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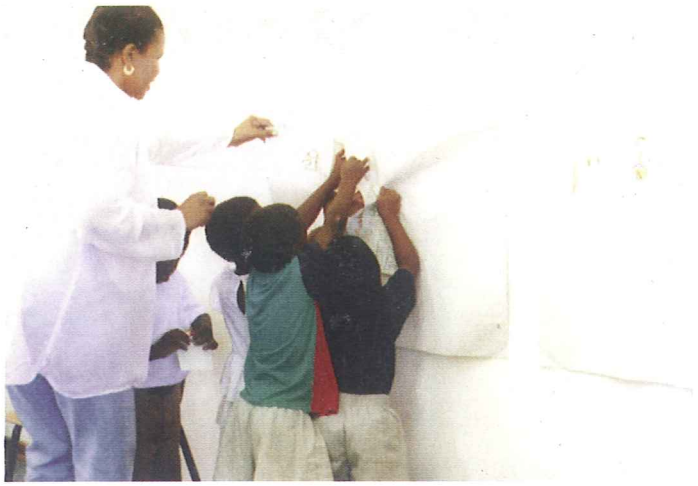


UNIVERSITY OF
FORT HARE

Eastern Cape Education
Department

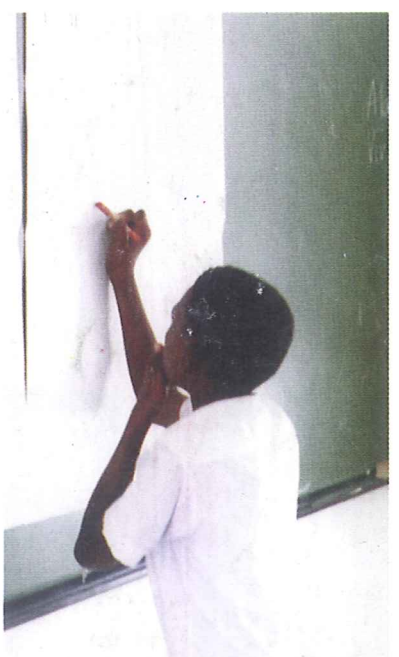
Distance Education Project

Core Learning Areas Course

Mathematical Literacy, Mathematics and Mathematical Science

Umthamo 3

Maths - Language



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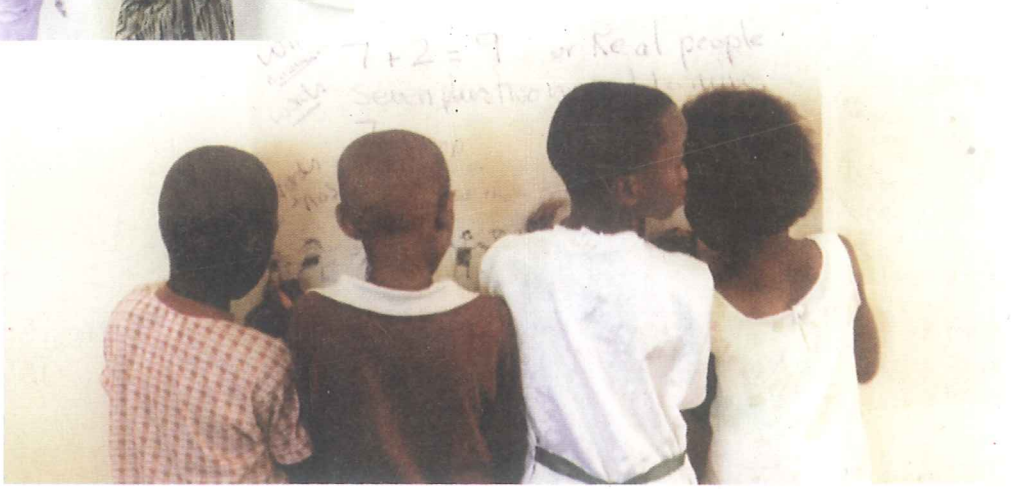
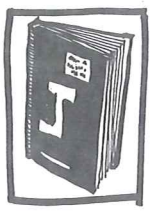
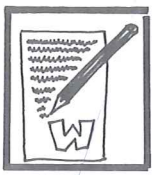




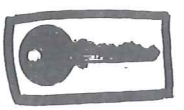
Journal

Thinking and Reflecting

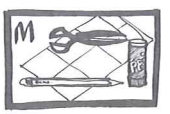


Written Report

Classroom or School



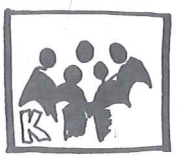
Key Activity



Making materials

Reading and Thinking

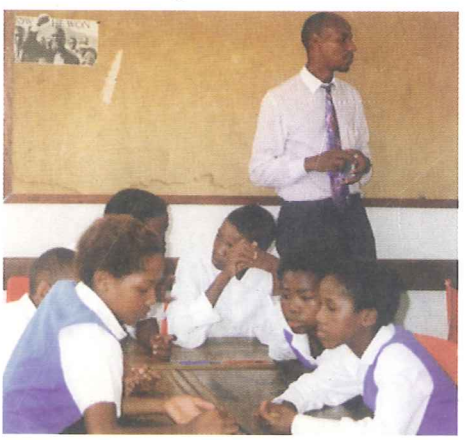
Discussion

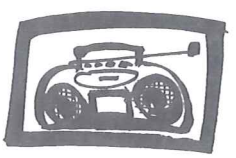


Face-to-face umkhwezeli

Concertina File for Portfolio

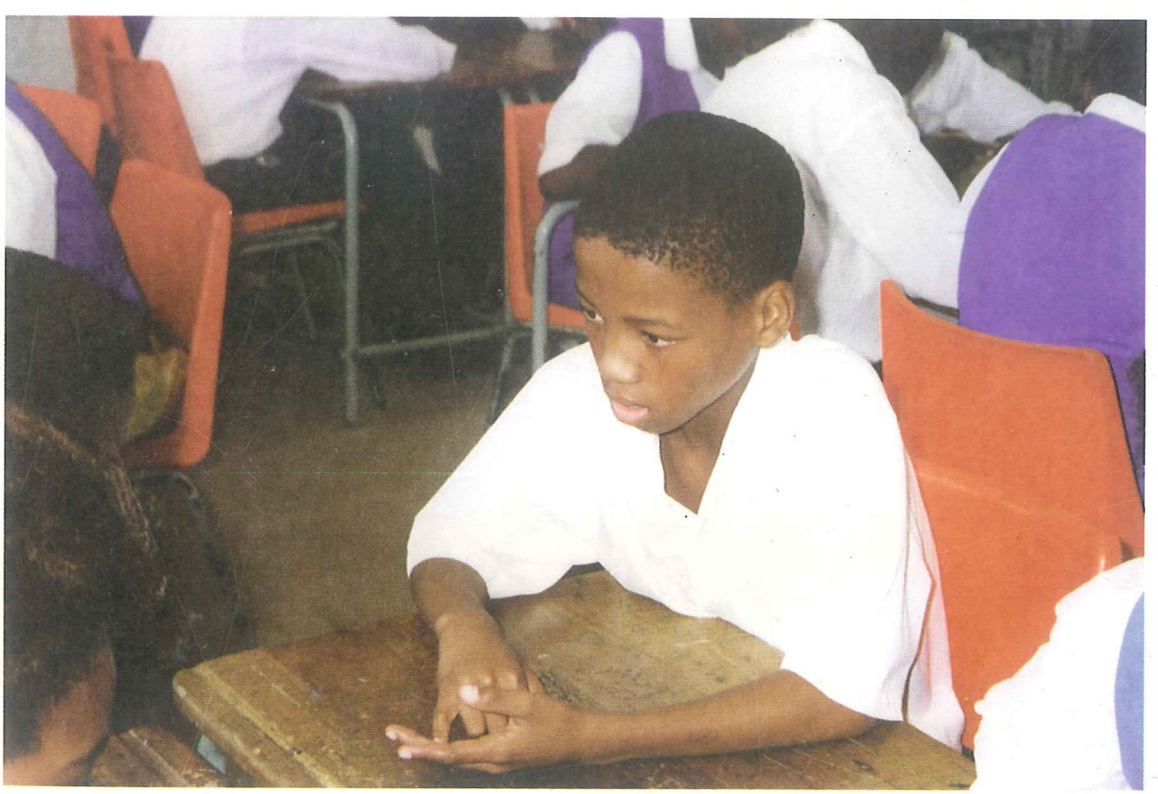
Time





Tape-recorder

Multigrade



Mathematics as a field of study includes a great deal of discussion, debate and dialogue. Mathematics is created constantly and must be posited, tested, defended, extended, and accepted or rejected by the mathematics community. The complications and complexity of mathematical ideas make mathematics a very human activity, involving communication in all forms.

If our students learn to do mathematics silently, they may find that they don't have words readily available to describe mathematical ideas. If asked, What does it mean to do division? A student may give an example: It's like 36 guzinta 895. Students give us the words they know - sometimes rote memorisations. The more students memorise our words, the less likely they are to have their own. How did you do it? often leads to a shrug. How did you know? To, I don't know - I just knew it.

It's too easy to forget that children need many, many experiences to develop language fully, even in mathematics classrooms. Children may learn arithmetic procedures by repetition alone; if so, their only tool for recalling how to find solutions is their memory. Mathematics, rather than resting on a rich base of exploration, discovery, conversation, and common sense, may rest exclusively on the relatively weak platform of memory. If it does, students' concepts are not robust enough to be used flexibly.

Participating in mathematical conversations is central to developing strong mathematical ideas. Talking allows students to compare their methods and discuss their ideas and theories with their classmates. Classmates' questions or counter-assertions often force a student to examine her own mathematical concepts and ideas. When students begin to comment on each other's methods and ask each other questions, confusion is clarified. Expressing their assumptions in the context of a conversation helps students articulate and refine their ideas.

Rebecca Corwin et al. 1996. Talking Mathematics: Supporting Children's Voices. Heinemann.

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Contents

Introduction

In a number of recent imithamo we have been thinking of the important role language plays in our learning. We have thought about how we actually learn to communicate through language. We have thought about the relationship between language and learning. And we have thought about the languages that are used in classrooms. This third Maths umthamo builds on the ideas in those imithamo. The focus of this umthamo is on the language we use to discuss and to express Maths ideas.

You will remember that in the first Maths umthamo of this course, you were asked to get your learners to explain exactly how they solved a particular Maths problem. We asked you to get your learners' protocols (Umthamo 5, page 17). And we pointed out how important it is for teachers to get protocols from their learners if they want to know what and how their learners are thinking.

This procedure of getting children to describe exctly 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. The procedure is often referred to as 'getting protocols' from children.

If we get protocols from learners, we can begin to work out how they are thinking.

In this umthamo the **Key Activity** requires you to:

- have an open-ended discussion with your learners on an aspect of Maths.
- write a Reflective Report on how this discussion went and your feelings and thoughts afterwards.

We hope that your and your learners find this Activity so valuable that you will want to repeat it. Ideally, this will mean that Maths discussions become a regular aspect of your work with learners, perhaps even every week. We would really encourage this, and would urge you to write up, and reflect on the discussions in your Journal each week.

In Unit 1 we problematise the focus of this umthamo. We want you to think about the relationship between Maths and language. We also want you to think about the relationship between the Maths we need and use in our daily lives, and the Maths of school

You will do the Activity in Unit 2 at the face-to-face session where this umthamo is introduced. Your umkhwezeli will give you a mathematical idea to think and talk about. This will give you an experience which we believe will be useful when you come to carry out the **Key Activity** with your learners.

In this umthamo, we ask you to listen carefully to your learners. We have included transcripts of teachers having conversations about mathematical ideas with their learners for you to read in Unit 3. You will need to read and think carefully about these readings.

The **Key Activity** is in Unit 4. We have provided three options so that you can choose the one which is most appropriate for your particular situation, depending on the age and stage of your learners.

In Unit 5, we describe how you can begin making Maths Word Books with learners. Again, you will need to choose the option most suitable for your class and your learners. This is a long-term activity, and will be an **important** part of your Portfolio Presentation at the end of this second part-time year of the course.

Intended Outcomes

When you have completed this umthamo you will have

- experienced for yourself what it is like to think and talk about an aspect of Maths, and you will have a sense of the importance of creating opportunities for Maths talk in the classroom
- read several transcripts of teachers and their learners having Maths conversations, so that you will know what to aim for
- begun a process of having regular open-ended Maths conversations with your own learners.

The Maths content of this umthamo

In the Appendix, you will find a content audit of the Maths connected to this umthamo. You will see that it focuses on fractions (which you will use as a basis for your open-ended discussion in Unit 2), and on mathematical operations, which will be the focus of your work with your learners in the **Key Activity.** Remember, it is up to you, as a qualified teacher, to ensure that you master the relevant content. If you are really stuck, turn to your Centre Co-ordinator and the learner support system for help in this regard.

Unit 1 - Thinking about the Links between Language and Maths

It is generally believed that many children face major problems when it comes to learning Mathematics in schools. What causes these problems? How can they be solved? As classroom teachers, you are in the best position to tackle these questions. But, what are the causes?

