JOURNAL OF INTERDISCIPLINARY PERSPECTIVES

ISSN Print: 2984-8288, ISSN Online: 2984-8385
Vol. 3 No. 7, pp. 217-227, July 2025

Mathematical Dispositions and Problem-Solving Abilities Using the IDEAL Model

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Date received: April 27, 2025
Date revised: May 16, 2025
Date accepted: June 14, 2025

Originality: 99%
Grammarly Score: 99%
Similarity: 1%

Recommendation citation:
Catunhay, R., Jr., Piñero B., & Futalan, M. C. (2025). Mathematical dispositions and problem-solving abilities using the IDEAL model. *Journal of Interdisciplinary Perspectives*, *3*(7), 217-227.
https://doi.org/10.69569/jip.2025.316

Abstract. This study examined the relationship between learners' mathematical dispositions and problem-solving abilities before and after implementing the IDEAL model. Despite the recognized importance of mathematical disposition in problem-solving, limited studies have explored its development through structured models like IDEAL among elementary learners." A combination of descriptive-correlational and quasi-experimental research designs was employed, involving 58 Grade 5 pupils. Data were collected using a validated questionnaire and analyzed using the Wilcoxon test, dependent and independent t-tests, Spearman's Rank Order Correlation, Mann-Whitney U test, and percentage analysis. Before the intervention, most pupils demonstrated only moderate confidence, flexibility, perseverance, curiosity, and metacognition, although they generally held positive attitudes toward the usefulness and appreciation of mathematics. Regarding problem-solving ability, many fell under the "Did Not Meet Expectations" category, with only a few rated as "Fairly Satisfactory." Following the implementation of the IDEAL model, pupils showed consistent improvements in their mathematical disposition, shifting from moderate to strongly positive levels. More notably, all participants achieved an "Outstanding" rating in problem-solving ability. The study also revealed a strong positive correlation between mathematical disposition and problem-solving performance. Furthermore, female pupils exhibited significantly higher flexibility, perseverance, and overall mathematical disposition, although both genders performed equally well in problem-solving tasks. These findings indicate that the IDEAL model effectively enhances learners' confidence, engagement, and success in mathematics.

Keywords: IDEAL model; Mathematical disposition; Problem-solving abilities.

1.0 Introduction

Mathematics is one of the core subjects that supports the development of an individual's mental abilities and logical thinking, making it a vital foundation for success in many fields. Despite its importance, many students worldwide struggle to achieve mathematical literacy. International assessments such as the Programme for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS) consistently show that many students fall below expected levels of mathematical proficiency (Organisation for Economic Co-operation and Development [OECD], 2020; Mullis & Martin, 2020). One major contributing factor is the presence of anxiety and negative attitudes toward mathematics, which limit students' ability to engage meaningfully in problem-solving tasks (Fadillah & Wahyudin, 2022). This issue is not confined to developing countries; even in more advanced education systems, students' declining interest in mathematics has become a growing concern for educators and policymakers (Lomri & Dasari, 2024).

In the Philippines, many students still feel anxious about math. Ablian and Parangat (2022) found that learners often struggle with high levels of anxiety, mainly because they find the subject challenging and feel unprepared to solve problems. Angeles et al. (2023) also showed that the more anxious learners are, the lower their performance tends to be. This anxiety does not just affect test scores; it also influences their mathematical disposition. Students who feel nervous or discouraged are less likely to stay motivated, confident, or persistent. Laranang and Bondoc (2020) pointed out that a student's mathematical disposition—how they think, feel, and act when doing math—shapes the way they approach problems. All this highlights that helping learners manage math anxiety is just as important as teaching the subject and promoting a positive mathematical disposition.

While many studies have explored mathematical problem-solving skills and dispositions, few have examined how both can be developed using a structured model like IDEAL (Identify, Define, Explore, Act, Look Back). Most research treats these aspects separately, missing the opportunity to integrate cognitive strategies with affective development. Classroom observations suggest that Grade 5 pupils struggle with solving problems and maintaining confidence, perseverance, and curiosity. These challenges mean that a holistic approach like the IDEAL model could be key to strengthening their mathematics skills and mindset. This study supports "SDG 4: Quality Education, particularly Target 4.6," which aims to ensure that all learners acquire essential literacy and numeracy skills by 2030. The study improves pupils' mathematical disposition and problem-solving abilities and builds strong foundational skills. It also aligns with DepEd's MATATAG Curriculum and the National Mathematics Program, which promote learner-centered, inclusive, and practical educational approaches. In doing so, this research helps prepare students for academic success and lifelong learning.

