Teachers' Perspectives on the Difficulties Learners Face When Solving Mathematical Word Problems Among Grade Seven Learners in Cheptiret Zone, Uasin-Gishu County, Kenya

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ABSTRACT

The performance of learners in mathematics remains abysmally low, as evidenced by national examination results, and word problems continue to be the greatest challenge faced by learners in junior school. The teachers' observation of learners' interactions with mathematical language are essential for understanding and investigating the challenges learners face in tackling mathematical word problems. The study was conducted among grade seven learners and their mathematics teachers at Cheptiret Zone, Uasin-Gishu County, Kenya, and was guided by the third objective of a broad research project, which aimed at determining teachers' perspectives on challenges learners face when solving word problems in mathematics. This study used a descriptive survey research design. The fifteen mathematics teachers in the sampled schools were carefully selected using purposive sampling techniques, and they were asked to respond to the structured questionnaire and the follow-up interview schedule. Quantitative data were summarized using frequencies and percentages and presented in tables; no inferential statistical tests were used. The reliability of the research instruments was measured using Cronbach's alpha coefficient, and the subscale of the teachers' perspective obtained a Cronbach's alpha coefficient greater than 0.7. The results indicate that, from the teachers' perspectives, word problems are difficult for many Grade Seven learners, that mathematical language is one of the reasons for the difficulty most teachers faced, and that most teachers adapted to varying their methods of teaching and actively encouraged learners to have positive attitudes towards mathematics. Learners' carelessness, lack of comprehension, and transformation of text into mathematical operations were other common challenges that were identified by teachers. The study concludes that teachers' perceptions identify mathematical language as an important contributor to word-problem difficulty, alongside comprehension, operation selection, and translation of text into mathematical form, and suggests that teachers should have ongoing professional development in mathematical-language pedagogy, use of simplified language in teaching, and collaborative teaching to improve word-problem-solving ability in learners.

Keywords: mathematical language, word problems, teachers' perspectives, problem solving, Grade Seven learners

INTRODUCTION

Mathematics is about the real world, and language is the main way mathematical ideas are shared in the classroom (Silby, 2006). Communication is broadly recognized as a key element of mathematics learning, and pupils need many opportunities to be involved in problem-solving in order to develop mathematical proficiency (Kilpatrick, Swafford & Findell, 2001). Word problems are used throughout the mathematics curriculum to illustrate and practice mathematics, but learners tend to have problems understanding the language used in word problems and understanding the problem (Sepeng & Madzorera, 2014).

Like any language, mathematical language has its own grammar, syntax, vocabulary, word order, synonyms, negations and sentence structure (Vacca & Vacca, 2016). Mathematical language is not frequently used in everyday communication, making it even more challenging for learners to encounter the language the first time in a word problem, as Krussel, Edwards & Springer (2004) state. Teachers, who are the first implementers of the curriculum, and the adults who have the longest, most regular interaction with learners' problem-solving

behavior, play a unique role in describing the nature of the problem-solving difficulties and the means that support or constrain the learner in the process of solving the problems.

There has been significant research focused on how learners experience math word problems, but relatively little has focused on the experience of teachers in the classroom and how they react to the problems. This manuscript is directed to this third goal of a larger study of mathematical language and problem-solving: to identify teachers' conceptions of the challenges that learners face in solving mathematical word problems.

Statement of the Problem

The Kenya Certificate of Primary Education (KCPE) results indicate a poor performance of the learners in mathematics over the years, which implies that the desired learning outcomes of the mathematics curriculum have not been fully realised. Teaching in the class should be exact and clear, and the words used in the topic should have a meaning and be readable to students to understand the problem they are asked to solve.

In teaching mathematical vocabulary, it is not enough just to give a definition of the terms; it is necessary to give them a conceptual understanding of the mathematical terms so that they can apply them properly when solving word problems. What is important in this study is that it explores these problems as reported by teachers in relation to their experience in the classroom. It does not provide direct measurement of learner performance or causal relationships or school context or teacher experience or systematic differences in reported difficulties.

Learner struggles in solving word problems are observed every day by teachers, who then design the instructional strategies to address the struggling every day; teachers are in the best position to see and identify patterns of struggling to solve word problems across cohorts of students. If teachers' language apprehensions are not documented, interventions aimed at enhancing the students' mastery of language surrounding mathematics may be based on assumptions and not evidence of the classroom experiences of those who are to be the beneficiaries. In this background, the present study aimed at finding the attitudes of mathematics teachers of the Cheptiret zone, Uasin-Gishu County, towards the challenges encountered by their learners in solving mathematical word problems.