Activity 1 - Problems with Maths

Work through the following list of possible causes and decide if you agree or disagree with the statements. You will see that we have left space for you to add additional causes you think of yourself, or that you may meet, or that you think of in the future.

- The way Maths is taught is itself a problem.
- Teachers don't know Maths, and communicate their own fear to their learners.
- There is a lack of opportunities and time to talk about Maths in a natural way.
- Children do not get enough practical hands-on experience with actual Maths activities.
- Maths is too abstract.
- We encourage rote memorisation and mindless 'chanting' more than understanding and explaining and thinking.
- We introduce new concepts before learners are ready for them.
- We prevent learners from meeting some ideas because we think they will be too difficult for them.
- Teachers don't bother to find out the informal knowledge their learners already have.
- We worry more about what children can**not** do, than what they **can** do.
- There is too much pencil and paper Maths and not enough hands-, hearts- and heads-on Maths in primary schools.
- Teachers don't realise that understanding Maths becomes easier if we bring children's experience into the classroom.
- We are too reliant on text-books and ready-made Maths work books.
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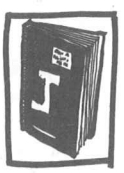
- We present Maths in a step-by-step logical mechanical fashion.
- We don't present Maths as a whole new exciting world and way of thinking, which is out there to be explored, discovered and enjoyed.



Open your Journal. Write the heading, *Umthamo 21 - Activity 1.* Then divide the page into two columns. Write at the top of the first column, *Statements I agree with,* and at the top of the second column, *Statements I disagree with.* Don't worry if there is some blank space in each column. You can add to these columns as you meet or think of any other causes in the future.

Well, what did you think of that list? Did you add any problems? Can you solve some or all of these problems? What needs to be done?

In the long run these problems are yours, so the answers will need to be yours. Nobody is going to come and solve them for you. As a classroom teacher committed to change, you and the other teachers you work with are going to have to start facing these problems. You will have to start solving them in a **thoughtful** and **professional** way. Otherwise, you, as a teacher, remain part of the **problem,** not part of the **solution.**

Remember Umthamo 17, where we saw how naturally and successfully almost all young children acquire their first language? Why is it so difficult for learners to do the same thing with Mathematics? If children can manage to master something as vast and complex as language, why should it be so difficult to master or acquire something as straightforward and logical as Mathematics? And what is the role of the teacher in promoting this mastery?

Activity 2 - Teacher as Listener

This activity is for you to do on your own. Carefully read the passage below by Courtney Cazden. It is the foreword to Vivian Gussin Paley's book, *Wally's Stories.* You have met with this book and its writer before in previous imithamo and readings.

In this book, Vivian Paley has daily open-ended discussions with her preschool learners. Their discussions include exploratory talk, serious conversation, sharing ideas, developing ideas, arguing and debating.

This book doesn't need a long foreword. Vivian Paley is such a sensitive observer and writer that her kindergarten children speak delightfully and wisely for themselves. But hers is an unusual classroom, and *Wally's Stories* is about only one part of its life.

The "stories" are of several kinds. Some are made up by Wally and his classmates, some are picture books and fairy tales. All are read, reread, and acted out again and again. Others are five-year-old discussions of very serious topics - like whether stones melt when they are boiled. When you are five, there is much in the world that needs to be accounted for, and these accounts are "stories" to us adults when children prefer their magical explanations to those we call "true".

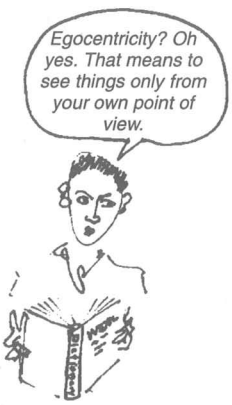
Teachers are usually counselled to respond to such stories with some version of what might be called "confrontation pedagogy": rub the children's minds in the errors of their thoughts by providing arguments against their inconsistencies and evidence that magic doesn't work. Although that advice seems plausible, there is reason to believe that this approach is more comforting to the adult than helpful to the child.

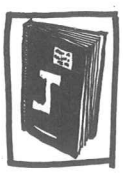
Language - the aspect of child development I know best - is a case in point. There are times during all children's pre-school years when their advancing knowledge of language as a rule-governed system produces words like *goed* and *holded,* and (in answer to the question, "What are you doing?") utterances like *"I doing dancing."* At those moments, the child seems impervious to contradiction, and no amount of adult correction has any obvious effect.

As with language, so too in the classroom. Instead of confrontation, it may be more useful for teachers to go beyond their own adult egocentricity and explore the ideas that flow from the children's own premises. That is what Paley has done, with the rich gains in language and behaviour in this five-year-old community. And that is the part of its life that *Wally's Stories* is about. Between the lines of the revealing sometimes poignant episodes, one catches glimpses of the teacher's complex role - supporting the children in their imagined worlds and providing firm anchor points to a more stable "reality" as well.

(Cazden, C. 1981. In Paley, VG. *Wally's Stories.*)

The usual advice for teachers is to ignore, or squash children's thinking as wrong, and to tell or show them how to think the "right" way.

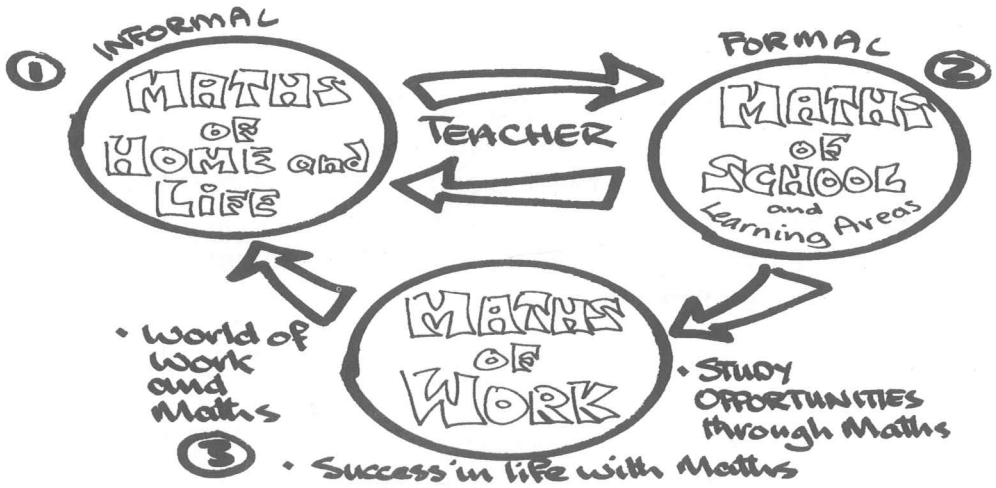




Spend a little while thinking about this foreword. You may even want to re-read it. Then open your Journal and write at least a page in response to what Courtney Cazden has written.

You will see from this quote, that Courtney Cazden believes the teacher has a complex role to play. She must strengthen what the child already has from one world. And she must link it to the other world of school, which is a preparation for adult life in the so-called 'real' world. The world in the middle, the world of school, is a very artificial world. This is why

the role is complex and challenging. The teacher needs to support and work with what the children have. Then she has to help them link this to what they don't yet have, but may need. And finally, she has to help them achieve what they need.



What Maths Language do Children have?

Most of our everyday knowledge is learned directly from our environment. It is the same with Maths. Young children come to school with a rich bank of Maths words or language, and Maths-related experiences. They pick up words and ways of saying things from their elders at home. There is often a rich playful repertoire of terms that may not always be 'properly' understood. But the basis of the Maths of number, size, shape and measurement is all there.

Many of these words and phrases provide a bridge between real situations and the Maths children experience at school. They have many number words. They love big-sounding numbers like eighty-eight. They find awesome a billion, zillion, trillion. And they are excited by the idea of infinity which they express as "over-countable".

On page 25, we give an example of Vuyelwa's niece. When this little girl was only 4, she knew Vuyelwa's cell'phone number - a number made up of 10 digits!

Maths can be seen as another conventional language to use and to learn how to use. In some ways it is a more precise language, with more conventions, and more use of abstract symbols. It is a relatively recent invention of people who now call themselves Mathematicians, and who have become something of an elite group. (That in itself is a large part of the problem.)

Many terms have fixed definite meanings and the ways we say and write things affects the meaning. Because of this, we can easily be fooled into thinking that the best way to learn this Maths language would be to break it down into simple steps. For example, to focus on learning all the words, and their meanings, and then learning all the signs, steps

and rules, one-by-one, from the simple to the more complex. It should all be very straightforward. But it isn't straightforward. We still end up with huge problems in Maths teaching and Maths learning.

The alternative to a 'parts to wholes' approach to Maths teaching, would be to consider a "whole language" type of approach. This means that teachers would try to find ways for learners to think about and use Maths in *real* situations. Then the context would be meaningful, and talking and listening would precede reading and writing. The purpose of many activities would be to share understandings and to negotiate meanings, before thinking of ways to represent or write down explanations.

Sharing and comparing each other's ideas through talk should be an important part of developing understanding. Children will be able to grasp new meanings if they and others see themselves as mathematical thinkers, with a responsibility to explain or give account of their reasoning. The teacher would be there as a sensitive, alert guide to encourage them and to push their thinking.

The writers believe that one of the best ways to promote the development of Maths language and Maths understanding is through peer **discussion.** Groups of learners should be encouraged to have serious **conversations** about Maths. The teacher's role would be to facilitate and participate in those discussions. By listening carefully, she will begin to see how she can challenge and extend the quality and level of discussion. She also needs to find ways to feed in more conventional and formal Maths language in an indirect and unforced way.

Then children would begin to use the key terms and phrases in appropriate ways alongside their own words in isiXhosa, and other languages from life. Knowing that both *iqhezu* and *isiqugatha* can refer to fractions, and *ziyalingana* and *zenza* can be used for the sign =, will help enrich the learners' understanding of the concepts. It will also help learners interpret the specific sense of a word or term, depending on the context, and how and why it is being used.

In many parts of the world, if you walk into a modern primary classroom, you will find that some of the learners are quietly getting on with their own individual work. In another part of the classroom, you will find the teacher and a largish group of learners busy with an intense business-like discussion or serious conversation about something related to school work. How often do we see that in the primary classrooms of South Africa?

Activity 3 - Teacher as Researcher

In the final Activity for this Unit, we would like you to carefully read an extract from the book, *Wally's Stories* by Vivian Paley. In the Appendix, Vivian Paley describes how, as a teacher, she searches for the child's point of view in order to take him a step further. If a child tries to explain himself in discussion, she will try to help him think about the problems he needs to solve. In this extract, the discussion starts with choosing partners.

Read the following extract carefully. When you read it, you will notice a number of things.

- You will get evidence of just how much Maths language very young children have.
- You will get some very valuable advice about the use of a cassette tape-recorder when you are researching your own practice as a teacher.
- You will be able to note how Vivian Paley reports on her own reflection of her role as a teacher.

Teacher: How about the children who will be disappointed? How many people can we allow to be sad before we say it's not fair?

Deana: One person.

Jill: No. That's not enough. Because you could only just be in a bad mood from something else.

Deana: All right. Half the class.

Teacher: How many is that?

Wally: When you say, "Half the class goes to music," is that the same as half the class?

Teacher: Yes.

Wally: Then that's eleven because Red group has eleven.

This is a good place to mention the tape recorder. I missed the implications of Wally's "Is that the same as half the class?" until I transcribed his comment from the tape later in the day. Then I was reminded of Lisa's, "Are you really Mrs Paley?" Is "half the class" an arbitrary label, Wally wondered, or is it the same "half" he already knows? The class was divided into two groups, Red and Blue, because only half of the children could attend music at one time. My occasional references to "half the class" came across to Wally as code for "group". He knew that each group had eleven members and was called "half the class"; I had been satisfied with this reasoning until I heard the tape. His asking if "half the class" meant *half* the class showed that he did not visualise a numerical meaning for half of twenty-two children. He could break a cookie in half, draw a line through a circle, and divide six blocks at a glance, but he could not see half of a large number.

Subsequent activities revealed that others were also uncertain about this concept. Lisa, for example, told us that if you don't know a group of people you could ask them their names and divide them into half and put half on each half of the circle and then count up to eleven and that would be "half the class".

Lisa's complicated statement tells something about what she knows and doesn't know. However, before I can weigh this information, four hands are waving, Tanya is fussing with Rose, and Earl's brother comes in with a message from their mother. Luckily the tape recorder preserves everything.

It has become for me an essential tool for capturing the sudden insight, the misunderstood concept, the puzzling juxtaposition of words and ideas. I began to tape several years ago in an effort to determine why some discussions zoomed ahead in an easy flow of ideas and others plodded to a halt, and I was continually surprised by what I was missing in all discussions.

I now maintain a running dialogue with each tape as I transcribe its contents into a series of dated notebooks. The margins fill with unasked questions. "Does Lisa mean that half of any class is automatically eleven, or does 'count up to eleven' describe the process by which a group is divided equally?" reads one marginal note. Another states, "Her 'ask them their names' refers to my question: how can you tell what half is if you don't know the class or how many children it has?"

