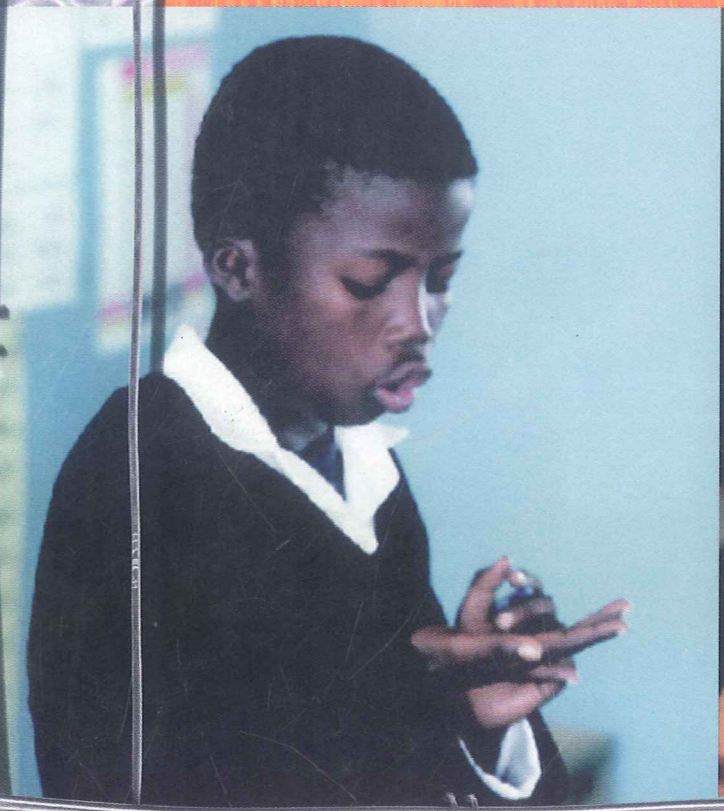
PRIM

School of Education

University of Fort Hare
Together in Excellence

B.Ed. (Foundation & Intermediate)
Core Learning Areas Course

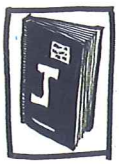


UMTHAMO 5

Mathematics

Developing and Using Number Concepts

Icons used in the Imlthamo



Journal

Thinking & Reflecting

Written Report

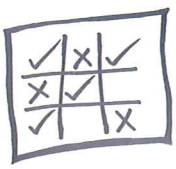
Classroom or School

Key Activity

Face-to-Face Umkwezeli

Concertina File for Portfolio

Making Materials



Assessment

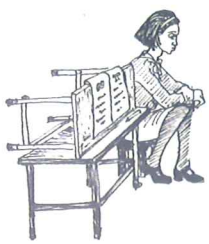
Discussion

Tape recorder

Reading and thinking

This unit should take you .... hours

Time



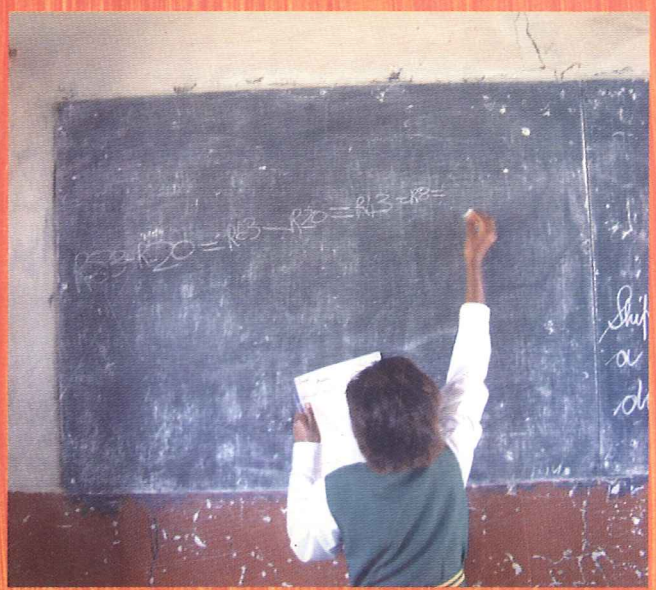
Gather Learners around You

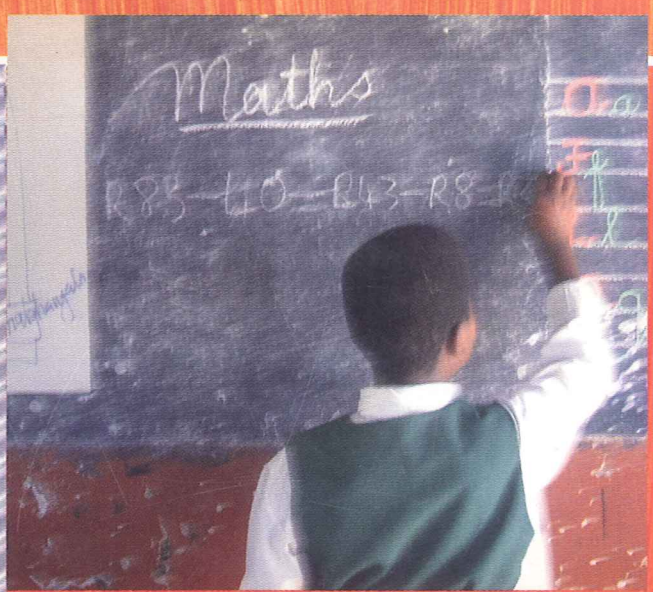
Bibliography

Hughes, M., (1986). **Children and Number.** Oxford: Basil Blackwell

Paling, D., (1982). **Teaching Mathematics in Primary Schools.** Oxford University Press

Baker, Clay and Fox(eds)., (1996). 'Frames of Knowledge' in **Challenging Ways of Knowing in English, Maths and Science**





All these pictures show learners using different methods to solve problems

'Are you good at Maths?

For many people, this would be the beginning of an embarrassing conversation. They regard themselves as weak at maths and think their ways of solving everyday problems with numbers, as not really proper maths but "their own" way of solving problems...

Mathematics has a double status - it is a particular kind of activity but also a form of knowledge. This is why mathematics, like literacy, is something that should be available to all. Yet the social definition of mathematics blinds us to the mathematical knowledge embedded in other activities. We learn *some* forms of mathematical knowledge at school and become blind to others which do not appear in school. If we were to consider as mathematics only the activities of mathematicians, we would end up concluding that mathematics is so specialised that it need not be taught to all pupils. It is because mathematical knowledge is a form of knowledge that permeates so many activities that mathematics is relevant for all pupils.'

Terezinha Nunes
-'Frames of Knowledge' in Challenging ways of Knowing in English, Maths and Science [1996]

CONTENTS

Umthamo 5

Developing and Using Number Concepts

Introduction

Welcome to the first umthamo of the Mathematics course.

In compiling this learning material, we have put together some samples of research about how young children develop their mathematical concepts (or ideas). We have also set you some tasks to carry out your own research with young children, and with children in the Intermediate Phase. Our aim is to enable you to have

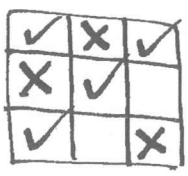
- a clearer understanding of basic number concepts
- an appreciation of how young children begin to make sense of numbers at home and in school
- a sense of how young children develop number concepts
- the beginnings of an understanding of how teachers can help their learners develop mathematical skills.

In this umthamo we ask: 'How do learners think about number?' We explore learners' thinking. And we begin to start the process of thinking more carefully about how young children develop their mathematical ideas, skills, and attitudes.

Learning Outcomes

We hope that as you work through this umthamo, you will begin to

- **treat learners as 'independent' thinkers in your classroom**
- **be able to plan activities that will reveal your learners' independent thinking**
- **be able to carry out activities with your learners which encourage them to use their own thinking in relation to school maths.**



Assessment and Evaluation

Remember that you will be asked to assess or evaluate yourself, and produce some evidence (proof) that you have done this. You will also assess the work of other teacher-learners, and they will assess your work. You are expected to complete all the activities in this umthamo. And your work from the **Key Activity** (Activity 6) is to be shared with the other teacher-learners doing this course, and then handed in to your umKhwezeli for appraisal.

You will be asked to record your memories and thoughts for Activities 1 and 2 in your **journal**. You will need to record your work for Activities 3, 4, and 5 on sheets of paper, which you will then store in your concertina file. You will have an opportunity to discuss what you have found in Activities 3,4, and 5 with other teacher-learners at a face-to-face session. These Activities will prepare you for Activity 6, which is the **Key Activity**. Activity 6 involves research, recording and analysis.

In Activity 3, you will look at some transcripts (or written records) of a researcher talking to young children about numbers. In Activity 4, you will interview some very young children to find out how they think about numbers, and you will write your own transcripts of these interviews.

In Activity 5, you will you will try to get some young children to explain their thinking. In the **Key Activity**, you will carry out a similar task with your own pupils. The results of your work will give you some data (information or findings), which you will need to store in your concertina file. You will also need to keep a record of your views, comments and understanding in your concertina file or **journal**. Remember that you will hand in a report of this Activity to your umKhwezeli for appraisal.

