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The Language Difficulties Learners' Face When Solving Mathematical Word Problem.

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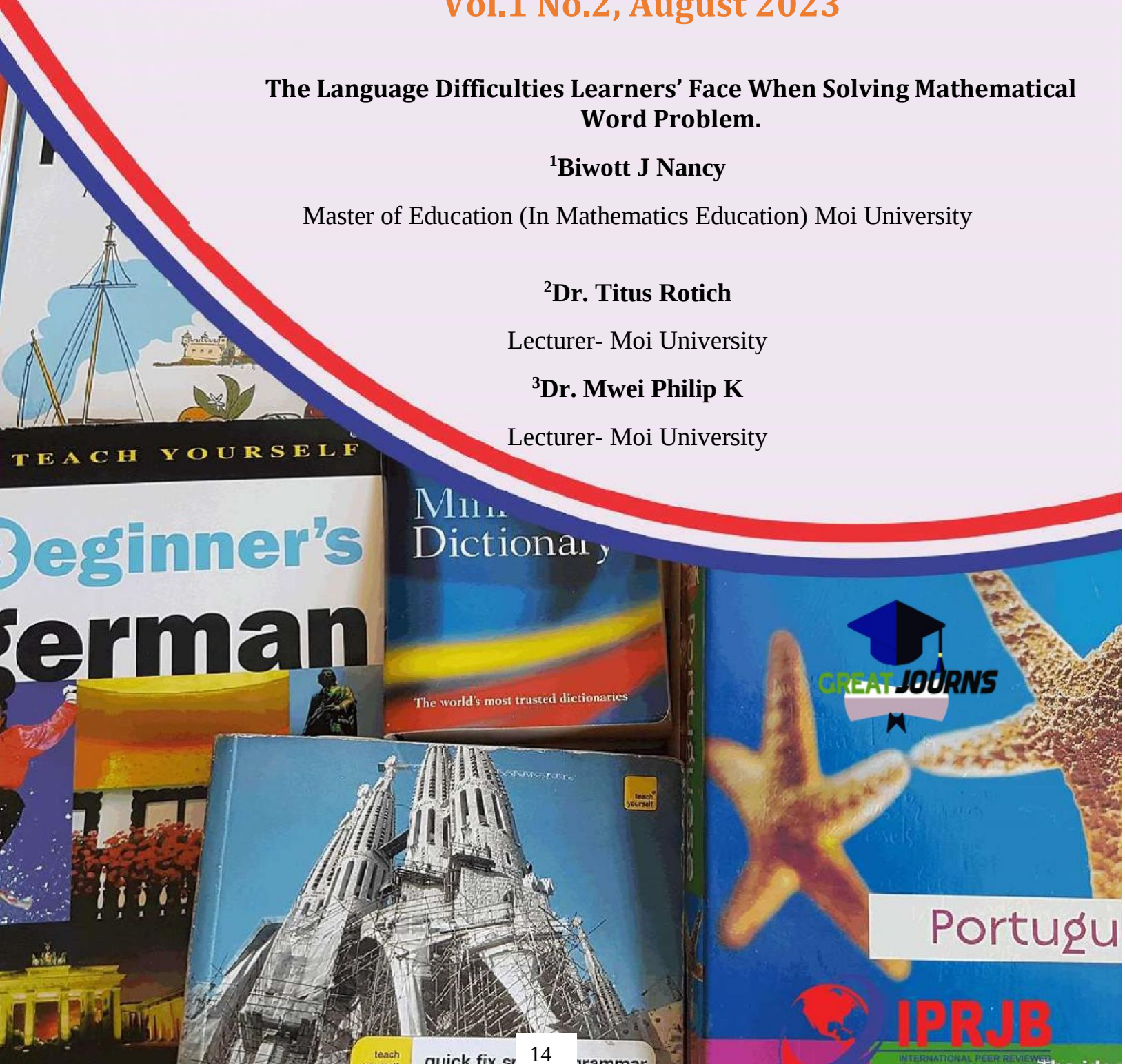

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ABSTRACT: Learner performance in Mathematics as reflected by the Kenya Certificate of Primary Examination (KCPE) results has remained poor over the years. It means that the set objectives in the primary school Mathematics syllabus have not been achieved fully. Yet, learner proficiency in the use of mathematical language to problem solving remains critical and has not been investigated in the recent past. The purpose of this study was to assess the language difficulties learners' face when solving mathematical word problem. The theory employed in the study was cognitive theory propounded by Piaget. The study used a mixed method research approach. The target population were all Standard seven pupils and teachers of Mathematics from public schools in Cheptiret zone, Uasin Gishu County. The study sample size comprised of 388 class seven learners selected through simple random sampling and 15 mathematics class seven teachers selected through purposive sampling from 15 schools. The research tools used for data collection included pupils' questionnaires, teachers' questionnaires, and teachers' interview guide. Quantitative data was analysed using descriptive statistics while qualitative data was analysed thematically. The analyzed data were presented in tables inform of percentages and frequencies. Quantitative findings revealed that over 37.5% of learners agreed that the mathematical language used affects their ability to solve word problems; 50% of the learners and 56.3% of teachers also agreed that the ability to read and comprehend the language used helped learners to be successful at solving mathematics word problems. From teachers' interview, findings revealed that most learners score highly when questions are numerically expressed but experience difficulties in interpreting wordy questions. In addition, on wordy mathematical problems, learners have a challenge in deciding on the operations to be performed. Based on the findings, the study made the following conclusions This study found out that learners face a number of challenges that influence how they solve mathematical word problem; key among them are solving mathematical word problem is hard to most class seven learners, the difficult part of solving mathematical word problem appears to be the process of understanding a problem and deciding what operations needs to be performed. Actively reading a problem supports individual to make sense of it however the depth and quality of learners decoding and subsequent understanding of the text impacts their success. Ability to read and know basic facts helped most learners be successful at solving word problem. Based on the findings and conclusion of the study recommends that: The study recommended a wide exposure to mathematical language from the lower classes and the use of simple and appropriate language during teaching, learning and assessment process.

