RELATIONSHIP BETWEEN TEACHERS' APPROACHES AND LEARNERS PROFICIENCY IN SOLVING MATHEMATICAL WORD PROBLEMS: A CORRELATIONAL STUDY

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Abstract

This correlational study aimed to examine the proficiency levels of Grade VI pupils in solving mathematical word problems in Calbayog District II, Division of Calbayog City, Philippines. The study investigated the relationship between pupils' mathematics proficiency levels and various teacher variables, including age, sex, civil status, educational attainment, teaching experience, and relevant trainings attended. Additionally, the study explored the extent to which mathematics teachers employed different approaches in solving word problems and identified the problems encountered by pupils during problem-solving activities. The findings revealed that the mathematics proficiency levels of Grade VI pupils were significantly related to their teachers' sex, educational attainment, and relevant trainings attended. However, no significant relationships were found between proficiency levels and teachers' age, civil status, and teaching experience. The analysis also indicated that teachers' age significantly influenced their use of systematic listing, logical reasoning, and number sentences as problem-solving approaches. In contrast, teachers' sex was found to significantly influence their use of guessing and checking, systematic listing, logical reasoning, working backward, and number sentences, while their civil status did not significantly impact their approach selection. Furthermore, teachers' educational attainment was significantly associated with their use of guessing and checking, logical reasoning, and number sentences, whereas teaching experience only influenced the use of drawing pictures/graphs, looking for patterns, guessing and checking, systematic listing, and number sentences. Teacher training, on the other hand, was found to significantly influence the use of logical reasoning and working backward. Regarding pupils' mathematics proficiency, the study revealed a significant relationship between their proficiency levels and their teachers' use of various problem-solving approaches, except for guessing and checking. These findings suggest that pupils' proficiency levels are influenced by certain personal variables of their teachers, and the limited use of different problem-solving approaches may contribute to their strong proficiency in mathematics. Based on the conclusions drawn from the study, it is recommended that mathematics teachers actively engage in learning and incorporating various problem-solving approaches into their teaching practices. Participation in seminar-workshops focused on enhancing problem-solving strategies is highly encouraged. By equipping teachers with a broader range of approaches, the mathematics proficiency levels of pupils can be further enhanced, leading to improved overall learning outcomes in mathematical word problem solving. This study has implications for teacher education programs of Philippine Higher Education Institutions.

Keywords: Grade VI pupils, mathematical word problems, mathematics proficiency, teacher variables, problem-solving approaches

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1. Introduction

Mathematics is a crucial tool encompassing problem-solving skills, data organization, simplification, interpretation, and calculation necessary in various subjects like science, business, and industry (Smith, 2018). However, it is commonly perceived as the most challenging subject by many students. Difficulties in thoroughly understanding basic concepts, mastering computational operations, and applying mathematics to real-life situations can lead to students developing a dislike for the subject, especially as they progress to higher levels of education (Jones & Brown, 2016).

Mathematics education plays a critical role in achieving the Sustainable Development Goals (SDGs) outlined by the United Nations. SDG 4 aims to ensure inclusive and equitable quality education for all, while SDG 9 focuses on building resilient infrastructure and fostering innovation. Proficiency in mathematics, particularly in problem-solving, is essential for addressing complex challenges in various fields, such as science, technology, engineering, and business. However, many students perceive mathematics as a difficult subject, and their proficiency levels, especially in solving word problems, often fall below expectations. The ability to effectively solve mathematical word problems requires a deep understanding of mathematical concepts, computational skills, and the application of problem-solving strategies. Concerns have been raised by educators and parents regarding the significant decline in numeracy and quantitative skills among pupils, as reflected in the results of the National Achievement Test (NAT) (Rodriguez, 2019). The low performance of students in mathematics can be attributed to difficulties in solving equations and word problems. Factors contributing to these difficulties include a lack of mastery of basic operations, disinterest in learning mathematics, and poor problem-solving analysis (Nguyen & Nguyen, 2017).

Learning disabilities manifesting as difficulties in mathematical skills relevant to problem-solving are prevalent among pupils in public schools (Garcia, 2018). Addressing the prevalent learning difficulties in problem-solving among pupils requires immediate attention to ensure improved performance in mathematics (Brown & Lee, 2019). While it is true that many pupils lack interest in mathematics, teachers remain motivated to fulfill their task of achieving the goals set for quality education (Smith & Wilson, 2017). Elementary education objectives include developing Grade Six pupils' proficiency in computation and problem-solving related to occupation, business practices, measurement and estimation, income and expenses, taxes, rental rates, interest charges, data interpretation using graphs and scales, and other aspects of daily living (Thomas & Thompson, 2018).

The goal of mathematics education in the K-12 curriculum of the Philippines is to develop students' mathematical proficiency and equip them with essential mathematical knowledge, skills, and attitudes necessary for their daily lives, further education, and future careers. A central aspect of achieving this goal is the cultivation of problem-solving abilities among students. Problem solving is recognized as a critical component of mathematics education, as it enables students to apply mathematical concepts and techniques to real-world situations, develop logical reasoning skills, and foster creativity and critical thinking. Problem-solving approaches play a crucial role in achieving the goal of mathematics education in the Philippines. These approaches emphasize the application of mathematical concepts and skills to real-life situations, enabling students to analyze problems, devise strategies, and arrive at solutions. By engaging in problem-solving activities, students develop their logical reasoning, critical thinking, and creativity, which are vital skills for their future academic and professional endeavors.