Objective of the Study: To determine teachers' perspectives on the difficulties their learners have when solving mathematical word problems.

LITERATURE REVIEW

Teachers' Knowledge and Problem Solving

Teachers need to hold knowledge of mathematical problem-solving both for themselves as problem solvers and in order to help learners become better problem solvers; a teacher's knowledge of and ability to teach problem-solving is therefore central to learner outcomes (Chapman, 2015).

Anderson (2009) agrees that problem-solving is an important mathematical activity because it requires learners to integrate abilities and concepts to deal with specific mathematical circumstances. According to the National Centre for Education Evaluation and Regional Assistance (NCEE, 2012), problem-solving is an essential component of all mathematics education and should not be treated as a separate subject; it should instead run through number and operations, algebra, geometry, measurement, and data analysis.

Stigler and Hiebert (2004) note that problem solving can be used to effectively introduce new mathematical knowledge to learners by establishing a need for it, while Carson (2007) observes that problem solving bridges the gap between theory and practice by allowing learners to apply abstract academic knowledge to real-world situations. Rigelman (2007) further argues that strong problem solvers are versatile and fluent thinkers who are confident in their knowledge and procedures and that fostering this disposition in learners is an important part of a teacher's role.

The Linguistic Aspects of Word Problems from a Teaching Perspective

Despite the many different types of word problems that exist, language plays a critical part in all of them. Sepeng and Madzorera (2014) found that the most challenging component of solving a mathematical word problem for learners is determining what operation or operations must be performed. From a teaching standpoint, this means that instruction cannot focus on computation alone; teachers must also explicitly teach learners how to decode the language of the problem itself. Word problems, according to Dela Cruz and Lapinid (2014), also expose learners to more mechanical difficulties, such as copying numbers incorrectly or confusing the sequence of values in a question, both of which teachers frequently cite as sources of learner error that are distinct from, yet compounded by, language difficulty.

Teachers' Attitude, Motivation and Classroom Practice

Motivated learners are more eager to interact and learn (Barwell, 2011, as cited in the broader study), and teachers are expected to detect learners who are disengaged and to devise strategies to re-engage them, such as embedding word problems within familiar or historical contexts to increase participation. Pearce, Bruun, Skinner and Lopez-Mohler (2013) found that working through a problem alone was the most commonly reported classroom practice and that reading skills had a substantial impact on learners' ability to solve word problems, reinforcing the argument that language instruction and problem-solving instruction cannot be separated.

Collaborative teaching has also been proposed as a strategy through which teachers can pool their expertise to address the challenges of teaching problem-solving. Although it exposes individual teaching styles more than a traditional one-teacher classroom, collaborative teaching allows teachers to engage in richer professional dialogue and to benefit from one another's approaches when tackling learners' difficulties with mathematical language (Chapman, 2015).

METHODOLOGY

Research Design and Study Area

Given the purposive sample of 15 teachers from one zone, the design is best interpreted as descriptive and exploratory. The findings are specific to the participating teachers and the Cheptiret Zone context and should not be generalized to all Grade Seven learners or mathematics teachers in Kenya. The study adopted a descriptive survey research design, which employs quantitative and qualitative techniques through questionnaires and interview schedules to describe a phenomenon as it naturally occurs. The study was carried out in Cheptiret Zone, Uasin-Gishu County, Kenya, an area with a Grade Seven learner population of 1,292 drawn from 31 primary schools.

Target Population, Sample and Sampling Procedure

In line with the third objective, the target population for this component of the study comprised the mathematics teachers of the sampled schools in Cheptiret Zone. Purposive sampling was used to select fifteen (15) mathematics teachers from fifteen schools in the zone on the basis that they were directly responsible for teaching mathematical word problems to Grade Seven learners and were therefore best placed to describe the difficulties learners face.

Research Instruments

Data were collected using two complementary instruments: a structured teachers' questionnaire employing a five-point Likert scale (strongly agree, agree, undecided, disagree, strongly disagree) and a semi-structured interview schedule administered to the same fifteen teachers. The questionnaire captured teachers' agreement with statements on the difficulty of word problems, the role of mathematical language, teaching methods used, and learner behaviour, while the interview schedule allowed teachers to elaborate on their best methods for teaching word problems, the specific difficulties their learners experienced, and their overall perspective on teaching mathematical word problems.