You should take about 1 hour to complete this unit

Unit 1 - The Way Maths is Taught

According to Paling (1982), much thought has been given to primary mathematics learning programmes (syllabi) during the past recent years. Paling states that some of the topics, which were traditionally included, were considered to be outdated. They were no longer relevant to the present day needs of everyday life, or to science and industry. Above all, too much emphasis had been placed on rote learning, and so many learners did not understand what they were doing.

Paling points out that changes have now been made. Topics that are more relevant to the learners, and to the needs of their country, have been introduced. The emphasis is now placed on

- learners thinking for themselves,
- learning through their own activity, and
- enjoyment.

Let's see whether you agree with what this author says by referring to your own practical experiences. In the Core Education Studies umthamo,' What do we know about learning?',

you were asked to think back to your childhood and to try to remember a powerful or emotional memory. Now we want you to try to remember your own experiences of learning maths. Spend some time thinking back to your experiences as a learner at school. What can you remember? Jot down your thoughts in your **journal**.

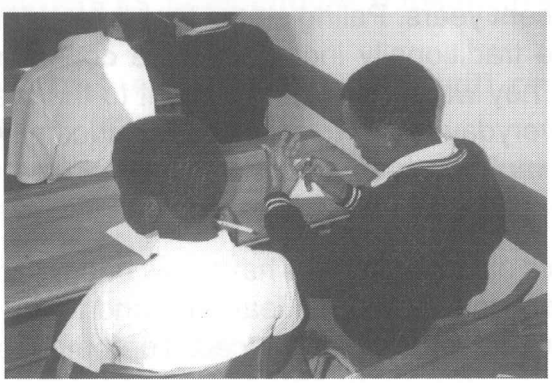
Activity 1- How I was taught Maths at school

Open your **journal**. First, write the date. Then write, 'How I was taught maths at school', as your title.

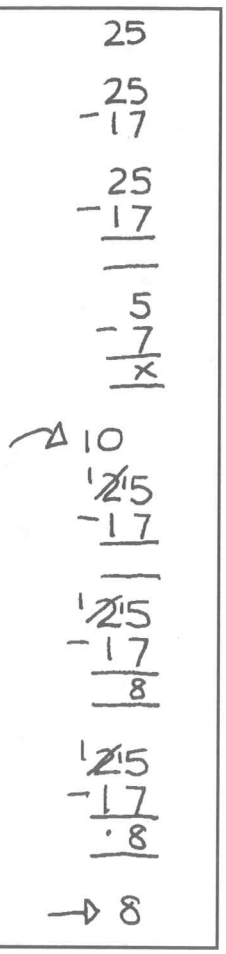
Now, think about your own early school days.

- Jot down the method(s) that most of your teachers used when they taught mathematics, or what was then termed 'Arithmetic'?
- Did you find these methods interesting or frustrating? Jot down a few of your reasons.
- Did the teachers allow you any opportunity for active learner participation in their lessons? How did you feel about this?
- If your teachers did not encourage active participation, give reasons why you think this was not possible.

Now think about how maths is being taught today. In your experience of teaching, have you noticed any changes in the teaching of mathematics? If so, describe at least ***three*** major changes that you have observed. If you **haven't** noticed any changes, describe at least ***three*** things that you consider need to change. Write down some suggestions of how these changes could happen.



Amongst your responses, you have probably mentioned something about reciting, drill or memorisation. A general experience amongst many of us is that teachers, during those days, used to teach mathematics as if it were simply the mechanical manipulation of numbers or formulae. For example, if we want to subtract seventeen from twenty-five, we might go through the following procedure:

• write down the big number first • write the small number underneath with the subtraction sign in front of this number • draw two lines • say, 5 take away 7 - you can't do it • borrow 10 • cross out the 2 and put a 1 • write another 1 next to the 5 - that makes 15 • 15 take away 7 is 8. Write 8 under the 7 • 1 take away 1 is nothing - put a dot under the 1 • the answer is 8.	

You may also have mentioned concepts such as 'multiplication tables'. Many of us were forced to memorise our 'tables' and then we had to recite them. Here is what one of the writers of this course remembers about learning mathematics.

In 1968, Nomfanelo was a Standard 6 student at a primary school in Graaff-Reinet in the Eastern Cape. This is what she says:

'It was the tradition of my school to hold what was termed 'morning classes' for the Standard 6 classes only. These morning classes started at seven o'clock in the morning, and the school started at eight o'clock.

During the "morning classes" we were expected to stand along the walls of our classroom and to recite the multiplication tables from the "Table of 1" up to the "Table of 12". This we would do all of us at the same time.

Whoever would be heard by the teacher giving an incorrect product would be punished instantly. It always soun-ded like a choir singing first thing in the morning. And whoever sang out of tune, would be punished each time.'

In those days of Bantu Education, Standard 6 was in the primary school, and secondary schooling started with Form I.

Nomfanelo's story demonstrates the common view amongst teachers at that time, that learners could only learn effectively through constant drill and practice. Maybe the teachers believed that learners could only acquire mathematical skills (for example the ability to multiply) by being taught by the teacher, or from certain specific materials. We know that some teachers **still** think that these are the best methods for teaching mathematics. Some teachers think that these methods should not be changed or replaced with other methods.

You may be teaching with some of the teachers who **still** go for this view. We hope that **you** will feel brave enough to start acting as an 'agent of change'. That little by little you may begin to help these teachers change their attitudes. You may begin to help them to change their approach to teaching. If you are one of the teachers who has favoured a rote learning approach, we hope that as you complete lomthamo, it will help you change your own attitude.

You should take about 1 hour to complete this unit

Unit 2 - What a pre-schooler thinks about number

Let's look at a pre-school learner and see the kind of thing he would do when he is learning to use numbers.

Zozo's Story

Zozo is a four-year old. One afternoon his mother asks him what he did at pre-school that morning. Zozo replies, 'I drew a big face. Come, let me show you.' He takes the paper with the drawing out of his school bag and shows it to his mother.

'Look,' he says. 'Two big eyes, two big ears, one big nose, and one big mouth!'

'You have forgotten to show the hair, ' his mother points out. Zozo takes out a pencil crayon and draws the hair and surprises his mother by saying, 'Look. Three big hairs!'

Zozo is already trying to make sense of how the school system works. He is working out what the pattern of the task is and what comes next. Don't you find this story interesting? Do you think that Zozo can count? To help you answer these questions, complete the next activity.

Activity 2 - How does Zozo think about numbers?

Zozo happens to know a bit about numbers.

- What do *you* think Zozo already knows about numbers?
- Why do you think Zozo drew just three hairs?
- Why didn't he draw lots of hair?

Take out your **journal**. Write the date, and then write the title, 'What I think Zozo already knows about numbers'. Then write down your answers to these questions.

Then jot down what you think Zozo **still** needs to learn in order to have a more developed concept of numbers.

It is important for you to know at this stage that by completing Activity 2, you have done what is known as 'analysing a transcript'. (A transcript is a written record of an interaction.)

When you analyse a transcript, you first read the written record of what a child has said and done. Then you think carefully about the text (words) that have been used. And then you write down what you think was going on. In other words, what you have really done is to interpret (explain the meaning of) given information. You have now analysed a transcript, just like a university researcher. Well done!

Now compare what you have written with the ideas another teacher has written into her **journal**.

Although I don't know exactly what Zozo thinks or understands, looking at what he says, I might say that he seems to know the purpose of counting. He is aware of the different parts of the human face and he seems to be able to associate each part of the face with numbers. For example, he associates the eyes and the ears with two, and the nose and the mouth with one.

But he then becomes confused when it comes to hair. As a matter of fact, it would be extremely difficult to count the number of hairs on anyone's head! So, Zozo makes things easier for himself by making a representation of just three strands of hair.

I wonder why Zozo draws only 3 strands of hair?

Why not 5, or 10? He does have one-to-one correspondence. But it seems as if he only thinks of numbers in terms of actual objects. He doesn't think of numbers on their own. He may think that we only use numbers in order to represent objects. Maybe he can only count up to three. Or perhaps he has no idea of representing more than three objects on paper.

Since Zozo finds it difficult to determine the amount of hair, I think he still has to learn that there are many other ways of representing amounts. He has to learn that we can think of amounts as comparisons, and use words like 'many', 'lots of', 'more', and so on.

As you can see, Zozo is not stupid. We think that he is counting by experience and he is still developing his concept of numbers. He doesn't yet show that he thinks about numbers in an abstract way. In other words, he only seems to use numbers linked to actual concrete things.

Perhaps Zozo needs plenty of opportunities with lots more chances to experiment with counting and playing with numbers. If he is given a range of different experiences, he will sharpen his own thinking about how numbers work. He will also develop a clearer understanding, based on his experiences, of how people use numbers.

Therefore, it is advisable that teachers do not rely on drill work, especially during the early school years of a learner.

You should take about 6 hours to complete this unit

Unit 3 - Young children thinking about numbers

At this point, you may have seen that learners, however young, are able to think, although sometimes their thinking is rather different from ours. Zozo thinks in his own way. The other children in his pre-school class may well think differently.

Let's have a look at other young children's thinking.

- First, we will look at some of the work of Martin Hughes. He is an Educational Researcher at Exeter University in Britain.

