How To Teach Mathematical Word Problems In Primary And Secondary Schools In Kenya

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ABSTRACT

The process of learning mathematics is one of evolution. No topic is ever finally exhausted. As one's experience one continually discovers thrilling new levels at which an idea can be investigated. Ultimately, the challenge at having to teach a topic to someone else reveals a further hierarchy of unsuspected subtleties in the concept every time it is presented. It is important to avoid teaching anything that will appear contradicting later. What you say may need further amplification and expansion, hidden assumptions may need to be exposed and examined. The more mature student may demand a more elaborate or precise enunciation.

1.0 INTRODUCTION

- ✓ Many mathematical problem encountered in daily life are not written in mathematical terms but in mathematical words. There is need to know how to translate verbal sentences into mathematical terms. To do this, the pupil has to understand these verbal statements and sentences and translate them into mathematical terms.

- ✓ How to teach mathematical word problem in primary and secondary has been written to teach mathematical skills for solving verbal problems. This paper is specifically designed to help students/pupils and teachers to overcome difficulty in solving word problems that are frequently encountered in these two levels and also in post secondary courses.

- ✓ It is a fact that most pupils can solve most written problem but have difficulty in transferring this knowledge to verbal problems. For the purpose of this paper, 'written problem' refer to problems written, in mathematical figures while 'verbal problems' refer to verbal sentences. The author hopes this paper will assist the teachers and pupils of these levels to solve verbal problems. It also aims to help the advancement of this areas where mathematics concepts are involved.

OBJECTIVES

Upon completion of this paper, the teacher/pupil will be able to:

- ✓ Read and interpret mathematical terminology.
- ✓ Read and use symbols.
- ✓ Translate verbal sentences into equivalent mathematical statements or equations.
- ✓ Apply basic mathematical concepts to solve verbal problems.
- ✓ Solve verbal problems.
- ✓ Check the accuracy of the solution to the problem.
- ✓ Build confidence in solving verbal problems.

Transfer mathematical problem-solving skills to practical problems encountered in life professions

2.0 PURPOSE

How to teach mathematical word problems is a self-instructional paper. Its purpose is to teach mathematical skills in solving verbal problems.

This paper is primarily designed to aid pupils in primary and secondary who have difficulty in solving verbal problems encountered in their mathematical programs. The paper shows steps that are often taken for granted by teachers but are vital in teaching verbal problems. It is meant also to bring out the language used in mathematics

3.0 STRUCTURE

'How to teach mathematical word problems' is a consumable paper. It is structured to develop skills in solving verbal problems by example, guiding pupils through each step and finally requiring pupils to work through a complete paper on their own.

The teacher can help pupils learn how to solve verbal problems quickly and accurately by insisting that the pupils give a written answer to every question. Most pupils dislike verbal problems and in most cases cannot solve them because:

- ✓ The verbal problems appear long, and the pupil cannot connect an important idea in one sentence to an idea in the next sentence.
- ✓ The pupils do not understand the mathematical language used in the problem. Example – find quotient of 6 and 2.
- ✓ The pupil can be misled by un-needed information in the question.
- ✓ Since mathematics is done in English, pupils who have a problem in understanding English definitely have a problem in understand mathematics.
- ✓ Tricks are often used by examiners mostly in word problem. Without using a methodological step by step solving of the problem, pupils rarely unearth these tricks and this end up getting less marks or no mark at all for the question.
- ✓ Using the methodological step by step solving of problems illustrated in this paper overcomes the above five hitches.

4.0 THE LANGUAGE OF MATHEMATICS

In order to translate a verbal sentence into mathematical terms, knowledge of the words used is required. The pupils should study the following chart to become familiar with common terms and symbols used for basic mathematical operation.

MATHEMATICAL EQUATION	TERMS	SYMBOL	EXAMPLE
Add	Total Sum And Increase by Plus More than Altogether Together with	**+**	Find total of 2&3 Sum of 2 and 3 3 and 2 Increase 3 by 2 3 plus 2
Subtract	Less Minus Decrease by Take away difference from fewer	**-**	5 less 2 5 minus 2 Decrease 5 by 2 Take away 2 from 5 Find the difference between 5 & 2
Multiply	of Product by per Times Repeated addition	X (y)(x)	12 of 10 Product of 2 & 3 10 `times 10+10+10 or 10 times 3
Divide	Quotient Shared		

	Over into ratio a to b	÷	6 over 3
Equals	Is		10% of 20 is 2
	Are Result in Is identical to Is equal to same as makes leaves yields equivalent	=	4 x 2 = 8

- ✓ Most problems are not hard to solve when written in mathematical terms. For example 3+6=9 is a simple addition problem written in mathematical terms. The difficulty arises when the problem is stated in a verbal sentence e.g. Find the sum of three and six. Part of the difficulty may be in reading the problem. Therefore, it is extremely important that you read the problem very carefully and as many times as needed.
- ✓ Since translating from words to mathematical terms is the main cause of difficulty, it requires much practice. When translating a verbal problem into mathematical terms a variable (a letter that represents a value, number) may be used in place of any unknown quantity or value. The variable used for the examples in the paper will be mainly X.

5.0 STEPS USED TO SOLVE VERBAL PROBLEMS

- ✓ Read the problem carefully (may be more than once).
- ✓ If need be, draw a sketch of the information needed to solve the problem.
- ✓ Decide on what the question is asking for i.e. understand the problem.
- ✓ Write down the necessary information given in the problem.
- ✓ Write the problem in mathematical terms.
- ✓ Write the variables down if required.
- ✓ Decide on a reasonable answer if possible.
- ✓ Solve the problem.
- ✓ Check the answer.

Note:

- ✓ Step two and six may not be required in some problems.