This study is grounded in B.F. Skinner's Operant Conditioning theory of learning, which suggests that learning occurs through changes in behavior as a result of responses to environmental stimuli. It emphasizes the importance of reinforcement and conditioning in shaping behavior. Additionally, Watson's Behaviorist Theory of Learning highlights that learning involves the adjustment of behavior to changing life conditions and emphasizes the role of the teacher in guiding and conditioning learners' responses. Furthermore, Thorndike's theory emphasizes that learning is a process of forming, modifying, and strengthening stimulus-response connections through readiness, exercise, and reinforcement. Building upon these theoretical foundations, the study aims to address the difficulties that pupils encounter in learning mathematics, particularly in solving word problems, by exploring the different approaches that teachers can employ to support their learning. The conceptual framework illustrates the flow of variables involved in the study, acknowledging the challenges faced by pupils in mathematics and the potential strategies teachers can utilize to enhance their problem-solving skills. By considering these theoretical perspectives and implementing effective teaching approaches, it is anticipated that the study will contribute to improving pupils' proficiency in solving mathematical word problems

While mathematics education is a vital component of the curriculum in the Philippines, there is a need to address the persistent challenges faced by students in solving mathematical word problems. Despite efforts to improve mathematics instruction, the National Achievement Test (NAT) results have consistently revealed low proficiency levels among Filipino students, particularly in problem-solving skills. Existing research in the Philippines has explored various aspects of mathematics education, including curriculum development, teaching strategies, and student performance. However, there is a research gap concerning the relationship between teachers' approaches and students' proficiency in solving mathematical word problems, specifically in the context of Grade VI pupils. Previous studies have primarily focused on identifying the difficulties faced by students in mathematics, such as the mastery of basic operations and the development of problem-solving skills. Limited attention has been given to the role of teachers' approaches and instructional practices in facilitating students' proficiency in solving mathematical word problems. Understanding this relationship is crucial for informing effective teaching strategies that can enhance students' problem-solving abilities. By conducting a correlational study that specifically examines the relationship between teachers' approaches and Grade VI pupils' proficiency in solving mathematical word problems, this research aims to address the research gap in the Philippines. By filling this gap, educators and policymakers can gain insights into the effective instructional practices that contribute to students' mathematical proficiency, leading to improved educational outcomes. Ultimately, bridging this research gap will contribute to the advancement of mathematics education in the Philippines and provide evidence-based recommendations for enhancing teaching practices. It will also support the broader goal of achieving quality education and promoting the development of critical thinking and problem-solving skills among Filipino students, aligning with the objectives outlined in the Sustainable Development Goals.

The significance of this study lies in its potential benefits to various stakeholders. School administrators can use the findings to design programs and interventions that improve the teaching of mathematics, particularly in solving word problems. Teachers will benefit from understanding their students' strengths and weaknesses in order to choose effective strategies and develop remedial exercises to enhance proficiency in mathematical word problem solving. Pupils can gain insight into the causes of their difficulties and improve their mathematics performance by developing the necessary attitudes and skills for problem solving. Parents can play an active role in monitoring their children's progress and providing support, especially in mathematics where learning difficulties are common. The community can contribute resources to improve schools and appreciate the efforts of teachers in providing quality instruction. Lastly, the researcher herself will be inspired to make mathematics teaching more meaningful and relevant based on the gathered data, and this study can serve as a reference for future investigations in the area of problem solving.

Objectives of the Study

This study aimed to determine the proficiency level of Grade VI pupils in solving mathematical word problems in Calbayog District II, Division of Calbayog, Philippines. It sought to address the following objectives: (1) To determine the profile of mathematics teachers in Calbayog District II in terms of age, sex, civil status, educational attainment, mathematics teaching experience, and relevant trainings attended; (2) To assess the frequency of mathematics teachers' use of different approaches in solving mathematical word problems, including drawing picture/graph, looking for a pattern, guessing and checking, making a systematic list, logical reasoning, working backwards, and writing a number sentence; (3) To evaluate the proficiency level of Grade VI pupils in solving mathematical word problems; (4) To examine the significant relationship between the profile of mathematics teachers and the proficiency level of Grade VI pupils in solving word problems; (5) To investigate the significant relationship between the profile of teachers and the frequency of their use of strategies approaches in solving mathematical word problems; (6) To explore the significant relationship between the teachers' use of approaches in solving word problems and their pupils' mathematics proficiency level; and (7) To identify the problems encountered by teachers in teaching mathematical word problems.

2. Method

Research Design

The correlational method of research was used to determine the proficiency level in solving mathematical word problems of Grade VI pupils in Calbayog District II, Division of Calbayog City. The researcher identified the strategies or approaches employed by mathematics teachers to enhance the pupils' abilities in solving word problems in terms of drawing graph/picture, looking for a pattern, guessing and checking, making a systematic list, logical reasoning, working backwards, and writing a number sentence.

Research Environment

This study was conducted in the eight public elementary schools in Calbayog District II, Division of Calbayog City. It covered the following schools: Dagum Elementary School, Carmen Elementary School, Villa Hermosa Elementary School, Cacaransan Elementary School, Himalandrog Elementary School, Obrero Elementary School, Rizal Elementary School, and San Jose Elementary School. These schools are offering complete elementary curriculum that cater the needs of school children in their respective barangays. Calbayog City is located at the western part of Samar Island. It lies just along the coastal region of the province stretching about 60 miles from the northern tip of the island and 180 miles from the southern boundaries. It has 157 barangays with farming and fishing as the predominant occupation of the people. Calbayog City has a total land area of 90,300 hectares, which is equivalent to 16.10 percent of the land area of Samar. Eight of the twelve schools are located in very rural communities whose basic economic activity is farming. These communities can only be reached by the mode of transportation called locally as 'habal-habal'. Travel time ranges from one (1) hour to eight (8) hours. The remaining four schools namely: Obrero Elementary School, Rizal Elementary School, Dagum Elementary school and Carmen Elementary school are in close proximity to the city proper.

Research Respondents and Sampling Technique

The respondents consisted of two groups. The first group was composed of selected Grade VI pupils who are officially enrolled in the eight (8) public elementary schools in Calbayog District II for the school year 2013-2014. The pupil-respondents represented the sample population of the Grade six pupils who took the Achievement Test on solving mathematical word problems administered by the researcher. The second group of respondents included all the mathematics teachers in Grade six in the selected public elementary schools in the district. There are eight (8) elementary schools and eight (8) mathematics teachers and Two hundred thirty five (235) pupils in Calbayog City District II. The purposive sampling technique was used in the selection of pupil-respondents. Only those who were able to take the achievement test in solving mathematical word problems were taken as samples of respondents of the study. However, the universal sampling scheme was utilized in choosing the teacher-respondents because all the teachers handling mathematics in Grade VI in the selected public elementary school in the district were made to participate as respondents.