The tape recorder trains the teacher, not the child, who never listens to the tapes and who is curious about the machine only the first time. The teacher learns to watch for inexactness in her questions, to repeat a child's inaudible comments, to ask for clarifications and additions. The initial incentive for these changes in style may be her desire for a more useful tape, but she soon realises that whatever produces a better tape also achieves a more articulate discussion.

"Mickey, when you say 'Put a block in the middle and then you'll know which is half,' what do you mean 'in the middle'?"

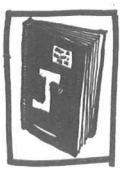
"Like ten over here and ten over there and then a block in the middle."

The continuity a teacher looks for in her curriculum can often be found on the tape. For this reason I own only one cassette, which forces me to transcribe material the same day it is produced. Many a new discussion begins with a statement like this:

Teacher: I was thinking about what Tanya said yesterday: "You put one on one side and say 'one'. Then one on the other side and say 'two'. Then one on the other side and say 'three'." Tanya, could you show me how that's done?

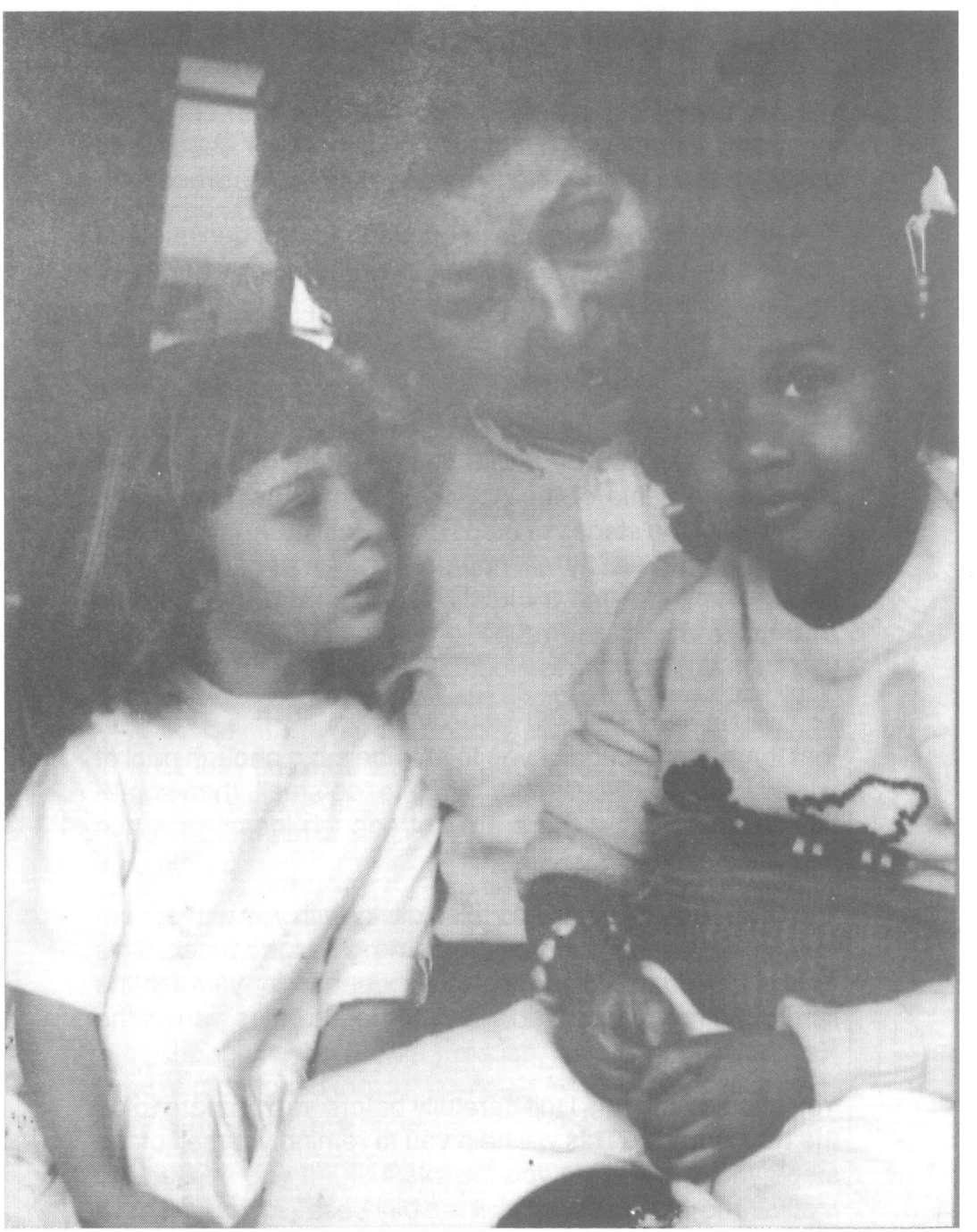
Step by step, the children and I can follow a train of thought, giving those who need more time the opportunity to reflect. And the teacher is there to make connections.

(Paley, VG. 1981:216-219)



Now open your Journal, write the date and time, and write at least a page on what you notice in this extract, your thoughts and feelings.

We hope that working through this Unit has provoked your interest and that you are keen to start open Maths discussions with your learners.



Unit 2 - Experiencing an Open Maths Discussion

This Unit acts as an introduction to the **Key Activity.** The Key Activity encourages you to try something different with your learners.

In our schools, usually the teacher tells learners what she thinks and understands, and the learners listen to her. In the **Key Activity** of this umthamo, you will be expected to ask learners to tell you what they *think, know* and *understand.* As they respond, you will try to **listen** to them, and to **learn** more about them and the way they *think.* This should help you to understand them better.

If you, as a teacher know the learners well, then you will be in a better position to help them develop as learners. You will also be in a better position to provide the learners' growing minds with a curriculum that nourishes their needs, and prepares them well for life in an uncertain future world.

The Activity in this Unit has been planned and designed so that you as teacher-learners will experience for yourselves an Activity like the **Key Activity.** This is an Activity where you think and talk about a specific part of Maths together with a group of other teachers.

We think that experiencing an Activity for yourself should help you when you try it with your learners. It should help you see the value of the Activity. It should help you get a good feel of the stages or steps of the activity. And it will also mean that the Activity will not feel so strange or new or different when you first try it with learners. Finally, it should also make it easier to reflect on the value of the Activity if you have done it once for yourself, as if you were the learner.

You will be part of a large group when you do this. This is so that there are enough of you to provide a big enough pool of varied ideas to discuss. If a group is too small, then sometimes if means that there are not enough ideas for a rich discussion.

Your umkhwezeli should do this Activity with you at the face-to-face session where this umthamo gets introduced. This was planned so that you would experience for yourself the kind of Activity you will do with your learners as part of the **Key Activity** in Unit 4.

You should read this Unit carefully before you prepare to do the **Key Activity.** This will help you to remind yourself of the steps you followed as you did this work. If you missed the first face-to-face session, that is a pity because you will have

missed an important learning experience. You will need to go through this Unit carefully to try as best you can to get a feel for what the important experience would have been like. If you were at the face-to-face session, you should be able to **reflect** on your own experience and to compare it with what you read here.

What follows is written as a descriptive report of what happened when the Activity in this Unit was tried with a group of your abakhwezeli at a workshop for abakhwezeli at All Saints' in Bisho on 12 January 2000. Vuyelwa, the main writer of this umthamo, was not able to be at the workshop, so Alan was the person who trialled the activity. Remember, some abakhwezeli are college lectures, some are departmental officials, and some are classroom teachers just like you. They all said that they found the Activity really interesting. Some said that they were sure that if Maths had been dealt with more in this way when they were in primary school, then they would have been more confident and more interested in Maths at school.

Activity 4 - A Maths Discussion

This Activity has been written in the form of a Reflective Report. Read through this carefully. Make careful notes of the Steps. It's also a good idea to compare this Report with what happened when you did the Activity at the face-to-face session where this umthamo was introduced.

What I did first - Setting the task

I started the activity by explaining that I wanted them as a large group to talk carefully about a single aspect of Maths. Our purpose as a group would be to take one thing and to carefully get as much talk and information as we could from that one starting point. The large group would be able to discuss, share, compare and think about what they knew as a group. I would act as scribe so that we had a record of the discussion. And I would have a good idea about what they knew collectively after the Activity.

I also made it clear that from our point of view there were no right or wrong answers. Whatever people think could not be wrong. Because the purpose was to share what they really believe, understand and think, nothing could be thought of as wrong. I realise, as I write, that I could have mentioned that things could be thought of as wrong from a strictly mathematical point of view.

On reflection, I think this would have confused the issue and maybe even have prevented them from feeling free

Things can only be considered 'wrong' if they do not match the rules of Maths. But these rules are artificial, and result from the developed ideas and habits of people who call themselves Mathematicians. Just because there is a law or rule, doesn't mean it is right. Think of the rule of Apartheid!! But generally rules need to be understood and followed.

if they knew that in some sense their answers could appear ignorant or untrue. I'm glad now that I didn't add this point because in the end I felt that the discussion was very free and open.

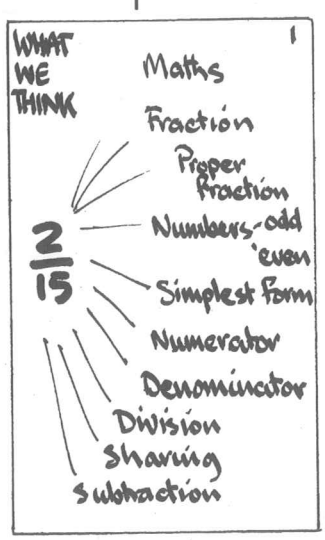
What I did next was to try to get a focus. The group was sitting in two clusters. In the one cluster of 15 were two gents. So mathematically, the gents formed two-fifteenths of that sub-group around one table. I wrote up two-fifteenths on a sheet of newsprint stuck to the wall. I asked everybody to look carefully at what I had written on the wall, and to think about it quietly for a few moments before we went on to the next step.

$\frac{2}{15}$

I watched them carefully as they began to think, to see if I could work out from their body language what they felt about what they were doing. Would they feel a bit embarrassed? Would this seem like a childish primary school activity? Would they be feeling confident? Some, whom I know to be language teachers, seemed quite worried by the task. They looked unsure of themselves. Others gave signs that they were finding the task an interesting challenge, and I guessed that they were anticipating some interesting discussion. Many looked keen to start talking. So I moved onto the next step.

What I did next - Probing first thoughts and ideas

I asked them to tell me what they thought. What ideas had come into their heads? I didn't have to point to people and call for answers. The large group was quite orderly and responsible about taking turns. I was able to record the following. After the first few things were written up, I had to probe a little to get a few more. You can see what they gave me in the illustration below.



When I sensed that they were beginning to add detail to what was already written up or said, I judged that they were ready for the next step.

Before I moved on, I wanted to make sure that we had captured most of the points on the paper. I did this by asking if everybody was sure that there was nothing new that needed to be added. As I asked the question, I moved my eyes from face to face, trying to make eye-contact to check that everyone felt comfortable. There were still one or two who avoided my eyes, and I wondered why. Were they still nervous? Did they have something to add, but perhaps they were afraid to feel foolish in front of the others?

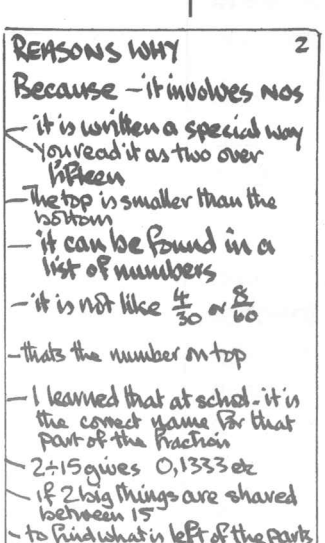
In retrospect, I realise that I could have called them afterwards and talked privately to find out why they had avoided my gaze. I suppose I could also have probed a little more then and there by saying something like, "Sekiwe, I'm wondering if you don't have something in your mind to add." I could then have reassured her by saying, "Remember, there are no wrongs or rights here in this discussion. This is about what we think of when we see something like this written down." If she had answered, I would have had to make sure that I valued and was pleased with her contribution.

The Next Step - Supporting Ideas

Now I told them that I wanted them to think more carefully about what we had written up in the brainstorm. They had told the group **what** they thought of when they first saw $^{2}/_{15}$ written up. Now I wanted them to try and explain **why** they thought that. I wanted them to explain their reasoning to the group.

I asked questions like, "Why do we say this is Maths?" "How do you know this is a fraction?" I realise now that I could have also allowed questions from the floor. I could have done this by saying things like, "Cecilia, is there anything you want to ask?" But I didn't think of that at the time. That would have been a more learner-centred thing to do.

I wrote the explanations they gave on a new sheet of paper that I had stuck up next to the first sheet on the board (see below). I linked the *'whys'* to the *'whats'* with lines so that the logic was clear. And I wrote in the word 'because'.



The group seemed to really enjoy this part of the discussion. They interrupted each other. Towards the end, they challenged answers and added to reasons given. The discussion got quite lively. I was quite impressed with some of the reasons given.