Key Words: Language difficulties, learners' face, solving mathematical & word problem.

1.0 INTRODUCTION

Mathematics is a way of viewing and making sense of the real world. Mathematics has been viewed differently by different people depending on their experiences of it. Other researchers view it as a search of patterns, as a way of solving problems, as a means of communicating information and ideas and as a creative activity. Mathematics is vital both for expanding internal advancement and for the maintenance of leading role with world community.

Mathematics Education at the primary school level is the bedrock and the foundation towards higher knowledge. It is an investment as well as instrument that can be used to achieve a rapid economic, social, political, technological, scientific and cultural development in the country. It lays the foundation for field such as engineering, medicine, computer and technological specialization (Githua, 2013).

Many mathematicians and mathematics educators have claimed that problem solving is at the heart of all the teaching and learning activities in mathematics. Various studies have indicated that the language challenge is one of the major factors contributing towards poor performance of many learners in mathematics (Barton, & Barton 2003).

According to Silby (2006), communicating mathematics to learners in a classroom is mediated by language. Therefore, language has a crucial role to play in communicating and developing mathematics education. The National Council of Teachers of Mathematics, NCTM (2000) stressed the importance of role of language in mathematics teaching and learning. In this study communication is emphasized as an essential part of mathematics and mathematics education. Learners need frequent opportunities to engage in problem solving so that they can become mathematically proficient.

Mathematical language proficiency characterizes learning mathematics successfully in such a way that one develops; conceptual understanding, procedural fluency, strategic competence, adaptive reasoning and a productive disposition towards mathematics (Kilpatrick, Swafford, & Findell, 2001)

Word problems are consistently used as practice exercises and illustrations throughout mathematic curriculum. Learners generally grapple with the language and experience difficulty in comprehending word problem Sepeng, P., & Madzorera, A. (2014). Therefore it seems reasonable to expect that a learner performance in solving word problem is affected by difficulties in comprehension. Bryant (2005) found that several difficulties were common in children with mathematical weakness, but the commonest problem was difficulty in carrying out multi step arithmetic. Problem solving goes beyond the typical thinking and reasoning learners employ while solving exercises (Polya 1945/2004; Verschaffel, Greer, & De Corte, 2000)

Mathematics is a compulsory subject in Kenyan primary school curriculum. The importance of school Mathematics cannot be overemphasized. Mathematics is crucial for an increased student's achievement in school, for producing informed citizens, success in careers, as well as in personal fulfilment. In today's technology driven society, greater demands have been placed on individuals to interpret and use Mathematics to make sense of information and complex situations. Mathematics is an essential tool in many fields, including natural science, engineering, medicine, and the social sciences. It is also used in day-to-day activities at home, in the market places and in offices (Neyland, 2014).

Despite the critical value of Mathematics in the society, Pupils' performance in the subject in Kenya Certificate of Primary Education (KCPE) has been dismal (KNEC, 2010). Every year KNEC reports low pupils performance in Mathematics in KCPE. For instance, the pupils mean mark was 19.04 (2006), 19.73 (2007), 21.295 (2008), 21.13 (2009), 21.19 (2010), 22.0 (2011), 28.7 (2012) respectively. (The Council attributes this to lack of conceptual understanding among the pupils (KNEC Report, 2010, 2011, 2012). A key component in understanding Mathematics is the learning of mathematical vocabulary. Vocabulary is the knowledge of word and its meanings (Stahl, 2015). However, it also encompasses comprehension of how words are used in oral and written formats. According to Miller (2013, p. 12), pupils are likely to be handicapped in their effort to learn Mathematics if they do not understand the vocabulary that is used in Mathematics classrooms, textbooks and assessment tests.

Mathematical vocabulary refers to words that label Mathematical concepts such as quotient, volume, vertex, dividend, and hexagon (Vacca & Vacca, 2016). One of the obstacles that make mathematical vocabulary difficult to learn is lack of opportunity to learn and practice the words (Monroe & Orme, 2012). This is because many of the vocabulary used in Mathematics classroom are rarely encountered in everyday life. In addition, Mathematics teachers often neglect meaningful vocabularies instruction, many terms have meanings in the realm of Mathematics differ from their meanings in everyday usage (Njoroge, 2013). These include power, difference, volume, factors among others. Without appropriate vocabulary instruction, pupils are likely to experience difficulties and interference in the learning of concepts for which they have background knowledge that appears unrelated to Mathematics. According to Vacca and Vacca (2016), the abstract nature of mathematical vocabulary is another factor contributing to difficulty in learning mathematical vocabulary. This is because many mathematical words represent concepts and not objects. Words such as quotient, fraction, and factor describe concepts but they have no unique unambiguous representations in the real world.

The importance of language in the learning of Mathematics cannot be overemphasized. Mathematics ideas can be understood by making connections between language, symbols, pictures and real-life situations (Haylock & Thangata, 2017). For the mathematical concepts to be understood and used, they require to be associated with a word or phrase. An integral part of learning Mathematics is using vocabulary to communicate Mathematical ideas; to explain, conjure and defend one's ideas orally and writing about Mathematics (NCTM, 2018). Pupils need to understand the meaning of mathematics vocabulary whether written or spoken-in order to understand and communicate mathematics ideas. According to Rubenstein and Thompson (2012), terms, phrases, and symbols are essential in communicating Mathematical ideas; and becoming fluent in them is vital for children's mathematical learning which is in line with 21st century pedagogy skills. Research reveals that the knowledge of Mathematics vocabulary directly affects achievement in arithmetic, particularly problem-solving Stahl and Fairbanks, (1986). Biemiller (2011) established that vocabulary knowledge is strongly related to the overall academic achievement in school. Although pupils may excel in computation, their ability to apply their Mathematics skills will be hindered if they do not understand the vocabulary required to master content or are unable to apply the skills in future situations. Thus, teaching vocabulary in the Mathematical content area is a critical element of effective instruction.