- Then we will ask you to find a few pre-schoolers to talk to. We will ask you to try to find out what *they* know and think about numbers.
- After that, we will also ask you to see if you can ask questions of young children. You need to try to find out what is in their heads when they are thinking about numbers.

Before Martin Hughes moved to Exeter, he worked with Margaret Donaldson in Edinburgh. You read some of Margaret Donaldson's research in the umthamo, What do we know about learning?.

This is what Martin Hughes says in his book, *Children and Number*:

> By the time they start school at around 5 years, most children can carry out a range of simple additions and subtractions involving both concrete and hypothetical situations. They know that two bricks added to one already in a box results in three bricks in the box, and that if there is one child in a shop and two more go in then there will be three children in the shop. However, when asked 'What does two and one make?' very few children can answer correctly.
>
> At first sight, this disparity does not seem too surprising. We feel intuitively that questions like 'What does two and one make?' will be harder for young children than questions about bricks in boxes, or about children in a shop. But in what does this hardness consist? ..... the answer to this question is not as straightforward as it might seem. (Hughes, 1986:37)

Now let's look at the transcripts to see what Martin Hughes found when he carried out his research.

Activity 3 (a) - Analysing transcripts

In these four examples, Martin Hughes is asking some pre-schoolers questions about number. Read the transcripts carefully. When you have read them, we are going to ask you to write about them.

(A)
Patrick, aged 4 years 1 month
MH: How many is two and one more?
Patrick: Four.
MH: Well, how many is two *lollipops* and one more?
Patrick: Three.
MH: How many is two *elephants* and one more?
Patrick: Three.
MH: How many is two *giraffes* and one more?
Patrick: Three.
MH: So how many is *two* and one more?
Patrick: Six. **(page 47)**

(B)
Amanda, aged 3 years , 11 months
MH: How many is two and one? (Long pause. No response.) Well how many bricks is two bricks and one brick?
Amanda: Three.
MH: Okay. So how many is two and one?
Amanda: (Pause.) Four (hesitantly)?
MH: How many is one brick and one more brick?
Amanda: Two bricks.
MH: So how many is one and one?
Amanda: One, maybe. **(page 46)**

(C)
Ram, 4 years, 7 months
MH: What is three and one more? How many is three and one more?
Ram: Three and what? One what? Letter? I mean number? [We had earlier been playing a game with magnetic numerals and Ram is presumably referring to them here.]
MH: How many is three and one more?
Ram: One more what?
MH: Just one more, you know?
Ram: (Disgruntled) I *don't* know. (page 45)

(D)
Alison, 4 years, 7 months
MH: What does one and two make?
Alison: I can't answer questions like that.
MH: Why not?
Alison: Because I don't go to school yet. (page 43)

(E)
Mary, no age given - +/- 4 years
Mary: Does two and two make four?
Mother: Mmm.
Mary: Three and three makes .... (Holds up three fingers on each hand and counts them.) One, two, three, four, five, six.
Mother: Mmm.
Mary: Count this! (Holds up four fingers on each hand and counts.) One, two, three, four, five, six, seven, eight.
Mother: Well done! Yes, that's right. (page 51)

Now take a piece of paper and write your name and the date at the top of the page. Then write, 'Young children thinking about number' as the heading. After that, write down your *own* analysis of each transcript.

Write the first letter, A, and then write down what you think is happening, and what Patrick is thinking. What is he able to do? What is he unable to do?

When you have finished analysing the first transcript, go on to the next one. Write B, and then describe what you think Amanda is doing as she answers Martin Hughes.

Work in this way through the five transcripts. As you do this, try to think about how these young children are thinking, and write down your understanding of what is going on. Store this work in your concertina file.

Aren't these transcripts interesting? Don't you find it fascinating that young children are looking for meaning and trying to make sense of everything that is going on around them? They have no difficulty adding, if they know what they're adding. But they struggle when the numbers are not attached to something *real*. 'What's so hard about two and

two?' (That is the title of the chapter that these transcripts came from!) Now we're going to give you a chance to compare what you think is going on with Martin Hughes' interpretations.

Activity 3 (b) - Comparing interpretations

Read Martin Hughes' interpretations of these transcripts carefully. Jot down where there are similarities and where there are differences between what you have written and what Martin Hughes thinks.

(A) It appears, then that most children start school at 5 years able to carry out simple additions and subtractions, provided these take place in contexts involving specific objects, people or events. In contrast, when they are presented with similar additions and subtractions in contexts where there is no reference to specific objects, they are usually unable to answer. How are we to explain this phenomenon? (p 39)

(B) Amanda clearly saw no connection between the questions concerned with bricks and the more abstract questions - indeed, she seems to be using a strategy of giving a different response to the latter. It is as if she is thinking, 'Well I don't understand this question but I know it's not the same as the previous one, so I'll try a different answer.' (p 46)

(C) A fundamental (or basic) strategy in comprehending spoken language is to locate (place) the topic, to ask: 'What is this utterance about?' As Ram's response makes clear, questions like 'What is three and one more?' are thus employing (using) language in a way radically (completely) different from the way in which children are accustomed (used) to hearing language used and for which they have developed appropriate skills. (p 45)

(D) This response (from Alison) suggests a perceptive (sharp) identification of the kind of language being used, and an accurate location (placing) of the context where it is most frequently found. (p 44)

(E) Here, Mary is not using her fingers to solve a specific problem but is instead using them to give a concrete referent (a real thing to refer to), to her use of the language of arithmetic. We do not know what experiences led up to this conversation, but it seems highly likely that using fingers in the way seen with Susan, Donna and Jane would lead on to this more abstract usage.

Fingers can thus play a crucial role in linking the abstract and the concrete, because they can be both representations of objects and objects in their own right. As we shall see ...., this property is also shared with another fundamental device: the use of a written mark or tally to represent an object. (p 51)

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Mary: Count this! (Holds up four fingers on each hand and counts.) One, two, three, four, five, six, seven, eight.
Mother: Well done! Yes, that's right. (page 51)

Take out your **journal**. Spend a few minutes writing about what you have just done.

- How did you feel when you were analysing these transcripts?
- What have you learned so far?
- What has surprised you?

To finish off this activity, we would like you to read what Martin Hughes writes in his summary of this chapter of his research.

Overview

> In this chapter I have argued that children's difficulties with questions such as 'What does one and two make?' can usefully be seen as stemming from their failure to understand a new kind of language, the language of mathematics. There are many aspects to this language, such as its unfamiliarity and its lack of concrete referents (real things to refer to), which cause children difficulty. While they may have an abstract understanding of number in the sense that they can apply their knowledge to new situations, they cannot express this knowledge in the abstract and formal language of mathematics. Children need to develop links - or ways of translating - between this new language and their own concrete knowledge. These translations are of fundamental importance in understanding mathematics.
>
> The ability to carry out such translations does not come easily to young children. One way they can be helped is with the familiar and fundamental device of using fingers. Fingers can be used both to represent absent objects (such as buns or children) and to stand in their own right as concrete referents for statements in the language of arithmetic. As such, they provide an important link between the abstract and the concrete. (Hughes, 1986:51-52)

Translating between the language of maths and real experiences, might be an important thing for teachers of maths to keep in mind.

To do the next activity you will need to find one or two preschool children who live near the school or at your home. (They need to be of the same age as the children that Martin Hughes interviewed, that is between 3 and 5 years of age.)

You will probably need to use the children's own language to find out what they know about number. You could even expect them to be using English number names mixed in with isiXhosa or seSotho. Here are some questions to think about:

- Will they show you numbers using their fingers?
- Which finger stands for which value or number?
- Will they be able to add simple numbers without a context - for example, three and one more?
- Or do they need a concrete example to get it right? For example, three boxes and one more box.

You will need to take your **journal** with you to make notes of what the children say and do. Listen carefully to what they say. Notice their non-verbal communication. Do they tilt their heads to one side to show that they're thinking? Do they look up into a corner of their heads?

Activity 4 - Listening to young children, and talking about number

Start by asking the child how old s/he is. (Note down how the child responds. Does s/he show her/his fingers? Does s/he use isiXhosa, seSotho or English?)

Then ask some questions using numbers in an abstract way. For example,

What does one and two make?

How many is three and one more?

What is two and one more?

Carefully record the children's answers.

If the children give the correct answer, then ask a few more questions using bigger numbers. If they give an incorrect or an unexpected answer, record it and ask the question again, referring to specific things. For example, 'What does two sweets and one more sweet make?' Or, 'How many sweets will you have, if you have two sweets and add one more?' Then record the children's answers.

If you want to, continue to talk to the child about numbers.

'What is the biggest number you know?'

'Can you count?' Etc.

When you have recorded your questions and the children's answers, in the form of a transcript (a written record of an interaction), write a comment on how each child seems to be thinking about numbers. Include anything you noticed about their body language and what this 'told' you about their thinking. Write this below the transcript.

Make sure that your name and the date is at the top of this sheet of paper. Then write the heading, 'Talking about number'. Store this sheet of paper in your concertina file.

Then take out your **journal** and write what you found that was similar, and what was different between your research and the work of Martin Hughes. What surprised you? You will have an opportunity to share these experiences, and what you have written, with other teacher-learners at the face-to-face session.