For example, there was uncertainty and some confusion about how to explain sharing as "2 big things being shared between 15". Ayanda said that the one big thing would be shared into 15 parts and each person would get one part. Each person would also get one part of the second thing, as well. So each person would have a $^{2}/_{15}$ share.

After that - Relating a mathematical item to a real-life situation

The next thing to do was to show that the thing which I had written up was not random or meaningless. It was something I had looked for carefully. I had found a mathematical way to describe something real in the classroom. So I told them that I had thought of the fraction $^2/_{15}$ when I had looked at the people sitting nearest to me around the front table. I asked if anyone could see what was two-fifteenths about that cluster. At first there was a bit of confusion. I heard somebody say, "Perhaps if we count?" And then, Glory Ndabankulu spotted that there were two men sitting in the group, Ayanda and S'boh, and there were thirteen women.

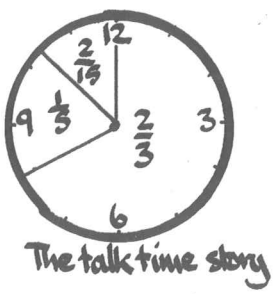
So I explained that we have a little story, or situation, in which the Maths has a true meaning in real life. In a room, at an abakhwezeli workshop, there was only a small number of men sitting around a table. In fact only two-fifteenths were men.

I then asked them to work in twos or threes to see if they could think of realistic stories where a value like $^2/_{15}$ would be reasonable or make sense.

As they talked in their small groups, I circulated to hear what they were saying. I commented on some of the developing ideas and made some suggestions. For example, in one group, Cecilia had thought of a school soccer team in a taxi, 11 boys and two teachers (a coach and a linesman). But that made $^2/_{13}$. So I suggested what about two more children as reserves so that they got a total of 15. They agreed that 15 persons would be 13 players and 2 adults. So the adults would be $^2/_{15}$ of the people using the taxi.

At one stage, I suggested that they share their ideas with another pair or group of three next to theirs. I had noticed that this was happening anyway. So I decided to give public permission for this natural next step.

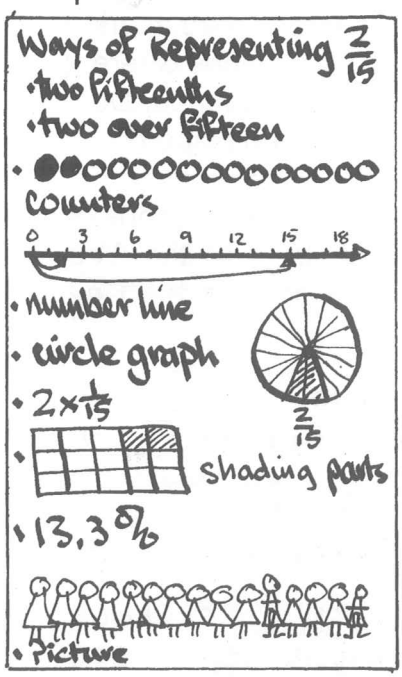
We finished off this part, by sharing and noting down some of the little narratives or stories. For example, a teacher was doing some research on talk in her classroom. She listened to a cassette-tape of an hour in her class. This is what she found. She was talking $^2/_3$ of the time (40 minutes). There was silence for $^1/_5$ of the time (12 minutes). The learners only got $^2/_{15}$ of the time to talk (8 minutes).

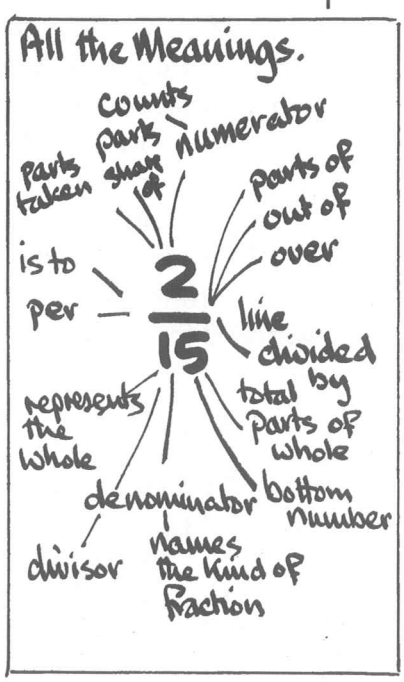


The next step - Representing mathematical ideas

I forgot to do this step, but this is what I think might have happened.

I should have asked if they could share with the group all the different ways that they could think of to represent or write down or make a record of the fractions we had started with. I would have expected some of the following ideas to be suggested:





Teasing out the meanings

The second last thing to do is to see what happens if the group try to unpack all the mathematical and possible meanings of the symbols, and the way the fraction is written. Here I wanted to see more carefully what specific Maths knowledge they had, and how many of the Maths conventions the group knew.

We wrote up as a summary of our discussion. We went through it part by part, focusing on the dividing line and what it meant. Then on the denominator and its function. Then the numerator and its function. We finished off by talking about the kind of fraction it was (see above).

In another discussion we go on to talk about what we can do with fractions, and how we use them.

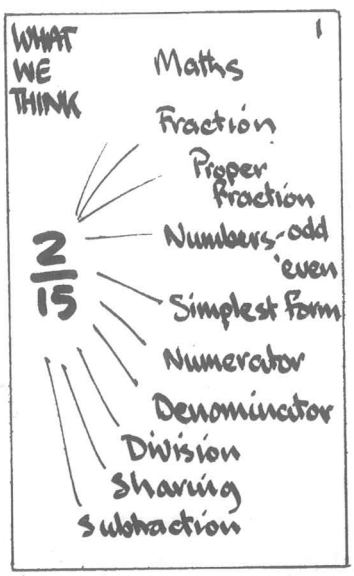
Reflection on the Activity

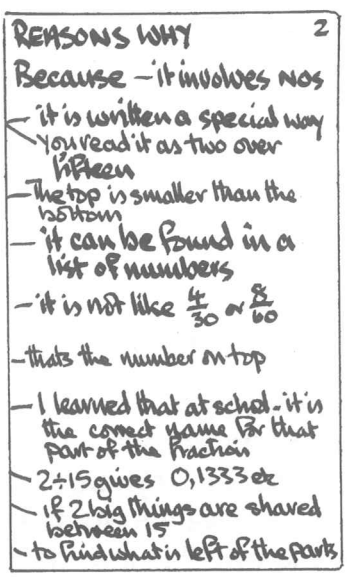
We concluded the activity by discussing and reflecting on the experience as a group. We did this by recapping what we had done. We also asked what we felt we had learned. And we asked whether the abakhwezeli would feel comfortable facilitating a discussion like this with teacher-learners at an introductory face-to-face session.

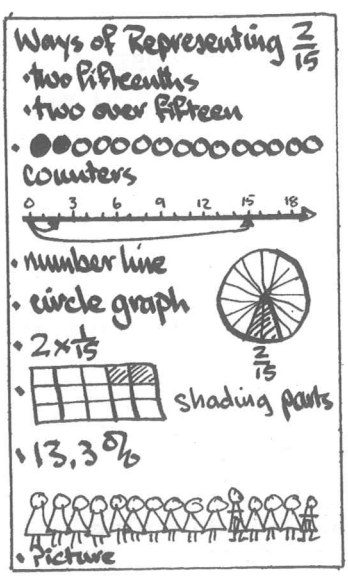
As I go over my rough notes, I am surprised at how much about fractions was covered in the space of about 20 minutes. I realise that we often underestimate how powerful a tool discussion is for helping people challenge their own thinking. It is clear that we are also able to shape, reshape, or even sharpen our ideas through discussion.

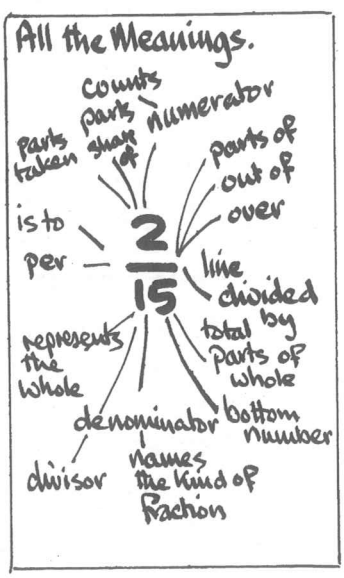
You have read this through to **make notes** of the Steps, and to **compare** the Report with what you did at the face-to-face session. After you have done this, read through the piece carefully **one more time.** As you re-read, mark in the margin (by writing in a large **R**) the places where the writer of this Report reflects on what happened. Do you see how reflection is built into the written Report?

In the next Unit you will get a chance to read more reports of teachers and children discussing aspects of Maths. You should read these carefully before moving onto the **Key Activity** in Unit 4.









Unit 3 - Reading about Mathematical Conversations

In this Unit we have selected some examples of children talking about Maths with an adult (either a parent or a teacher), and with other children. We would like you to read and think about the passages.

As you work through the readings in this Unit, you need to be asking yourself the following two questions:

- Do the children I teach ever get the chance to talk in this way about Maths?
- Can I find ways to help my learners have mathematical conversations?

When you talk to one or more persons about something interesting or important, it is called having a conversation. Cónversation or discussion is a very human way of sharing, learning, knowing and growing. When we converse or discuss, we are communicating and sharing what we understand in a social setting. People converse or discuss in order to find out things from each other or to help develop shared understanding. When somebody understands something really well, we say that person is **conversant** with that topic.

Educators now regard this open conversation or discussion as a crucial aspect of learning. It is clear that we learn through social interaction. More and more, primary teachers are finding ways to make conversation and discussion part-and-parcel of the regular primary school day.

The Readings

We start with two short readings that show how much a sensitive adult can gain or find out about what children think mathematically. Adults just need to take the time and trouble to talk and converse with children, and note what they say.

Then we have a third reading which shows how much a teacher gains when she starts to become a researcher in her own Grade 3 classroom. She listens to what her learners say in conversations about Maths in order to research what they know, to find out what they understand.

The final reading compares the quality of Maths conversation (or talk) in two different examples. It points to the danger of the unnatural 'table-tennis' type of talk we often get in our classrooms. How normal and natural is this kind of talk? And how useful is it educationally?

Reading 1 - "And the Answer is ...Symbolic Literacy"

Read and make sense of the anecdote where the writer, Mary Lou Witherspoon, comments on something she has observed. She has recorded this anecdote in an article she has written for an education journal called, *Teaching Children Mathematics.* The article is about symbolic literacy.

MJ is in the first grade. While he and his mother waited in a classroom for the teacher, MJ entertained himself by writing number sentences, such as 3 + 5 = 8, on the chalkboard. His mother, who is a mathematics professor, wrote 3 + 4 = 5 + 2 on the chalkboard.

MJ told her that her sentence was not right because only one number could be written after the equals sign. When asked what he thought the equals sign meant, MJ replied, "And the answer is".

This interpretation of the equals sign is not uncommon. Pre-service teachers in the mathematics-method course that I teach conduct structured interviews with children. In one interview, they ask a child to fill in the blanks of __ + __ = __ + __ so the resulting sentence is true. It is not unusual for students, even in the upper elementary school, to respond in this way: 3 + 4 = 7 + 2. In other words, they write a number fact in the first three blanks and then put a random number in the right-most blank. When asked what the equals sign means, many of these students will respond that it indicates where to put the answer for the computation to its left. They do not understand that the equals sign expresses a relationship between the quantities on its left and its right.

.....the episode of MJ and his mom has a happy ending. She did not lecture him about the appropriate meaning of the equals sign. She simply pointed out that both 3 + 4 and 5 + 2 are 7. Not at that instant, but later, after he had mulled over the merits of the information, he came to her and said, "Mommy, *equals* could mean *is the same as.*" I think that MJ is well on his way to mathematical literacy.

(Witherspoon, ML. 1999: 396)

Reading 2 - Listening to Students

Read the next short transcript of a Maths discussion between a teacher and learners, which deals with angles.

Teacher: What type of angle is this?
Students: [In unison] A right angle.
Kathie: But if you turned it the other way, it would be a left angle.
Teacher: If this is a right angle [fig a], and this is a left angle [fig b], what is this [fig c]?
Kathie: That's not an angle.
(Atkins, SL. 1999: 289)

(a) – A right angle

(b) – A left angle

(c) – Not an angle

Can you explain why Kathie thinks the way she does? Think about what you could do to help Kathie, and others like her, realise that a right angle is a right angle, no matter which position it is in.

Reading 3 - Wondering About Students' Knowledge

Here is a teacher who is starting with a simple focused open-ended task in order to see what the children will think of and say. This is quite similar to what you will be required to do in the Key Activity, so read it carefully.

When you respond with curiosity and interest, your students feel their ideas are interesting and valuable, and they will talk more, thus rewarding you with new information about their thinking.

Don't you wonder what your students really think about odd versus even numbers? Do you understand what sense they make of regrouping in subtraction? What does your class think about the hundred board or the number line?

There are times when we become researchers in the classroom - when our students say things we do not expect and we follow that reasoning in many directions. We can't do this all the time, but when we do, (we) show our students that mathematics and mathematical ideas are interesting and worth understanding.