Mathematics can be described as a specialized language. It is viewed as a language, which is concise, and precise (Breakwell, 2012). It consists of both terminologies (vocabulary) and symbols. Unlike English language, Mathematics language is highly symbolized and it mainly uses ideograms (symbols for communicating ideas) as opposed to phonograms (symbols for words). Communication in Mathematics embraces the usage of various symbols and notations for brevity. Mathematics textbooks, examinations and instruction classrooms are often in mathematical language as well as in English Language. Moreover, it is a universal language with syntactical and rhetorical structures (Njoroge, 2003). Its rhetorical structures consist of indefinite terms, definite terms, axioms and theorems.

Mathematical language, like other languages, has its peculiar grammar, syntax, vocabulary, word order, synonyms, negations, conventions, abbreviations, sentence structure, and paragraph structure.(Rudd,2008) It has certain language features unparalleled in other languages. Likewise, Mathematics vocabulary is not commonly used in daily settings because of its technical nature and due to the fact that is it is often narrowly defined. Krussel (2018) views language as an essential part of the Mathematics construct as language is an indispensable tool in Mathematics. Pupils are therefore likely to face difficulties in solving word problems loaded with difficult and unfamiliar vocabulary (Abedi & Lord, 2011; Solano-Flores & Trumbull, 2013). The syntax-language structure used in Mathematics is highly complex and very specific. Mathematics uses syntactic features that many pupils find both cumbersome, and quite confusing. This research study assessed how mathematical language affects problem solving ability among class seven learners in Cheptiret zone, Uasin-Gishu County.

1.1 Statement of the problem

Mathematics instruction in classrooms should be done precisely by giving meaning to the vocabulary embedded in the topic under consideration. This meaning help the learner to read and comprehend the question. There has not been any deliberate effort for direct instruction of mathematical vocabulary (Njoroge, 2013). To be effective, mathematical vocabulary instruction must provide more than simple definitions. Pupils need not just surface knowledge of the vocabulary but conceptual knowledge. Teaching mathematical vocabulary words solely as definitions as is the practice in most Kenyan schools does not assist pupils in comprehending the word when found in Mathematics textbooks and examination items. Pupils must be actively engaged in building background knowledge using key content specific vocabulary. Development of vocabulary is crucial to any experience involving language.

An important component in mathematical language is learning mathematical vocabulary. Mathematical language is an essential element of learning, thinking, understanding and communicating Mathematics. The Frayer model is one the best strategy of direct instruction of Mathematics vocabulary (Marzano, 2013).

Kigamba & Wanjiru (2020) undertook a study to investigate the influence of Mathematical vocabulary instruction on students' Mathematics achievement in Muranga County, revealing that there was a positive association between Mathematical vocabulary instruction and students' performance. However, there are few studies done so far in Uasin Gishu County on the effects of Mathematical language to problem solving on pupils' achievement in Mathematics. It is in view of this gap that the study was designed to assess how mathematical language affects problem solving ability among class seven learners in Cheptiret zone, Uasin-Gishu County.

1.2 Purpose of the Study

The purpose of the study was to find out the Language Difficulties Learners' Face When Solving Mathematical Word Problem.

II: LITERATURE REVIEW

2.1 Language difficulties learners face when solving mathematical word problem.

Solving mathematical word problem is an integral part of mathematics education because these problems allow learners to apply their mathematical knowledge and skills to real world situations. Researchers have shown that the process of modelling word problem is often affected by the language. (Verschaffel, Geer & De Corte 2000) have noted that the wording and rewarding of word problems have systematic effects in the problem solving performance of learners. Such effects have been associated with difficulties in understanding certain types of problems, such as those that use ambiguous and abstract language Moreau, S., & Coquin Viennot, D. (2003) and contexts. Reading completely

depends on being able to understand the structures of texts and nuances of language; to interpret the authors' idea; and to visualize, evaluate and infer meaning (Ball & Bass, 2003; p.29)

2.1.1 Reading and Comprehending Word Problem

When reading a text, a mental representation of the text is created by the reader, which describes how the reader understands the text. Many studies about reading comprehension show, or support the conclusion, that "multiple levels of representation are involved in making meaning" (Van Oostendorp & Goldman, 1998, p. viii). Language difficulties prevent learners from comprehending the text of the word problem. The difficult part of solving mathematical word problem appears to be the process of understanding a problem and deciding what operations needs to be performed. Actively reading a problem supports individual to make sense of it however the depth and quality of learners decoding and subsequent understanding of the text affects their success (Pape, 2004). To solve a word problem, individuals must manage both the text and the mathematics encoded within the text (Vilenius Tuohimaa, Aunola & Nurmi 2008). It is essential to sufficiently decode a problem text Adams (2003) asserts that many learners struggle to solve mathematical word problems because they have trouble reading, comprehending and understanding the language of the problem. Additionally, literature (Hosp & Jacek, 2003) proposes that children struggle to solve mathematical word story problems because the problems are complex and hard for them to grasp. Other literature (Barton, Heidema & Jordan, 2003; Vilenius-Tuohimaa, Aunola, & Nurmi, 2008) suggest that explicit analytic reading skills instruction improves learners' ability to solve mathematical problems in a written format.

The National Center for Education Statistics (NCES) (2011) found that many learners struggle to achieve basic proficiency in mathematics and reading. They also assert that reading and mathematics are the foundations to success later in school. Adams (2003) proclaims that learners are not fluently and accurately solving mathematical problems in a written format due to the lack of understanding of the specific language, and not comprehending the written text. He also adds that learners do not consider mathematical written text a language; and therefore, do not utilize reading strategies in order to understand the text.

Furthermore, Jitendra & Griffin (2007) suggest that learners are not properly instructed to solve mathematical word problems. They further assert that teachers rely on the use of textbooks for instruction, which do not effectively teach children to reason and make connections. These scholars opine that this hinders learners' ability to effectively solve written format mathematical problems.

