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Teachers' attitude towards teaching math problem solving in Prosperidad Districts I and II: basis for a training program

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Abstract: This study investigated teachers' attitudes towards teaching math problem-solving in Prosperidad Districts I and II, focusing on integrating Polya's problem-solving method. Polya's method, a framework emphasizing understanding, planning, executing, and reviewing strategies, is essential for developing effective math instruction training programs. Using a mixed-methods approach, the research collected quantitative data via surveys from a sample of teachers in the districts, exploring their attitudes and instructional practices related to Polya's method. Quantitative analysis examined the correlation between teachers' attitudes towards Polya's method and their instructional practices. Qualitative analysis provided contextual understanding by exploring the reasons behind certain attitudes and practices. The findings highlighted various aspects of teachers' attitudes, including their familiarity with Polya's method, perceived effectiveness, challenges, and professional development needs. The study also explored how factors such as educational background, teaching experience, and exposure to Polya's method influence teachers' attitudes and practices. Based on the results, recommendations were formulated to develop a tailored training program aimed at enhancing teachers' effectiveness in teaching math problem-solving using Polya's method. The training program includes strategies for increasing awareness and understanding of Polya's method, providing practical implementation guidance, fostering a positive attitude towards systematic problem-solving, and offering ongoing support and professional development opportunities. By addressing these areas, the training program aims to empower teachers with the knowledge, skills, and confidence to integrate Polya's method into their math instruction, ultimately improving students' problem-solving abilities and overall mathematical proficiency in Prosperidad Districts I and II.

Keywords: Teachers' attitudes, Teaching math problem-solving, Training program, Systematic problem-solving

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INTRODUCTION

In the field of education, Mathematics problem-solving is a critical skill that equips students with the ability to analyze, interpret, and solve complex Mathematical problems. It plays a significant role in developing students' critical thinking, logical reasoning, and problem-solving abilities. The effectiveness of teaching mathematics problem-solving is significantly influenced by the attitudes and beliefs of the teachers who facilitate the learning process.

Existing literature suggests that teachers' attitudes towards teaching Mathematics problem-solving directly impact students' learning outcomes. Studies have shown that teachers who possess positive attitudes towards Mathematics problem-solving tend to employ innovative instructional strategies, create engaging learning environments, and foster students' motivation and confidence in tackling Mathematical challenges (Szabo et al., 2020). Conversely, teachers with negative attitudes may struggle to effectively teach problem-solving and may inadvertently hinder students' progress in this essential area (Verschaffel et al., 2020).

In the Philippine setting, Mathematics education has been a significant concern, with national assessments indicating students' below-average performance in problem-solving tasks (Albay, 2019). This highlights the need for a closer examination of teachers' attitudes towards teaching Mathematics problem-solving. By understanding teachers' prevailing attitudes and beliefs, appropriate interventions and training programs can be developed to address gaps and enhance instructional practices.

The primary problem this research aims to address is the disparity in teachers' confidence and strategies when teaching math problem-solving. This gap often results from insufficient training and limited access to contemporary resources, which can negatively affect student outcomes. These issues included a lack of familiarity with problem-solving methods, inadequate professional development, insufficient resources, and challenges related to student engagement, classroom management, and assessment. By examining teachers' attitudes, the research can identify specific areas of strength and areas that may require improvement in their approach to teaching math problem-solving. This geographical area provided a unique context for exploring the attitudes, challenges, and potential solutions related to mathematics problem-solving instruction. By focusing on this specific setting, the study aimed to provide localized insights and recommendations to improve mathematics education in the district. Examining teachers' attitudes towards teaching Mathematics problem-solving in Prosperidad Districts I & II, valuable information can be gathered to inform the development of a training program that addresses the identified gaps. This study sought to contribute to the enhancement of mathematics education by empowering teachers with the knowledge and strategies necessary to effectively teach mathematics problem-solving, thereby positively impacting students' learning outcomes in the field of mathematics.

Research Objectives

This study aimed to assess teachers' attitude towards teaching Mathematics Problem Solving in Prosperidad Districts I & II. Specifically, it sought to answer the following.