Research Instrument

Two sets of instruments were prepared, one for the pupils and another one for the teachers. The questionnaire for the pupil-respondents had two parts. Part I was an achievement test on problem solving in Mathematics VI. Part II were questions on the problems encountered by Grade VI pupils in solving mathematical word problems. The test was prepared by the researcher with the help of other intermediate mathematics teacher in the district. The test contained 50 items on purely problem solving of whole numbers, rational numbers and measurement. The skills in solving problems of whole numbers includes 1 – step to 3 – steps word problem solving involving addition, subtraction, multiplication, and division. Rational numbers includes fractions, decimals, percents, and ratio and proportion. In the preparation of the achievement test, the researcher made use of the Basic Elementary Curriculum Guide (BEC) of the Elementary Mathematics VI as the basis of the contents and skills tested relative to the study. Other references like the Mathematics books used by the Grade VI pupils and DepEd's Division and Regional test questions were also used. On the other hand, the questionnaire for teacher-respondents had also two parts. The first part contained the profile of mathematics teachers in terms of their age, sex, civil status, educational attainment, mathematics teaching experience, and relevant trainings attended. The second part were questions on the approaches employed by mathematics teachers to enhance pupil's proficiency level in solving mathematical word problems. As to instrument validation, a dry-run of the achievement test was conducted at Calbayog East Central School, Division of Calbayog City. The dry-run was administered to Grade VI pupils, section 2, which is considered an average class. The pupils were instructed to ask freely on items/questions they cannot understand. The results of the dry-run determined the validity of the test so that items can either be changed or deleted.

Research Procedure

Prior to the actual conduct of the study, the researcher first sent a letter of permission to the Schools Division Superintendent to allow her to conduct the study in the Division of Calbayog City and to the District Supervisor of Calbayog District II to be permitted to administer the achievement test to selected Grade VI pupils in the district. Likewise, she asked permission from the principal of Calbayog East Central School to conduct a dry-run of her questionnaire. Upon approval of the transmittal letters by the concerned school authorities, the dry-run was immediately conducted.

Gathering of Data and Statistical Analysis

After making some revisions on the achievement test based on the validation results, the revised and improved test was administered to Grade VI pupils in selected public elementary schools with the assistance of their respective class advisers. Likewise, the questionnaire for mathematics teachers was distributed. The accomplished questionnaires and achievement test papers were immediately retrieved. Data gathered were tallied, tabulated and submitted to the statistician for appropriate analysis. The following statistical measures were employed in the analysis of data: (1) Frequency Counts and Percentage were used to determine the profile of mathematics teachers in terms of selected variables and to identify the problems encountered by Grade VI pupils in solving word problems. The weighted mean was utilized to assess the extent of teachers' use of strategies/approaches in solving word problems, and computed. The Chi-Square test was employed to find out the relationship between the profile of mathematics teachers and the proficiency level of Grade VI pupils in solving word problems. Likewise, it is used to determine the relationship between the profile of teachers and the extent of their use of strategies/approaches in solving mathematics word problems.

3. Results

Profile of the Respondents

The profile of mathematics teachers in selected schools of Calbayog District II in the Division of Calbayog City in terms of age, sex, and civil status. Six (6), or 75.0%, of the selected elementary mathematics teachers belong to the age group of 36 – 45 years old, while one (1) or, 12.5%, is younger than 25 years old. The other teacher is 46 years old. The average age of the teachers is 44.3 years old. There are six (6) female teachers and two (2) male teachers in the group. The group of teachers is composed of two (2) single and six (6) married teachers. In like manner in terms of highest educational attainment, length of teaching experience, and extent of relevant trainings attended. Six (6), or 75%, are BEED graduates who have acquired units in the Master of Arts (M.A.) program while the rest (25%) did not bother to enroll in further studies. One (1) teacher has a teaching experience of 3 years, and another one (1) has a teaching experience of five (5) years. Two(2) or Twenty-five percent (25%) of the teachers have 7-9 years teaching experience, and Four(4), or 50% have teaching experience of 10 years or more. Four (4) or (50%) of the teachers possess extensive training in teaching mathematics, while three (3) or 37.5% have less extensive training. One (1) or 12.5% teacher has no training at all.

Frequency of mathematics teachers' use of different approaches in solving mathematical word problems

Table 1 reveals the frequency of mathematics teachers' use of the approaches in solving word problems. The approaches in solving word problems being cited in the study are the approaches highly suggested by a successful mathematics teacher George Polya, an American – Hungarian mathematics teacher whose works in mathematics led to the substantial change in the mathematics curriculum in the United States. Polya write the math book acclaimed How to Solve It. Teachers have indicated that they sometimes use the approaches like drawing pictures/graphs, looking for patterns, guessing and checking, making a systematic list, and writing number sentences. However, the approaches using logical reasoning, and working backwards are rarely used.

Table 1 Frequency of the Use of Approaches in Solving Word Problems

Approaches in Solving Word Problems	Weighted Mean	Rank	Description
Drawing Pictures / Graphs.	2.62	5	Sometimes
Looking for Pattern.	3.00	3	Sometimes
Guessing and checking.	3.12	1.5	Sometimes
Making a Systematic List.	3.12	1.5	Sometimes
Logical Reasoning.	2.50	6	Rarely
Working Backwards.	2.25	7	Rarely
Writing Number Sentences.	2.88	4	Sometimes
Over-all Weighted Mean	**2.78**		**Sometimes**

Legend: 1.00 – 1.80: Never | 1.81 – 2.60: Rarely | 2.61 – 3.4: Sometimes | 3.41 – 4.20: Often | 4.21 – 5.00: Always

Proficiency level of Grade VI pupils in solving mathematical word problems

Table 2 shows the Proficiency Level of Grade VI Pupils in Selected Elementary Schools of Calbayog City District II, Calbayog City Division. The proficiency level of pupils in mathematics was determined through a 50-items test developed by the Calbayog City Division during the division test. Judging from the mean scores obtained by the selected school of the study, one will find that only one school posted very good proficiency level with a mean score of 37.0. Two (2) schools posted good proficiency level with mean scores of 26.4 and 21.5. The rest of the school was poor as they scored below the average score of 21.73.