Research by Jitendra & Griffin (2007) asserts that story problems present difficulties for many learners. These scholars say solving these problems poses difficulties because they require learners to understand the language and factual information of the problem, and translate the problem with pertinent information to create an acceptable mental representation. The learners must then devise and monitor a solution plan, and implement effective technical computations.

According to Jitendra & Griffin (2007) learning how to solve story problems involves knowledge about semantic structure and mathematical relations. They emphasize the notion that learners need to know basic arithmetical skills and strategies in order to solve problems in a written format. Jitendra & Griffin (2007) describes story word problems as critical in helping children make connections of meanings, understandings, and relationships to mathematical operations. (NCTM, 2011) emphasizes that problem solving is an essential part of upper classes mathematics curriculum. There is need to integrate mathematical word problem solving strategies and skills. They assert that mathematical word problems can promote learners 'conceptual understanding, foster their ability to reason and communicate mathematically, and capture their interests and curiosity. Developing learners 'abilities to solve problems is not only a fundamental part of mathematics learning across content areas but also an integral part of mathematics learning across grade levels. This study suggests there are specific skills needed for learners to process written information, such as decoding skills and reading comprehension. It further suggests that these play a role in understanding the overall problem and helps being able to effectively solve the problem. Ponce & Garrison (2005) stress the notion that if a student does not have the understanding of what a problem is saying they are not able to figure out the meaning due to comprehension thus they frustrates learners because they are not able to effectively solve written format problems.

Adams (2003) urges educators to emphasize the notion that mathematics is a language and not just something that we do: He reminds us that ignoring this means children may miss the concepts of mathematics that enhance and reinforce their understanding. Adams (2003) asserts that the words, terminology and vocabulary used in mathematics are critical factors in comprehending and communicating answers to problems, and that recognizing and employing formal definitions is essential to understanding and applying important mathematical concepts when reading text. Adams emphasizes the importance of teaching mathematics as a language. Adams (2003) asserts that teachers have to provide different reading strategies in order for learners to comprehend mathematical problems. This has created a need to investigate why they are affected with the reading and comprehending of such questions. This study therefore seek to find out if mathematical language can be a problem in solving mathematics word problem or if the learners are affected by reading and comprehending of mathematical word problem questions.

2.1.2 Transformation/ translation

Learners who are capable of reading and understanding word problem could not transform. They lack the ability to adequately represent the information in the problem in order to solve the problem, and they do not correctly apply appropriate strategies to select the correct operation. Many learners face frustration when solving word problems because multiple steps are required to reach one correct answer, and if a mistake is made at any point in the process, then the whole solution is incorrect. As a result, many learners will simply give up or guess at an answer. Creating a visual representation for a problem helps learners link the relationships between the numbers in the problems with the operations needed to solve them. Learners with learning difficulties in the area of mathematics can benefit from instruction that teaches them to visualize, represent, and think analytically about the problem.

The challenge for teaching word problems is how to help student's use quantitative reasoning to identify the relationship between the quantities in the problem and connect those relationships to appropriate operations. If learners are encouraged to understand and meaningfully represent mathematical word problems rather than directly translate the elements of the problem into corresponding mathematical operation, they may more successfully solve their problems and better comprehend the mathematical concepts embedded within them. Most learners are not able to translate word problem to mathematical equations thus the gap has to be filled. This study will therefore find out apart from reading and comprehending can the learner be affected with the translation of the word problems.

2.1.3 Working out and looking back

After the learner has translated word problem into mathematical equation, he or she has to work out the equation until the correct answer is arrived at. This step has become a difficult stage for the learners due to multi-steps required to solve most questions (Jitendra, 2007). Hence there is need for them to be given proper guidelines in solving multi-steps questions. Different researchers have come up with different techniques to support learners in working out such questions. According to (Mercer, Mercer & Pullen 2011) they came up with a strategy called RIDE; R - Remember the problem correctly.

I - Identify the relevant information.

D - Determine the operation and units for expressing the answer.

E - Enter the correct number, calculate and check the answer.

The above steps were intended to assist learners who experience difficulty with abstract reasoning, attention, memory and/ or visual spatial skills.

TINS Strategy (Owen, 2003) allows learners to use different steps to analyze and solve word problems.

T- Thought, Think about what you need to do to solve this problem and circle the key words.

I - Information circle and write the information needed to solve this problem; draw a

Picture; cross out unneeded information.

N - Number sentence, write a number sentence to represent the problem.

S - Solution sentence, write a solution sentence that explains your answer.

According to (Polya, 1992) there are four steps that a learner has to understand and use to solve mathematical word problem. He suggests steps one must use to solve a problem from the basis of strands in problem solving. The steps are; understanding the problem, devising a plan, carrying out the plan and looking back. This study will investigate if learners after translating the word problem can be capable of working out the word problem and look back to check their working.

2.1.4 Word problems

Word problems are simply problems situated in a real life context (Verschaffel, Van Dooren, Greer, & Mukhopadhyay, 2010); it is this characteristic that differentiates them from other types of problems. This context requires learners to read and understand in order to solve the problem while at the same time incorporate their mathematical understanding. As word problems are not given in a "plain" mathematical expression, they require complex steps to solve (reading, comprehending, transforming into mathematical expression, processing the mathematics, interpreting result to context given, and evaluating the result) (Reys, Lindquist, Lambdin, & Smith, 2014; Ryan & Williams, 2007; Verschaffel et al., 2010). Despite their real life context, the context of word problems is "situated" or encoded into syntax and diction familiar to mathematics (Reed, 1999). The role of learners in reading and comprehending the words in word problems thus affected by this mathematically-situated context.