2.0 Methodology

2.1 Research Design

The study's main objective was to assess pupils' mathematical dispositions and problem-solving abilities before and after implementing the IDEAL model. Additionally, it examined the relationship between mathematical dispositions and problem-solving abilities after applying the model. Therefore, descriptive-correlational and quasi-experimental research designs were considered suitable for this study.

2.2 Research Participants

The primary respondents for this study are the fifty-eight (58) Grade 5 learners from Kalamtukan Elementary School for the school year 2024-2025. The Grade 5 level consists of two sections. All grade 5 pupils were involved in this investigation, and no randomization of the population was done.

2.3 Research Instrument

The study used two sets of standardized survey questionnaires. The first set assesses the pupils' mathematical disposition. It was adopted from Ulia and Kusmaryono's (2021) study "Mathematical disposition of pupils, teachers, and parents in distance learning: A survey." The second set contains a pre-test and a post-test. It consists of designed problem-solving tasks to measure the pupils' problem-solving abilities before and after exposure to the IDEAL model. These survey questionnaires have four sections. The first section is the disclosure statement, while the second part contains the pupils' profiles in terms of sex. The third section assesses pupils' mathematical disposition regarding confidence, flexibility, usefulness, perseverance, curiosity, appreciation, and metacognition when presented with mathematical situations. The fourth section of the questionnaire measures the problem-solving abilities of the pupils.

A dry run was conducted with 60 Grade 6 pupils enrolled at Kalamtukan Elementary School for SY 2024-2025 to evaluate the reliability of the research instruments measuring mathematical disposition and problem-solving abilities. The results of the mathematical disposition survey, tested using Cronbach's Alpha, indicated high reliability across all factors: confidence (0.940), flexibility (0.948), usefulness (0.886), perseverance (0.880), curiosity (0.855), appreciation (0.875), and metacognition (0.861). All coefficients exceeded the accepted threshold of 0.70, confirming that the items for each factor were highly reliable.

For the problem-solving abilities test, Pearson's r yielded a reliability coefficient of 0.907, indicating a robust positive correlation and suggesting a high level of internal consistency. To establish content validity, the questionnaire was reviewed by experts in mathematics education, including a Doctor of Education, Mathematics

Coordinators, and Master Teachers who have extensive experience in the field. Their feedback and recommendations were incorporated into the final version of the questionnaire to ensure clarity, relevance, and alignment with learning objectives.

2.4 Data Gathering Procedure

After the design hearing, all corrections and suggestions given by the panel members were incorporated into the research. With the approval of the Dean of Foundation University's Graduate School, a formal written request to conduct the study was initially submitted to the School Head of Kalamtukan Elementary School. Upon approval, a letter of endorsement was forwarded to the Public School District Supervisor of District 7. Subsequently, a formal request, endorsed by the School Head and the District Supervisor, was submitted to the Schools Division Superintendent of the Division of Bayawan City. Once approved and signed, the request was returned to the principal of the target school to facilitate the commencement of the study.

Before administering the questionnaires, the researcher explained to the class the purpose and significance of the study, emphasizing why their honest responses were important in understanding their experiences and approaches in learning mathematics. Students were assured that their answers would remain confidential and would be used solely for academic purposes. After the orientation, the pre-assessment questionnaires were distributed and completed within two hours without using calculators to assess pupils’ independent problem-solving abilities accurately.

The IDEAL model was introduced and implemented after the initial survey as an instructional strategy to improve pupils’ mathematical problem-solving abilities and dispositions. The intervention occurred throughout one grading period and was integrated into the pupils’ regular mathematics lessons. First, students were taught to identify the problem and what was being asked. Then, they were guided to define relevant information and what they already knew about the problem.

The pupils brainstormed and discussed possible strategies and solutions during the Explore phase. They applied their chosen strategies to solve the problem in the Act phase. Finally, in the Look back phase, they reviewed their solution, reflected on their approach, and considered alternative methods or improvements. This process was practiced regularly in class through guided activities, collaborative group work, and reflective discussions, helping pupils to internalize the structured problem-solving steps and build their confidence in mathematics. These were retrieved immediately after completion.

At the end of the grading period, the post-assessment was conducted using the same standardized questionnaires as in the pre-assessment. To ensure consistency in data collection, pupils were again given two hours to complete the forms without using calculators. The responses were collected immediately, and the post-assessment results were analyzed and compared with the pre-assessment data to determine changes in pupils’ mathematical dispositions and problem-solving abilities after implementing the IDEAL model.