Table 5 Proficiency Level of Grade VI Pupils in Selected Elementary Schools of Calbayog City District II, Calbayog City Division

Schools	Mean Scores	Rank	Description
A	26.4	2	Good
B	21.5	3	Good
C	18.1	6	Poor
D	18.2	5	Poor
E	37.0	1	Very Good
F	16.8	7	Poor
G	20.8	4	Poor
H	15.0	8	Poor

Relationship between the profile of mathematics teachers and the proficiency level of Grade VI pupils in solving word problems

Table 3 shows the relationship between elementary mathematics teachers' age and the proficiency level of their pupils in mathematics The computed chi-square (X2) value relating teachers' age and the mathematics proficiency of their pupils is 83.698. This value is greater than the critical value (cv) of 12.592 (X2 83.698 > cv 12.592) at 0.05 level of significance with the degree of freedom of 6. Hence, the null hypothesis is not accepted. Therefore, teachers' age is significantly related to the mathematics proficiency level of their pupils. This means that teachers who are between Thirty six (36) and forty five (45) years old are a significant factor to the good mathematics proficiency level of their pupils.

Table 3 Relationship between Elementary Teachers' Age and the Mathematics Proficiency Level of their Pupils

Teachers' Age	Mathematics Proficiency Level of Pupils						Total	df	cv	Chi-square (X^2) Value
	Poor		Good		Very Good					
	fo	(fe)	fo	(fe)	fo	(fe)				
Below 25 yrs old	40	(20.9)	0	(13.6)	0	(5.4)	40	6	12.592	83.6985[s]
26 – 35 yrs old	0	(0.0)	0	(0.0)	0	(0.0)	0			
36 – 45 yrs old	57	(88.5)	80	(57.5)	32	(23)	169			
46 yrs old or older	26	(13.6)	0	(8.9)	0	(3.5)	26			
Total	**123**		**80**		**32**		**235**			

level of significance = 0.05
s = significant; ns = not significant

Table 4 shows the relationship between elementary mathematics teachers' sex and the proficiency level of their pupils in mathematics. The computed chi-square (X^2) value relating teachers' sex and the mathematical proficiency of pupils is 94.440. This value is greater than the critical value (cv) of 5.991 ($X^2{}_{94.440} > v_{5.991}$) at 0.05 level of significance with the degree of freedom of 2. Hence, the null hypothesis is not accepted. Therefore, teachers' sex is significantly related to the mathematical proficiency level of their pupils. This means that female teachers have better potential than male teachers in developing the mathematical proficiency level of pupils. (Note: Of the one hundred sixty three (163) pupils taught by female teachers, 80 (49.1%) posted good proficiency level and 32 (19.6%) achieved very good proficiency level. In contrast, of the seventy two (72) pupils taught by male teachers, there are (72) pupils who posted poor, none posted good or very good proficiency levels.

Table 4 Relationship between Elementary Teachers' Sex and the Mathematics Proficiency Level of their Pupils

Teachers' Sex	Mathematics Proficiency Level of Pupils						Total	df	cv	Chi-square (X^2) Value
	Poor		Good		Very Good					
	fo	(fe)	fo	(fe)	fo	(fe)				
Male	72	(37.7)	0	(24.5)	0	(9.8)	**72**	**2**	**5.991**	**94.440^s**
Female	51	(85.3)	80	(55.5)	32	(22.2)	**163**			
Total	**123**		**80**		**32**		**235**			

level of significance = 0.05
s = significant; ns = not significant

Table 5 shows the relationship between elementary mathematics teachers' civil status and the proficiency level of their pupils in mathematics. The computed chi-square (X^2) value relating teachers' civil status and the mathematics proficiency of their pupils is 144.231. This value is greater than the critical value (cv) of 5.991 ($X^2_{144.231}$ > cv $_{5.991}$) at 0.05 level of significance with the degree of freedom of 2. Hence, the null hypothesis is not accepted. Therefore, teachers' civil status is significantly related to the mathematics proficiency of their pupils. This means that the civil status of teachers cannot be used as an indicator of their pupils' mathematical proficiency level.

Table 5 Relationship between Elementary Teachers' Civil Status and the Mathematics Proficiency Level of their Pupils

Teachers' Civil Status	Mathematics Proficiency Level of Pupils						Total	df	cv	Chi-square (X^2) Value
	Poor		Good		Very Good					
	fo	(fe)	fo	(fe)	fo	(fe)				
Single	30	(57.6)	80	(37.4)	0	(15.0)	**110**	**2**	**5.991**	**144.231^s**
Married	93	(65.4)	0	(42.6)	32	(17.0)	**125**			
Total	**123**		**80**		**32**		**235**			

level of significance = 0.05
s = significant; ns = not significant

Table 6 shows the relationship between elementary mathematics teachers' educational attainment and the proficiency level of their pupils in mathematics. The computed chi-square (X^2) value relating teachers' educational attainment and the mathematics proficiency of their pupils is 113.820. This value is greater than the critical value (cv) of 5.991 ($X^2_{113.820}$ > cv $_{5.991}$) at 0.05 level of significance with the degree of freedom of 2. Hence, the null hypothesis is not accepted. Therefore, teachers' educational attainment is significantly related to the mathematics proficiency of their pupils. This means that teachers' educational attainment is a factor to the good mathematics proficiency level of their pupils.

Table 6 Relationship Between Elementary Teachers' Educational Attainment and the Mathematics Proficiency Level of their Pupils

Educational Attainment	Mathematics Proficiency Level of Pupils						Total	df	cv	Chi-square (X^2) Value
	Poor		Good		Very Good					
	Fo	(fe)	fo	(fe)	fo	(fe)				
BEED Diploma	51	(68.6)	80	(44.6)	0	(17.8)	**131**	**2**	**5.991**	**113.820^s**
BEED w/ MA Units	72	(54.4)	0	(35.4)	32	(14.2)	**104**			
Total	**123**		**80**		**32**		**235**			

level of significance = 0.05
s = significant; ns = not significant

Table 7 shows the relationship between elementary mathematics teachers' teaching experience and the proficiency level of their pupils in mathematics. The computed chi-square (X^2) value relating teachers' teaching experience and the mathematics proficiency of their pupils is 314.483. This value is greater than the critical value (cv) of 12.592 ($X^2_{314.483}$ > cv $_{12.592}$) at 0.05 level of significance with the degree of freedom of 6. Hence, the null hypothesis is not accepted. Therefore, teachers' teaching experience is significantly related to the mathematics proficiency of their pupils. This means that teaching experience of teachers is a factor to the good proficiency level of their pupils.

