonstrate expected competencies in mathematical knowledge and application. It is influenced by multiple interacting conditions rather than a single learner characteristic. Study habits, prior mathematical foundations, instructional practices, engagement, and learning resources can shape achievement (Bentil et al., 2018; Salters, 2019). In the classroom, teachers therefore need approaches that both strengthen mathematical understanding and sustain pupil participation in learning.

Instructional environments that encourage active engagement and meaningful problem solving may support achievement. Zakaria and Syamaun (2017) found that realistic mathematics education improved achievement, while Kurt and Benzer (2020) reported positive effects of STEM practices on academic achievement and problem-solving skills. These findings suggest that interventions for elementary pupils can combine explicit mathematical support with engaging activities and opportunities to apply reasoning, rather than treating performance as a product of attitudes alone.

Attitudes, Motivation, and Mathematics Achievement

Research has repeatedly considered how affective factors relate to Mathematics learning. Kele and Sharma (2014) described students' beliefs about learning Mathematics as part of the way they engage with the subject, and Sanchal and Sharma (2017) showed that teaching Mathematics in a sporting context could influence pupils' attitudes. Hourigan et al. (2016) likewise documented changes in attitudes toward Mathematics through educational experiences. These studies indicate that attitudes can be shaped by classroom experiences and by the ways teachers organize mathematical activity.

The relationship between attitudes and achievement, however, should not be interpreted as purely causal. Mathematics performance also depends on knowledge, skill development, the learning environment, and available support. Hoorfar and Taleb (2015) linked mathematics anxiety with metacognitive knowledge, while Hannula et al. (2019) framed affect as involving motivation, engagement, and identity. Thus, a positive attitude can support persistence and participation, but effective Mathematics learning also requires sound instruction, appropriate tasks, feedback, and opportunities for practice.

Intervention Approaches for Mathematical Problem Solving

School-based interventions can address both academic and affective dimensions of problem solving. Ndlovu (2017) examined learners' attitudes toward Mathematics and their relationship with performance, providing the instrument basis for the present study. Sturm and Bohndick (2021) further demonstrated the value of training that encourages learners to generate external representations, analyze their work, and reflect on problem-solving processes. Such approaches align with the need to support confidence while strengthening pupils' actual problem-solving behaviors.

Intervention design may also include collaborative learning, teacher support, and home-school involvement. Positive teacher attitudes and supportive interactions can help create confidence and engagement, while small-group work provides opportunities to discuss strategies and receive immediate assistance. Evidence from problem-based and challenge-oriented learning suggests that pupils can benefit when Mathematics activities are purposeful, interactive, and appropriately demanding (Hendriana et al., 2018; Russo & Minas, 2020). These principles informed the study's proposed intervention program for Grade 4 pupils.

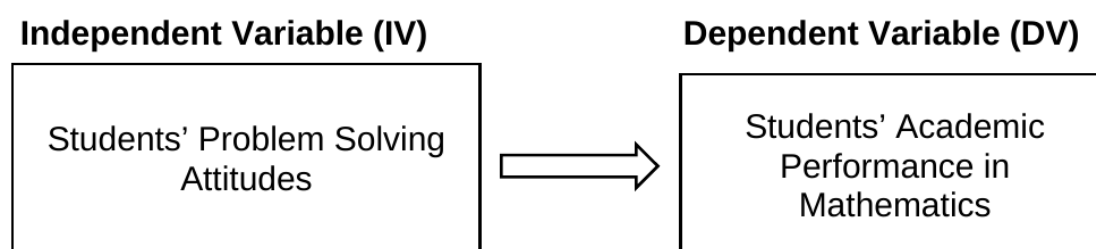


Figure 1. *Conceptual framework showing the relationship between students' problem-solving attitudes and academic performance in Mathematics.*

METHODS

Research Design

The study used a descriptive-correlational research design to describe Grade 4 pupils' problem-solving attitudes and academic performance in Mathematics and to determine whether the two variables were significantly related. No variable was experimentally manipulated. Correlational research was appropriate because the study examined the direction and strength of an association among naturally occurring variables (Bhandari, 2023). The descriptive component summarized the observed levels of problem-solving attitudes and academic performance, consistent with descriptive approaches that document conditions within their implementation context (Gu & Warren, 2017).

Research Locale

The study was conducted at Annafunan Integrated School, 103 Maharlika Highway, Barangay Annafunan East, Tuguegarao City, Cagayan Province, Philippines, during School Year 2024–2025. The school offers elementary and secondary education and served as the setting in which the participating Grade 4 pupils received Mathematics instruction.

Participants and Sampling Technique

The population consisted of 202 Grade 4 pupils of Annafunan Integrated School. Using the Raosoft sample-size calculator at the study's specified 5% setting, a sample of 133 pupils was obtained. The participants were selected through simple random sampling so that pupils in the population had an opportunity to be included in the study.