1. What is the profile of Mathematics teachers in Districts I & II of Prosperidad, in terms of:

1.1 Number of years for Teaching experience in Mathematics;

1.2 Related Trainings Attended;

1.3 Highest Educational Attainment;

1.4 Number of Ancillary Functions; and

1.5 Average Rating per Classroom Observation For Teacher?

2. What is the level of teachers' attitude towards teaching Mathematics in Problem Solving along the following:

2.1 Understanding the Problem (Analysis);

2.2 Devising a Plan (Planning);

2.3 Carrying out the Plan (Implementation); and

2.4 Looking back (Reflection)

3. Is there a significant relationship between the profile and the level of teachers' attitude towards teaching Mathematics problem solving?

4. What training program can be proposed based on the results of the study?

METHODOLOGY

Research Design

This study assessed teachers' attitudes towards teaching Mathematics Problem Solving in Prosperidad Districts I & II. Given the nature of the data required, the study employed a descriptive research design. Descriptive research was advantageous because it provided information that formed the basis for scientific judgments. It offered crucial insights into the characteristics of objects and individuals, facilitated detailed observations of practices, behaviors, methods, and procedures, and significantly aided in developing measurement instruments such as questionnaires and interviews. In this study, descriptive research allowed for the systematic collection and analysis of data to describe and understand teachers' attitudes, beliefs, and behaviors in a specific population. This approach was appropriate for several reasons. First, it enabled a detailed examination of teachers' current attitudes towards math problem-solving instruction without manipulating any variables, ensuring that the findings accurately reflected the existing situation. Second, by furnishing a comprehensive picture of teachers' attitudes, descriptive research helped identify strengths and areas for improvement, which were crucial for designing targeted training programs. Third, the method supported the development of effective data collection tools tailored to capture the nuances of teachers' experiences and perspectives. Overall, this approach provided a thorough understanding of teachers' attitudes towards math problem-solving, informing the creation of a training program that addressed the specific needs and challenges identified in Prosperidad Districts I and II.

Respondents and Locale of the Study

The research was conducted in ten (10) elementary schools in Agusan del Sur, Philippines. Specifically, the study focused on the public elementary schools in the Municipality of Prosperidad District: the San Jose Elementary School, the Sta. Maria Elementary School, the Doña Rosario Elementary School, the Awa Elementary School, the Libertad Elementary School, the Magsaysay Elementary School, the Los Arcos Elementary School, the Aspetia Elementary School, New Maug Elementary School, and La Purisima Elementary School.

These schools have a similar demographic makeup, with a mix of rural and urban students from various ethnic and socioeconomic backgrounds. The teachers in these schools have dissimilar levels of experience and education, and follow the same curriculum as mandated by the Department of Education.

The target population of this study were the teachers of Prosperidad District of the Division of Agusan del Sur. A total of fifty-six (56) teachers who were teaching Mathematics served as the participants of this study.

Research Instrument

The research instrument used in this study had two parts. Part I dealt with the profile of Mathematics teachers in Districts I & II of Prosperidad, in terms of the number of years of teaching experience in Mathematics, related trainings attended, highest educational attainment, number of ancillary functions, and average rating per classroom observation (CO). Part II determined the level of teachers' attitudes towards teaching Mathematics in terms of understanding the problem (analysis), devising a plan (planning), carrying out the plan (implementation), and looking back (reflection), also known as Polya's Problem-Solving process.

Data Analysis

Various statistical treatments were employed to analyze data to answer this study's objectives.

Weighted Mean. This was used to determine the level of teachers' attitude toward teaching Mathematics in terms of Understanding the Problem (Analysis), Devising a Plan (Planning), Carrying out the Plan (Implementation), and Looking back (Reflection), also known as Polya's Problem-Solving process.

Spearman's Rank Correlation Coefficient. This was used to analyze the relationship between the level of teachers' profiles and the level of teachers' attitude in teaching Mathematics problem-solving.

Percentage. It determined the equivalent value of the frequency count in terms of a hundred.