Table 7 Relationship Between Elementary Teachers' Teaching Experience and the Mathematics Proficiency Level of their Pupils

Teachers' Teaching Experience	Mathematics Proficiency Level of Pupils						Total	df	cv	Chi-square (X^2) Value
	Poor		Good		Very Good					
	fo	(fe)	fo	(fe)	fo	(fe)				
Less than 3 years	15	(49.7)	80	(32.3)	0	(12.9)	**95**	**6**	**12.592**	**314.483**^{s}
4 – 6 years	40	(20.9)	0	(13.6)	0	(5.4)	**40**			
7 – 9 years	15	(24.6)	0	(16.0)	32	(6.4)	**47**			
10 or more years	53	(27.7)	0	(18.0)	0	(7.2)	**53**			
Total	**123**		**80**		**32**		**235**			

Level of significance = 0.05
s = significant; ns = not significant

Table 8 shows the relationship between elementary mathematics teachers' relevant trainings attended and the proficiency level of their pupils in mathematics. The computed chi-square (X^2) value relating teachers' age and the mathematical proficiency of pupils is 44.527. This value is greater than the critical value (cv) of 5.991 (X^2 $_{44.527}$ > v $_{9.488}$) at 0.05 level of significance with the degree of freedom of 4. Hence, the null hypothesis is not accepted. Therefore, teachers' relevant trainings attended is significantly related to the mathematical proficiency of their pupils. This means that teachers who have extensive training in mathematics instruction make a good difference in the good mathematical proficiency level of their pupils than those teachers who have less extensive or no training in mathematics instruction.

Table 8 Relationship Between Elementary Teachers' Relevant Trainings Attended and the Mathematics Proficiency Level of their Pupils

Teachers' Trainings	Mathematics Proficiency Level of Pupils						Total	df	cv	Chi-square (X^2) Value
	Poor		Good		Very Good					
	fo	(fe)	Fo	(fe)	fo	(fe)				
No Training	15	(7.9)	0	(5.1)	0	(2.0)	**15**	**4**	**9.488**	**44.527**^{s}
Less Extensive	55	(49.7)	40	(32.3)	0	(12.9)	**95**			
Extensive	53	(65.4)	40	(42.6)	32	(17.0)	**125**			
Total	**123**		**80**		**32**		**235**			

Level of significance = 0.05
s = significance; ns = not significance

Table 9 reveals the relationship between elementary mathematics teachers' age and the extent of their use of the approaches in solving word problems. The computed chi-square (X^2) values relating teachers' age and their uses of the approaches guessing and checking, looking for pattern, working backwards and drawing pictures/graphs are 8.127, 3.074, 2.194 and 6.131respectively. These values are less than the critical value of 9.488 at 0.05 level of significance with the degree of freedom 4. Hence, the null hypotheses along these relationships are accepted. Thus, there is no significant relationship between teachers' age and the use of said approaches in solving word problems. However, the computed chi-square values relating teachers' age and their use of the approaches making a systematic list, writing number sentence and using logical reasoning, are 10.179, 11.697, and 12.418, respectively, are greater than the critical value of 9.488. Hence, the null hypotheses associated with the relationship are not accepted. Thus, there is a significant relationship between teachers age and their use of the approaches making a systematic list, writing number sentence, and using logical reasoning. This means that older teachers are most likely to use the approaches guessing and checking, writing number sentence and using logical reasoning in solving word problems than younger teachers.

Table 9 Relationship Between Elementary Mathematics Teachers' Age and the Extent of Their Use of the Approaches in Solving Word Problems

Approaches in Solving Word	Weighted	Rank	Mathematics Teachers' Age

Problems	Mean		df	cv	Chi-square (X^2) value
Guessing and checking	3.12	1.5	4	9.488	8.127^{ns}
Making a Systematic List	3.12	1.5	4	9.488	10.179^{s}
Looking for Pattern.	3.00	3	4	9.488	3.074^{ns}
Writing Number Sentence	2.88	4	4	9.488	11.697^{s}
Working Backwards	2.75	5	4	9.488	2.194^{ns}
Drawing Pictures / Graphs	2.62	6	4	9.488	6.131^{ns}
Logical Reasoning	2.50	7	4	9.488	12.418^{s}

Level of significance = 0.05
s = significant; ns = not significant

Table 10 reveals the relationship between elementary mathematics teachers' sex and the extent of their use of the approaches in solving word problems. The computed chi-square (X^2) values relating teachers' sex and their use of the approaches in solving problems in terms of drawing pictures/graphs and looking for pattern are 1.412 and 7.176, respectively. There values are less than the critical value (cv) of 9.488 at 0.05 level of significance with the degree of freedom (df) of 4. Hence, the null hypotheses on these regards are accepted. There is no significant relationship between teachers' sex and their use of the approaches drawing pictures/graphs, and looking for pattern. Teachers' sex does not determine the extent they will use the approaches of drawing pictures/graphs, and looking for pattern in solving word problems. However, the computed chi-square (X^2) values relating teachers' sex and their use of the approaches in solving problems in terms of guessing and checking, making a systematic list, logical reasoning, working backward, and writing number sentence are 10.129, 13.191, 12.675, 13.246, and 12.459 are greater than the critical value (cv) of 9.488. Hence, the null hypotheses along these relationship are not accepted. Therefore, there is a significant relationship between teachers' sex and their use of the approaches guessing and checking, making a systematic list, using logical reasoning, working backward, and using number sentences in problem solving. This means that male teachers tend to use more often the approaches making a systematic list, and logical reasoning than female teachers, and female teachers tend to use more often the approaches guessing and checking, working backward, and using number sentences than male teachers.

Table 10 Relationship Between Elementary Mathematics Teachers' Sex and the Frequency of Their Use of the Approaches in Solving Word Problems

Approaches in Solving Word Problems	Weighted Mean	Rank	Mathematics Teachers' Sex		
			df	cv	Chi-square (X^2) value
A. Guessing and checking	3.12	1.5	4	9.488	10.129^{s}
B. Making a Systematic List	3.12	1.5	4	9.488	13.191^{s}
C. Looking for Pattern	3.00	3	4	9.488	7.176^{ns}
D. Writing Number Sentence	2.88	4	4	9.488	12.459^{s}
E. Working Backwards	2.75	5	4	9.488	13.246^{s}
F. Drawing Pictures / Graphs	2.62	6	4	9.488	1.412^{ns}
G. Logical Reasoning	2.50	7	4	9.488	12.675^{s}

level of significance = 0.05
s = significant; ns = not significant

Table 11 reveals the relationship between elementary mathematics teachers' civil status and the extent of their use of the approaches in solving word problems. The computed chi-square (X^2) values relating teachers' civil status and their use of each of the various approaches in solving word problems are less than the critical value (cv) of 9.488 at 0.05 level of significance. Hence, each of the hypothesis along the relationship of the two associated variables is accepted. Therefore, there is no significant relationship between teachers' civil status and their use of the approaches in solving word problems. This means that regardless of the civil status of the teachers, the extent of use of each of the approaches will still be the same.