"Tell me everything you can about these," says Ms A to her third-grade class at the beginning of the year. The children are sitting in a circle on the rug. She opens her hands and shows them two numeral 2's and two numeral 3's. She waits.

Aisha: There are twos and threes.

Paul: I see two twos and two threes.

Elie: There's a three for every two and a two for every three.

Ms A: Yes, there's one for each.

Neelie: If you make them add up, you get ten.

Ken: If you make them all double, you get twenty-two and thirty-three.

Ms A: Would you show your idea on the board so we can all see? (Ken goes to the board and draws.) Thank you.

Ham: I think you can make two hundred and twenty-three and three, too.

Ms A: Are there other numbers we can make?

Several students: Three hundred and twenty-two and three.

Several students: Twenty-three and twenty-three.

Jeremy: There is three thousand two hundred and twenty-three if you put them all in the same number.

Su-Mei: If you say there are two twos then you say there are four. If you say there are two threes then you say there are six. So it's kind of like four and six in disguise.

Students continue exploring the other ways the numerals can be combined to make "disguised" numbers. It lasts for twenty minutes, much to Ms A's surprise.

With one open-ended question, Ms A learned a great deal in a short time. She felt that these third-grade students displayed flexibility in thinking

about numerals. She hadn't known what to expect when she started, but she wanted her students to have a chance to do something with them. She had not wanted to prejudge what they were likely to know and express.

On reflection, Ms A concluded that many students were interested in exploring ways of representing different numbers, that Su-Mei enjoyed looking beneath the surface of a problem, and that Jeremy was able to see and create numbers well into the thousands. After this session she made some notes and decided to pursue the question throughout the school year, recording children's observations at different times. We can all become classroom researchers like this, exploring the many ways our students understand mathematics and the approaches that seem to help them best.

(Corwin, RB et al. 1996: 26-28)

How many times does the teacher speak out of the 13 utterances? It would be interesting to analyse what she is doing each time she speaks. The first time she accepts Elie's contribution by saying, "Yes" and then saying the same thing in a different way. Perhaps she is doing this to consolidate what Elie has said.

What do you think she is doing the second time, and the third time? As a teacher, how would you have responded to Su-Mei? What would you have said after Su-Mei had spoken, and why?

Reading 4 - What is a Mathematical Conversation and Why is it Important?

This reading comes from the same book as the previous reading, *Talking Mathematics* by Rebecca B Corwin and others. Here she helps the reader to make an interesting comparison between two types of classroom talk.

It is hard to imagine a mathematical conversation, especially one that takes place in an elementary school classroom. So here are a few examples.

Four first graders are working with a square pyramid made of plastic. Jason is writing down everyone's comments as the group recorder. As they talk, they pass the model of the pyramid back and forth.

Ms B: Look at the shape and write down anything you can tell each other.

Cathy: Let me feel the point on the top.

Jason: Okay! Now - a square.

Jon: Jason, what are you spelling?

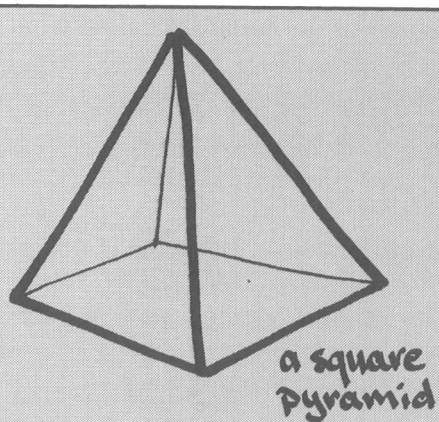
Jason: Okay. That's a rectangle.

Cathy: It's a triangle!

Jason: A rectangle!

Kaisha: No, it's a square! I mean, no, um, pointy -

Cathy: Triangles have one, two, three sides. One, two, three, four. A triangle has four sides.



Jon: It has a pointy top.

Jason: It has four sides. I know how to spell that.

Kaisha: And it's got a point on top.

Cathy: And it gots a smooth bottom.

Kaisha: It has stripes up the sides.

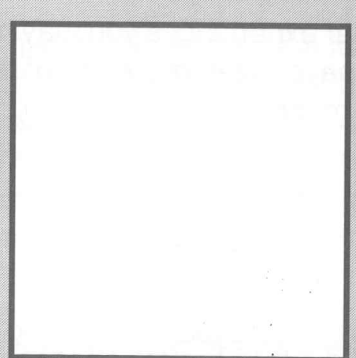
Cathy: And it gots a pointy top at the bottom … it gots little stripes.

Jason: Wait a second! It has one little stripe over …

Cathy: And there's big triangles and little triangles.

Jason [laughing]: Where do you see that?

For these students, the key features of this square pyramid include a pointy top, four sides, stripes (we might call these edges), the bottom (or base), and the triangular shapes of the sides. Because they have talked with one another about this solid shape, their collective understanding is richer than any individual's would be. This playful, relatively calm talk is an important step in mathematical discourse, in which students compile their ideas and build a shared description of a mathematical concept, relationship, or object.



In contrast, in the next example fourth graders are being asked about the features of a square. Think about the kind of thought this discourse supports.

Ms F: What is this called?

Kiku: A square.

Ms F: What is this called?

Jamie: Rectangle.

Ms F: This one part of the square is called what?

Raina: Divider?

Ms F: Well, what is it? What's the name we say?

Maura: Poles?

Jimmy: One half?

Ms F: One half of the whole, but what is this called?

Minou: Divisor.

Sandy: Divisor.

Ms F: No, wait a minute. What is a square?

Ann: Four corners.

Ms F: Four corners and what? [Silence] These are the corners. What are these called?

Jamie: The sides.

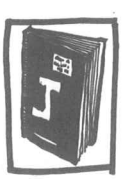
Ms F: Sides. All right, so these two corners are connected by?

Students: Sides?

Ms F: A side. Okay.

These questions ask students to recall and recite facts Ms F has previously presented to them. Talk is closely directed and there is little room for students' own ideas. The children are fishing for what the teacher wants them to say. They do not seem to be making sense of what they are being asked, but rather they fill in the blanks in "right answer" questions. Being right, in this lesson, means knowing what the teacher wants.

(Corwin, RB et al. 1996:2-4)



Activity 5 - Reflecting on Mathematical Conversations

Finish off your work on this Unit with a Journal Write.

Reading 1

Write down any similar experiences you may have had where something a young child says gives evidence of a misunderstanding of some mathematical meaning.

Reading 2

Write down your explanation of why Kathie thinks the way she does, and what you could do to extend her mathematical understanding.

Reading 3

Write down what you think the teacher is doing each time she speaks. Re-read what Su-Mei said, and write your response to this.

Reading 4

Write down your own comments on these two examples, comparing the classroom talk. Make sure you refer to the length of the children's responses in the two examples. You should also compare the number of times each teacher speaks.

Conclude your Journal Write by noting down what you think you have learned or gained from each reading.

Unit 4 - Facilitating Maths Talk

In this Unit, we want you to get your learners to think about the words they use when they explain or talk about some Maths. In other words, you will be extending and developing their understanding and use of Maths language, the language we use when we do Maths.

The next Activity is the **Key Activity.** We have provided three different options for the Key Activity. Option A has been designed for learners in a Pre-school, Reception or Grade 1 class. Option B is directed towards learners in a Grade 2 or Grade 3 class. Option C is for learners in a Grade 4, 5, or 6 class. If you work in a multi-grade setting, we have special suggestions for you at the end of the Unit.

If you teach Grade 1 learners, you will need to choose the option which you feel is most appropriate for your learners. If you are carrying out this Activity at the beginning of the year, you may prefer to start with Option A. If you are doing this Activity with your learners towards the end of the year, you may prefer to try Option B.

If you work with Pre-school learners, you may be a little surprised at what we are asking you to do with them. But we know from working with very young children and primary school learners, that children will take from an activity whatever they can. The richer or more challenging their experiences, the more choices and chances they have to grow and develop their own thinking. We have to trust them and not underestimate them and their abilities. When we trialled the activity with pre-schoolers from a rural village, we were surprised at what some of the youngest ones could do.

When Vuyelwa's niece, Sibulelele, was just four years old, she knew Vuyelwa's cell 'phone number. In other words, she could recite a ten digit number! Vuyelwa was very surprised. But most young children in our province these days see numbers and hear them being used daily. Young children in some urban areas even see house numbers in the thousands! Others are sent to the nearby spaza shop to buy some bread or milk. They are using and working with numbers out of school each day. And to think that for so many years we have only taught Grade 1 learners the numbers 0 to 9!

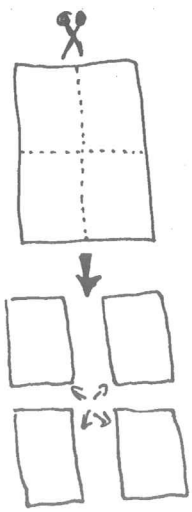
You will also see that the steps we suggest for leading a Maths discussion for teachers who work with learners in the Early Years are different from the steps we suggest for those who work with learners in the Foundation Phase. This is because we don't feel it is appropriate to have a special step in which you unpack the way we represent ideas mathematically. Instead, you will find that we point out specific

places where you can draw your learners' attention informally to something mathematical that you are writing. We are suggesting that you begin to *informally* use and model the way things are represented in Maths *without making it a teaching point.*

Activity 6 - Key Activity - Talking Maths

Option A - Working with young learners

Preparations



First of all, you need to prepare some rectangles of paper, measuring approximately 10cm x 15cm. Make sure that you have quite a few extra ones, so that learners who are not happy with their first drawings, can have a second 'go'. You also need to have some large sheets of paper or some newsprint so that you can record the work that you do with your learners.

If you fold a blank A4 sheet of paper into 4, that will do fine.

When you are with your learners, get each learner to draw a picture of her/himself on one of these pieces of paper. Explain that you want to use these pictures for a special activity. Tell them that you want them to make really careful pictures of themselves. Allow enough time for them to work carefully on these drawings. Make sure that each child's name is written underneath her/his self-portrait.

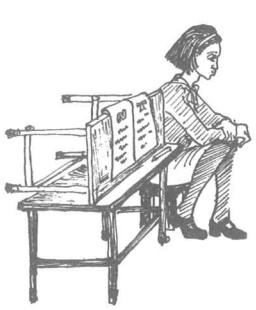
This does not have to be a 'whole class activity'. You may choose to get your learners to do their drawings group by group.

When your learners have finished their drawings, you will have to decide if you want to carry on with the next part of the Activity, or whether you would prefer to do it at another time, or even on another day.

Start with a group of about 20 learners gathered around you. If you have a very big class, make sure that the rest of the class has enough challenging activities or work which they can do without your help, while you work with this group. Make sure that you have the self-portraits of the learners whom you have gathered around you.

The number you work with should be suitable to break down into convenient sub-groups. For example, 20 ÷ 4 = 5;
20 ÷ 8 = 2 r 4.
15 ÷ 3 = 5;
15 ÷ 6 = 2 r 3.

Step 1 - Setting the task



Hand out the children's self-portraits. Then say something like, "Let's make a big picture of our group with your self-portraits." Next, get each learner to come forward to stick her/his drawing on one of the large sheets of newsprint. As the learners stick their pictures on the paper, try to make sure that the pictures are fairly close to each other. You want them to form one large group of portraits.

When all the learners sitting with you have put up their self-portraits, count them. You will find that many of your learners will join in. Some will count all the pictures. Others

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will join in and then stop. This is fine. Don't expect everybody to be at the same stage of development. But it is also important, not to work only at the level and pace of your slowest learners.

"So, we've got twenty children in this group." Take a koki pen or crayon, and write in big numerals, **20.** Underneath the numerals write, *There are 20 children altogether in the group.* As you write the sentence, say the sentence aloud so that your learners make a connection between what you are saying and the words you are writing.

This is very important. You don't need to say anything more, unless one of your learners asks something more about the numeral. But the fact that your learners see the number you have counted together written down will be important for when they are ready to start writing numbers themselves.

Step 2 - Probing first thoughts and ideas

Next, say, "Now, I want you to get into groups of four children." We don't think this will take very long. Try not to rush to help them. As a teacher, sit back and carefully watch what happens. Give them a chance to fix their groupings. We found that some of the pre-schoolers we worked with were very capable organisers!

Step 3 - Getting learners to support their ideas

As your learners arrange themselves, go from group to group and ask, "How do you know that you are 4?" "Are you sure you are 4 in your group? What do you need to do?" You may wish to involve other learners. Listen to hear what the children say, and even make notes in your Journal of what different ones tell you. What they tell you will reveal their thinking and something of their understanding of the number 4. You will also be able to observe their strategies for counting themselves.

When Vuyelwa asked a group to tell her how they knew they were a group of 4, Viv was surprised to see how one little girl, Noluvuyo, counted. She started by pointing to herself, and counted "One." Then she pointed to the other three children, one by one and continued counting, "Two, three, four." In Viv's experience, many pre-schoolers forget to count themselves. We were fascinated by Noluvuyo's understanding of one-to-one correspondence.