Regarding this mathematically-situated context, O'Halloran (2015) added that word problem is constructed by its own language system. This language system organizes choices of language function, mathematical symbol, and visual display. Failure in understanding this system will lead to failure in understanding word problems due to its linguistic features. Thus, in order to address linguistic difficulties in solving word problems, it is appropriate to explore linguistics features constructing them. Literatures have described several linguistic features or aspects that construct mathematics language. The work of Schleppegrell (2007) and O'Halloran (2015) provided a thorough exploration of linguistic features of mathematics language. The works used linguistics perspective to elaborate the system and categorize the features of mathematical discourse. They formulated three main features of mathematical discourse i.e. multiple semiotic systems, vocabulary, and grammar and syntax. In accordance with them, the work of Lee (2005) highlighted the features of mathematics language specifically for assessment and instructions. The work mentioned the naming power, a power of particular word or phrase to awaken related concepts in mind, besides vocabulary and syntax as the main features of mathematical language. Although these studies categorized mathematical language into three similar features, Lee focused more on the role of word and syntax while the first two did more on multiple semiotic systems feature. Abedi and Lord (2001) added more by focusing on the use of mathematics language especially in written tests, including word problems. This work contributed to the feature of written instructional language inside word problems. All these references complete each other and are used to give the most accurate picture of linguistic difficulties in mathematics word problems.

Mathematics discourses, and thus word problems, have specific vocabulary. Lee (2005) mentioned the classification of these vocabularies as same-meaning words, math-specific words (technical words), and different meaning words. Same meaning words are words whose meaning in real life and mathematics is the same. For example panjang in both Indonesian daily language and mathematical language has meaning of length or being long. Some other words are specific or technical words only exist in mathematics. For example koefisien (coefficient) and hipotenusa (hypotenuse) only exist in mathematics language, they are not used in daily Indonesian language conversation. The last type of words is words that are used in both daily conversation and mathematics discourse but have different meaning in each. For example fungsi (function) is used in both daily conversation and mathematics, but in Indonesian daily conversation it means the use or functions, while in mathematics it means a mapping of a set to another. Ganjil in daily Indonesian language means strange or odd while in mathematics it means "not even", or a number that is not a multiplication of two. The understanding of the meaning of vocabulary as it exists in mathematics word problems is an important point of attention. Some studies (Seifi et al., 2012) found that learners failed to solve word problems because they could not define the vocabulary in it. The word problems in these studies were given in learners' mother language thus the challenge is not due to translation, but due to how learners make meaning from vocabulary. Interestingly, some studies showed how learners even neglected the meaning of vocabulary in word problem. This issue was addressed in the study by Verschaffel, Greer, and de Corte (2000) and Verschaffel et al. (2010). When given a word problem, learners are more likely to pay attention to only the numbers or symbols rather than the vocabulary. An extreme example was

learners came up with a numerical answer when given the problem "There are 13 boys and 15 girls in a class. How old is the teacher?". This shows that to vocabulary, learners still have lack attention, let alone make meaning from it.

Riccomini, Smith, Hughes, and Fries (2015) suggested a possible strategy to make learners exercise their vocabulary in mathematics word problems. The strategy, called vocabulary teaching, used explicit vocabulary instruction, mnemonic strategies, and multiple on vocabulary, game-like activities, and technological applications to promote mathematical vocabulary. For example, a mnemonic strategy to introduce term "parallel lines" is to associate the phrase "parallel lines" with a "pair of elves" who cannot intersect .This mnemonic strategy helped learners understand the concept of parallel lines in an interesting and memorable fashion. The strategy is not new in and of itself, yet it was sometimes not utilized by teachers due to technicalities (lack of time, no proper training, etc) regardless its effectiveness. In relation to multiple semiotic systems, the challenge created by characteristics of mathematic vocabulary is in understanding each term independently, regardless of the sentence in which it is put, while in multiple semiotic systems, the challenge is in how learners can relate the meaning of a representation (be it language, symbols, or visual representation) to another. It should be understood that the challenges created by the two can be seen as both separated and interrelated at the same time, when considering linguistic challenges in mathematics word problems.

Grammar and Complex Syntax Mathematical discourse also has its own grammar system, a system of rules of words, phrase, and clauses structure in a text; Riccomini, Smith, Hughes, and Fries (2015) suggested a possible strategy to make learners exercise their vocabulary in mathematics word problems. The strategy, called vocabulary teaching, used explicit vocabulary instruction, mnemonic strategies, and multiple exposures on vocabulary, game-like activities, and technological applications to promote mathematical vocabulary. For example, a mnemonic strategy to introduce term "parallel lines" is to associate the phrase "parallel lines" with a "pair of elves" who cannot intersect .This mnemonic strategy helped learners understand the concept of parallel lines in an interesting and memorable fashion.

111: RESEARCH DESIGN AND METHODOLOGY

3.1 Research design

The study followed a mixed method approach. Mixed methods research is an approach to inquiry that combines or associates both qualitative and quantitative forms. Mixed methods approach provides researchers, across research disciplines, with a rigorous approach to answering research questions. Mixed methods were especially useful in understanding contradictions between quantitative results and qualitative findings. Reflect participants' point of view. The study was concerned with ways in which learners can solve mathematical word problem with ease. It is specifically intended to investigate the relationship between effects of mathematical language and problem solving. The approach was employed mainly because it gave a voice to study participants and ensure that study findings are grounded in participants' experiences. Quantitative data was collected through a questionnaire. A questionnaire with structured and open-ended question was administered to explore the extent to which learners made sense of the mathematical language that were used in the word problem solving tasks while qualitative data was collected through interview schedule issued to the teachers.

3.2 Study Area

The study was carried out among class seven learners in Cheptiret Zone, Uasin-Gishu County, which has a population of 1292 learners from 31 schools.

3.3 Target population

The target population refers to the specific group relevant to a particular study. Mugenda and Mugenda (2013) explain that a population is a group of individuals or objects that have the same form of characteristics. The target population of this study was 1292 class seven learners and their mathematics teachers of Cheptiret zone Uasin Gishu County.

3.4 Sample size and Sampling techniques

Sample is part of the research target selected to participate in research, representing general target group. Sampling process is a practise of selecting part of research target to represent whole population. Simple random sampling was used to select class seven learners in fifteen schools from the zone because the schools were of much interest to the researcher. Also Purposive sampling was used to select 15 mathematics teachers in the sampled schools. According to Mugenda and Mugenda (2009), when the study population is less than 10,000 a sample size of between 10% and

30% is good representation of the target population and hence 30% which is the maximum representation is adequate for analysis. Therefore, 388 learners (1292 x 0.30) were considered.