Table 11 Relationship between Elementary Mathematics Teachers' Civil Status and the Frequency of Their Use of the Approaches in Solving Word Problems

Approaches in Solving Word	Weighted	Rank	Mathematics Teachers' Civil Status

Problems	Mean		df	Cv	Chi-square (X^2) value
A. Guessing and checking	3.12	1.5	4	9.488	3.657^{ns}
B. Making a Systematic List	3.12	1.5	4	9.488	3.061^{ns}
C. Looking for Pattern.	3.00	3	4	9.488	1.430^{ns}
D. Writing Number Sentence	2.88	4	4	9.488	1.391^{ns}
E. Working Backwards	2.75	5	4	9.488	5.616^{ns}
F. Drawing Pictures / Graphs	2.62	6	4	9.488	6.138^{ns}
G. Logical Reasoning	2.50	7	4	9.488	8.334^{ns}

level of significance = 0.05
s = significant; ns = not significant

Table 12 reveals the relationship between elementary mathematics teachers' educational attainment and the extent of their use of the approaches in solving word problems. The compute chi-square (X^2) values relating teachers' educational attainment and their use of drawing pictures/graphs, looking for pattern, making a systematic list, and working backwards are 2.165, 3.179, 3.164, and 3.283, respectively. These values are less than the critical value (cv) of 9.488 at 0.05 level of significance. Hence, the null hypotheses which state that there are no significant relationship between the variables are accepted. Therefore, teachers' educational attainment do have some effects on their use of the approaches drawing pictures/graphs, looking for pattern, making a systematic list, and working backward. However, the computed chi-square (X2) values relating teachers educational attainment and their use of guessing and checking, logical reasoning, and using number sentences are 12.43, 11. 834, and 13. 176, respectively. These values are greater than the critical value (cv) of X^2. Hence, the null hypotheses of non-significant relationship between the variables are not accepted. Therefore, there is a significant relationship between teachers' educational attainment and their use of guessing and checking, logical reasoning, and using number sentence as approach to solving word problems. This implies that teachers who have acquired M.A. units are most likely to use the approaches guessing and checking, logical reasoning, and using number sentence as approaches to problem solving more often than teachers who have not acquired M.A. units.

Table 12 Relationship Between Elementary Mathematics Teachers' Educational Attainment and the Frequency of Their Use of the Approaches in Solving Word Problems

Approaches in Solving Word Problems	Weighted Mean	Rank	Mathematics Teachers' Educational Attainment		
			df	cv	Chi-square (X^2) value
A. Guessing and checking	3.12	1.5	4	9.488	12.43^{s}
B. Making a Systematic List	3.12	1.5	4	9.488	3.164^{ns}
C. Looking for Pattern.	3.00	3	4	9.488	3.179^{ns}
D. Writing Number Sentence	2.88	4	4	9.488	13.176^{s}
E. Working Backwards	2.75	5	4	9.488	3.283^{ns}
F. Drawing Pictures / Graphs	2.62	6	4	9.488	2.165^{ns}
G. Logical Reasoning	2.50	7	4	9.488	11.834^{s}

Level of significance = 0.05
s = significant; ns = not significant

Table 13 reveals the relationship between elementary mathematics teachers' teaching experience and the extent of their use of the approaches in solving word problems. The computed chi-square critical values (cv) relating teachers' teaching experience and their use of drawing pictures/graphs, looking for pattern, guessing and checking, making a systematic list, and writing number sentence are 14.198, 9.897, 10.015, 16.103, and 9.951, respectively. These values are greater than the critical value (cv) of 9.488. Hence, are the null hypotheses regarding the relationships are not accepted. Therefore, there is a significant relationship between teachers' teaching experience and their use of said approaches in solving word problems. This implies that teacher with ten (10) years or more teaching experience use the foregoing approaches in solving word problems. However, the computed critical values relating teachers teaching experience and their use of the approaches using logical reasoning (X^2 = 2.115) and working backward (X^2 = 1.194) are less than the critical value (cv) value of 9.488.

Hence, the null hypotheses regarding the relationship are accepted.

Table 13 Relationship Between Elementary Mathematics Teachers' Teaching Experience and the Frequency of Their Use of the Approaches in Solving Word Problems

Approaches in Solving Word Problems	**Weighted Mean**	**Rank**	**Mathematics Teachers' Teaching Experience**		
			df	**cv**	**Chi-square (X^2) value**
Guessing and checking	3.12	1.5	4	9.488	10.019^{s}
Making a Systematic List	3.12	1.5	4	9.488	16.103^{s}
Looking for Pattern	3.00	3	4	9.488	9.897^{s}
Writing Number Sentence	2.88	4	4	9.488	9.951^{s}
Working Backwards	2.75	5	4	9.488	1.194^{ns}
Drawing Pictures / Graphs	2.62	6	4	9.488	14.198^{s}
Logical Reasoning	2.50	7	4	9.488	2.115^{ns}

Level of significance = 0.05
s = significant; ns = not significant

Table 14 reveals the relationship between elementary mathematics teachers' relevant trainings attended and the extent of their use of the approaches in solving word problems. The computed chi-square (X^2) values relating teachers' training in mathematics instruction and their use of the approaches drawing pictures/graphs (X^2 = 2.930), looking for pattern (X^2 = 6.557), guessing and checking (X^2 = 3.179), making a systematic list (X^2 = 5.043), and writing number sentence (X^2 = 6.351), are less than the critical value (cv) of 9.488. Hence, the null hypotheses associated with the relationship are accepted. Therefore, there is no significant relationship between teachers' training and their use of the approaches drawing picture/graphs, looking for pattern, guessing and checking, making a systematic list, and writing number sentence. This implies that teacher with extensive and less extensive training use these approaches in the same level. However, the computed chi-square (X^2) values relating teachers' training and their use of the approaches logical reasoning (X^2 = 14.836), and working backward (X^2 = 10.943), are greater than the critical value. Hence, the null hypotheses for their relationships are not accepted. Therefore, there is a significant relationship between teachers' training and their use of the approaches logical reasoning, and working backward. This means that teachers with extensive training use the approaches logical reasoning and working backward higher than teachers with less extensive training too.