Remember to take this work with you to the monitoring face-to-face session of this umthamo.

We are including the transcript of a conversation between one of the writers and a young child. We are also including our analysis of the child's answers or responses. This will give you an example of what we expect you to do in Activity 4. It will also be there for you to **compare** with your own work.

1. *This shows that K knows her age and she can show 4 fingers to indicate how old she is.*

You will find the analysis of paragraph 1 in box 1; the analysis of paragraph 2 in box 2; etc.

2. *This shows that K knows the number three.*

3. *This shows that K needs to see the actual items (in this case, sweets) to do this number operation because we know she knows the number three.*

Vuyelwa and Khanyisile talk about number

4. *K seems to know the 'oneness of one'.*

1. Vuyelwa: How old are you?
   Khanyisile: I'm four years old. (Holds up four fingers on one hand.)
2. Vuyelwa: How many balloons are you holding? (K was holding three green balloons in her hand.)
   Khanyisile: Three.
3. Vuyelwa: What do you get when you add two sweets and one more?
   Khanyisile: Two sweets.
4. Vuyelwa: Show me one.
   Khanyisile: (Holds up one finger.)
5. Vuyelwa: Show me two.
   Khanyisile: (Holds up three fingers on one hand.)
6. Vuyelwa: How many is two dogs and one cat?
   Khanyisile: Three cats.
7. Vuyelwa: What is one plus one?
   Khanyisile: (Long pause. No response.)
8. Vuyelwa: How many children are there at your home?
   Khanyisile: (uses fingers to count) Nondumiso, Themba and Zola. Four.
9. Vuyelwa: Write down two
   Khanyisile (Writes 2 correctly on paper.)
10. Vuyelwa: Write down one.
    Khanyisile: (Writes 1 correctly on paper.)
11. Vuyelwa: Write down how many are two girls and one more
    Khanyisile: (Writes the numeral 5 on paper.)

5. *Perhaps K's understanding of numbers is not developed yet. Why has she held up 3 fingers? Is she adding two to one? It seems that she knows one. And she seems to know three and four. But is she unsure of the 'twoness of two'?*

6. *K seems to find it hard to think of dogs and cats at the same time. (It means that my question was not right for K.) But she tries to do the number operation and comes up with the answer, 'Three cats'. So why couldn't she do the sum, two sweets and one more?*

7. *This question seems to confuse K. Has she met the word, 'plus', before?*

8. *The way K deals with this question (counting on her fingers), suggests that she is beginning to develop one-to-one correspondence. When she says 'Four', is she including herself? Or is she unclear about the difference between three and four?*

9. *K seems to know the numeral 2.*

10. *K seems to know the numeral 1.*

11. *This answer is in line with the findings of Martin Hughes. Perhaps K calculated and did the number operation correctly, but she drew the wrong numeral. (The numeral 3 looks similar to the numeral 5. Also, for a beginning writer it is easy to confuse these two numerals.)*

We are sure that from the work you have done so far, you will agree that individual children give different responses to questions. What could be the reason for this? What is happening in different children's heads when they come up with different responses? Spend some time thinking about these questions. You do not need to come up with firm answers, but it is very useful to think about *possible* answers.

Here is a story of how one child explained her thinking.

> Noluvuyo was about 6 years of age. One day her mother was talking to her. When her mother asked Noluvuyo, 'How many is two and three?', she answered, '5'.
>
> Her mother asked, 'How did you get to the answer 5?' Noluvuyo said, 'In my mind I saw two apples and another three apples. And when I counted them all, I got five. There were two apples first, and then there came another three apples. Whenever you want to count, you must close your eyes and you will see these apples.'

What is Noluvuyo doing to work out her answer? She is using her imagination to make a picture in her mind. She is trying to put real physical objects with the abstract numbers. She is making her own picture in her head to solve the problem her own way. Her referents in her head are apples.

Here is another thing to try. Talk to some young children (pre-schoolers or children in an early Foundation Phase class). We want you to ask the children some careful questions to see if you can get an idea of what is happening in their heads when they think about numbers.

When you carry out this activity, you will need to listen very carefully to what the children say. You will also need to *pay* attention *to* the children's non-verbal communication.

Do they tilt their heads to one side to show that they're thinking?

Do their heads bob up and down to show that they're counting?

Do they move or use their fingers as they count?

If they look puzzled, is that a signal that your question is confusing?

If they smile, does this mean that they're comfortable with what you're asking?

Activity 5 - Getting children to explain their thinking

See if you can get some young children to explain their thinking when it comes to using numbers. Think of your **own** questions, questions that you can use to try to get children to explain their thinking.

You may want to think of questions that are suitable or culturally appropriate for young Southern African children. **You** know the children in your community. **You** know how they have been raised. Think of some good questions that will help you to see how they think. Don't ask questions that will confuse them. Don't ask 'tricky' questions!

As you ask the children your questions, and you listen to their answers, make notes of what both you and the children *say* and *do*. After the interviews, take a sheet of paper and make transcripts of these short interviews or discussions. Include your comments and descriptions of any non-verbal communication. Make sure that you write your name, the date, and the heading, 'Children explain their thinking' at the top of the page. Store these transcripts safely in your concertina file.

Give the child or children who you are interviewing, a simple number problem to solve. When the problem is solved, ask them to describe **exactly how** they worked out their answers. What is happening in their heads when they try to work out the answer?

This is a very important way of getting children to think carefully about all the steps involved when they do something. This activity will help them to become more conscious of what's happening in their heads when they work something out.

As the child or children solve the problem, and describe what they have done, make notes. Watch their faces. Watch their non-verbal communication. Do they look into the distance, or up at the ceiling? Why do you think they do that? What do they do with their hands and fingers?

Later, on the same day, read the notes that you made when you talked about numbers with the children. Then open your **journal** and write what you found interesting about the ways your learners solved the problem. What did you learn from this experience? What surprised you?

This procedure of getting children to describe exactly how they work something out, or how they solve a problem, is being done more and more by people in education all over the world. This procedure is often referred to as getting **protocols** from children. As this degree course develops you will learn more about protocols.

If we get protocols from learners, we can begin to work out how they are thinking. This encourages the children to think more about what they are doing, and how they do it. Working more thoughtfully, helps them to become more aware of how their own minds are working.

You should take about 6 hours to complete this unit

Unit 4 - Giving children a chance to reveal their thinking

The purpose of this activity is to try to get your learners to show you how **they** think. When we adopt an OBE approach, we need to use the children's own independent thinking as a starting point for the work that we plan. This is one way to make what takes place in our classrooms more 'learner-centred'.

You will remember in the umthamo, 'What do we know about learning?', that we thought about the **values** that children bring from home to school. In this umthamo, we want you to think about the **experiences** that the children bring from home. (They are not empty vessels when they come to school.)

In this **Key Activity** we ask you to give your children a chance to share their 'independent' thinking with their peers and with you. Their independent thinking will be based on their experiences at home. You will need to give them a chance to explain their different ways of thinking. And then we want you to give your own mathematical interpretations of their explanations.

Try the next activity with some learners in the Intermediate Phase. If you are teaching in the Foundation Phase, work with a friend or colleague who teaches an Intermediate Phase class. This activity was planned specifically for a Grade 5 class. But you could try it in another class if you wanted. You will need to be flexible about the numbers that you use for this activity. **You** know your learners best.

When we trialled these materials, we found that the activity worked well with Grade 4's and calculations like 24 - 9.

Activity 6 - Giving status to the way children think

This activity could be done with a whole class, or with a group when you have group work going on in your class.

Write the following problem clearly on the chalkboard (or on a piece of paper):

Choose one of the following problems to tell your learners (If you have time, you might like to try more than one):

Please feel free to adapt the numbers in the problems to suite the needs of your learners.

Sipho has R83. He spends R48 on a soccer ball. How much money does he have left?

Thembeka eats 7 sweets everyday. She has 42 sweets. For how many days does she have sweets?

Nomonde buys 25 packets of crayons. There are 12 crayons in each packet. How many crayons does she have?

*Make sure that they are clear that you want them to share their own methods of solving the problem. Try to make them feel comfortable to share **their own** independent thinking and ways of solving number problems. When we trialled this activity, we found that we had to reassure the learners that we were serious about being interested in their ways of working out the answer to the sum.*

- Then ask the learners to find a solution to this problem, using any method that suits them.
- Remind them that when they go home after school, there isn't only one way to get home: there are many ways. Some ways are longer. Some are shorter. Some ways are safer. Some are more interesting. Etc.
- Tell the learners that it is the same with maths problems. There is often more than one way to find the answer. Comparing different ways might be interesting.
- Tell them that they will have a chance to share their own way of solving the problem with a partner or their group.
- Watch your learners as they try to solve the problem. Look at their facial expressions. Do any of the children look up, as though they are looking into their heads? Do they look into the distance as if they're trying to remember something? What do they do with their hands? Do some of your learners write on their hands? Watch their body language carefully.

- In your **journal** make notes of what you observe.
- When your learners have found an answer, get them to share the way they worked it out. They can share with a partner or with a small group. Encourage them to discuss and explain the various methods that they have used. Try to encourage your pupils to share as many different ways of solving the problem as they can. Make it quite clear that you don't want them to just come up with one way.