Research Instrument

Problem-solving attitudes were measured using an adopted questionnaire from Ndlovu (2017), titled Grade 10–12 Learners' Problem-Solving Attitude Towards Mathematics and How These Attitudes Affect Performance. The instrument contained 40 statements rated on a four-point Likert scale: 4 = Strongly Agree, 3 = Agree, 2 = Disagree, and 1 = Strongly Disagree. The questionnaire was reviewed by an expert and the research adviser for validity and appropriateness. Pupils' academic performance was obtained from their final Mathematics ratings for School Year 2024–2025.

Data Gathering Procedure

Before data collection, the researcher secured permission from the school principal to administer the survey and prepared a separate communication for the parents of the Grade 4 pupils. Parents were informed of the study and were involved in supporting their children during participation. After the required permissions had been obtained, the questionnaire was administered to the selected pupils, and the final Mathematics ratings needed for the academic-performance analysis were gathered in accordance with the approved procedure.

Data Analysis

Weighted mean and descriptive analysis were used to summarize the pupils' problem-solving attitudes. Mean scores of 3.25–4.00 were interpreted as Strongly Agree, 2.50–3.24 as Agree, 1.75–2.49 as Disagree, and 1.00–1.74 as Strongly Disagree. Mathematics performance was classified using the study's grading categories: 90–100 = Outstanding, 85–89 = Very Satisfactory, 80–84 = Satisfactory, 75–79 = Fairly Satisfactory, and below 75 = Did Not Meet Expectations. Pearson product-moment correlation was used to test the relationship between problem-solving attitudes and Mathematics performance at the .05 level of significance.

Ethical Consideration

The study observed voluntary participation, informed consent, confidentiality, and privacy. The school head approved the conduct of the research and distribution of the questionnaire, Grade 4 teachers were informed, and permission was sought from parents. Participants were informed about the study and assured that their identities would not be disclosed and that collected information would be used only for the stated research purposes. These procedures reflected the study's commitment to transparency, participant welfare, and responsible handling of research data (Žukauskas et al., 2018).

RESULTS AND DISCUSSION

Problem-Solving Attitudes of Grade 4 Pupils

The Grade 4 pupils generally expressed favorable problem-solving attitudes in Mathematics. Across the 40 indicators, the grand mean was 2.91, interpreted as Agree. The highest-rated statement was that problem solving is an important skill in Mathematics ($M = 3.10$). Pupils also agreed that problem solving helps develop the mind and teaches a person to think ($M = 3.07$) and that they feel a definite positive reaction toward mathematical

problem solving ($M = 3.07$). The lowest-rated item, although still within the Agree range, concerned not finding problem solving to be one of the most feared skills in Mathematics ($M = 2.68$).

Table 1. *Summary of Problem-Solving Attitudes of Grade 4 Pupils*

Selected indicator	Weighted mean	Interpretation
Problem solving is an important skill in Mathematics	3.10	Agree
Problem solving helps develop the mind and teaches a person to think	3.07	Agree
Definite positive reaction toward problem solving in Mathematics	3.07	Agree
Problem solving is a useful and necessary skill	3.06	Agree
Try to understand the problem before solving it	3.04	Agree
Inspired to solve word problems when the teacher is kind and understanding	3.04	Agree
Do not find problem solving among the most feared Mathematics skills	2.68	Agree
Grand mean across 40 indicators	2.91	Agree

The pattern indicates that pupils recognized the value of problem solving and were generally willing to engage with mathematical challenges, although some anxiety-related items received comparatively lower scores. This is consistent with evidence that learners can develop positive responses to challenging mathematical tasks when the activities are purposeful, engaging, and supportive (Russo & Hopkins, 2019; Russo & Minas, 2020). It also aligns with Sturm and Bohndick (2021), who emphasized willingness, perseverance, and self-confidence as important elements in the relationship between attitudes and problem-solving performance.

Academic Performance in Mathematics

The pupils' overall Mathematics performance was Very Satisfactory, with an average of 86.2. The largest group consisted of 61 pupils (45.86%) in the Very Satisfactory category. Thirty-seven pupils (27.82%) were Satisfactory, 21 (15.79%) were Outstanding, and 14 (10.53%) were Fairly Satisfactory. No pupil was classified as Did Not Meet Expectations. The distribution therefore shows that most pupils met or exceeded the expected Mathematics performance level, while a smaller group continued to require additional academic support.

Table 2. *Academic Performance of Grade 4 Pupils in Mathematics*

Performance level	Frequency	Percentage
Outstanding	21	15.79
Very Satisfactory	61	45.86
Satisfactory	37	27.82
Fairly Satisfactory	14	10.53
Did Not Meet Expectations	0	0.00
Total	133	100.00

The favorable distribution suggests that most participating pupils had developed adequate to high levels of Mathematics competence. At the same time, academic achievement should be understood as multifactorial. Prior foundations, instructional methods, study habits, task design, and learning support may all contribute to performance (Bentil et al., 2018; Salters, 2019). Accordingly, even in a generally high-performing group, targeted support remains appropriate for pupils who experience difficulty or show lower confidence in problem solving.