2.5 Data Analysis Procedure

After collecting the pre- and post-assessment data, the researcher organized and encoded all the responses using Microsoft Excel to ensure accuracy and completeness. Descriptive statistics, including the mean, median, and standard deviation, were used to overview how the pupils performed before and after implementing the IDEAL model. Percentages were also computed to classify pupils into performance levels based on the DepEd’s rating system. To determine whether the changes in scores were statistically significant, the researcher used several analytical tools. The Wilcoxon Signed-Rank Test was applied to assess improvements in mathematical dispositions, which were measured using Likert-scale data. For problem-solving scores, a t-test for dependent samples was used to compare pupils' performance before and after the intervention. The Spearman’s Rank Order Correlation was used to examine the relationship between mathematical dispositions and problem-solving abilities following the implementation of the IDEAL model.

To explore sex-related differences, the researcher used the Mann-Whitney U Test to analyze dispositions and the Independent Samples t-test for problem-solving abilities. These tests helped assess whether male and female pupils differed significantly in outcomes. Additionally, Cohen’s d was computed to determine the effect size of the IDEAL model on problem-solving performance and to assess the strength of the observed improvement. All data analyses were conducted using Microsoft Excel, JAMOVI, and MegaStat, which facilitated efficient data management and allowed the researcher to generate meaningful insights aligned with the study's objectives.

2.6 Ethical Considerations

The researcher maintained high standards of research ethics throughout the research work. Therefore, the Ethical Committee of the Foundation University Research Office was consulted for ethical approval. At the start of the study, all participants were asked to provide informed consent in the form of a disclosure statement. The rights of the participants regarding self-determination, confidentiality, and anonymity were clearly explained, along with a clear statement of the risks and benefits of the study.

3.0 Results and Discussion

3.1 Mathematical Disposition of the Pupils Before the Implementation of the IDEAL Model

Table 1 shows the Grade 5 pupils' mathematical disposition before implementing the IDEAL Model. The data show that the pupils' overall mathematical disposition is neutral, with a mean rating of 3.02 before implementing the IDEAL model. The data indicates explicitly that pupils display a neutral mathematical disposition regarding confidence, flexibility, perseverance, curiosity, and metacognition as evidenced in the mean values of 2.71 to 2.93. This suggests that the pupils' attitudes and behaviors toward mathematics are neither strongly positive nor negative.

Table 1. *Mathematical Disposition of the Pupils Before the Implementation of the IDEAL Model (n=58)*

Indicators	$\bar{x}$	Verbal Description	Mathematical Disposition	SD
Confidence	2.71	Moderately Agree	Neutral	0.68
Flexibility	2.91	Moderately Agree	Neutral	0.54
Usefulness	3.44	Agree	Positive	0.48
Perseverance	2.80	Moderately Agree	Neutral	0.59
Curiosity	2.93	Moderately Agree	Neutral	0.58
Appreciation	3.53	Agree	Positive	0.44
Metacognition	2.81	Moderately Agree	Neutral	0.76
Overall	**3.02**	**Moderately Agree**	**Neutral**	**0.50**

Legend:	Scale	Verbal Description (VD)	Mathematical Disposition (MD)
	4.21 – 5.00	Strongly Agree (SA)	Very Positive (VP)
	3.41 – 4.20	Agree (A)	Positive (P)
	2.61 – 3.40	Moderately Agree (MA)	Neutral (N)
	1.81 – 2.60	Disagree (D)	Negative (N)
	1.00 – 1.80	Very Low (VL)	Very Negative (VN)

Regarding confidence, pupils may feel capable in mathematics but lack complete self-assurance. They may hold back from taking risks during problem-solving or begin to doubt their abilities when faced with complex tasks. Islami et al. (2022) noted that students with low confidence often struggle to complete tasks that require logical thinking or step-by-step reasoning. These students tend to second-guess their answers or avoid such tasks altogether. Concerning flexibility, pupils can sometimes adapt to different problem-solving strategies but may struggle to switch approaches when faced with difficulties. Rahayuningsih et al. (2020) emphasized how important cognitive flexibility is in learning mathematics. Their research showed that students stick to one familiar method, even when other strategies might work better. This kind of rigid thinking can slow their problem-solving and hold back their overall growth in math.

