

Solving word problems involving numbers

The first numeracy area that many students from PILNA 2021 had difficulty with was solving word problems involving numbers.

These types of questions are those that require a student to perform mathematical operations presented using sentences rather than symbols. For this reason, these questions also require a level of reading comprehension that enables the student to understand the question that is being asked.

Example question

An example of one of these questions and how students responded to it is provided. Various mathematical operations were tested using sentences, this example requires two operations to be performed, first subtraction and then addition.

Figure DEF#1 / Sample question:
Solving word problems involving numbers

Question:

Tom picked 24 mangoes. Peter picked 5 mangoes less than Tom.

How many mangoes did they pick altogether?

Learning outcome:

Solve a word problem using subtraction (less than) and addition with 2 digit and single digit whole numbers.

Responses:

✓ Correct response:
43

Possible misconceptions:

✗ 29

Adding 24 and 5 which shows that students were only focussing on the question without looking at the initial 2 statements which gives the clue to what needs to be done first.

✗ 19

Subtracting 5 from 24 which means that the students only looked at the clue in the second statement which means that they would have done the first steps correctly.

Level of difficulty:

🏆 Expected performance:

We would expect only higher performing Year 4 and Year 6 students to successfully answer this question.

The question item is asked of both Year 4 and Year 6 students.

The question item is on level 6 of the numeracy proficiency descriptors, which is above the minimum level of proficiency expected from Year 4 (level 3) and also Year 6 (level 5)

Performance analysis:

Code	Descriptor	Score	Year 4		Year 6	
0	Incorrect response	0		36.2%		26.8%
1	Expected response	1		2.5%		7.4%
2	Correct number sentence	0		0.1%		0.1%
3	Subtracting 5 from 24	0		4.7%		4.7%
4	Adding 24 and 5	0		51.3%		55.2%
7	Not applicable	0		0.1%		0.1%
9	No response/blank	0		5.1%		5.7%

A very small number of students correctly answered this question. This is likely, at least partially, because it was expected to be difficult for both year four and year six students.

This question was above the expected minimum level of numeracy performance for year six students and substantially above the minimum expected performance for year four students. Only high performing year six students and very high performing year four students were expected to answer this correctly. Still, only 3% of year four students and 7% of year six students correctly answered this question. Both year levels experienced similar proportions of the various types of incorrect responses.

There may be a need to support students' critical reading skills, particularly comprehension, so that they can understand the relationships established in these types of questions.

Students may also need support to understand what mathematical concepts mean in context, to better recognise and apply mathematics in 'real' situations rather than purely numeric presentations.

How can teachers support learning in this area?

Addressing how these types of questions are taught in schools may increase student performance in future. Below, SPC present some ways that teachers might support learning in this area.

1. Emphasise the importance of understanding the question in its full context and extracting clues which can then be put in a mathematical sentence. This is particularly important when it relates to word problems involving multiple operations.
2. Use techniques such as the [issue detail="link?"]'Part - Part - Whole' method to solve word problems. Highlight important information like "less than" and "altogether" which are clues and associated with mathematical operations. Identify the parts and make a mathematical sentence using these parts that will give the unknown.
3. Give students a variety of methods to solve these types of questions. Students can then use the method they know best from their repertoire.