LANGUAGE, LEARNING AND PROBLEM SOLVING

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WORKSHOP on "The Influence of Language on Problem Solving in Mathematics"

WORKSHEET 1: (1) Stories without Numbers (2) Stories without Questions

WORKSHEET 2: Why not have Comprehension Exercises in Mathematics too?

WORKSHEET 3: Ordinary English (OE) and Mathematical English (ME)

WORKSHEET 4: How can I do the sum when I do not understand the situation?

WORKSHEET 5: Written Language in Mathematics - Recording

WORKSHEET 6: Do "pictures" offer an escape from Language Problems in Mathematics?

(1) STORIES WITHOUT NUMBERS

In the following examples, quantitative information (numbers) has been omitted. Rewrite, adding number information wherever you feel that it is necessary.

- (a) The school tuck shop has some Yumbars and some Aeros in stock. The Yumbars and the Aeros do not cost the same. How much did a customer pay for some Yumbars and some Aeros?
- (b) Bottles of cooldrink are packed in boxes. A cafe owner bought some boxes of cooldrinks. How many bottles of cooldrink did the cafe owner buy?

(2) STORIES WITHOUT QUESTIONS.

Here are three stories without questions. Make up at least one question for each story.

- (a) Pete and Pat went to the shop. Pete had 53c and Pat had 37c. A 500-ml bottle of cooldrink costs 75c.
- (b) A snail crawls 15 cm along the ground in the first hour, and then 7,5 cm further in the second hour. He nibbled at a delicious young plant which was in his path 16 cm from his starting point.
- (c) There were 3 dozen eggs on the shelf. Mother used 6 eggs to bake cookies for the Church Meeting. We had scrambled eggs for supper, and this used 5 eggs.

Here are some Mathematics Comprehension Exercises based on word problems. (They are obviously not at the same Standard level). Do you think that this kind of exercise might help pupils to focus firstly, on the situation itself and, secondly, on the quantitative aspects, before they try to make decisions about which processes to use?

Have a critical look at the questions, and then delete or add or modify as you see fit.

STORY 1

Susan was reading an interesting book. Last night she started reading on page ll8 and read to page l34. This was the end of the book.

1. On which page did Susan start reading last night?
2. How many pages are there in the whole book?
3. Did Susan finish reading the book last night?
4. Last night Susan read from page __ to page __.
5. Write down how many pages Susan read last night.

(Check: did you include page 118? Should you have included page 118?)

STORY 2

The Brown family decided to smarten up their house. They chose carpeting which cost R28,50 in order to carpet their lounge which was 7 m long and 5 m wide.

1. What is carpeting usually used for?
2. What are the measurements of the floor of the lounge?
3. What is the cost of l square metre of carpeting?
4. How could the Browns find out how many square metres of carpeting they would need?
5. Write down the amount of carpeting needed as a number sentence, filling in the answer.

6. Write down an open number sentence to show how to find the cost of the carpeting required.

STORY 3:

If you drove 250 km by car yesterday and 340 km the day before, how far would you have to travel today if the whole journey is 800 km?

Now write some questions which you think might lead pupils on to the correct solution to this story.

In Mathematical English (ME) certain words have precise meanings, sometimes different meanings, which they do not have in Ordinary English (OE). Here are some examples:

EXAMPLE 1:

(OE) This is an odd picture. (strange)
(ME) This is an odd number. (not even)

EXAMPLE 2:

Two sticks are 23 cm and 16 cm long respectively. What is the difference between them?

(OE) answer might be: One stick is longer than the other one.
(ME) answer might be: One number is odd and the other is even.
Or, the difference is 7 cm.

(There is a notation problem here too: do we write 23 - 16 or 16 - 23?)

Now try and think of (OE) and (ME) problems related to the following words:

1. quarter
2. sum
3. block/square
4. even/equal
5. value
6. base
7. cut
8. round off

Now think of other words which give problems because they have different or more precise meanings in Mathematical English. Think of examples in your own home language which are relevant. We would like to hear about them.

Read through this word sum and make a list of the words, terms and phrases that a Std 5 child

may never have come across in his everyday life.