FINDINGS AND DISCUSSION

Profile of the mathematics teacher

Based on the data, comprehensive insights were acquired regarding teachers' experience, education, ancillary functions, and job performance in teaching mathematics, with 1.8% of teachers having 2 years or below experience in teaching math. The 21 teachers with 8-9 years of experience (37.5%) indicate a proactive stance towards professional development. Only 28.6% of seasoned teachers have over 15 years of experience. 21.4% of the teachers were teachers with 3-7 years of teaching experience.

Professional development opportunities were notably abundant, as evidenced by the 29 teachers who had earned Master's degree units (51.8%) and those who had completed their Master's degrees (37.5%), and also six (6) teachers who only have a Bachelors' degree, underscoring the institutions' commitment to furthering teacher education and promoting a culture of continuous learning and improvement. Ancillary functions were fairly distributed among the teaching staff, with 27 teachers holding 0-1 (48.2%) and 28 teachers holding 2-3 (50.0%) functions, while only one (1) teacher held 4-5 functions (1.8%) suggested specialization or limited role availability within the institutions.

Job performance ratings were predominantly "Outstanding" (55.4%), reflecting a culture of quality teaching and continuous professional growth, complemented by 25 teachers rated as "Very Satisfactory" (44.6%), indicative of strong overall performance. These insights informed decision-making for administrators, enabling them to tailor support programs, enhance teaching quality, and improve job satisfaction among teachers.

Level of teachers' attitude towards teaching mathematics problem-solving

The level of teachers' attitudes toward teaching mathematics problem-solving is crucial for effective instruction and student success. Positive attitudes can enhance teaching methods, fostering a supportive learning environment that promotes critical thinking and problem-solving skills. Conversely, positive attitudes can improve instructional quality and student engagement. This study aims to assess these attitudes in Prosperidad Districts I and II to inform the development of targeted training programs and improve mathematics education.

Level of teachers' attitudes towards teaching mathematics in terms of understanding the problem

The data show that the highest weighted mean is 4.75, indicating that teachers strongly emphasized ensuring students had a clear understanding of the problem before moving on to the next steps of problem-solving. This suggested that teachers placed a significant priority on comprehension as a foundation for effective problem-solving. The lowest weighted mean is 4.48, related to addressing students who struggled to understand the problem independently. Despite being the lowest, this still reflected a strong agreement, showing that teachers were very supportive but slightly less confident in this area than others. The overall weighted mean is 4.64, demonstrating that teachers consistently valued and practiced strategies to enhance students' understanding of math problems. This overall high rating indicated an outstanding commitment to the first step of Polya's problem-solving process.

The use of strategies to help students comprehend math problems and promote active engagement with the problem statement is also in line with best practices for teaching mathematics problem solving (NCTM, 2000; Boaler, 2016; National Academies of Sciences, Engineering, and Medicine, 2018)."

The strong agreement across all indicators demonstrates that mathematics teachers prioritize comprehensive understanding and active engagement in problem-solving. These practices are consistent with best practices in mathematics education, emphasizing the importance of conceptual understanding, interactive learning, and diverse teaching aids and technologies. By incorporating real-life examples and technology, teachers can make mathematics more accessible and engaging, ultimately leading to better learning outcomes for students.

Level of teachers' attitudes towards teaching mathematics in terms of designing a plan

The data show that the highest weighted mean is 4.71, indicating that teachers strongly emphasized the importance of creating a plan before students attempted to solve a math problem. This suggested that teachers viewed this as a critical step in the problem-solving process, believing it laid the groundwork for successful outcomes.

The lowest weighted mean was 4.52, related to several indicators, including believing in the importance of a well-thought-out plan, using strategies to guide students, encouraging plan adaptation when encountering difficulties, and utilizing differentiated instruction. Teachers were pressured to cover a certain amount of material within a limited amount of time, leaving little room for strategic planning and adaptation.

The overall weighted mean was 4.57, demonstrating that teachers consistently placed high importance on designing a plan for solving math problems. This overall high rating indicated an outstanding commitment to the second step of Polya's problem-solving process, highlighting that teachers believed effective planning was essential for student success in mathematics.