3.5 Research Instruments

This involves the techniques for data gathering phase of the work. In order to meet the objective of the study, the following instruments namely questionnaires and interviews were used to collect data.

3.5.1 Questionnaires

In this study questionnaires were used because it can be given to a large number of respondent simultaneously, it is less expensive particularly in terms of time spent collecting the data. Using this instrument make the respondent to feel that they can remain anonymous and thus may be likely to express controversial opinions. There were open-ended questionnaires where the respondents created their own answers and closed-ended questionnaires which were limited to what researcher provided.

3.5.2 Interview schedule

According to (Kothari, 2012) interview is a conversation where questions are asked and answers are given. In common parlance, the word interview refers to a one-on-one conversation with one person acting in the role of the interviewer and the other in the role of the interviewee. The interviewer asks questions, the interviewee responds, with participants taking turns talking. The study employed both structured and unstructured interview schedule. For the unstructured or free-wheeling and open-ended conversations there is no predetermined plan with prearranged questions, while highly structured conversations specific questions occur in a specified order. This was used to obtain data from the mathematics teachers. This was suitable since it allowed room for more elaboration. The use of interview schedule was essential to the respondent since the data collected was first hand.

3.6 Data collection Procedures

After assessment, corrections were made, the researcher sought clearance from Moi University through the Ethical Review Committee and letter from Dean School of Postgraduate Studies and then consent sought from National Council of Science and Technology (NACOST) to conduct the data collection.

The researcher then obtained a letter of authorization from the School of Education Moi University. This letter was taken to the ministry of Education, County Education officer Uasin Gishu County to obtain permission before proceeding to the field. Letter was dispatched to the Head teachers' of the sampled schools to allow the researcher to use the school for the purpose of the study. One week was considered so as to give the respondent enough time to read and understand then fill in the questionnaire, after dispatching the letters to school the researcher visited the schools to collect data for the study. During the visit questionnaires were administered to teachers and learners. The researcher then collected data from the selected respondents after receiving clearance to conduct the research in the schools sampled for the research.

3.7 Pilot Study

The pilot study was conducted from the neighbouring Keiyo Zone. A 10 percent representative sample size as recommended by Mugenda and Mugenda (2003) was used for the purpose of the pilot study; three (3) schools [10% of 31 schools of the target population] and 38 learners [10% of the 388 targeted learners]. A reason for piloting is to test the instruments accuracy and appropriateness. From the pilot study it was evident that most learners have difficulties in solving mathematics word problem. Learners need to be given thorough practice on solving word problem. After the pilot exercise some items were revised to address the objectivity of the study. The researcher re-framed the items, which appear vague and insert more items to improve the quality of the instruments and this reduced the possibility of misinterpretation.

3.8 Data analysis

The filled questionnaires were checked for completeness to verify that all the questions in the questionnaires were filled. Data collected from questionnaires, was examined to remove those with incomplete items and multiple entries. Quantitative data was coded and entered into the computer for analysis using the Statistical Package for Social Sciences (SPSS) version 24 for windows. Quantitative analysis tends to be based on numerical measurements of specific aspects of phenomena (Hall, 2018; Pritchard, 2013). Closed-ended questions were analysed using nominal scales into mutually exclusive categories and frequencies by employing descriptive statistics using the statistical package for social science (SPSS V 24). Open-ended questions were analysed using conceptual content analysis. Analysis involved the production and interpretation of frequencies counts and tables that was described and summarize

the data. The items on teachers and learners questionnaires were scored on a 5 point as follows: SA- Strongly Agree = 5 points, A –Agree = 4 points, U- Undecided = 3 points, D-Disagree = 2 points and SD- Strongly Disagree = 1 point. Thematic analysis was used to analyse qualitative data from the interview schedules. A thematic analysis strives to identify patterns of themes in the interview data.

3.9 Validity and Reliability of research instruments

3.9.1 Validity of the Research instrument

According to Mugenda and Mugenda (2010), validity refers to the degree to which results obtained from analysis of data collected actually represent the phenomena understudy. This is supported by (Orodho, 2012) who notes that validity refers to the degree to which a test measures what it purports to measure. In other words, validity is the degree to which the results obtained from the data actually represents the phenomena under a study. (Kimberlin & Winterstein 2008) notes that validity of an instrument is improved through expert judgement. To achieve content and construct validity, the researcher sought assistance from the university supervisors and other research experts from the School of Education to ascertain whether the question items in the instruments measured what they were purported to measure. Content validity ensured that the instrument covered all areas to be examined while construct validity ensured that the question items measure the construct it purports to measure. For face validity, the researcher ensured that the general outlook of the instrument is appropriate and appealing to the respondents by use of correct font size and type, adequacy of workspace, clarity of printing among others. Feedback was revised and reviewed to ensure that the question items are adequately and properly structured.

3.9.2 Reliability of the Research instrument

According to Mugenda and Mugenda (2010) reliability is the measure of the degree to which a research instrument yields consistent results or data after repeated trials. Orodho (2012) refers to reliability as the extent to which a test in the research is internally consistent and yields consistent results upon testing and retesting. Reliability enhances dependability, accuracy and adequacy of the instruments through piloting.

Reliability of research instruments were tested after piloting using Cronbachs' Coefficient Alpha method, which is a measure of internal consistency of items. The method is found to be the most appropriate as it involves a single administration of the instruments. A reliability Coefficient level of 0.7 or more would indicate that the instrument is reliable enough to solicit for the required information (Shevlin, 2000). The equation below was based on Cronbach (1951) which was applied by Feldt, Woodruff & Salih (1987) on Statistical inference for coefficient alpha:

$$\alpha = \frac{N \cdot \bar{c}}{\bar{v} + (N-1) \cdot \bar{c}} \quad \text{.....(iii)}$$

Where N is equal to the number of items, c-bar is the average inter-item covariance among the items and v-bar equals the average variance. Reliability coefficient of 0.7 or higher would be considered acceptable as generated by Santos (1999) on a tool for assessing the reliability of scales. The following are the reliability results which indicated that the research instruments were reliable and allowed data collection to take place, see results in Table 3.1.