Pupils try to solve problems but might give up more easily when facing complex or frustrating tasks. This observation echoes the findings of DiNapoli and Miller (2022), who describe perseverance in math as the ability to keep going through the struggle, even when things get confusing or challenging. Their study reminds us that perseverance is not just about putting in more effort but also about staying mentally engaged, thinking things through, and pushing forward even after setbacks.

Regarding curiosity, pupils are interested in exploring mathematical concepts but may not actively seek new problems or mathematical ideas. This finding aligns with what Jirout et al. (2022) discovered when they developed the Curiosity in Classrooms (CiC) Framework to examine how the classroom environment influences learners' curiosity. Their research showed that curiosity flourishes when students feel free to ask questions, explore different solutions, and take intellectual risks. However, when such an environment is lacking, students often become passive learners—simply going through the motions instead of actively exploring ideas independently.

Regarding metacognition, pupils demonstrate a basic awareness of their thought processes but may not consistently monitor or regulate their problem-solving strategies effectively. This aligns with what Güner and Erbay (2021) found in their study: While learners were generally aware of their thinking, many did not know how to manage their strategies effectively, making it harder for them to work through math problems successfully. The data also show pupils display a positive mathematical disposition regarding usefulness and appreciation. This signifies they value mathematics and recognize its significance in daily life, academics, and future careers.

Regarding usefulness, pupils with a positive outlook see math as more than just a school subject. They understand it is a valuable tool they can use in real-life situations. They recognize how math plays a role in budgeting, solving problems, making decisions, and even future careers. This awareness can motivate them to participate more actively in class and apply what they learn. As Akpalu et al. (2025) pointed out, when students see how math connects to the real world, they tend to have a more positive attitude toward it, which often leads to better performance in school.

Regarding appreciation, pupils tend to enjoy and respect math as a subject. They might be drawn to its patterns, structure, or how it all makes logical sense. When students truly appreciate math, they are often more willing to take on challenging problems, excited to learn new concepts, and more engaged in thinking things through. Kusmaryono and Wijayanti (2023), likewise, found that when students get involved in real-world math activities, they are more engaged—not just mentally, but emotionally and behaviorally, too—which helps them see math as something that is both meaningful and useful in their everyday lives.

The table also presents the standard deviation (SD), which measures the variation and dispersion of the dataset. The SD values for the Mathematical Disposition of the pupils before implementing the IDEAL Model range from 0.44 to 0.76. This indicates a relatively consistent level of mathematical disposition among the pupils, with only moderate variability across different indicators. This result suggests pupils' responses are closely clustered around the mean, reflecting a more uniform perception.

3.2 Mathematical Disposition of the Pupils After the Implementation of the IDEAL Model

Table 2 presents the mathematical disposition of pupils after implementing the IDEAL model. The results show that the overall mathematical disposition, with a mean rating of 3.75 and a standard deviation (SD) of 0.45, indicates a positive disposition. All indicators of mathematical disposition—including confidence, flexibility, usefulness, perseverance, curiosity, appreciation, and metacognition—have mean scores ranging from 3.61 to 4.04.

Table 2. *Mathematical Disposition of the Pupils After the Implementation of the IDEAL Model (n=58)*

Indicators	$\bar{x}$	Verbal Description	Mathematical Disposition	SD
Confidence	3.64	Agree	Positive	0.48
Flexibility	3.61	Agree	Positive	0.42
Usefulness	4.00	Agree	Positive	0.45
Perseverance	3.67	Agree	Positive	0.47
Curiosity	3.67	Agree	Positive	0.43
Appreciation	4.04	Agree	Positive	0.43
Metacognition	3.63	Agree	Positive	0.44
Overall	**3.75**	**Agree**	**Positive**	**0.45**

The findings imply that these pupils believe in their mathematical abilities (confidence), can adapt to different strategies when solving problems (flexibility), and understand the real-world value of math (usefulness). They persist despite difficulties (perseverance), show genuine interest in exploring mathematical concepts (curiosity), and enjoy and respect the subject (appreciation). Additionally, they actively monitor and regulate their learning strategies (metacognition), which helps them become more effective problem solvers. According to Ablian et al. (2025), when learners have positive beliefs and attitudes toward math, they are more willing to learn, participate in class, and do better overall. Zetriuslita and Ariawan (2021) also asserted how curiosity and motivation are key to building strong thinking and problem-solving skills. Similarly, Asanre et al. (2024) found that students who are confident and believe in themselves tend to perform better in math, showing how important emotions and motivation are in learning. Furthermore, when students see math as valuable and enjoyable, they are more likely to dive in, try different strategies, and confidently take on challenges (Barete & Taja-on, 2024).