Huang et al. (2019) highlighted that explicit problem-solving instruction and the incorporation of visual aids significantly improve students' mathematical skills. Similarly, Goos et al. (2019) explored how collaborative learning and the integration of technology positively influence students' engagement and comprehension in math education. Schoenfeld (2019) also emphasized the significance of planning and adaptive thinking for effective problem-solving. These studies corroborated the notion that well-thought-out plans, diverse instructional strategies, and technology integration significantly enhance students' problem-solving skills and overall mathematical proficiency. The data from this study underscored teachers' alignment with these effective educational practices, suggesting a robust framework for fostering problem-solving abilities in students.

Level of teachers' attitudes towards teaching mathematics in terms of carrying out the plan

The data revealed that teachers strongly emphasized the importance of carrying out problem-solving plans systematically, as indicated by a high overall weighted mean of 4.58 with a standard deviation of .273. The highest weighted mean was 4.62 for evaluating the effectiveness of pupils' execution of their problem-solving plans, showing a robust focus on assessing and ensuring the success of the problem-solving process. This showed that teachers focused on how they evaluate on how students executed the plan, which leads to the students ' success if they have an effective plan. The lowest weighted mean was 4.52, attributed to both highlighting the necessity of a systematic approach and incorporating opportunities for students to revise their plans, indicating a consistent, though slightly less emphatic, agreement on these aspects.

This reflects that the teacher consistently valued the execution phase of problem-solving, reinforcing the significance of systematic follow-through, adaptive strategies, and collaborative efforts among students. The high ratings for encouraging students to follow through with their plans and fostering a positive mindset during execution underscore the supportive and proactive teaching environment. Moreover, the focus on collaboration and peer discussion is consistent with findings from recent studies (e.g., Schoenfeld, 2019), highlighting the importance of planning and adaptive thinking in successful problem-solving.

Overall, the data suggest that teachers in this study maintained a strong commitment to structured problem-solving approaches, continually assessed and adapted their methods to support student success, and promoted a collaborative learning atmosphere.

The level of teachers' attitudes towards teaching mathematics in terms of looking back

The data revealed that mathematics teachers strongly agree on encouraging students to reflect on their problem-solving processes, with an overall weighted mean of 4.58 and a standard deviation of 0.226. This highlights a strong commitment to fostering reflective practices in math education.

The highest weighted mean of 4.70 (SD = 0.502) is observed in the indicator related to teachers describing a situation where a student's reflection on their problem-solving process led to noticeable improvements in their overall approach to math problems. This suggests that teachers strongly recognize and value the impact of reflection on enhancing students' problem-solving skills.

Although still high, the lowest weighted mean is 4.54 (SD = 0.538) for incorporating reflective components into assessments, where students explain their problem-solving journey and discuss what they learned. This slightly lower mean compared to other indicators might reflect teachers' challenges in integrating and assessing reflective components within traditional assessment structures. However, the strong agreement indicates that teachers see the value in such practices despite these challenges.

The high level of agreement across all indicators suggests that teachers value reflection in mathematics education. They believe in the power of reflection to enhance learning, support improvement, and build resilience and effort among students. Teachers use specific strategies, prompts, and activities to foster meaningful reflection and provide feedback on the reflection process. This holistic approach to teaching underscores the importance of viewing problem-solving as an ongoing learning journey rather than a fixed outcome.

Incorporating reflective practices into mathematics problem-solving corresponds with current educational research, which underscores the significance of metacognition, iterative learning, and growth mindset in cultivating deeper comprehension and student achievement (NCTM, 2000; Boaler, 2016; National Academies of Sciences, Engineering, and Medicine, 2018; Hattie & Zierer, 2018).

The data illustrate that mathematics teachers strongly emphasize encouraging reflection and iterative improvement in problem-solving. This practice is crucial for developing students' problem-solving skills and mathematical understanding. Teachers recognize that reflective practices help students learn from their mistakes and enhance their ability to tackle complex problems with confidence and resilience.