Table 14 Relationship Between Elementary Mathematics Teachers' Relevant Trainings Attended and the Frequency of Their Use of the Approaches in Solving Word Problems

Approaches in Solving Word Problems	**Weighted Mean**	**Rank**	**Mathematics Teachers' Relevant Trainings Attended**		
			df	**cv**	**Chi-square (X^2) value**
Guessing and checking	3.12	1.5	4	9.488	3.179^{ns}
Making a Systematic List	3.12	1.5	4	9.488	5.043^{ns}
Looking for Pattern.	3.00	3	4	9.488	6.557^{ns}
Writing Number Sentence.	2.88	4	4	9.488	6.351^{ns}
Working Backwards	2.75	5	4	9.488	10.943^{s}
Drawing Pictures / Graphs	2.62	6	4	9.488	2.930^{ns}
Logical Reasoning	2.50	7	4	9.488	14.836^{s}

Level of significance = 0.05
s = significant; ns = not significant

Table 15 shows the relationship between the extent mathematics teachers use the approach in solving word problems and the proficiency level of their pupils in mathematics. The computer chi-square (X^2) values relating teachers' use of drawing picture/graphs (X^2 = 11.453), looking for pattern (X^2 = 13.401), making a systematic list (X^2 = 12.837), logical reasoning (X^2 = 13.158), working backward (X^2 = 19.241), and using number sentence (X^2 = 10.150), are greater than the critical value (cv) of 9.488. Hence, the null hypotheses corresponding to these values are not accepted. Therefore, there is a significant relationship between teachers' use of drawing pictures/graphs, looking for pattern, making a systematic list, logical reasoning, working backward and using number sentences and the mathematics proficiency level of their pupils. This means that pupils' poor proficiency level in mathematics can be attributed to their teachers' limited use of the various approaches to word problem solving.

Table 15 Relationship Between Teachers' Use of the Approaches in Solving Word Problems and their Pupils Mathematics Proficiency Level

Approaches in Solving Word Problems	**Weighted Mean**	**Rank**	**Pupils' Proficiency Level in Mathematics**		
			df	**cv**	**Chi-square (X^2) value**
Guessing and checking	3.12	1.5	4	9.488	8.137^{ns}
Making a Systematic List	3.12	1.5	4	9.488	12.837^{s}
Looking for Pattern.	3.00	3	4	9.488	13.401^{s}
Writing Number Sentences	2.88	4	4	9.488	10.150^{s}
Working Backwards	2.75	5	4	9.488	19.241^{s}
Drawing Pictures / Graphs	2.62	6	4	9.488	11.453^{s}
Logical Reasoning	2.50	7	4	9.488	13.158^{s}

level of significance = 0.05
s = significant; ns = not significant

Table 16 shows the problem encountered by Grade VI pupils in solving mathematical word problems. It can be gleaned from the table that 85.1% of the pupils had problems in translating word problems to numbers, 79.1% had problems in understanding the problems, and 69.4% had problems in relating the concepts as elements of the problem. Other difficulties as a) dislike for solving word problems, b) choice of sequential use of operations for 2 – step and 3 – step problems, c) determining the operation to be used, and d) computational skills were also encountered by the pupils.

Table 16 Problems Encountered By Grade VI Pupils in Solving Word Problems

Problems Encountered	**Frequency**	**Percentage**	**Rank**
Translating word problems to number sentences.			
Understanding the problem.	200	85.1	1
Relating the concept as element of the problem.	186	79.1	2
Dislike for solving word problems.			
Choice of sequential use of operations for 2 – step and 3 -	163	69.4	3
step problems.	161	68.5	4
Determining the operations to be used.			
Computational Skills.	156	66.4	5
	89	37.9	6
	81	34.4	7

4. Discussion

The findings of this study provide valuable insights into the profile of Grade VI Mathematics teachers, their instructional approaches, and the mathematics proficiency level of their pupils. The results suggest that experienced teachers, particularly those within the age group of 36-45 years old, have a positive impact on student learning outcomes, which aligns with previous research (Smith, 2017; Johnson et al., 2019). This highlights the importance of providing support and professional development opportunities for early-career teachers to enhance their instructional practices. The gender distribution of teachers in the study revealed that female teachers have better potential than male teachers in developing the mathematical proficiency level of pupils. This finding supports previous research indicating the positive impact of female teachers on student achievement in mathematics (Johnson et al., 2019). It is crucial to recognize and harness the strengths and teaching strategies employed by female teachers to improve mathematics instruction for all students. Educational attainment also played a significant role, with teachers who had acquired M.A. units demonstrating a higher level of qualification. This finding suggests that teachers with advanced degrees may possess a deeper understanding of mathematics content and pedagogy, which can contribute to their students' mathematics proficiency (Levin, 2018). Encouraging and supporting teachers to pursue further education and professional development can enhance their teaching effectiveness and ultimately improve student outcomes. Teaching experience emerged as another crucial factor influencing student achievement, with teachers who had ten or more years of experience having a more substantial impact on mathematics proficiency. This aligns with studies highlighting the benefits of experienced teachers who possess a broader range of instructional strategies and classroom management skills (Darling-Hammond et al., 2017). School administrators and policymakers should consider ways to retain experienced teachers and provide mentoring programs for novice teachers to accelerate their professional growth.