Validity and Reliability of Research Instruments

Content and construct validity were established through expert judgement from university supervisors and research experts in the School of Education, who reviewed the instruments to confirm that the question items measured what they were intended to measure. Reliability was assessed through a pilot study conducted in the neighbouring Keiyo Zone, using a 10 per cent representative sample following the methodological guidance cited in the study. Cronbach's alpha coefficient was applied, with a coefficient of 0.7 or above considered adequate. As shown in Table 1, the language-difficulties and problem-solving-ability sub-scales returned alpha values of 0.836 and 0.787, respectively, both above the acceptable threshold.

Table 1: Reliability of Research Instruments

Variable	Number of Items	Alpha Value
Language difficulties	3	0.836
Problem solving ability	5	0.787
Teachers' perspectives	7	0.812*

*Computed for the teachers' perspectives sub-scale using the same Cronbach's Alpha procedure.

Data Collection and Analysis Procedures

For interpretation of the five-point Likert items, 'Strongly Agree' and 'Agree' were treated as agreement, 'Disagree' and 'Strongly Disagree' as disagreement, and 'Undecided' as a separate category. The analysis reports frequencies and percentages only; therefore, the response patterns are descriptive rather than tests of statistical significance.

Following ethical clearance from the Moi University Ethical Review Committee and authorisation from the relevant education offices, questionnaires were administered to teachers and interviews were conducted at their respective schools. Completed questionnaires were checked for completeness before analysis. Quantitative data from the Likert-scale items were analysed using descriptive statistics, namely frequencies and percentages, and presented in tables, while qualitative data from the interview schedule were analysed thematically and used to corroborate and enrich the quantitative findings.

RESULTS

Response Rate and Demographic Characteristics

All fifteen (15) sampled mathematics teachers completed and returned the questionnaire and participated in the interview schedule, giving a response rate of 100%. Table 2 presents the gender distribution of the respondents, while Table 3 presents their teaching experience.

Table 2: Gender of Respondents

Gender	Frequency	Percentage (%)
Male	9	60.0
Female	6	40.0
Total	**15**	**100.0**

Majority of the mathematics teachers were male at 60%, compared to 40% female, a pattern that may partly reflect broader staffing patterns in upper-primary mathematics teaching in the zone.

Table 3: Teaching Experience of Respondents

Experience	Frequency	Percentage (%)
0 - 5 years	4	26.7

6 - 10 years	2	13.3
11 - 15 years	5	33.3
Above 15 years	4	26.7
Total	**15**	**100.0**

Majority of the teachers, 33.3%, had between 11 and 15 years of teaching experience, while 26.7% each had 0-5 years and above 15 years of experience, and 13.3% had 6-10 years of experience. This spread suggests that the perspectives gathered were drawn from teachers with a broad range of classroom experience.

Teachers' Perspectives on Difficulties Learners Face when Solving Word Problems

Table 4 presents teachers' responses to statements on the difficulties their learners experience when solving mathematical word problems.

Table 4: Teachers' Perspectives on Learners' Difficulties in Solving Mathematical Word Problems

Statement	SA f(%)	A f(%)	UD f(%)	DA f(%)	SD f(%)
Solving mathematical word problems is hard to most learners	4 (26.7)	5 (33.3)	3 (20.0)	3 (20.0)	0 (0.0)
Mathematical language is a major cause of poor performance in mathematics	0 (0.0)	6 (40.0)	4 (26.7)	2 (13.3)	3 (20.0)
I often vary my teaching methods of problem solving	6 (40.0)	4 (26.7)	3 (20.0)	0 (0.0)	2 (13.3)
Learners rarely seek assistance in word problems	0 (0.0)	7 (46.7)	7 (46.7)	1 (6.6)	0 (0.0)
Most mathematics teachers avoid word problems during lesson presentation	0 (0.0)	0 (0.0)	3 (20.0)	5 (33.3)	7 (46.7)
I always motivate learners to develop a positive attitude towards mathematics	8 (53.3)	4 (26.7)	2 (13.3)	1 (6.7)	0 (0.0)
Learners take longer than the stipulated time to solve word problems	0 (0.0)	9 (60.0)	3 (20.0)	2 (13.3)	1 (6.7)

On whether solving mathematical word problems is hard for most learners, 26.7% of teachers strongly agreed and 33.3% agreed, giving a combined agreement of 60%, while 20% disagreed. Within this sample, a majority of teachers reported that word problems were difficult for their learners. This finding should be read as a description of participating teachers' perceptions rather than as a direct estimate of learner ability. On whether mathematical language is a major cause of poor performance in mathematics, 40% of teachers agreed, while 33.3% disagreed or strongly disagreed, suggesting that although language is widely recognised as a contributing factor, teachers do not view it as the sole explanation for poor performance. Because the sample contains only 15 teachers, percentages should be interpreted as descriptive patterns within this group; individual responses can materially affect the reported percentages.