- Give at least three learners a chance to explain to you and the rest of the class, the method that they used to solve the problem.
- As they explain, you can act as a 'scribe' or secretary. On a sheet of paper, record clearly the method that each child describes. (You will need to store this in your concertina file, as evidence of your learners' thinking.)
- Finish off the lesson by asking the learners informally how they felt about being given a chance to share and show you their own personal way of working out problems.

- In your **journal**, make notes of the explanations of the **different** methods that your learners used.
- Also note down what they tell you about how they felt about this activity and experience.

Later, on the same day, read the notes that you made. What did you notice about the children's non-verbal communication (body language)? How did they solve the problem? Look at each explanation carefully. Try to analyse your pupils' approaches. For each one ask:

Is it logical?
Is it effective?
Is it efficient?

Does it make mathematical sense?
Does it save time?
Does it take too long to work out?

How did your learners feel about this experience?

In your **journal** write down some answers to these questions. When you have answered these questions, add how **you** felt while you were doing this. What surprised you? What do you feel you have learned from this activity?

Then you will need to discuss your findings with someone. It could be your 'buddy', or a small group of other teacher-learners who are also doing this course, or a colleague at your school, or an interested friend. Try to describe what you were trying to do. Describe what happened. Talk about what surprised you, and what you think you have learned.

Talking about something is important because when we talk about an experience with someone, it often becomes clearer to us.

Writing a Reflective Report

In the first umthamo in this Core Learning Areas Course, you were asked to write a careful, detailed Reflective Re-

port about your body language in the classroom. Now we want you to write a detailed Reflective Report about what you found when you did this activity.

Take a piece of paper. Put your name at the top, and write the date. Then write the title, 'Mathematics - umthamo 1 - Activity 6 - Giving status to the ways children think'.

Start by writing a sub-heading, 'Introduction'. Then describe what you did and how you got your children to do this activity. Make sure that you include the problem you gave them.

Then write another sub-heading, 'Ways the learners solved the problem'. Refer to the notes you made in your **journal** about the different ways your learners solved the problem, and write a **detailed** description of each method. You will also need to include your own analysis (interpretation) of each way or method. [margin box - text follows this activity] Comment on the children's different non-verbal communication and what you were able to guess from this.

Next, write a third sub-heading, 'What I have learned, and how I think this will affect my teaching in the future'.

- In this section of your report you will need to read what you wrote about your feelings while you did this activity with your learners.
- Then you will need to describe in detail, what surprised you.
- You should also include what the children told you about **their** feelings when they did this work.
- Finally, you will need to write down what you feel you have learned from this way of working with learners, and how you think this experience will affect the way you teach in the future. Give reasons for your comments.

When you have written your first draft of this report, leave it for a few days. Then come back to what you have written, and read it. As you read it, make any changes you think will improve your report. Ask yourself if your report truly reflects what took place when you tried this activity. Have you put in enough detail for someone else who was not present in your class. Will the person who reads your report get a clear picture of what happened?

Some learners might have used expanded notation in various ways in order to solve the problem. Some of the learners might have used column subtraction depending on their Grade level. In both cases, 'borrowing' will be involved.

Pupils may have grouped numbers in interesting ways or broken down numbers in different ways. You may be surprised by the creative ways some learners solve the problem. The important thing is to begin to look for the positive features of learner logic. We have included some examples from when we trialled this activity at Bulelani, Mpongo, Auckland and Ndzuzo Primary Schools, in Appendix A.

Then write your second draft neatly with the changes you have made. At the face-to-face session where this umthamo is concluded, you will have a chance to share what you experienced and what you have written with a group of teacher-learners.

Then you will be asked to appraise or evaluate each report in your small group. You will also be asked to critically assess your own report. Finally, you will hand in your report to your umkhwezeli to assess.

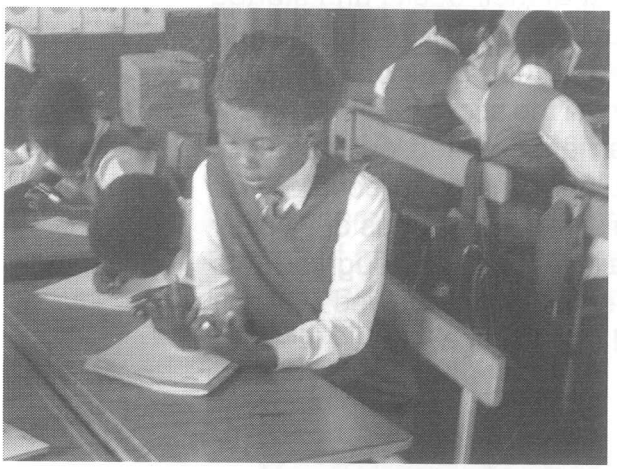
83-48=45
8 3
-4 8
4 5

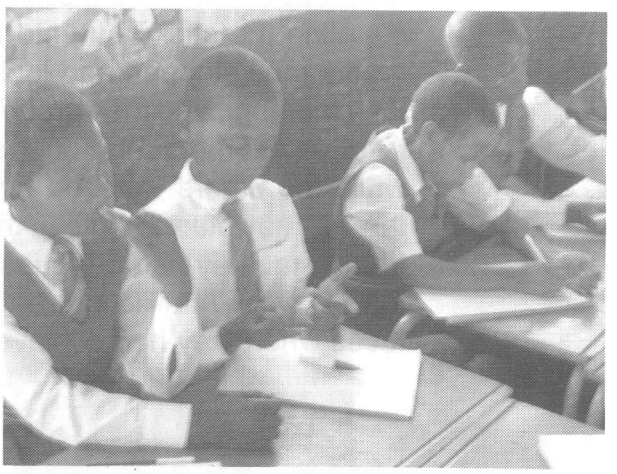
Sible

Both these problems were trialled at Auckland Primary School in February 2002. Mrs Gogela worked with the Grade 5 learners. We found that many learners tried to do the subtraction sum using the method they had been taught, that is, putting one number under the other and then 'borrowing'. Many of the learners who did this, did not manage to find the correct answer.

Answer
Ayanda

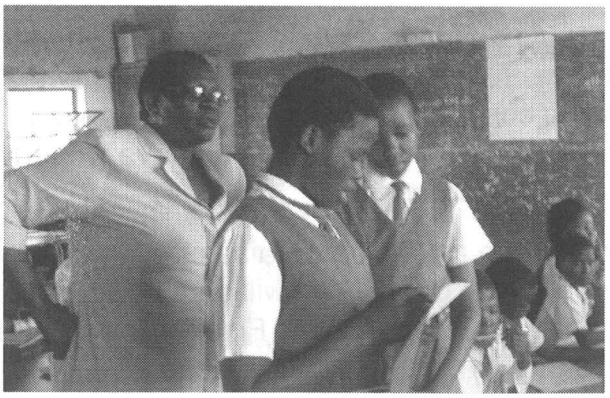
Many tried their 'own method' to solve the problem. Some learners used their fingers, while most of the others 'made smaller subtraction sums'. You will find examples of their work in Appendix A.





Using fingers to work out the problem.

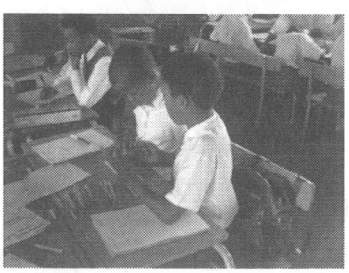
The learners were not shy to share their ideas or to compare their answers. We found that by doing this, they helped one another to find easier ways to solve the problem and helped others to find their mistakes. In this way, they learnt from each other.

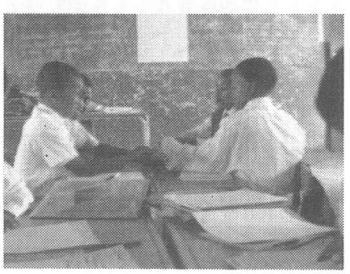


Sharing ideas and comparing answers

What happened next, really took us by surprise! One of the problems, as we know it, is a division problem. Very few of the learners tried to do it that way. The majority chose to find other methods to solve the problem. Some of the learners discussed the problem with each other. Some looked very puzzled. Some tried to work it out using their fingers. Others started to make 42 marks on their piece of paper.

Then, all of a sudden, without saying a word, three learners got up out of their desks and to Mrs Gogela's surprise, walked right past her to the back of the classroom. They opened a box at the back of the classroom and each took out a handful of sticks. They went back, sat at their desks and started counting the sticks out into bundles of 7. After a few moments they stopped and looked at their piles of 7, thought for a moment, and then grouped all the sticks together again. After a few moments, one learner counted out 42 sticks while the others watched him. After they had counted out the 42, they started putting the sticks into groups of 7. They found that they had 6 groups and therefore enough sweets for 6 days. What delight and satisfaction showed on their faces when they had achieved the solution.





Solving the problem using sticks. What satisfaction!

Although this problem seemed to be somewhat difficult at first, the amount of mathematics that took place in that classroom that day was amazing! You will find other methods used by learners in Appendix A.