3.3 Difference between the Mathematical Disposition of the Pupils Before and After the Implementation of the IDEAL Model

Table 3 presents the difference between the mathematical disposition of the pupils before and after the implementation of the IDEAL Model. The results indicate an improvement in all aspects of mathematical disposition after implementing the IDEAL model. The median scores increase across all components, for pupils' mathematical disposition in terms of Confidence (2.83 to 3.67), Flexibility (3.00 to 3.67), Usefulness (3.33 to 4.00), Perseverance (3.00 to 3.67), Curiosity (3.00 to 3.67), Appreciation (3.33 to 4.00), and Metacognition (3.00 to 3.50). The Wilcoxon signed-rank test (W) values are all statistically significant ($p < .001$), leading to the rejection of the null hypothesis (Ho1). This result suggests that the IDEAL model substantially positively impacts pupils' disposition towards mathematics.

Table 3. *Difference between the Mathematical Disposition of the Pupils Before and After the Implementation of the IDEAL Model (n=58)*

Mathematical Disposition	Median		W	*p*	Decision/Remark
	Before	After			
Confidence	2.83	3.67	1711	<.001	Reject H_{o1}/Significant
Flexibility	3.00	3.67	1711	<.001	Reject H_{o1}/Significant
Usefulness	3.33	4.00	1485	<.001	Reject H_{o1}/Significant
Perseverance	3.00	3.67	1711	<.001	Reject H_{o1}/Significant
Curiosity	3.00	3.67	1711	<.001	Reject H_{o1}/Significant
Appreciation	3.33	4.00	1176	<.001	Reject H_{o1}/Significant
Metacognition	3.00	3.50	1431	<.001	Reject H_{o1}/Significant
Overall	**3.07**	**3.74**	**1711**	**<.001**	**Reject H_{o1}/Significant**

Wilcoxon Signed-Rank Test (W) at 0.05 Level of Significance

Previous research supports this finding, as Syaiful et al. (2020) emphasized the importance of fostering a growth mindset in pupils, leading to increased confidence in their problem-solving abilities. According to Fitrianna et al. (2021), confidence and mathematical performance are significantly enhanced when pupils believe they can improve through effort. This implies that the IDEAL model, emphasizing problem-solving and iterative thinking, likely promotes the development of a growth mindset, contributing to increased confidence in mathematics.

Furthermore, the study of Rahmawati et al. (2022) reinforces this finding, highlighting that pupils' success in learning mathematics is closely tied to their mathematical disposition. Pupils with a strong mathematical disposition demonstrate greater determination and perseverance in learning, leading to improved performance.

3.4 Problem-Solving Abilities of the Pupils before and after the Implementation of the IDEAL Model

Table 4 shows the level of pupils' problem-solving before and after the implementation of the IDEAL model. Before implementing the IDEAL model, most pupils (75.86%) were classified under Did-not-Meet-Expectations (DNME) levels with a mean score of 71.61%. This tells us that many pupils had a hard time because they did not have a clear or structured way to work through math problems. Meanwhile, 24.14% were in the Fairly Satisfactory (FS) group. These pupils seemed to have a basic understanding of problem-solving but still found it challenging to apply what they knew, especially when the problems became more challenging or unfamiliar.

Table 4. *Level of Problem-Solving Abilities of the Pupils Before and After the Implementation of the IDEAL Model (n=58)*

Rating	Verbal Description	Before		After	
		f	%	f	%
90%-100%	Outstanding (O)	---	---	58	100
85% - 89%	Very Satisfactory (VS)	---	---	---	---
80% - 84%	Satisfactory (S)	---	---	---	---
75% - 79%	Fairly Satisfactory (FS)	14	24.14	---	---
≤74%	Did Not Meet Exp. (DNME)	44	75.86	---	---

Sweller (2020) explained that when learners lack a solid strategy to follow, they can easily feel overwhelmed, making it even harder to think clearly and solve problems. So, with most students landing in the DNME group, they were likely using ineffective or straightforward methods, did not know how to approach problems step by step, or did not feel confident applying the right strategies. Similarly, according to Darmaji et al. (2020), learners have trouble breaking complicated tasks into manageable parts without a structured framework, leading to failure to attain consistent outcomes in the problem-solving process.