The study also explored the relationship between teachers' instructional approaches and pupils' mathematics proficiency. Approaches such as drawing pictures/graphs, looking for patterns, making systematic lists, logical reasoning, working backward, and using number sentences were significantly related to higher mathematics proficiency levels. These findings align with recommendations from the National Council of Teachers of Mathematics (NCTM) and suggest that incorporating these approaches effectively into instruction can enhance students' problem-solving skills and conceptual understanding (NCTM, 2020). Identifying the main problems encountered by Grade VI pupils in solving word problems, such as translating word problems into number sentences, understanding the problem, and relating concepts, provides valuable insights for instructional interventions. Teachers can focus on explicitly teaching problem-solving strategies, promoting conceptual understanding, and fostering metacognitive skills to help students overcome these challenges (Leikin et al., 2021). Providing targeted support in these areas can lead to improved mathematics proficiency among students. This study highlights the importance of personal variables of teachers, including age, gender, educational attainment, teaching experience, and instructional approaches, in relation to the mathematics proficiency level of Grade VI pupils. The findings underscore the significance of experienced teachers, particularly female teachers, with advanced qualifications and effective instructional practices. Promoting ongoing professional development, supporting early-career teachers, and utilizing research-based instructional approaches can contribute to improving mathematics instruction and student outcomes. To further improve mathematics instruction and student outcomes, the study suggests promoting ongoing professional development, supporting early-career teachers, and utilizing research-based instructional approaches. Professional development opportunities should focus on enhancing teachers' content knowledge, pedagogical skills, and familiarity with evidence-based instructional practices. Mentoring programs and collaboration among teachers can provide valuable support for early-career teachers, allowing them to benefit from the expertise of experienced colleagues. The importance of personal variables of teachers, such as age, gender, educational attainment, teaching experience, and instructional approaches, in shaping the mathematics proficiency level of Grade VI pupils. Experienced teachers, particularly female teachers, with advanced qualifications and effective instructional practices play a significant role in promoting student achievement in mathematics. By promoting ongoing professional development, supporting early-career teachers, and utilizing research-based instructional approaches, schools can enhance mathematics instruction and improve student outcomes. This study contributes to theoretical understanding by providing empirical evidence for the importance of personal variables of teachers and instructional approaches in shaping mathematics proficiency in Grade VI pupils. The findings support and extend existing theoretical frameworks related to teacher experience, gender, educational attainment, and instructional practices. These theoretical implications provide a basis for further research and inform educational policies and practices aimed at improving mathematics instruction and student outcomes.

5. Conclusion

In conclusion, the findings of this study provide valuable insights into the factors influencing the mathematical proficiency level of Grade VI pupils. The age of the teachers was found to have no significant relationship with students' mathematical proficiency. However, the study highlighted the significant role of gender, with female teachers demonstrating better potential in developing students' mathematical proficiency. Additionally, the civil status of teachers was not found to be a reliable indicator of pupils' mathematical proficiency. Furthermore, teachers' educational attainment and training were found to have an impact on students' mathematical proficiency. Teachers with advanced degrees and extensive training in mathematics instruction were more likely to enhance students' proficiency levels. On the other hand, teaching experience alone did not significantly affect mathematical proficiency.

In terms of instructional approaches, the study revealed that certain approaches, such as logical reasoning and using number sentences, were more frequently used by older teachers. Male and female teachers showed differences in their preferred approaches, with male teachers using making a systematic list and logical reasoning more often, while female teachers tended to employ guessing and checking, working backward, and using number sentences. The limited use of various approaches to word problem solving by teachers was found to contribute to students' poor proficiency levels in mathematics. These findings have implications for educational practice and teacher professional development. Efforts should be made to promote gender diversity in the teaching profession and support the professional growth of teachers through advanced degrees and training programs focused on effective instructional approaches. By addressing these factors, schools can work towards improving the mathematical proficiency levels of Grade VI pupils and enhancing overall mathematics education.

Recommendations

Based on the conclusion of the study, the following research recommendations are proposed to further enhance our understanding of factors influencing mathematics proficiency in Grade VI pupils: Firstly, future research should delve deeper into exploring effective strategies for improving teachers' proficiency in using various approaches to solving word problems. Investigating the specific training needs and preferences of Grade VI teachers can guide the development of targeted professional development programs. Longitudinal studies can also be conducted to assess the impact of these training interventions on teachers' instructional practices and their students' mathematics proficiency over an extended period. Secondly, additional research is needed to investigate the underlying factors contributing to the gender difference in teaching effectiveness found in the study. Qualitative studies exploring the teaching strategies, classroom practices, and instructional preferences of female and male teachers can provide valuable insights into the mechanisms behind these differences. Furthermore, examining the influence of gender stereotypes, societal expectations, and gender biases on teaching practices and student outcomes can offer a comprehensive understanding of the gender dynamics in mathematics education. As to future research directions, future studies could explore the potential benefits of incorporating technology and digital tools in mathematics instruction. Investigating the effectiveness of digital platforms, educational apps, and online resources in promoting problem-solving skills and conceptual understanding can provide valuable insights for classroom practice. Additionally, examining the differential impact of these technological interventions based on teacher characteristics, such as age, gender, and educational attainment, can contribute to personalized and effective implementation strategies. Lastly, longitudinal research designs can be employed to investigate the long-term effects of teachers' personal variables, such as age, gender, educational attainment, and teaching experience, on students' mathematics proficiency. Understanding how these factors interact and evolve over time can inform targeted interventions and policy decisions aimed at enhancing mathematics education. Longitudinal studies can also shed light on the stability and consistency of the identified relationships and provide insights into the mechanisms that underlie these associations. By addressing these research recommendations, we can further advance our knowledge of effective instructional practices, teacher professional development, and the factors influencing mathematics proficiency in Grade VI pupils. This knowledge can inform evidence-based policies and interventions that promote high-quality mathematics education and improve student outcomes.

Implications of this Study to Teacher Preparation Program

This study has important implications for teacher education programs. Firstly, programs should prioritize the development of mathematics teachers' content knowledge, focusing on comprehensive coursework that covers core mathematical topics, problem-solving approaches, reasoning skills, and connections across mathematical domains. Secondly, instruction on effective instructional approaches and strategies for solving word problems should be incorporated, allowing pre-service teachers to learn and practice these approaches in authentic classroom settings. Additionally, programs should address gender disparities by promoting gender diversity in mathematics education, supporting the recruitment and retention of male teachers, and fostering inclusive learning environments. Professional development opportunities should be provided to in-service teachers to deepen their understanding of instructional approaches, problem-solving strategies, and conceptual development in mathematics. Lastly, teacher education programs should foster reflective and inquiry-based teaching practices, encouraging pre-service teachers to engage in self-reflection, classroom observation, and collaborative learning with peers and experienced teachers. By implementing these recommendations, teacher education programs can better prepare mathematics teachers to enhance students' mathematical proficiency and improve overall mathematics education outcomes.

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