Relationship Between Problem-Solving Attitudes and Academic Performance

Pearson product-moment correlation showed a weak positive relationship between problem-solving attitudes and Mathematics performance ($r = .186$). The corresponding p-value was .033, which was below the .05 level of significance. The null hypothesis was therefore rejected. Pupils with more favorable problem-solving attitudes tended to have slightly higher academic performance, although the magnitude of the association was small.

Table 3. *Relationship Between Academic Performance and Problem-Solving Attitudes*

Statistic	Value	Interpretation / decision
Pearson r	.186	Weak positive relationship
p-value	.033	Significant at $\alpha = .05$
n	133	Null hypothesis rejected

The result supports the view that attitudes matter for mathematical engagement but do not explain achievement by themselves. Positive dispositions may encourage learners to persist, attempt alternative strategies, and participate more actively in problem solving, which can support academic learning. Similar literature links favorable mathematical beliefs, confidence, and learning experiences with engagement and performance (Kele & Sharma, 2014; Sanchal & Sharma, 2017). The weak coefficient, however, indicates that effective instruction, prior knowledge, parental support, learning conditions, and individual skills remain important alongside problem-solving attitudes.

Proposed Intervention Program

Based on the findings, the study proposed “Problem-Solving Ease: From Worry to Wow!” an intervention program intended to strengthen Grade 4 pupils’ problem-solving attitudes and support Mathematics performance. The program addresses confidence, worry, engagement, instructional responsiveness, and home-school support through recurring activities involving pupils, teachers, and parents. It is particularly relevant for pupils with lower or fairly satisfactory performance and for those who require additional support in approaching mathematical problems confidently and strategically.

Table 4. *Core Components of the Proposed Intervention Program*

Component	Purpose / activity	Frequency
Math Confidence Workshops	Interactive games and engaging problem-solving activities to build confidence and a growth-oriented response to Mathematics	Monthly
Small-Group Tutoring Sessions	Peer and teacher-supported tutoring, strategy sharing, and low-pressure collaborative problem solving	Weekly
Teacher Sensitivity Training	Training for Grade 4 Mathematics teachers on recognizing problem-solving attitudes and applying responsive classroom strategies	Quarterly
Parent-Teacher Tandem Talks	Communication with parents of pupils needing support, progress updates, and home-based guidance/resources	Weekly / as needed
Monitoring and Evaluation	Pre- and post-program assessment, participant feedback, and monitoring of changes in academic performance	Throughout implementation

The intervention is consistent with the study’s finding that the attitude-performance relationship is significant but weak: affective support should be combined with substantive Mathematics instruction rather than used in isolation. Problem-based learning, challenging tasks, guided collaboration, timely feedback, and opportunities to reflect on strategies can support both confidence and mathematical competence (Hendriana et al., 2018; Russo & Minas, 2020; Sturm & Bohndick, 2021). The program therefore treats positive attitudes as one component of a broader support system for improved problem-solving performance.

CONCLUSION

Grade 4 pupils at Annafunan Integrated School generally demonstrated positive problem-solving attitudes in Mathematics, with a grand mean of 2.91 interpreted as Agree. Their academic performance was also generally favorable, with an overall average of 86.2 or Very Satisfactory; most pupils were classified as Very Satisfactory, Satisfactory, or Outstanding, and none fell below expectations. These findings indicate that the group possessed both a generally favorable disposition toward problem solving and an adequate to high level of Mathematics performance.

A weak but statistically significant positive relationship was found between problem-solving attitudes and academic performance ($r = .186, p = .033$). Thus, more favorable attitudes were associated with slightly better Mathematics performance, but the small effect indicates that attitudes are only one of several factors relevant to achievement. The study's principal contribution is a school-based intervention framework that combines confidence-building and attitude support with tutoring, responsive teaching, parent involvement, engaging mathematical tasks, and continuing assessment. This approach recognizes the value of positive problem-solving dispositions without overstating their influence on academic performance.

Recommendation

Grade 4 Mathematics teachers should continue strengthening pupils' positive problem-solving attitudes through engaging, student-centered, and problem-based activities, including open-ended and real-life mathematical problems. Pupils who need additional support should receive small-group tutoring, guided strategy practice, timely feedback, appropriate use of games or manipulatives, and positive reinforcement that builds confidence and persistence.

Annafunan Integrated School should consider implementing the proposed "Problem-Solving Ease: From Worry to Wow!" program and integrate its components into regular Mathematics support activities. Teacher sensitivity training and parent-teacher communication should be used to maintain consistent support across school and home. Academic performance and problem-solving attitudes should be monitored before, during, and after implementation so that activities can be refined based on pupil progress. Future studies may include multiple schools, additional grade levels, and other factors such as prior knowledge, teaching strategies, home support, anxiety, or study habits to explain Mathematics performance more comprehensively.

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