*As you say this, you will be using words which have special and specific meanings in a mathematical context. You don't need to explain this to your learners. You are simply providing a rich mathematical language context for the task. This is like real life. Children absorb and learn language because there is rich language in use around them. Children will do the same with Maths language if it is used around them often, and in a **real** context.*

Step 4 - Representing mathematical ideas

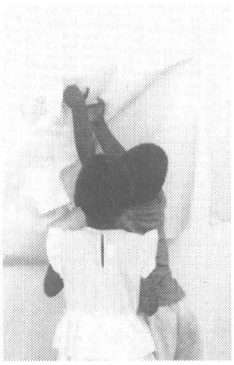
Now you need to put up a second sheet of newsprint. While your learners are still in their groups of four, get them to sit down, and face you. Now ask them, "How can we make a picture of what we have done? Let's make a picture to show how we have made new groups. We want to show how we divided our big group of 20 into smaller groups of 4. Can we use our small pictures to show what we just did?" We're sure that at least one or two learners out of the 20 will volunteer to help you make a picture of the way they grouped themselves.

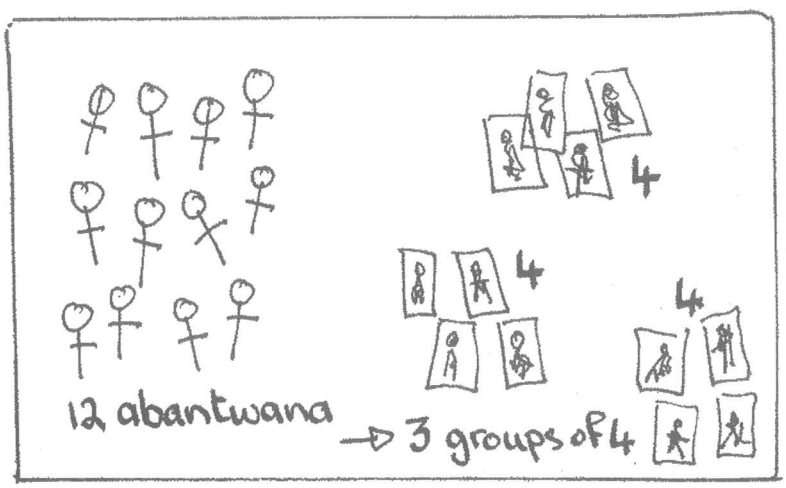
As the learners remove their self-portraits, make a simple mark, or draw a simple drawing of a person, on that spot. This is really important. Try not to leave this out because when you come to the end of this step, you need a visual (picture) record to match the verbal (words) sentence you write.

As they arrange their pictures into groups of four children, write a large numeral **4** under each group of pictures. If you feel that some of your learners would like to help you write some of the 4s, involve them too.

You could say something like, "Wow! That's great. What have we done?" Get your learners to share their ideas with you. Then summarise what they have said, "So, we've changed the one large group of 20 into groups of 4. How many groups of 4 did we make? Let's count. 1, 2, 3, 4, 5! 5 groups of 4 children each." Under the picture of the 5 groups of children write, *20 children → 5 groups of 4 children.*

As we said before, when your young learners see you writing up their words, this is a very important experience. Without you saying very much, they will see that the words they speak can be written down. So when they see some writing, or a text (the written words) in a book, they will know that those words can be read (spoken aloud). This is an important literacy lesson.





Step 5 - Extending the task

Now say to your learners, "Let's try to make another pattern. I want each group of 4 to join with another group of 4, so that they can make a group of 8 children." As you will predict, one group will not be able to join up with another group. So you will have two groups of 8 children, and one group of 4 children.

If you are working with 15 children, you will need to ask each group of 3 children to get together with another group of 3 children. And as you will predict, one group will not have another group to join up with. So you will have two groups of 6 children, and one group of 3 children.

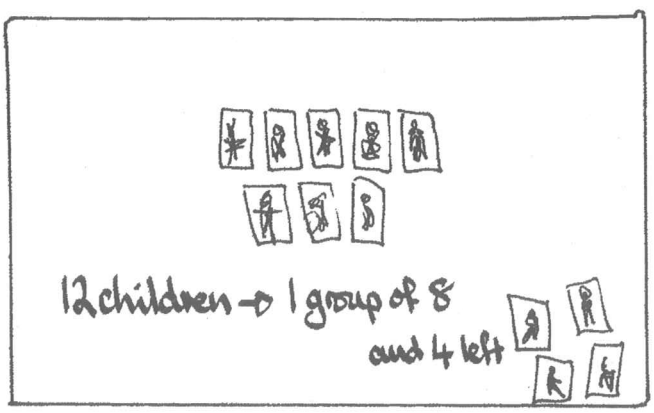
You need to make sure that your learners do not end up with just two groups: that is, one large group and one small group. It would be better to have just large groups and no small group over, or remaining.

Then elicit from your learners how they can describe the group of children who were not able to join up with another

group. Will they say that there is a group of 4 children left over? Encourage them to think of as many ways as they can to describe this group.

Ask your learners, "What will it look like if we make a picture of this arrangement?" Then let one or two of your young learners come forward and re-arrange the pictures to make a picture of the new arrangement. Try not to offer your help too soon. Let them try to make an accurate picture of the new grouping. Only offer your help if you can see that they are very confused and frustrated.

Make sure they stick their portraits in this new arrangement on a 3rd sheet of paper. Again make a mark for each drawing as it is moved from the 2nd sheet.



Then write under the new picture, *20 children → 2 groups of 8 children + 4 not in a group.*

Step 6 - Thinking and talking about the task (Reflecting)

It is important not to labour this step of the discussion. But don't omit it. You want to encourage your learners to think about what you have asked them to do, and how they carried out the task. You also want to be able to ascertain (work out) and to assess how well your learners have understood the activity. Here are some suggested questions which might help you with this step.

- What have we done?
- How did we do it?
- What have we learned?
- Could you tell someone else about what we have done?
- What else would we like to know or do?

When we asked these questions, the young children we were working with gave the following responses:

We drew.
We drew people.
We counted people.
We took people.

Option B is suggested for teachers who work with learners in Grade 2 or 3. Option C is more appropriate for learners in Grade 4 and upwards. Activities like this can be challenging for any level of learners. Discussing and thinking deeply about how we write, read, talk about and understand Maths is an interesting challenge. Even college students or in-service teachers can learn more about their own thinking and ideas, as well as the thinking and ideas of others, through an activity like this one.

We propose that you try this as a large group activity. Work in turn with about one-third or one-quarter of your class. For an activity like this, you want to be able to make sure that everyone participates as actively as possible. If the group is bigger than about 20, you cannot keep making eye-contact with all of them to keep them involved. If the group is smaller than 10, then you might find that there are not enough different ideas to discuss.

Working with a group of 16 to 20 learners means that you will need to plan ahead so that the rest of the class all have a busy task that they can get on with on their own, without adult supervision. It is also a good idea if they all know of something *else* useful that they can get on with, if they finish the first task before you finish with the group you are working with.

We watched two sets of videos at the abakhwezeli workshop in January 2000. One was from America and the other from England. Both teachers made the point that they had to plan to specifically train their learners to be able to get on with useful work quietly and on their own so that the teacher could devote time and attention to working with groups on a special task.

You might decide to set them some work from a text book, or a work book. Or you may ask them to do a careful detailed drawing and write about what they have drawn. Maybe they can complete a simple personal questionnaire about themselves, answering questions by writing down and illustrating their answers.

Explain to the whole class how you plan to work and what you plan to do with each group. Make sure that they know that each large group will get a turn to discuss some Maths and Language with you, while the rest of the class gets on quietly with other work. Ask if they mind if you tape the discussion so that **you** can go on thinking about what was said at home.

Option B - Working with learners in the Foundation Phase

Gather the first group around you so that they are relaxed and comfortable. Try to sit at your learners level so that you blend in as part of the group. Sit so that you can write and keep a record of the discussion on the paper or board behind you. As the group settles, see if you can spot a simple addition word sentence that represents

something obvious about the group. (You will see why in Step 4. It could be that there are 7 boys and 5 girls, making 7 + 5 = 12. Or perhaps 4 are wearing sweaters and 11 are wearing shirts, so 4 + 11 = 15.)

Step 1 - Setting the task

When they are settled, write up the addition sum you have chosen in the middle of a sheet of newsprint or blank paper. Say, "I want us to spend some time discussing and thinking about **everything** that we know, understand and can think of based on what I have written here." Then give them some time to think.

Step 2 - Probing first thoughts and ideas

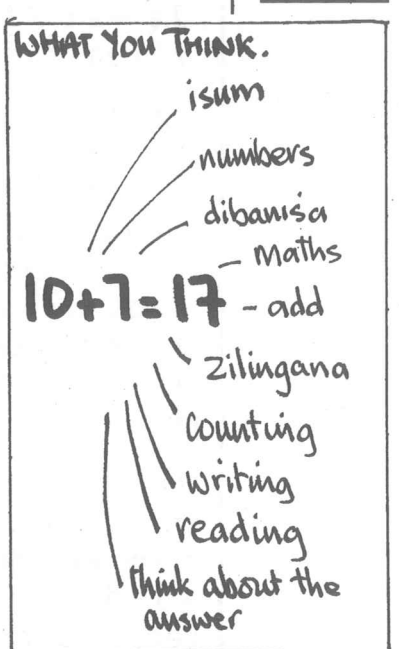
Ask the simple open-ended question, "What is this?" and point to the number sentence you have written up. Tell your learners you are giving them a few minutes to think of the answer that they want to give. Explain that you expect quite a few different answers. You want to know what they think.

When most of them seem to be ready with answers, collect their answers. Explain that you will write down what they say. Say, "Yes, Sipho? What do you say this is?" As you write up what Sipho says, ask the rest of the group if anybody wants to comment on what Sipho has said. Deal with one or two comments before you go on to the next child's answer.

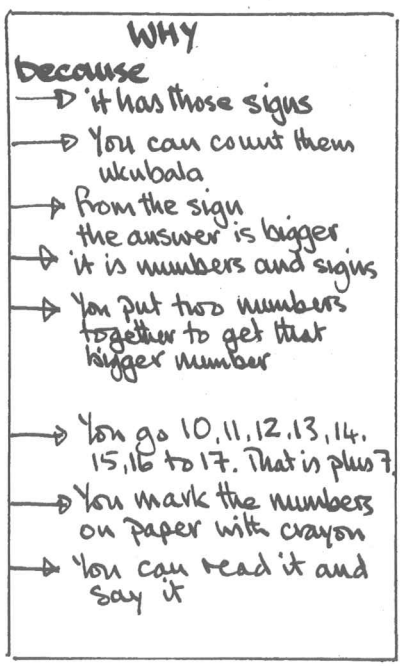
Continue in this way until you have recorded all the possible answers from the group. You may decide to add one of your own, if you think it might be useful.

10 + 7 = 17 was an example we used when we trialed this activity.

You need to think of (predict) the possible answers you expect so that you are ready to take things further and can spot the unexpected and decide how to use it. Remember you are interested in noting and finding out what the children think and how they express their understanding in words and gestures. As you facilitate the discussion, you also want to challenge and extend the answers they give. You do this by getting them to think more carefully about what they are saying. It will help you do this well if you have thought about the sort of responses you are likely to get from your learners, and have some ideas of how you will **push their thinking.**



Step 3 - Getting learners to support their ideas



Explain that you are now going to give them a chance to put forward reasons for what they or their fellow learners have **said** about the first thing you **wrote** up. "How do you know it's what you say it is?" Link their statements to the reasons they give with the word *'because'* and arrows.

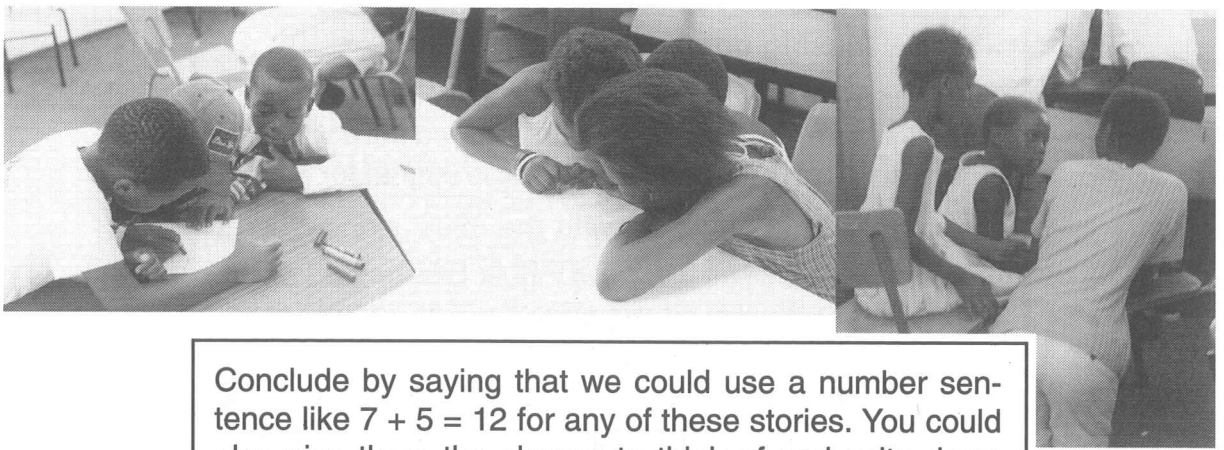
When you feel that they are ready to move on, having shared and discussed all that is known, tell them that you want to try and summarise what they have told you that they know. Then summarise the **main** points that have been raised. Don't repeat everything. Carefully select the main items of interest. Praise them for the quality of their ideas and their thinking. Tell them how impressed you are with all they know. Point out how much there is to say about one little Maths sum.