Table 3.1 Reliability Results

Variables	Number of items	Alpha value
Language difficulties	3	0.836
Problem solving ability	5	0.787
Teacher's perspective	6	0.772

The pilot results indicated that the reliability of the language difficulties was 0.836 using Cronbach's alpha test of reliability; the reliability of the problem solving ability was 0.787; the reliability of the teacher's perspective was 0.772. Accordingly, Sekaran and Bougie (2011), opine that a Cronbach's alpha of 0.70 and above is considered good.

The study results revealed that all the variables gave an alpha test value of greater than 0.70, therefore all the items were regarded reliable hence valid for data analysis.

3.8 Ethical Consideration

The researcher sought permission to do the study from School of Education and Department of Curriculum Instruction and Media of Moi University and from the respondent who participated in the study. This was done through letters which were written to the Ministry of Education, Uasin Gishu county education office, and head teachers of the respondent schools. The nature and purpose of the study was explained to the respondent by the researcher. The researcher respected the respondent rights to safeguard their integrity and confidentiality. The results of the study were availed to the Uasin Gishu County Education Office and to those participants who were interested in the outcomes of the research study.

IV: DATA ANALYSIS AND PRESENTATION

4.1 Language difficulties learners face when solving mathematical word problem

The study sought to find out the challenges learners' face when solving mathematical word problem, a likert scale was used as follows SA= Strongly Agree, A= Agree, UD = Undecided, DA = Disagree SD = Strongly Disagree.

Table 4.1 Language difficulties learners face when solving mathematical word problem

Statement	SA		A		U		UD		SD	
	f	%	f	%	f	%	f	%	f	%
Mathematics language affects my ability to solve word problems	45	14.1	122	38.1	60	18.8	80	25	13	4.0
I often seek assistance in word problem questions	110	34.3	132	41.3	0	0	78	24.4	0	0
Ability to read and knowing basic facts help me be successful at solving maths word problem	140	43.8	162	50	18	6.2	0	0	0	0
Am given time by my teacher to read and interpret word problems	102	31.88	180	56.25	38	11.87	0	0	0	0
I usually skip and come back if I get stuck on a word problem	90	28.1	125	39.0	80	25	20	6.3	5	1.6

***Source*: Field data (2021)**

The study sought to determine the challenges learners face when solving mathematical word problem in among class seven learners in Cheptiret Zone, Uasin-Gishu County, Kenya and the findings were as shown in Table 4.1

The research findings on how mathematics language affects learners ability to solve word problems were, 45(14.1%) strongly agreed, 122(38.1%) agreed, 60(18.8%) undecided, 80(25%) disagreed and 13(4.0%) strongly disagreed .From

the results it's clear that majority of the respondents 122(38.1%) agreed that the mathematical language used affects their ability to solve word problems while minority 13(4.0%) strongly disagreed with the statement.

The findings were in agreement with the study by (Pape, 2004) that language difficulties prevent learners from comprehending the text of the word problem. The difficult part of solving mathematical word problem appears to be the process of understanding a problem and deciding what operations needs to be performed. Actively reading a problem supports individual to make sense of it however the depth and quality of learners decoding and subsequent understanding of the text impacts their success (Pape, 2004). To solve a word problem, individuals must manage both the text and the mathematics encoded within the text (Vilenius-Tuohimaa, Aunola & Nurmi, 2008).

The research findings on i often seek assistance in word problem questions were as follows 110(34%) strongly agreed, 132(41.3%) agreed and 78(24.4%) disagreed with the statement. From the results it's clear that majority of the learners 132(41.3%) often seek assistance in word problem questions from their teachers in order to comprehend the word problem, minority 78(24.4%) disagreed with the statement meaning that they don't often seek assistance in word problems this could be interpreted to mean that they experience little to no challenge hence no need to seek assistance.

The research findings on the ability to read and knowing basic facts help me be successful at solving mathematics word problem were as follows;140(43.8%) strongly agreed,162(50%) agreed and 18(6.2%) undecided. From the results, it's clear that majority of the respondents 162(50%) agreed that ability to read and know basic facts help them be successful at solving mathematics word problem while the minority 18(6.2%) were undecided whether this helps them at solving mathematical word problems or not. These results could be interpreted to mean that most learners who had the ability to read and know basic facts help them be successful on solving mathematical word problem.

The findings were in agreement with the study done by Adams (2003) proclaims that learners are not fluently and accurately solving mathematical problems in a written format due to the lack of understanding of the specific language, and not comprehending the written text. He also adds that learners do not consider mathematical written text a language; and therefore, do not utilize reading strategies in order to understand the text. Furthermore, Jitendra et al. (2007) and Griffin and Jitendra (2008) suggest that learners are not properly instructed to solve mathematical word problems

The research findings on if learners are given time by their teacher to read and interpret word problems were as follows; 102(31.88%) strongly agree,180(56.25%) agree and 38(11.87%) disagree. From the results, it's clear that majority of the respondents 180(56.25%) agreed that they were given time by their teacher to read and interpret word problems while minority 38(11.87%) disagreed. These results could be interpreted to mean that learners who were given enough time by their teacher to read and interpret word problems were able to solve this problem and therefore overcome the challenge.