To expand on each of the steps: -

- ✓ Step one implies reading <u>carefully</u> the problem and <u>noting the mathematical language used</u>. This can be done by reading the question part by part and underlined each mathematical language used. The question has to be broken down <u>into smaller components</u> for easier interpretation. Verbal problems should not be read in a <u>hurry</u> and <u>impatience</u> as the reader will always miss out <u>the hidden detail/concept</u> in the problem.
- ✓ Step two gives you the pictorial view of the problem. It is important in solving problems involving measurement of geometrical shapes and graphs and charts figures bring out the hidden concept in a verbal problem. For example when asked to find the surface area of an open cylinder of base radius 7cm, height 15cm, drawing out the sketch brings out the concept of finding surface area of a cylinder more dearly. Furthermore, in some cases, sketching simplifies the problem.
- ✓ Step three requires you to understand the hidden concept in the verbal problem. This requires you to interpret all the difficult words as well as mathematical language used.

- ✓ In step four write down the necessary information given in the problem. This means writing down the information that will guide you in working out the problem in a verbal problem, not all the information given is necessary that means not all information given will be needed. This requires you to separate the needed information from unneeded information in a given problem. This is more likely to bring out the concept examined in the problem. The skill to be used and the operations are going to come out dearly.

- ✓ In step five, write down the verbal problem in mathematical terms. This means, write the verbal problem in terms of values and/or variables (letters that represent numbers). This step reveals the verbal problem in mathematical terms and the operations to be used in the problem. When the pupil reaches this stage, the question becomes easy because it is in the form understood by everybody. What the pupil needs to remember is the order of performing operations (BODMAS).

- ✓ In step six, when required, insert variables for unknown quantities. This step is essential for some topics in the syllabi (std 7 & 8) for example equations. This step will help the pupil to work out the unknown values in the given verbal problem. At this stage the pupil has to understand where to insert the unknown values and which operations to use. This step presents most difficulty to both pupils and teachers. When the question is presented in long sentences the pupil does not understand when and how to use the unknown. It becomes even more complex when more than three or more unknowns are used as in higher levels. The method of confronting the problem is the same: break down the problem into stages and read and interpret each stage. This can be best achieved by writing your interpretation in mathematical terms.

- ✓ A reasonable answer is decided upon in step seven. By looking at the interpretations written down in mathematical terms, one can approximate the answer or how to get to the answer. This step guides both the pupil and the teacher not to venture into finding unnecessary information that will not give us correct answers. The answers you have decided upon will increase your confidence in solving the problem. This motivates the pupil not to give up. It makes the pupil to have self-drive in wanting to complete the question so as to arrive at the answers decided upon in the brain.

- ✓ Step eight is the easiest after the other previous steps have been understood. This is because it involves the four major operations (i.e. + , x , - , /) which the pupil is more familiar with. It involves the actual working out of the problem. Here, what the pupil needs to understand is that for one to divide, multiplication is paramount. He needs to understand that addition is related to multiplication. The rule of BODMAS is also very important at this stage. This is the order followed while performing operations in a problem.

- ✓ Step nine is the last and most important. It involves checking the answer of the problem you've just solved. It reveals the errors of performing operations, of interpretation, or writing down the numbers. If any of the above errors have been made, the answer will not be right and accurate. It is an important step because it gives the pupil assurance about the answer and on solving the next problem.

6.0 CONCLUSION

- ✓ One reason that makes mathematics a hard subject and feared by most pupils\ students is the understanding of verbal problems. Most of the mathematical problems in life are in verbal statements. This paper if well implemented by both teachers and pupils will remove this particular hurdle and pupils will find verbal problem easy and they will start enjoying mathematics as a subject. This will make many pupils and teachers enjoy doing mathematics which in turn makes many students do the science subjects which require one to have a good base in mathematics. The teachers will also find it easy to teach the verbal problems. Using the methodological step by step solving verbal problems illustrated in this paper the teachers will make and enjoy teaching mathematics.

- ✓ My concern is about how any teacher comes to own the ideas they use in their classrooms. Ownership of teaching ideas is not about inventing the ideas in the first instance, neither is it about using another person's ideas without applying some critical analysis in the light of experience. Ownership is how a teacher adapts any ideas they pick up from various sources, meetings, conferences, resource books, etc. and makes them their own according to how they use them in their classrooms. When teachers are confident with the ideas they own, they can help students to become more independent autonomous and responsible learners.

- ✓ More teacher need to employ these strategies such as these to enable students/pupils to be more effective learners for example : -
  1. become more autonomous and independent learners,
  2. develop research and enquiry skills and

3. Take more responsibility for their own progress and achievement in mathematics.
4. As students develop enquiry skills they become more autonomous and responsible, in short, they become more confident, more effective and more wiser learners. As such I hope anybody who reads this paper will consider how the ideas can be used and built upon to development existing schemes of work and to deepen students' experience of mathematics and their expertise in being mathematicians.
5. Trying to help students see that while finding answers is important, there is value in engaging with the process and in recognizing that an answer need not be an end point but a staging post of asking other questions such as why and when and what happened if.........?

7.0 REFERENCES

- ✓ A.E Ashworth: (1981) teaching of mathematics, London press.
- ✓ Betty S. Lawing: (1983) solving mathematical word problems, Dalmar publishers and London press.
- ✓ Wheeler Roger: (1981) Rethinking mathematical concepts, Ellis Horwood ltd and Chichester.
- ✓ Michael Holt: (1973) mathematics 5th year, Macmillan education, London.
- ✓ Ian Steart and David Tall: (1977) The foundations of mathematics, Oxford University press.
- ✓ Duncan and Christine Graham: (1981) mathematics for you, Hutchinson press London.