Step 4 - Relating their thinking to real-life and personal experiences

Tell them that you looked carefully at the group to get the idea for the thing (number sentence/sum) which you wrote up when they first started. Ask them if anyone can see how you got 7 + 5 = 12 from looking at the group. See what they come up with? Write up a simple narrative story, in a few short sentences, that explains your sum. This models an example for your learners. For example, *There are 7 boys and 5 girls in the larger group of 12 children.*

Now ask them to work in pairs to think of some other place or time in their own experience or in real life where 7 + 5 = 12 might fit. Give them some time to try to think of their own example, or little story. Let them tell their little 7 + 5 = 12 stories. If they struggle, have another example of your own for them. For example, a taxi-driver left Qumbu for Kokstad with 7 passengers. At Mount Frere 5 more people got on. Now he has 12 passengers in his taxi.

Hand out some blank pieces of paper. Give your learners more time to work in pairs or groups of three to think of and write down their simple little stories for the sum 7 + 5 = 12. They can read these aloud and stick them under your story when they are ready.



Conclude by saying that we could use a number sentence like 7 + 5 = 12 for any of these stories. You could also give them the chance to think of and write down stories at home to bring the next day to add to the others.

Comment to your learners that a number sentence like 7 + 5 = 12 **makes sense** and has a **correct** answer in Maths language. But it only really has a **meaning** if it is used or fits into real life. It only has a meaning if there is a story to go with it.

After Step 4, you have the chance to judge how things are going. Is the rest of the class still occupied quietly, or are they getting restless? Is the group you are working with ready for more, or are they ready to stop? It depends on how the discussion has gone. If you get the feeling that this would be a good place to stop, do so, and plan to continue another time.

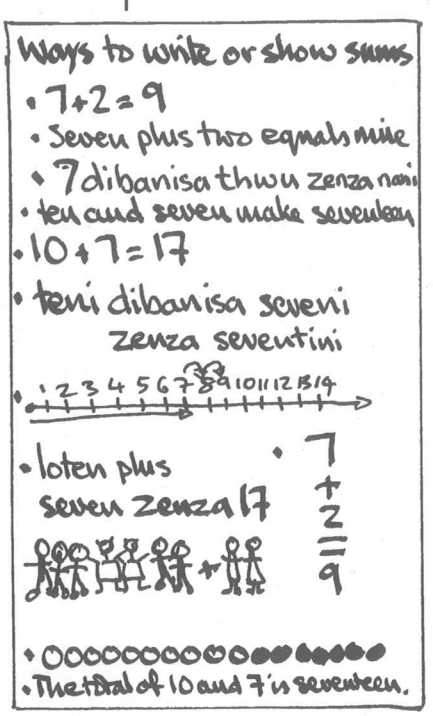
Step 5 - Representing mathematical ideas

Put up another large sheet of paper. Tell the group that you want them to think of other ways of writing or showing, or talking about and explaining the idea of 7 + 5 = 12.

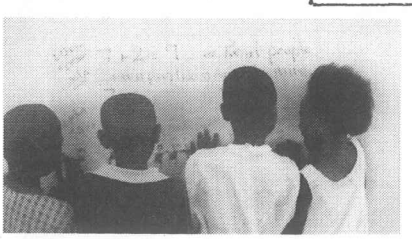
Remind them that they have already used simple mini-stories from real life. These can be **told** or **written** using **words** and **sentences.** Remind them that we can also just write the **numbers** and **signs** to make a **number sentence.**

Now ask them if they can think of any other ways to **show** or **write** the idea of 7 + 5 = 12. Give them time to think and see what they come up with before you offer any further guidance. Make sure that you let them struggle for a bit.

Surely they will think of drawing a picture, or using counters, or even real things like coins. (It might be useful to have some counters and some coins ready, just in case.) What will they suggest? Will they come up with any innovative ideas of their own? Record these suggestions and ideas on the clean sheet of paper.



Finally, add any of your own ideas that you think your learners might be ready for. For example, a function box, or a number line.



It is quite clear that these children have created their own maths language and can even spell the words.

Step 6 - Teasing out meanings

Tell your learners that you want to finish off by talking and thinking more carefully about all the different meanings of some of the words and symbols (signs) for Maths.

We suggest that you start with the 'plus' sign. Write it down in the centre of a large sheet of paper.

Analyse the meaning of the signs + and =. You can do this from the point of view of a number of languages that your learners may know. Try to brainstorm a list of all the possible words and meanings associated with the sign +. Then do the same thing for the = sign. By comparing meanings and differences it may help learners get clearer ideas of the Maths they are talking about.

Also, think of what we understand by the position of numbers and signs when we write Maths

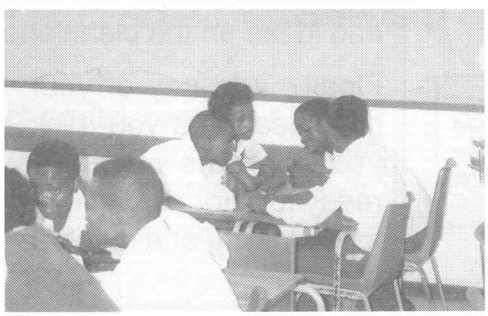
eg Does 7 + 5 = 12 mean the same
as 5 + 7 = 12?
Does 7 + 5 = 12 mean the same
as 12 = 7 + 5?

Remember that we are not after **correct** answers here. The teacher is getting a feel of what the learners understand and think, and the learners are getting a chance to hear and think about the ideas of other learners.

Step 7 - Reflecting on the Task

It is important not to labour this step of the discussion. But don't omit it. You want to encourage your learners to think about what you have asked them to do, and how they carried out the task. You also want to be able to ascertain (work out) and to assess how well your learners have understood the activity. Here are some suggested questions which might help you with this step.

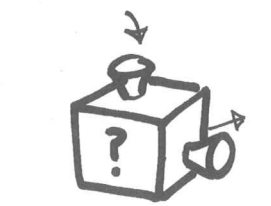
- What have we done?
- How did we do it?
- What have we learned?
- Could you tell someone else about what we have done?
- What else would we like to know or do?



Option C - Working with learners in the Intermediate Phase or Beyond

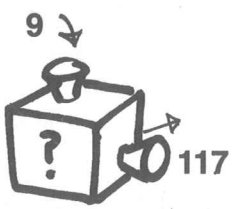
Gather the first group around you so that they are relaxed and comfortable. Try to sit at your learners level so that you blend in as part of the group. Sit so that you can write and keep a record of the discussion on the paper or board behind you. Begin by telling them that you are going to start by giving them a puzzle to work out. The solution to the puzzle will give them a Maths focus for the group to discuss. Explain that your role as teacher will be to steer (guide or facilitate) the large group discussion and to help record the main points.

Step 1 - Setting the task

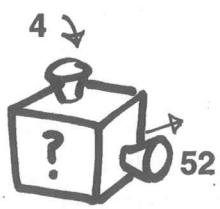


Maths Function Box

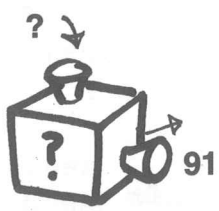
We suggest that you use the following puzzle as a way to lead into the aspect of Maths you want them to discuss (multiplication operations). A number goes into the function box and comes out changed. It is changed because it has been operated on in a certain way. Something has happened to change the numbers. The rule and effect of the operation is hidden in the box. If **9** goes in and comes out **117** (example A), what are the possible hidden functions in the box? If **4** goes in and comes out **52** (example B), what is the fixed function of that box? Learners should be able to work out what Maths function operates the box. They should then be able to work out the mystery number that goes in (see example C), so that **91** comes out. Encourage them to think aloud and to share the process of working out the answer. (This is rather like the first umthamo in Maths. Don't spend time on this, or emphasise this aspect. We hope that by now you give your learners opportunities to explain their own Maths strategies as a regular thing.)



Example A



Example B



Example C

To help you, we have provided a drawing of a Maths function box. You can write the numbers on spare paper and stick them on with Prestik. In this way you will be able to use, re-use, and even re-re-use the drawing in later Maths sessions.

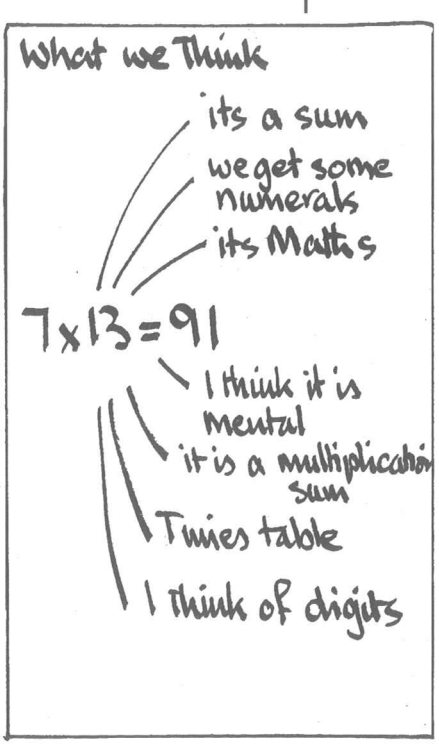
Try to remember or note the words your learners use, and the way they express the Maths and talk about their strategies. You can reflect on this later in your Journal.

Finish off this step by writing down the number sentence 7 x 13 = 91 on the left-hand side of the chalkboard, or on the first sheet of paper. Tell the group that this will be the focus for their discussion and thinking. They will **think** about and **talk** about what this means to them.

Step 2 - Probing first thoughts and ideas

You want to know what your learners think of when they see a number sentence like this. Ask the simple open-ended question, "What is this?" and point to the number sentence you have written up. Tell your learners you are giving them a few minutes to think of the answer that they want to give. Explain that you expect quite a few different answers. You want to know what comes into their minds when they see such a thing written down.

When most of them seem to be ready with something to say, get them to talk about what comes to mind when they see something like this. Explain that you will write down what they say. Say, "Yes, Sipho? What do you **say** this is?" As you **write** up what Sipho says, ask the rest of the group if anybody wants to comment on what Sipho has said. Deal with one or two comments before you go on to the next child's answer.

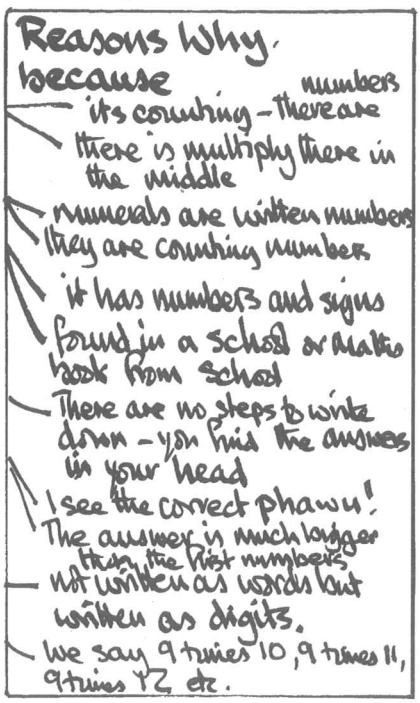


Continue in this way until you have recorded most of the possible responses from the group. You may decide to add one of your own, if you think it might be useful.

You need to think of (predict) the possible answers you expect so that you are ready to take things further and can spot the unexpected and decide how to use it. Remember you are interested in noting and finding out what the children think and how they express their understanding in words and gestures. As you facilitate the discussion, you also want to be challenging and extending the answers they give. You do this by getting them to think more carefully about what they are saying. It will help you do this well if you have thought about the sort of responses you are likely to get from your learners, and have some ideas of how you will **push their thinking.**

Step 3 - Getting learners to support their ideas

Explain that you are now going to give them a chance to put forward reasons for what they or their fellow learners have **said** about the first thing you **wrote** up. "How do you know it's what you say it is?" Link their statements to the reasons they give with the word *'because'* and arrows.

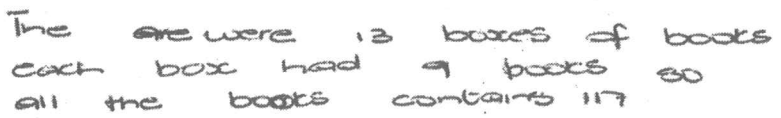


When you feel that they are ready to move on, having shared and discussed all that is known, tell them that you want to try and summarise what they have told you that they know. Then summarise the main points that have been raised. Don't repeat everything. Carefully select the main items of interest. Praise them for the quality of their ideas and their thinking. Tell them how impressed you are at all they know. Point out how much there is to say about one little Maths sum.