Conclusion

As you can see, there is no need for us as teachers to think **for** our learners, since the learners are clearly able to think for themselves. There is no need for us to give them 'recipes' for calculations. We cannot regard learners as empty buckets which need to be filled up with knowledge by us, their teachers.

Instead, we need to make an effort to understand **how** our learners think. The way learners think is very much important when it comes to the learning process of mathematical concepts. They have developed their own ideas based on their experiences. They have constructed their own knowledge. And they have developed their own logical strategies (or ways) for working things out.

As teachers, we need to focus on the ways our children think so that we can help them think about numbers in an abstract way. If we **celebrate** their abilities in this regard, we will build confidence in Maths for **all** learners.

Our classrooms should enable every learner to use different ways of representing ideas so that good, flexible mathematical thinking can develop. Teachers should really try to avoid rote learning, because it leads to bad, rigid mathematical thinking (which is often not even logical or accurate).

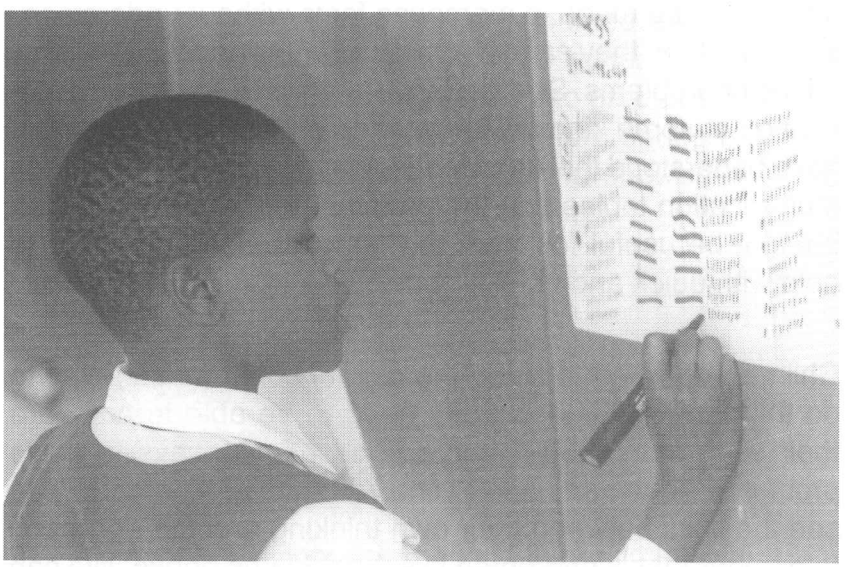
If learners are made to memorise facts without understanding them, then they cannot apply that knowledge to new situations or problems. So teachers are advised to allow memorisation of some kinds of knowledge only **after** the learners have understood that knowledge. Once learners understand multiplication tables and the patterns and regularities, then it might be useful for them to memorise such patterns, to help with quick and confident calculation.

Children do need to know the conventional (usual) way to do things with number. They need to be able to compare their own methods with more conventional ways to solve problems. Teachers need to find ways to help their pupils to see the links between their own thinking and the approach to number that is presented in school Maths books. We can do this by integrating the experiences and skills that children bring from outside school, with what Mathematical tradition says children need to learn at school.

Experience, common sense and research show that children learn a great deal before they go to school. They are able to begin to think about and use numbers even at pre-school age. Before a child goes to school, s/he learns much from all that is happening at home, in the streets and in the shops. For example, s/he knows the price of a loaf of bread, her/his street number, her/his home telephone number (if s/he has one), and s/he can even count up to say 20 or 30.

We hope that in working through this umthamo you have had an opportunity to think and talk about your learners' independent thinking in your face-to-face sessions. We also hope that the awareness that children are able to think independently and creatively comes upon you from time to time, especially when you plan lessons for your learners.

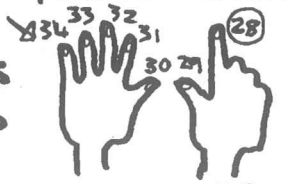
We also hope that you have seen a link between what we have written in this umthamo and the first umthamo from the Core Education Studies Course, 'What do we know about learning?' Both of these imithamo have been looking at how we can find out more about the way our learners learn and think. And both imithamo show how important it is that we make space or a 'home' **inside** our classrooms, for what our learners bring from their experiences outside the classroom.



Appendix A – Examples from trialling

Date: 26/5/1998
Anele at Bulelani - grade 5 pupil in a multigrade class
Teacher. Mr Buntu Fosiava

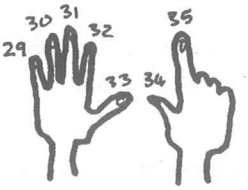
Anele explains to the class how he works out 35-7
He says he knows "the answer is 28"
To find the answer he puts his hands in front of him on the desk
He counts backwards from the left. He says '34, 33, 32, 31, 30.' He presses each finger on the desk as he counts.
Then he moves to the right hand. He says '29, 28.'
'The answer is 28.'



He writes the sum like the teacher tells him but works out the answer with his fingers

35
- 7
28

Anele tells us that he checks by counting on. He demonstrates
He doesn't reverse the operation. He starts again from the left
He says '29, 30, 31, 32, 33' on the one hand.
Then he says '34, 35' on the right hand.



Anele uses the simple method of counting back or counting on to find out the answer to 35 - 7 = □. He uses his fingers to stand for the numbers. It seems that in his head the number 7 is his right hand index finger. This finger stands for seven. He starts counting back from the little finger on his left hand. He knows from experience that the answer will be correct when he gets to the 7th finger. It is interesting that he doesn't just reverse the process to check. He starts again from the left little finger and counts on until he gets to the 7th finger.
I would be curious to see what he does with larger numbers?

Date: 21.4.1998
Miranda at Mpongo Primary

Miranda has a very unusual method for subtraction. She got the answer to 23-9=□ very quickly.
She explained that she finds the answer by counting in 3's
She showed us on the board

3, 6, 9
3 + 3 + 3
'thats 9' she says

Then she counts on

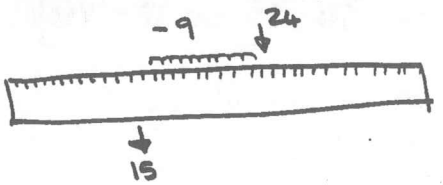
12, 15, 17, 20, 23
3 + 3 + 2 + 3 + 3
'thats 14' she says

What is she doing?

It seems that she is breaking down (decomposing) the numbers into convenient units. 3 is convenient in 9. So she uses the regular pattern of counting in 3's to help her. She knows that 3×3 is 9. Now she must work out what is left if the 9 has been taken. So she counts on in 3's. But at the same time she seems to be counting back from 23 in 3's). This means that the hop from 15 to 17 is only two. She must then re-combine the four 3's with the two to get her answer – 14. She does this all very quickly. She is often the first child with her hand up. She is very clear and confident with numbers. But she has 'invented' her own special way to do things.

Lumko - grade 4 (and Buzwe, and Siyabonga)
Ndzuzo Primary School.

Given the problem 24-9=□
Lumko says, 'I take my plastic ruler. I start from 24. I count backwards 9. I stopped at 15. That is the answer.



Lumko is using his ruler as a number line. By locating the value 24 on the number line and counting back 9 units. He finds the answer easily. It is 15. Buzwe does the same thing.

But Siyabonga tells us that he marks off 24 lines. Then he scratches off 9 to find the answer. Then he checks with his ruler.

42 ÷ 7 = 6 days

Xhanti

Date : 28/2/2002
Xhanti at Auckland - Grade 5
Teacher : Mrs Gogela

Xhanti drew a 'number line' with 42 markings. He grouped 7 together. He made 6 groups. Xhanti worked out he would have enough sweets for 6 days.

Like Funeka, Xhanti has not yet developed the concept of the number 42 and he had to draw it visually first.

7+7=14+7=21+7=28+7=35+7=42. There are 6 days.

Andiswa

Date : 28/2/2002
Andiswa at Auckland - Grade 5
Teacher : Mrs Gogela

Andiswa explained that for 2 days 14 sweets would have been eaten. If you add 7 and add 7 and add 7 until you get 42, you will see that you added 7 - 6 times. Andiswa worked out she would have sweets for 6 days.

Instead of dividing, Andiswa found the answer by adding. She changed the sum into a situation which she felt comfortable working with.

28 February 2002 Alunge

1. He left = R83 - R48 = R80 - R40 = R40 - 8 = R32 + R3 = R35 : Difference maths

Date : 28/2/2002
Alunge at Auckland - Grade 5

Alunge subbracted the multiples of 10 first. R80 - R40 and found R40 was left. He continued to subbract the 8. He then added 3 which made up the original R83 to get the difference of R35.

[redacted]

[redacted]

42 ÷ 7 = 6 = [redacted]

[redacted]

Date : 28/2/2002
Funeka at Auckland - Grade 5
Funeka made 42 marks on her page. As I watched her, she marked off 7 and then put up 1 finger. She marked off a second 7 and put up another finger. She repeated this exercise until she had marked off all 42 marks. She counted the number of fingers she had put up, and came to the answer of 6.

Funeka had not yet developed a concept of the number 42 and therefore she found it necessary to make 42 marks.