Test of significant relationship between the profile and the level of teachers' attitude towards teaching mathematics

The study aimed to examine the significant relationship between the demographic profile of mathematics teachers and their attitudes towards teaching mathematics problem-solving. This study was grounded in the premise that teachers' attitudes significantly influence their instructional practices and student outcomes in mathematics. By analyzing the relationship between these profile variables and teachers' attitudes towards problem-solving instruction, this study sought to uncover potential predictors of effective teaching practices.

Correlation analysis between teachers' profile and their level of attitude towards teaching mathematics

Data shows the result of the correlation analysis between the teachers' profile and their level of attitudes towards teaching Mathematics. Results show that years teaching mathematics have a significant relationship with the attitude toward understanding the problem (ρ= -.303; p=.023). Thus, the null hypothesis concerning these variables is rejected. The negative correlation suggests that teachers with fewer years of experience might emphasize the step of understanding the problem in Polya's problem-solving process. This could imply that less experienced teachers may not assume that students already possess the skills to understand problems independently and might focus more on this step in the problem-solving process. Addressing this through professional development could help less experienced teachers balance their attention across all steps, ensuring that the understanding of the problem is adequately reinforced without neglecting other steps.

The results conform with Valiandes & Neophytou, (2018), when teachers receive thorough training and assistance, they tend to cultivate a favorable attitude towards problem-solving instruction. Insufficient training and restricted access to resources can lead to negative attitudes or a lack of confidence among teachers regarding the teaching of mathematics problem-solving..

Moreover, according to Gocmen & Gulec (2018), teachers who view themselves as proficient and self-assured problem solvers tend to demonstrate favorable attitudes towards teaching problem-solving.

Proposed training program based on the results of the study

This training initiative aimed to enhance the teaching proficiency of mathematics educators by integrating insights from recent research findings. The program covers important topics such as effective teaching strategies, deepening math knowledge, and integrating technology in the classroom. One key part of the program is learning and applying POLYA's four-step method to solve math problems effectively. This approach aids both teachers and students in gaining a clearer understanding of problems and systematically finding solutions.

CONCLUSION

Based on the findings, the following are the conclusions drawn:

1. These findings suggest that the mathematics teachers in this study are highly qualified and highly regarded in their teaching performance. This strong foundation in experience, education, and effectiveness supports the continued development of teaching strategies and professional growth initiatives.

2. This indicates that teachers strongly believe they effectively promote and implement problem-solving strategies in their classrooms. Their high self-assessment suggests confidence in their teaching methods and a commitment to helping students excel in math problem solving.

3. This suggests that the number of years a teacher has been teaching impacts their emphasis on ensuring students understand the problem. Experienced teachers may be able to state

mathematics problems most simply, owing to their experience of how the students may understand a given word problem. In contrast, newer teachers might focus more on this step. Professional development should address this by encouraging all teachers, regardless of experience, to consistently emphasize understanding the problem.

RECOMMENDATIONS

Based on the premise that teachers who gained experience in teaching mathematics have a lower level of attitude towards teaching mathematics, the following recommendations may be considered:

1. Teachers: Classroom educators are primarily recipients of the recommendations as they directly teach math problem-solving. They can incorporate the recommended strategies and approaches into their instructional practices to enhance students' problem-solving skills and attitudes towards mathematics.

2. School Administrators: Principals, vice principals, and other school administrators play a crucial role in supporting teachers and implementing instructional initiatives. They can endorse the recommendations, allocate resources, and provide leadership to implement the proposed changes effectively within their schools.

3. Professional Development Providers: Organizations or individuals responsible for delivering professional development programs and workshops can integrate the study's recommendations into their offerings. By training teachers in effective problem-solving instruction, these providers can support educators in honing their skills and improving student outcomes.

4. Curriculum Developers: Those involved in designing and revising curriculum materials can incorporate the study's findings into the development of math curricula. By aligning instructional materials with the recommended strategies and approaches, curriculum developers can ensure teachers can access resources that facilitate effective problem-solving instruction.

5. Policy Makers: Government officials, policymakers, and educational authorities can use the study's recommendations to inform policy decisions related to mathematics education. They can advocate for policies that prioritize developing problem-solving skills and support initiatives aimed at improving math instruction in schools.

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