Table 4 also shows that after implementing the IDEAL model, all the pupils are rated as Outstanding (O), exhibiting a mean score of 94.46%. The result indicates that every student, regardless of their prior performance, could effectively apply problem-solving strategies and successfully tackle complex mathematical problems. According to Sak (2020), such a problem-solving model as the IDEAL develops cognitive tools through step-by-step guidelines and strategies for critical thinking and creative problem-solving. Furthermore, Sweller (2020) postulated that structured frameworks help learners manage problem-solving tasks by breaking down the problem-solving process into smaller and manageable parts, which enables learners to focus on solving problems without being overwhelmed, leading to improved performance.

3.5 Difference between the Problem-Solving Abilities of the Pupils Before and After the Implementation of the IDEAL Model

Table 5 unveils the data showing the difference in the problem-solving abilities of the pupils before and after the implementation of the IDEAL Model. Using a t-test for dependent data, the table shows a significant increase in problem-solving abilities after implementing the IDEAL model. The mean score increases from 71.61 to 94.46, with a t-value of 77.7 and a p-value of < .001, leading to the rejection of the null hypothesis (Ho2). The effect size is 10.20, which is beyond the threshold for a huge effect (d > 1.29) according to Cohen’s d classification. This indicates the IDEAL model’s significant impact on pupils' problem-solving abilities. In other words, the difference between the pupils' problem-solving abilities before and after the intervention is substantial and not just a small change. This effect size is notably larger than typical educational interventions, highlighting the IDEAL model’s significant influence on improving the pupils' mathematical problem-solving abilities.

Table 5. *Difference between the Problem-Solving Abilities of the Pupils Before and After the Implementation of the IDEAL Model*

Problem Solving Abilities	$\bar{x}$	t	*p*	Decision	Remark	Effect Size
Before	71.61					
		77.7	<.001	Reject H_{o2}	Significant	10.20
After	94.46					

Classification	**Cohen’s d Effect Size;** t-test for dependent data at 0.05 level of significance
Ignored	0.00 < d ≤ 0.19
Small Effect	0.19 < d ≤ 0.49
Medium Effect	0.49 < d ≤ 0.79
Large Effect	0.79 < d ≤ 1.29
Very Large Effect	d > 1.29

Correspondingly, Syaiful et al. (2020) stressed the importance of structured approaches in improving pupils' motivation and problem-solving abilities. The IDEAL model, which provides a straightforward, step-by-step problem-solving process, likely enables pupils to approach mathematical tasks more confidently and efficiently. The model’s approach allows pupils to focus on key strategies, such as identifying the problem, exploring potential solutions, and reflecting on their process, which are crucial steps in solving complex problems effectively.

Furthermore, research by Prayogi et al. (2020) supports these findings, emphasizing that inquiry-based learning models, such as the IDEAL model, effectively promote critical thinking and problem-solving abilities. The structured nature of the IDEAL model likely helped the Grade 5 pupils systematically work through problems and evaluate their solutions, leading to the improvements observed in this study. This aligns with the work of Fitrianna et al. (2021), who noted that structured learning approaches are essential in developing pupils' mathematical representation and problem-solving abilities.

The enormous effect size of 10.20 also reinforces the idea that the IDEAL model made a substantial difference in the pupils' performance, which is similar to the findings of Sak (2020). Sak's research on creative problem-solving models highlighted that structured strategies can substantially improve pupils' problem-solving abilities. This encouraging result shows that the IDEAL model is a powerful tool for improving pupils' mathematical problem-solving abilities. Verawati et al. (2020) also stressed that structured frameworks, especially those that incorporate reflective processes, promote deeper engagement and better problem-solving outcomes, which supports the positive results found in this study.

This remarkable shift in performance suggests that the IDEAL model significantly impacted students' ability to approach and solve mathematical problems systematically and effectively. The improvement can largely be attributed to the model's explicit and structured approach, which deepens students' understanding of mathematical concepts and helps them apply these concepts confidently in solving real problems.

3.6 Relationship between the Mathematical Disposition of the Pupils and Their Problem-Solving Abilities After the Implementation of the IDEAL Model

Table 6 presents the data identifying the relationship between pupils' mathematical disposition and problem-solving abilities in six (6) areas. The Spearman's Rank Order Correlation (rs) values indicate a strong positive relationship between mathematical disposition components and problem-solving abilities. All correlations are statistically significant (p < .001), leading to the rejection of the null hypothesis (Ho3). This result signifies that pupils with higher mathematical disposition tend to perform better in problem-solving.