Siphokazi

Maths

R83 − 40 = 43 − 8 = R35 Difference

Date : 28|2|2002
Siphokazi at Auckland - Grade 5
Teacher : Mrs Gogela

When Siphokazi solved the problem of R83-R48, she decided to decompose (break down) 48 into smaller numbers, that is 40 and 8. Then she subtracted the 40 from 83 and got 43. She proceeded to subtract the 8 from 43 and got the answer of R35.

Siphokazi felt comfortable working with the numbers 40 and 8.

Sinazo

Maths

28 February

R83 − 20 = R63 − 20 = R43 − 8 = R35 Difference

Date : 28|2|2002
Sinazo at Auckland - Grade 5
Teacher : Mrs Gogela

Sinazo decided to decompose (break down) the number 48 into a 20; another 20 and an 8. She subtracted 20 and got the answer of 63. Again she subtracted 20 and got R43. Sinazo then subtracted 8 and found the answer of R35.

Sinazo felt comfortable working with 20; 20 and 8. She decomposed the number into smaller numbers that she found easier to work with.

Appendix B - Content Audit

Number in the Primary School

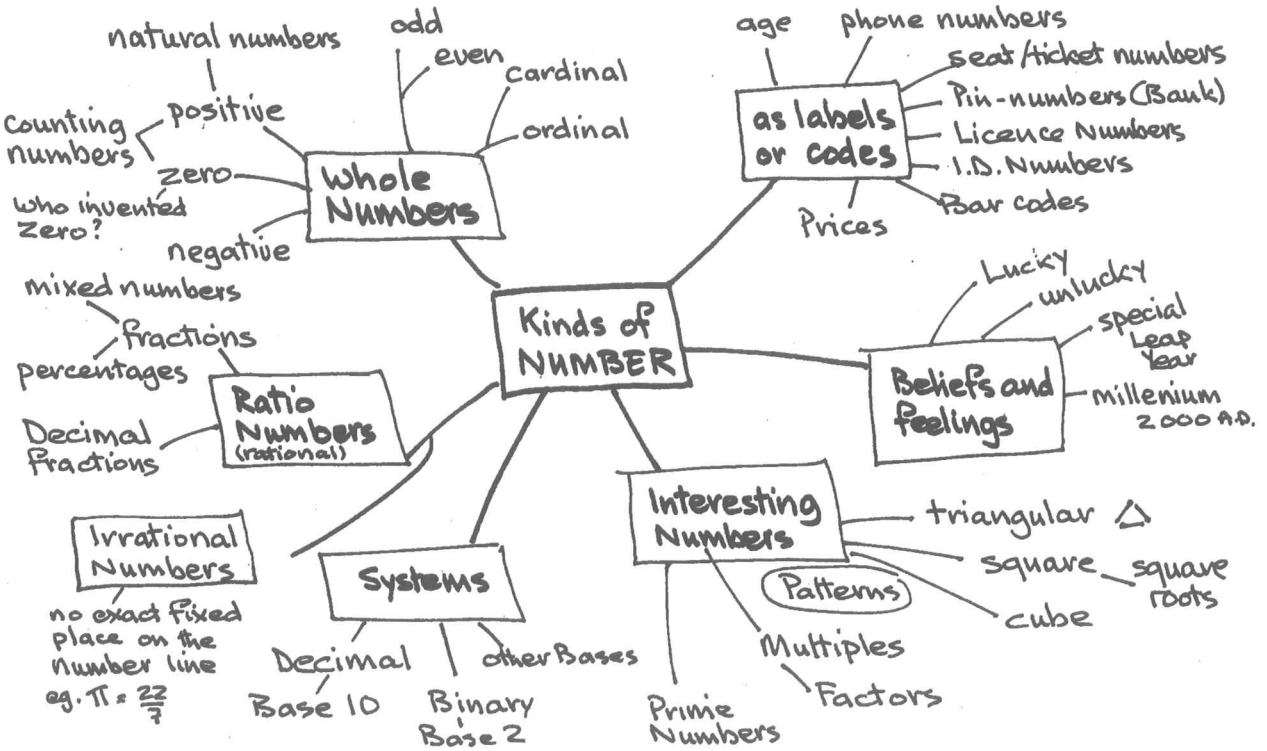
In this umthamo you have been thinking about children and number, number concepts, and how children work with numbers. As a teacher you need to be confident and clear yourself about the topic. You need to take responsibility for making sure that you *are* clear about the topic.

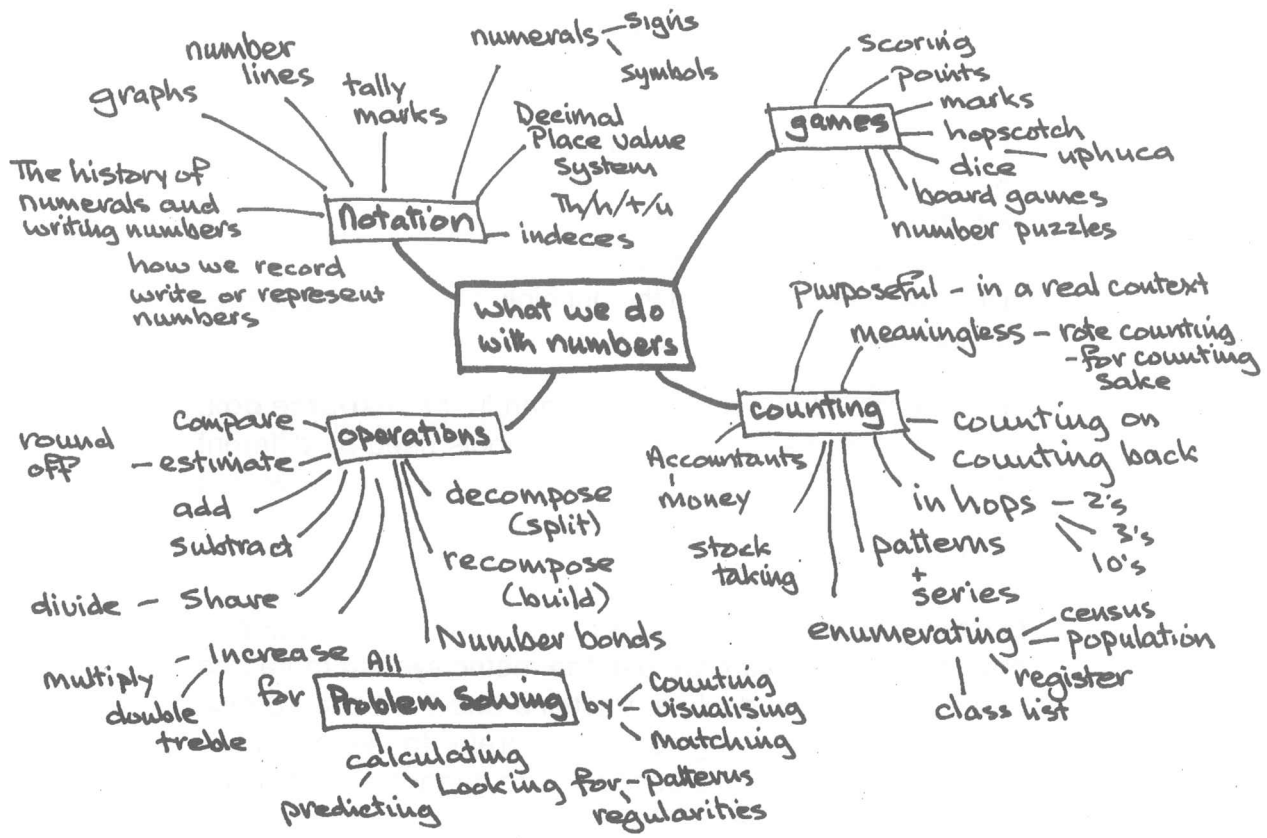
What does a primary school teacher need to know about this topic? What information and understanding must s/he have to be well-equipped to support children's learning of mathematics, so that they in turn are clear and confident?

Numbers play an important role in our daily life. Counting, estimations, measurements and calculations are all done by using numbers. Amongst many others, bank tellers, cashiers, petrol attendants, cooks, artists, pilots, accountants, economists, mathematicians and engineers are people who frequently use numbers in their jobs. Almost every field of life requires a knowledge and the use of numbers. Do you know anything about decimal, binary, rational and irrational numbers?

We have prepared two mind-maps that show what a teacher may need to know. Use the mind-maps to check that you have the necessary background knowledge. **Circle** any aspect that you are uncertain about. Then it is up to you to find out about the aspects that you have circled. In this way you can fill in any gaps in your background knowledge of number.

- You can do your own finding out using school text-books
- You can consult other teachers in your school
- There may be a Key Teacher in your area who has done a Further Diploma in Education or who has other Maths qualifications, who would be prepared to help you
- Remember, each Centre will have **resource boxes** for the Core Learning Areas Course. You will find relevant books, readings and other materials for you to consult and use in the **resource box** for number
- If you are still stuck, ask your Centre Co-ordinator to help. This will be easier to organise if you first find other teacher-learners who have the same problem. Then you can approach the Centre Co-ordinator as a group.