The research findings on learners usually skip and come back if they get stuck on a word problem were as follows; 90 (28.1%) strongly agreed, 125(39.0%) agreed, 80(25%) undecided, 20(6.3%) disagreed and 5(1.6%) strongly disagreed. It's evident that majority of the respondents 125(39.0%) agreed that they usually skip and come back if they get stuck on a word problem and thus able to solve the mathematical word problem. The degree to which learners can master mathematical language, because of their mastery of the grammatical language of teaching, will determine their success at interpreting and solving word problems. Light and DeFries (quoted in Velenius-Tuohimaa, Aunola & Nurmi, 2008) point out that Mathematics performance and reading skills are closely related and that difficulties in arithmetic are associated with the development of reading ability. In the same article, Velenius-Tuohimaa et al., (2008:409) note that Jordan, Hanich & Kaplan (2003), in a two-year longitudinal study, found that reading disabilities predict children's progress in Mathematics, but that Mathematics disabilities do not affect children's progress in reading. Pape (2004:188) states that the semantic content of seemingly identical items often differs significantly in different languages and that identical meaning in different languages are expressed in different ways.

The learners were also interviewed on what helps them learn maths well, most of the learners indicated that the positive attitude towards maths was the main thing that made them learn maths well. Attitude is the will or zeal to do something either fully or positively for a better result or negatively for wrong/ unpleasant result. Mathematics involves application of varied technique; therefore children need varied methods of teaching learning to make learning realistic and

enjoyable. The teaching method of a teacher was also cited as a contributing factor that helps the learner learn maths well. Chapman (2015) found out that teachers could hold different conceptions of contextual problems that have the potential to limit or enhance how problem solving is perceived, experienced and learnt by their learners.

On the issue of learners' comprehension and application of math's concept the learners interviewed indicated that when solving a mathematical problem, the learner follows a certain pattern. According to (Polya, 1992) there are four steps that a learner has to understand and use to solve mathematical word problem. He suggests steps one must use to solve a problem from the basis of strands in problem solving. The steps are; understanding the problem, devising a plan, carrying out the plan and looking back.

The learners were also interviewed on which mathematical operation they use to solve a problem, majority of the respondents indicated that they read the question, internalize and figure out which math operation to use in solving the mathematical problem. Choosing mathematical operations is an important part of the larger process of translating English sentences into mathematical expressions. Success depends upon two things:(a) the ability to understand the literal meaning of the sentence(b) the ability to express this meaning mathematically Learners who cannot understand the literal meaning of the sentence will not be able to express it mathematically, even if they have the necessary mathematical skills. (Imagine trying to solve a word problem in a language you don't know, such as Arabic.)Even if learners can understand the literal meaning of the sentence, they will not be able to solve the problem unless they can also express this meaning mathematically. In other words, successful solutions to word problems involve both reading skills and mathematical skills. In particular, choosing an operation involves, in part, identifying language clues that suggest mathematical interpretations.

The learners were also interviewed on the way in which they determine if they have chosen the correct method to solve a mathematical problem. Most of the learners indicated that they read the mathematical sentence, highlight the keywords while reading the mathematical problem, reread the question, draw a picture of the situation that the problem presents and determine the goal of the problem. According to Blessman and Myszczak (2000), one of main causes of confusion in mathematics is vocabulary. Learners need a stronger understanding of mathematical vocabulary to be successful in mathematics. Understanding of mathematical vocabulary influences the comprehension of lessons, tasks, various tests, especially in solving word, so a lack of understanding of mathematical terms affects capabilities to solve problems (Amen, 2006).

V: SUMMARY, CONCLUSION AND RECOMMENDATION

5.1 The Language Difficulties Learners' Face When Solving Mathematical Word Problem

The research findings, it's clear that majority of the respondents 162(50%) agreed that ability to read and know basic facts help them be successful at solving mathematics word problem. These results could be interpreted to mean that most learners who had the ability to read and know basic facts help them be successful on solving mathematical word problem.

The findings were in agreement with the study done by Adams (2003) proclaims that learners are not fluently and accurately solving mathematical problems in a written format due to the lack of understanding of the specific language, and not comprehending the written text. He also adds that learners do not consider mathematical written text a language; and therefore, do not utilize reading strategies in order to understand the text. Furthermore, Jitendra et al. (2007) and Griffin and Jitendra (2008) suggest that learners are not properly instructed to solve mathematical word problems.

The research also indicated that the majority of the respondents 180(56.25%) agreed that they were given time by their teacher to read and interpret word problems. These results could be interpreted to mean that learners who were given enough time by their teacher to read and interpret word problems were able to solve this problem and therefore overcome the challenge.

Light and DeFries (quoted in Velenius-Tuohimaa, Aunola & Nurmi, 2008) point out that Mathematics performance and reading skills are closely related and that difficulties in arithmetic are associated with the development of reading ability. In the same article, Velenius-Tuohimaa et al., (2008:409) note that Jordan, Hanich & Kaplan (2003), in a two-year longitudinal study, found that reading disabilities predict children's progress in Mathematics, but that Mathematics disabilities do not affect children's progress in reading. Pape (2004:188) states that the semantic content

of seemingly identical items often differs significantly in different languages and that identical meaning in different languages are expressed in different ways.

Majority of the mathematics teachers noted that language barrier was cited as a major hindrance to learners' ability to read and comprehend word problem, According to Hegarty, Mayer and Monk (1995) two distinct paths are used by learners while comprehending text: the direct translation approach and a problem model approach. The former relies on key words rather than forming mental representations of the problems. What research has found is that if learners are asked to rely solely on knowing certain key words it can actually detract them from trying to understand the problems (Krick-Morales, 2006).

5.2 Conclusion

Based on the findings, the study made the following conclusions

This study found out that learners face a number of challenges that influence how they solve mathematical word problem; key among them are solving mathematical word problem is hard to most class seven learners, the difficult part of solving mathematical word problem appears to be the process of understanding a problem and deciding what operations needs to be performed. Actively reading a problem supports individual to make sense of it however the depth and quality of learners decoding and subsequent understanding of the text impacts their success. Ability to read and know basic facts helped most learners be successful at solving word problem.

5.3 Recommendation

Based on the findings and conclusion of the study recommends that:

I. The study recommended a wide exposure to mathematical language from the lower classes and the use of simple and appropriate language during teaching, learning and assessment process.

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