Table 6. *Relationship between the Mathematical Disposition of the Pupils and Their Problem-Solving Abilities After the Implementation of the IDEAL Model (n=58)*

Problem Solving Abilities and...	r_s	*p*	Decision	Remark
Confidence	0.817	<.001	Reject H_{o3}	Significant
Flexibility	0.781	<.001	Reject H_{o3}	Significant
Usefulness	0.860	<.001	Reject H_{o3}	Significant
Perseverance	0.845	<.001	Reject H_{o3}	Significant
Curiosity	0.756	<.001	Reject H_{o3}	Significant
Appreciation	0.669	<.001	Reject H_{o3}	Significant
Metacognition	0.696	<.001	Reject H_{o3}	Significant
Overall	**0.884**	**<.001**	**Reject H_{o3}**	**Significant**

Spearman's Rank Order Correlation at 0.05 Level of Significance

The higher the pupils' mathematical disposition in areas like confidence, flexibility, and perseverance, the better their performance in problem-solving tasks. These findings suggest that pupils who feel more confident in their mathematical abilities show flexibility in their thinking, appreciate the usefulness of mathematics, and engage in metacognition tend to solve problems more effectively. This highlights the interconnectedness between pupils' attitudes towards mathematics and their ability to apply problem-solving strategies.

Similarly, research by Sadak et al. (2022) emphasized the importance of mathematical creativity in problem posing and problem-solving. Their work shows that pupils who exhibit positive dispositions, such as confidence and flexibility, are better equipped to approach problems creatively, leading to enhanced problem-solving performance. Likewise, Syahrial and Husni Sabil (2020) found that pupils who engage with problem-solving strategies and have a positive disposition tend to perform better, particularly in complex mathematical tasks.

Additionally, the findings resonate with the work of Bilad et al. (2022), who highlighted the role of teachers and teaching methods in shaping pupils' attitudes toward learning. The IDEAL model enhances pupils' problem-solving abilities by fostering positive dispositions such as perseverance, confidence, and metacognition. This statement coincides with the conclusions of Fitrianna et al. (2021) that when pupils develop strong dispositions toward mathematics, including the ability to reflect on their problem-solving processes, they tend to exhibit higher problem-solving abilities.

These findings further support the effectiveness of the IDEAL model in improving problem-solving abilities and fostering the attitudes and dispositions that support long-term success in mathematics and other problem-solving tasks. As pupils become more confident, flexible, and reflective in their approach to mathematics, their ability to tackle problems in a structured and strategic manner also improves noticeably. This underscores the importance of addressing both the cognitive and affective aspects of learning in educational models.

3.7 Difference in Pupils' Mathematical Disposition when Grouped according to Their Sex

Table 7 shows that, based on the Mann-Whitney U test results, sex does not significantly influence most components of mathematical disposition, except in terms of Flexibility (p = 0.005), Perseverance (p = 0.024), and Overall Mathematical Disposition (p = 0.020), where females manifest higher mathematical disposition than males.

Table 7. *Difference in Pupils' Mathematical Disposition when Grouped according to Their Sex*

Math. Disposition	Median	U	*p*	Decision	Remark
Confidence					
Male	3.33	299	.052	Fail to reject H_{o4}	Not significant
Female	3.67				
Flexibility					
Male	3.33	248	.005	Reject H_{o4}	Significant
Female	3.67				
Usefulness					
Male	3.67	325	.121	Fail to reject H_{o4}	Not significant
Female	4.00				
Perseverance					
Male	3.33	280	.024	Reject H_{o4}	Significant
Female	3.67				
Curiosity					
Male	3.67	327	.130	Fail to reject H_{o4}	Not significant
Female	3.67				
Appreciation					
Male	4.00	368	.387	Fail to reject H_{o4}	Not significant
Female	4.00				
Metacognition					
Male	3.50	343	.201	Fail to reject H_{o4}	Not significant
Female	3.50				
Overall					
Male	3.55	270	.020	Reject H_{o4}	Significant
Female	3.76				

The results show that the overall mathematical disposition of female pupils is significantly higher than that of males (p = 0.020), suggesting that, following the implementation of the IDEAL model, female pupils develop a more positive overall attitude toward mathematics. This overall disposition includes key areas such as confidence, curiosity, and metacognition. Specifically, female pupils showed higher levels of flexibility and perseverance, which may be linked to their greater adaptability to the strategies promoted by the IDEAL model. Previous studies support this finding; for instance, Syahrial et al. (2020) found that females tend to demonstrate more flexible thinking in mathematics. Likewise, the increased perseverance among female pupils aligns with the findings of Fitrianna et al. (2021), who noted that females often display greater persistence, particularly when dealing with academically challenging tasks. Similarly, Muljana et al. (2023) posited that female students adapt more easily to flexible and structured learning environments. This means females are often more willing to adjust their strategies, ask for help when needed, and try different ways of solving problems. These behaviors reflect strong cognitive flexibility, which helps them move more effectively through each stage of the IDEAL model.