Kinds of NUMBER
Whole Numbers
natural numbers
positive
counting numbers
zero
negative
Who invented Zero?
odd
even
cardinal
ordinal
as labels or codes
age
phone numbers
seat/ticket numbers
Pin-numbers (Bank)
Licence Numbers
I.D. Numbers
Bar codes
Prices
Beliefs and feelings
Lucky
unlucky
special
Leap Year
millenium 2000 A.D.
Ratio Numbers (rational)
mixed numbers
fractions
percentages
Decimal Fractions
Irrational Numbers
no exact fixed place on the Number line
eg. π = 22/7
Systems
Decimal
Base 10
Binary
Base 2
other Bases
Interesting Numbers
triangular
square
square roots
cube
Patterns
Multiples
Factors
Prime Numbers


What we do with numbers
Notation
number lines
graphs
tally marks
numerals
signs
symbols
Decimal Place value System
Th/h/t/u
indeces
The history of numerals and writing numbers
how we record write or represent numbers
games
scoring
points
marks
hopscotch
dice
uphuca
board games
number puzzles
Purposeful - in a real context
meaningless - rote counting - for counting sake
counting
counting on
counting back
in hops - 2's 3's 10's
patterns + series
Accountants
money
stock taking
enumerating
census
population
register
class list
operations
Compare
round off
estimate
add
substract
divide - Share
decompose (split)
recompose (build)
Number bonds
multiply - Increase
double
treble
All for Problem Solving by
counting
visualising
matching
calculating
predicting
Looking for patterns regularities

Some things to think about

A Brief History of Numbers

Outcomes Based Education (OBE) states in the learning area, Mathematical Literacy, Mathematics and Mathematical Sciences, that learners have to show the evidence of knowledge of number history in their own communities, as well as the history of Roman numerals and the history of Arabic numerals.

You could ask your learners to go and do research at their homes. They could ask their parents and grandparents and relatives about the way numbers were used in their own communities in the past.

According to Colliers Encyclopedia, people had learned to count long before they knew how to write. Hence there are no records of the words they used in connection with early number activities.

Ancient nomadic people developed a spoken language of number. But when people began to settle into agricultural communities, they felt a need for numerical records. It then became necessary to develop systems of written numerals. It is these which have been the basis of the growth of mathematics.

Did you know? The oldest known record of people recording number comes form Africa. Tally marks have been found on bone. Some say that it was the women who made these marks to record and check their menstrual cycle!

The earliest people could recognise more or less when some objects were added or taken away from a small group. They probably kept a count of cattle, sheep, and life years by some simple tally method, or by matching with pebbles or shells. In this way they employed the principle of 'one-to-one correspondence'.

We have included a numeration chart in the **resource box**, so that you can see the various symbols used by different people. Then there is also an interesting chapter, 'The written number systems of other cultures' from *Children and Number* by Martin Hughes.

In every day life, particularly since the invention of computers and the calculator, we use the metric system more and more. This means decimal fractions and the base 10 system. Scientists and engineers also prefer to use decimals. Do you know why? It is because one cannot add common fractions on a calculator. The calculator has to convert them to decimals. To show a fraction of a whole, a calculator uses a point, for example, 32.46. South Africa is one of the very few countries in the world which use a comma as a decimal sign, for example, 32,46.

Have you watched athletes running on TV and seen the stop-watch ticking time? Once the winner reaches the finishing line, the time is reflected in seconds. Say the time taken by the winner is 9,6 seconds. This means that he took 9 full seconds, and 6/10 of a second to run the race. In other words, 9 6/10 seconds can be recorded as 9,6 seconds. Results and records are now being recorded in hundredths of a second

Can you find out what the world record is for the 100 metres?

The Binary System (A system based on 2)

The binary system of numbers was used from as early as the beginning of the seventeenth century. This system of numbers was discovered more than four thousand years ago in Mesopotamia. In recent years it has become very important in the field of applied mathematics, particularly for use in electronic computers. Do you know why this is so?

*People have ten fingers to count with, so the decimal system is logical for people. But an electronic machine can only be **on** or **off**. So it can only count in twos.*

The binary system is a system in which only the digits 0 and 1 are used. This is unlike the case of a decimal system where digits 0 up to 9 are used. Have a look at the following tables of conversions from decimal to binary numbers. (Can you spot the pattern, and fill in the missing numbers?)

Decimal	Binary	Decimal	Binary	Decimal	Binary
0	0	6		12	1100
1	1	7	111	13	
2	10	8	1000	14	1110
3	11	9	1001	15	1111
4	100		1010	16	10000
5	101	11	1011		

If you want to know more, refer to Colliers Encyclopedia Volume 18 (page 13) at your local public library (or in the **resource box** at your Centre).

Pattern

Mathematics begins with numbers. All languages world-wide have words for numbers. Mathematics today uses many symbols, but numbers are the most ancient ones, and they are what the child learns first.

There is a wonderful order about numbers that was noticed by the ancients as they began to formulate their number systems. Patterns of numbers can be formed by combining or separating numbers, and can be repeated perfectly again and again and again. Noticing, understanding and using patterns is one of the most important **learning tools** in Mathematics.

Running Notes for Umthamo 5

Introducing Number Concept
Preview umthamo (± 30 minutes)

- Hand out copies of umthamo. Ask t-ls to spend a few minutes looking at pictures on cover.
- Next, suggest they turn to the Contents page.
- Ask them to work in pairs and share what they think this umthamo is all about and what they expect to do in their classrooms.
- Draw a mind-map (see page 2 of Guide) and record ideas from the whole group.

Journal Write (± 30 minutes)

- Tell t-ls to turn to page 4 of the umthamo, and to read Activity 1. Remind them that in Learning about Learning they had to remember powerful/emotional memories. **Now,** we want them to remember learning Maths at school.
- Tell them to open their **Journals** and to write the time and date. Then tell them to write down what they remember about learning Maths.
- Next, ask them to think about how Maths is taught today. What is different? Why?
- Get them to swap their Journals, and to comment.
- **Remind them what they must complete for the next face-to-face session, and what they must do for the f-t-f where this umthamo is concluded.**

Monitoring Umthamo 5
Sharing experiences (10 minutes)

- Teacher-learners share their experiences of working with transcripts (Activity 3a and 3b). [10 mins]
- Teacher-learners share what they have found when they interviewed children for themselves. What have they learned about young children's thinking? (Activity 4) [30 mins]

Journal Write (10 mins)
T-ls write what they have learned so far by doing these activities. They swap, write a response, and return Journals.

Remember to write in your own Journal.

Remind them of what they must do for the face-to-face session where this umthamo is concluded. Check that they are clear about Activity 5 and Activity 6. Check that they know what is required for the Reflective Report (see pages 19 and 20).

Concluding Umthamo 5
Sharing Reports (40 mins)

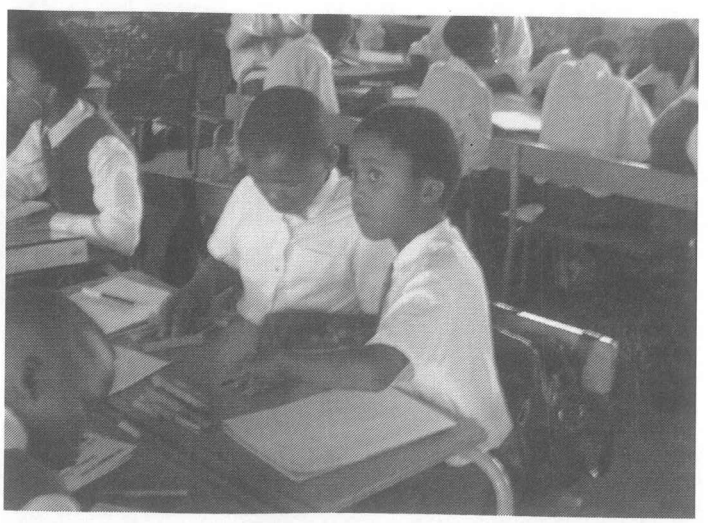
Make sure that everybody has brought their report, either completed or in draft form. In small groups, teacher-learners share experiences of Key Activity. Remind them to listen carefully, and to appraise one another's reports. As they do this, move around and observe the groups, and individual teacher-learners. Make notes in your Profile book.

Appraisal (10mins)

Hand out appraisal slips for each teacher-learner in each group to access themselves, and one another. First of all ask each one to appraise her/himself. Ask each one to think about how well s/he reported on the Key Activity.

- Was my report clear?
- Did I have, and show, evidence that I had carried out the activity in my class?
- Did I include what the children said about how they felt about this activity?
- Did I share what I have learned from this experience?
- Ask each member of each group to appraise the reports of the other people in their group. They can use the same questions we have suggested above.

Collect your teacher-learners' reports.



NOTES

University of Fort Hare, Distance Education Project

B.Ed. (Foundation & Intermediate Phase)

CORE LEARNING AREAS COURSE -YEAR 1
Mathematics

Developing and Using Number Concepts

First Pilot Edition - 1998
Revised Edition - 2002
Pilot Version:
Written by: Blanche Nomfanelo Bolosha & Vuyelwa Tokwe
Co-ordinated, illustrated and edited by: Alan & Viv Kenyon
Revised by: Claire Fraser
Front cover design by: Z van der Westhuizen
Front cover photograph: A learner using a specific method to solve mathematical problems

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