A majority of teachers, 40% strongly agreeing and 26.7% agreeing, reported that they often vary their teaching methods for problem-solving, and 53.3% strongly agreed that they always motivate learners to develop a positive attitude towards mathematics. Teachers were divided on whether learners rarely seek assistance with word problems, with agreement and undecided responses each at 46.7%. Notably, 46.7% of teachers strongly disagreed that most mathematics teachers avoid word problems during lesson presentation, indicating that, in the teachers' own assessment, word problems are not being sidestepped in instruction. Finally, 60% of teachers agreed that learners take longer than the stipulated time to solve word problems, indicating a reported pacing challenge. The questionnaire alone cannot establish whether the longer time is caused specifically by comprehension demands, since other factors may also contribute.

Interview Findings on Teachers' Perspectives

The results of the interviews were consistent with the questionnaire results. Most teachers reported that they "feel good while teaching mathematics" and they see mathematics as "a fun subject to learn about", which was very different from how the learners see mathematics as "a difficult subject". Teachers reported that most learners performed fairly well in mathematics papers containing more word problems, some performed poorly, and a minority performed exceptionally well; most teachers rated their teaching of these papers as being "meets requirement", and a minority rated it as being "exceptional".

Concerning the specific problems learners meet, teachers most often mentioned that learners are careless, for example, copying the numbers incorrectly (for example, copying 500 instead of 1,500) or mixing up the numbering of the statements in a question. In addition, teachers commented that some children often perform the wrong operation, for instance, using addition when multiplication was needed. Regarding their preferred teaching methods, teachers reported using one single mathematical topic and approaching it from different angles, using group discussion to tackle topics that were difficult for learners, sorting problems by difficulty, and starting with 1-step problems before moving to 2-step or 3-step problems.

Table 5 summarizes the main themes generated from the interview responses. The evidence is paraphrased because the manuscript contains summarized responses rather than verbatim interview transcripts.

Major theme	Evidence from interview responses	Interpretation
Carelessness and inaccurate copying	Errors due to carelessness and inaccurate copying was reported by teachers such as copying 500 when the actual number is 1,500 and getting the sequence of numbers wrong.	There are some errors reported that are not only when computing but also when reading and recording information.
Incorrect operation selection	Teachers reported that some of the learners use the wrong operation, e.g., using addition when multiplication is needed.	It can be challenging for students to interpret the relationship in the text to a suitable operation.
Translation of text into mathematics	Difficulty getting from the wording of the problem to the mathematical operation or representation was identified as a difficulty for teachers in the translation process	This emphasizes the focus of the study, mathematical language and problem interpretation.
Instructional responses	teachers used a variety of approaches, graduated difficulty, and one-step problems before two- or three-step problems, and described multiple approaches.	Teachers indicated that they adapted their teaching, rather than using only one approach to teaching.
Learner attitudes and engagement	Teachers said they encourage positive attitudes, and that mathematics is enjoyable to teach; some learners, however, think mathematics is difficult.	Affective and motivational issues can interfere with comprehension or procedural issues.

DISCUSSION

Reading ability and working memory have also been identified in the literature as being relevant for this study, and teacher responses to the interview questions and classroom practices reported indicated that pre-teaching mathematical concepts, the sequence of instruction, amount of time to practice, and attitudes of the learners might also have an impact on performance.

The majority of teachers' perceptions of the difficulty of word problems for most learners are aligned with Pape (2004), who found that the difficult part of solving a mathematical word problem is understanding the problem and deciding which operations to perform, and with Sepeng and Madzorera (2014), who also found operation

selection to be the most challenging component of word problems. The teacher endorsement of mathematical language as "the" cause of poor performance was not unanimous, which resonates with the larger literature that acknowledges that other factors such as level of reading, working memory, and instructional strategy play a role in the poor performance of mathematical language, in addition to language (Lee, Ng, Ng & Lim, 2004).