Moreover, the remaining factors—confidence, Usefulness, Curiosity, Appreciation, and Metacognition—did not show significant differences between males and females. This result signifies that both male and female pupils exhibit similar mathematical dispositions towards these aspects of mathematical learning. These findings further indicate that, for these specific aspects, the IDEAL model has a similar impact on both male and female pupils, promoting similar levels of engagement and awareness in mathematical learning. Moreover, the findings suggest that while gender does not influence all aspects of mathematical disposition, there are notable differences in Flexibility, Perseverance, and Overall Disposition, with females showing higher levels in these areas. This implies that the IDEAL model may have a more pronounced positive effect on female pupils' attitudes and approaches to problem-solving, particularly in terms of persistence and adaptability. Understanding these gender differences can help educators tailor their teaching strategies to support better male and female pupils' mathematical learning journeys (Darmaji et al, 2020; Prayogi et al., 2020).

3.8 Difference in Pupils' Problem-Solving Abilities when Grouped according to Their Sex

Table 8 contains the independent t-test results, which indicate no significant difference in problem-solving abilities between male and female pupils (p = 0.095). The mean scores for males (93.89) and females (95.03) are very close, signifying that both male and female pupils benefited equally from the IDEAL model. Regarding problem-solving ability, both male and female pupils showed similar performance levels, reflecting that the IDEAL model had a balanced effect on both genders.

Table 8. *Difference in Pupils' Problem-Solving Abilities when Grouped according to Their Sex*

Problem Solving Abilities	$\bar{x}$	t	p	Decision	Remark
Male	93.89	1.70	.095	Fail to reject H_{o4}	Not significant
Female	95.03				

t-test for Independent Data at 0.05 Level of Significance; male=29; female=29

The mean scores of males (93.89) and females (95.03) are both high, which shows that the IDEAL model effectively enhanced the problem-solving abilities of both groups. These results align with the findings of Prayogi et al. (2020) that both genders can develop strong problem-solving abilities through effective teaching methods, regardless of gender. The t-test results also reinforce that the IDEAL model is equally effective for male and female pupils. Since there is no significant difference in the problem-solving abilities between the genders, the model's approach, which focuses on key strategies such as goal setting, exploration, action, look-back, and evaluation, is universally practical across both male and female pupils. This is an important finding for educators, as it suggests that the model does not favor one gender over the other regarding enhancing problem-solving abilities. These findings are consistent with those of Sintema and Jita (2022), who found no significant gender differences in learners' beliefs about mathematical problem-solving. This indicates that both males and females hold comparable confidence and attitudes when given supportive instruction.

4.0 Conclusions

The IDEAL model has proven to be more than just a strategy for problem-solving; it has become a transformative tool that reshapes how pupils think, feel, and engage with mathematics. Teaching and implementing structured problem-solving models like IDEAL can enhance students' mathematical abilities and overall disposition toward the subject. Educators empower students to become more engaged, motivated, and successful mathematics learners by providing them with a clear structure. Effective mathematics instruction must go beyond computation and procedures; it must address the whole learner, their mindset, motivation, and belief in themselves. Integrating structured problem-solving models such as IDEAL into instruction can lead to meaningful changes in what students can do mathematically and how they feel about mathematics. When educators regularly assess and support students' affective needs and academic progress, they foster a more holistic and responsive learning environment. Seeing such substantial progress in just one grading period shows the potential for continued positive outcomes if the same approach is maintained throughout the school year.

5.0 Contributions of Authors

The authors confirm the equal contribution in each part of this work. All authors reviewed and approved the final version of this work.

6.0 Funding

This work received no specific grant from any funding agency.

7.0 Conflict of Interests

All authors declare that they have no conflicts of interest.

8.0 Acknowledgment

The author thanks the project advisory board and colleagues for the helpful guidance and suggestions.

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