> A bicycle can be bought for cash for R216. The bicycle can also be bought
> by paying a deposit of R50,00 and 24 monthly instalments of R8,50. How
> much more does the bicyle cost if bought on instalments instead of for
> cash?

What if Father pays by cheque? Is this different from "cash"? Do we have to explain about in-

terest on the unpaid portion of the price? How can we simulate - act out - this story sum in the

classroom?

Think of any other word problem(s) where the difficulty experienced by the children is, in the

first place, that they are unfamiliar with the situation, and can therefore not relate any num-

bers to the situation.

(Some of our Fraction Word Problems probably fall into this category.)

We tend to be very prescriptive when we teach our pupils to record in Mathematics. The WRIT-TEN part of Mathematical Language in the pupils books tends to be exclusively symbolic.

However, with non-routine problem solving a variety of forms of recording are required, and we need to make our pupils familiar with them.

The problem below requires a grid or matrix in order to be able to solve it.

In order to READ the solution, we have to understand the significance of the position of the words along the rows and the columns and their intersections.

We are actually solving a problem which does not require a number answer: it requires a relationship answer, in which Language plays a vital, if rather different role.

We are also providing the pupils with experience in sorting out VERBAL INFORMATION.

> Janet, Sangita, Anne and Margaret like to play badminton together but cannot all be free to play on the same day. Janet is unable to play on Tuesdays, Wednesdays and Saturdays. Sangita is free to play on Mondays, Wednesdays and Thursdays. Anne has to stay at home on Mondays and Thursdays. Margaret can play on Mondays, Tuesdays and Fridays. None of them play on Sundays.

Can each pair find a day on which to play?

Are there any days in addition to Sundays when no games can be played?

Are there days when more than one game can be played?

* Here is a grid or matrix. Sort out the information into this grid.

	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
Janet						
Sangita						
Anne						
Margaret					~	

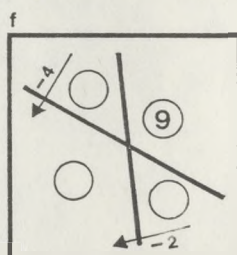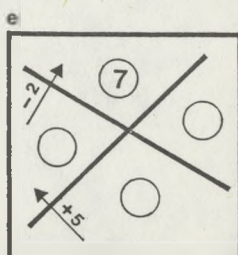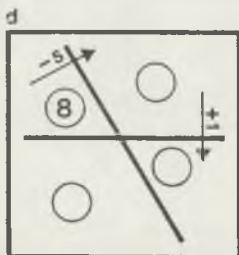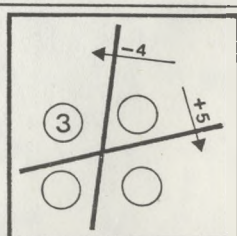*This problem demonstrates the translation from the linguistic representation of the problem to the pictorial representation of the table.*

In the example below, pupils are expected to "look at the diagrams, understand what has been done, then do the same".
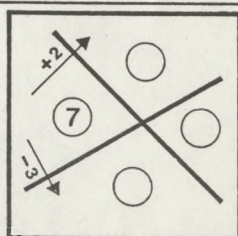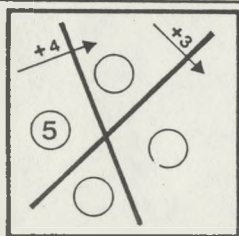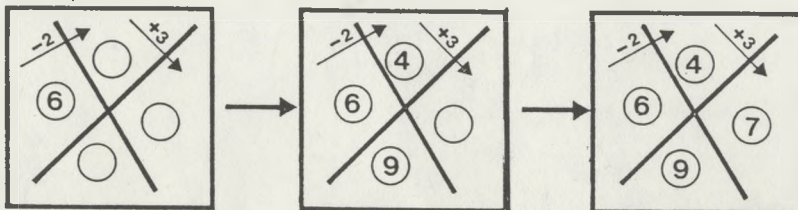
2   Make up 3 of your own.

It would appear that the VERBAL (aural and reading) aspect of Language has been circum-
vented.

We still have the WRITTEN (symbolic) form of Mathematical Language.

* Look at the given example and discuss whether language has really been
  excluded in the understanding of what is required.
* Does this kind of mathematical work, with "non-reading instructions", have
  a place in the teaching of Mathematical Language?