The findings revealed teachers' reported usage of varied teaching methods as well as their deliberate motivation of learners corresponds with Rigelman's (2007) observation that building learners' confidence and versatility as problem solvers is central to effective mathematics teaching and with Chapman's (2015) argument that teachers' own conceptions of contextual problems have an impact on the way problem solving is experienced by the learners. The positive finding is that teachers do not report avoiding word problems when presenting lessons, as doing so would preclude students from experiencing the mathematical language that they need to become fluent in, in line with Stigler and Hiebert (2004), who state that problem-solving should be used to directly present new mathematical knowledge and not set aside.

The teachers' focus on learners' carelessness in solving word problems, learners' incorrect selection of operations, and the difficulty involved in translating word problems into mathematical representation corroborates Dela Cruz and Lapinid's (2014) findings that learners' difficulties in solving word problems fluently are due to the carelessness of expression, the difficulty in translating word problems into mathematical representation, and the difficulty in selecting the appropriate operation. The emphasis of learner carelessness, incorrect operation selection, and difficulty in translating text into mathematical form is in line with Adams' (2003) argument that many learners experience difficulty in solving word problems fluently because they have not been taught to read word problems in a way that is appropriate for mathematical problems. The findings as a whole, however, indicate that the teachers' views align with the broader research literature on factors contributing to learning difficulties and with pedagogical interventions likely to help learners with such difficulties, thereby substantiating the study's more general recommendations in practice.

Limitations of The Study

Lastly, the data from the interviews were thematized based on the summarized responses. The manuscript does not contain verbatim quotations and an audit trail of individual coding decisions. Future studies should include and report on correctly anonymized excerpts from the interviews and triangulate teachers' perceptions with data from learners' tasks or classroom observations. Thirdly, analysis is descriptive and frequencies and percentages are used. Because of the study's design, no statistically significant differences in teachers' perceptions by gender, experience, or school context can be drawn. Secondly, the study relies on teachers' self-reported perceptions, not actual observation of teacher/learner interaction in class or on word-problem tasks. The results of the analysis can reveal patterns of errors that teachers notice, but do not reveal the actual level of errors, and cannot show that mathematical language is a source of poor performances. There are several limitations of the study which need to be taken into account when interpreting the results. The sample only had 15 teachers of mathematics who were purposively selected from one zone. The results, therefore, are exploratory, descriptive and restricted to the Grade Seven learners at the schools involved and should not be extrapolated to all the Grade Seven learners or mathematics teachers in Kenya.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Based on the findings, the study concludes that the participating teachers in Cheptiret Zone perceive mathematical word problems as difficult for many Grade Seven learners. Mathematical language is recognized as an important contributor, but the questionnaire responses do not support treating it as the sole explanation for poor performance. Teachers also reported difficulties involving comprehension, copying and sequencing information, selecting appropriate operations, and translating text into mathematical form. The findings further indicate that teachers report varying their instructional methods and encouraging positive learner attitudes. These conclusions describe teachers' perceptions within the study setting and do not constitute direct evidence of learner ability or causal effects.

Recommendations

Based on the findings and conclusion, the study recommends the following:

1. Teachers should be supported through continuous professional development that explicitly addresses mathematical-language pedagogy, equipping them with strategies for teaching learners to decode and translate word-problem language into correct mathematical operations.

2. Schools should encourage collaborative teaching arrangements in mathematics, allowing teachers to share effective strategies for teaching word problems and to jointly address recurring learner difficulties identified through classroom observation.

3. Mathematics teacher trainers, through the Ministry of Education, should be equipped with clear guidance on presenting appropriate definitions of mathematical language when preparing content for learners, so that this is reinforced consistently from teacher training through to classroom delivery.

4. The Kenya Institute of Curriculum Development should place a premium on the clarity and consistency of mathematical language used in approved textbooks, given teachers' repeated identification of language and text-based difficulties as a barrier to learners' success.

5. Teachers should be encouraged to allocate adequate instructional time for word-problem practice, given teachers' own observation that learners take longer than the stipulated time to solve such problems, and to sequence practice from simple, one-step problems toward more complex, multi-step problems.

Suggestion for Further Research

Further research should triangulate teachers' perceptions with learner performance data, classroom observations, and analysis of actual word-problem tasks. A larger sample drawn from multiple zones or counties would also permit more defensible comparisons across teacher characteristics and school contexts. If respondent-level data are collected, inferential analyses could then examine whether teachers' perceptions vary by gender, teaching experience, or other relevant contextual factors.

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