Step 4 - Relating their thinking to real-life and personal experiences

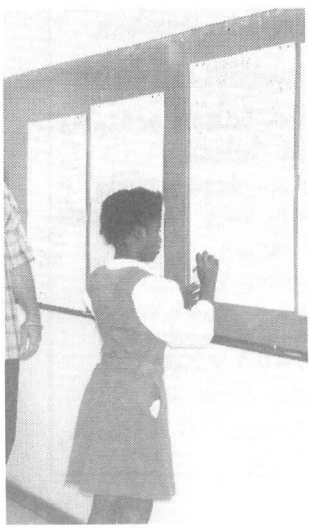
Now ask them to work in pairs to think of some other place or time in their own experience or in real life where 7 x 13 = 91 might fit. Give them some time to try to think of their own example. Can any tell their little 7 x 13 = 91 stories? If they struggle, have an example of your own for them. For example, 7 primary school cricket teams from Bisho are going to Border trials in East London. Each team has one reserve and a teacher to go with them. How many people will be on the bus? Write up your example as a model. Then hand each pair or three a blank piece of paper and ask them to write down a good story of their own. They can read these aloud and stick them under your story when they are ready.

Vela
Bongiwe
Sweet
Thandokwethu
Lwando 89
Siviwe



Conclude by saying that we could use a number sentence like 7 x 13 = 91 for any of these stories. Comment to your learners that a number sentence like 7 x 13 = 91 **makes sense** and has a **correct** answer in Maths language. But it only really has a **meaning** if it is used or fits into real life.

After Step 4, you have the chance to judge how things are going. Is the rest of the class still occupied quietly, or are they getting restless? Is the group you are working with ready for more, or are they ready to stop? It depends on how the discussion has gone. If you get the feeling that this would be a good place to stop, do so, and plan to continue another time.



Step 5 - Representing mathematical ideas

Tell the group that you want them to think of other ways of **writing** or **showing** or **talking about** and **explaining** the idea of 7 x 13 = 91.

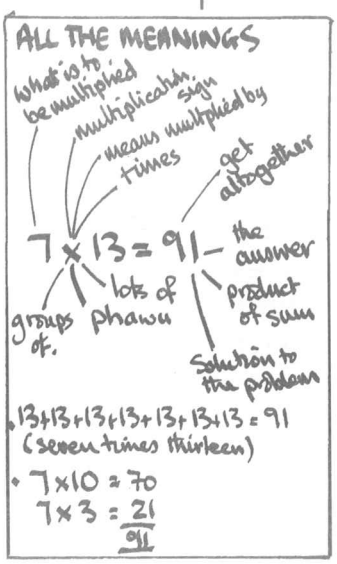
Remind them that they have already used simple mini-stories from real life. These can be **told** or **written** using **words** and **sentences.** Remind them that we can write the **numbers** and **signs** to make a **number sentence.**

Now ask them if they can think of any other ways to **show** or **write** the idea of 7 x 13 = 91. Give them time to think and see what they come up with, before you offer any further guidance. Make sure that you let them struggle for a bit.

Surely they will think of drawing a picture, or using counters, or even real things like coins. (It might be useful to have available 91 counters, or 7 ten-cent coins and 21 one-cent coins, so that you can make 7 sets of 13.) Record their suggestions on a new sheet of paper.

Finally, add any of your own ideas that you think your learners might be ready for. For example, a number line, if nobody has thought of using one.

Step 6 - Teasing out meanings



Write up 7 x 13 = 91 again, on a fresh sheet of paper. Ask your learners to tell you all the meanings that they can think of for the sign in the middle. Expect them to say, *multiplication sign, times, times-table, of.* Make a mind-map of their answers. It will become evident that there are a range of related meanings. The exact interpretation or meaning will depend on the context.

Do the same thing for the *'equals'* sign. What is the sign called? What names do we have, and what do these names mean? And so on. You should have some interesting open discussion to reflect on later.

Now think a bit about the numbers and their positions. Does the meaning or sense change if we change the order? The outcome of this step should be that you and your learners realise that there are many ways to read and interpret what is written down. You can judge the best way from the context or situation. For example,

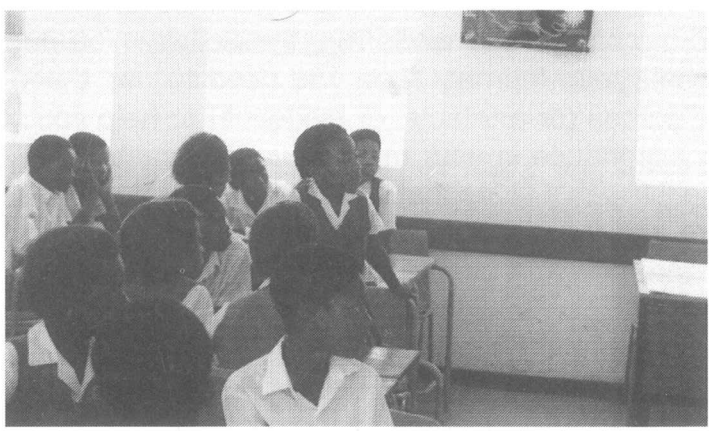
We want 7 lots of 13 people (meaning 91 people) not, 13 lots of 7 taxis (meaning 91 taxis)!

What about technical terms like Multiplicand, Multiplier, Product? Are your learners ready for them? Do they make sense? Would it be worth memorising them? Can you survive in life without knowing them? Remember, you as a teacher will need to make your own professional judgement here. What are your learners ready for? What do they really need to know? What knowledge is valuable or really useful? Knowledge for knowledge's sake, is a problem.

Step 7 - Reflecting on the Task

It is important not to labour this step of the discussion. But don't omit it. You want to encourage your learners to think about what you have asked them to do, and how they carried out the task. You also want to be able to ascertain (work out) and to assess how well your learners have understood the activity. Here are some suggested questions which might help you with this step.

- What have we done?
- How did we do it?
- What have we learned?
- Could you tell someone else about what we have done?
- What else would we like to know or do?



Suggestions for Multi-grade settings

Discussions work very well in multi-grade settings. The younger children enjoy the fact that they are challenged and extended by being with older and more experienced learners. The older learners have to think more carefully about how they say things, and often find that this helps them to think more clearly.

You will find that older learners are very sensitive to younger learners' needs, and will naturally give them space to say what they think first. When they take their turn, older learners often build on and extend what has already been said in very skilful ways.

Depending on your numbers, and the Grades you teach, we suggest that you try the range of options that you feel suit your learners. But, for your hand-in Report, you need only write a report on **one** of the options. However, you can make reference to how things went with the other options, when you are reflecting on how things worked. Being able to compare and give reasons for differing outcomes is a very important part of reflection and research.

Writing a Report

By now, you should be used to writing reports on activities you try with your learners. You also have the Report in Unit 2 on Fractions, as a model. **Please don't copy (paraphrase) that Report. Write for yourself. That is so important.**

You are very important as a classroom teacher in the New South Africa. What you think and feel is important and needs to be taken seriously. If you feel that you have to copy, or paraphrase the ideas of somebody else, it means that you **do not take yourself seriously as a professional.** And if you don't take yourself seriously, who will? Not your learners, not your peers, not your community. When you resort to copying, it is a clear sign that you are under-valuing yourself.

- You know that you need to gather together your notes and the samples of work from the Activity. You need to consult your Journal. Then you need to use these bits and pieces (or artefacts, or evidence) to help you relive the experience in your mind's eye. It is rather like skipping through a video that you have seen before. You stop here and there to look at something carefully. You fast-forward now and then to get to the next highlight or interesting bit. You may want to jot down your main points in the form of a mind-map.
- Then you need to write out a **first rough draft,** using the usual headings. This can be point form.
- After that, you go on thinking about what you have written and want to say, and even re-read your rough draft a few times. As you re-read this draft, you can make notes in the margin as a reminder of any additions and changes you might want to think about.
- When you feel ready, set aside a few hours and write a **second rough draft.** Make any major changes at this point. You might want to give this to a trusted colleague or peer to read and comment on.
- Finally, read your second draft like an editor would to make small minor corrections or changes. You should then be ready to copy it neatly, with the alterations, and submit it.
- One last thing we want you to do is to mark in the margins with a capital **R,** the precise places in your Report where you have actively **reflected** on your work and experiences.

If you need further ideas or advice about writing your Report, look back at Umthamo 17 on pages 24-28, and Umthamo 11 pages 7, 14 and 26 where you have been given very clear advice about writing Reports.

Unit 5 - Making Maths Word Books

Developing your learners' awareness of the language they use for mathematics activities, both inside and outside the classroom, is very important. When we are conscious of the words and phrases we use, we can make good choices about which ones we use for a specific purpose. This can help us to communicate better.

The next Activity will help you to extend and develop both your learners' mathematical language, and the language they use for Maths purposes. It will also contribute towards their growing awareness of the words and phrases they use, and the various meanings of those same words and phrases in different contexts. In this way you will be developing their mathematical literacy.

This Activity is not designed to be completed in a few weeks or months. You will need to build up and develop your dictionaries or word books with your learners over the whole year.

If you work with learners in the Early Years, you will need to work with your learners to develop a class Maths Word Book. If you work with learners in the Intermediate Phase, your learners will be able to work on individual Maths Word Books, or even on group Maths Word Books. If your learners are in the Foundation Phase, you will need to decide which option is most appropriate for them.

Activity 7 - Making a Maths Word Book

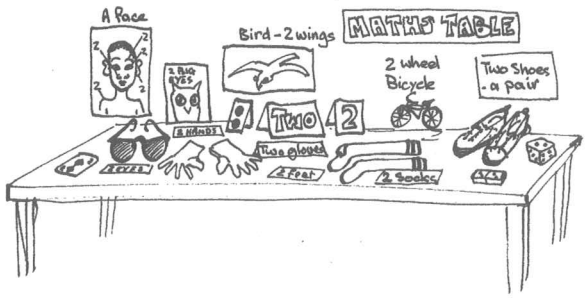
Option A - Working with young learners

You have been collecting words and phrases that your learners frequently use in mathematical contexts. You are also listening for what they bring from outside school. We suggest that you start working with those words first. Numbers are a good place to start. But you know your learners. You know which word might be the best word to start with. Perhaps they are interested in size words, like "big" or "long". Or perhaps they are interested in words of comparison like "same" or different". Trust your instincts. We can make suggestions, but we don't know your learners as you do.

Preparation

You will need to do some preparation first. We suggest that you make a big book following the instructions we gave you in Umthamo 9 on pages 43 and 44. You will have to decide how many pages you need. But if you find that you need more pages later on in the year, you could always add a few.

We would also suggest that you cut lots of small rectangles of paper approximately 7cm x 10cm for your learners to draw on to illustrate the class Maths Word Book.



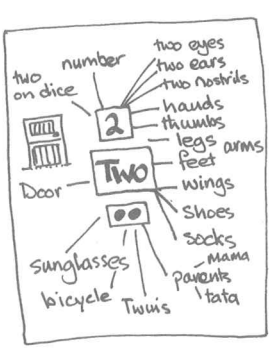
Then we suggest that you set up a table in your classroom with a Maths display which has examples of the word you have chosen to begin your class Maths Word Book. Choose a word which we use in mathematical contexts that you are certain your learners are clear about. For example, if you have chosen the word **two,** you will need to find examples of things that come in twos. These could include a picture of two eyes, a picture of two hands, a picture of two feet, a picture of a bicycle with two wheels, a pair of twins, and so on. Cut out the pictures carefully. If you are able to find some actual things that have something to do with the number **two,** then put them on the table as well. Then make a neat label for each picture or item, and a slightly bigger label with the word **two** written clearly.

If you want the pictures to last, mount them (stick them on cardboard). Then you will be able to use them again and again, for other activities and purposes.

You will also need a large sheet of paper (newsprint is very good), with the word you are focusing on written in a circle or box in the middle of the page. You will need this to make a mind-map of your learners' suggestions and your discussion with them.

When your display is ready, gather your learners around you near to where the display is. Now have a discussion with your learners of the word and the items you have collected. We suggest that you have this discussion with the whole group, or class. Start by holding up one of the items, or one of the pictures, and ask your learners to tell you about it. Then do the same with the rest of the items and pictures.

If you are not quite sure what they mean or you think that they have said something that you feel has nothing to do with the word you are discussing, ask them to explain. Expect them to be making meaningful suggestions. Try to understand what they are trying to tell you. Encourage the other children to support the speaker, and to help make the meaning clear.

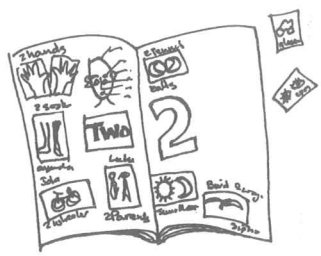


When you have worked in this way with all the items and pictures, take the label with the word **two** written on it, and ask your learners if they can guess what it says. Then ask them to think very carefully and to tell you of any other things that they know or can think of which have something to do with the word **two.** Listen carefully to their suggestions and write them up on the large sheet of newsprint with the word **two** in the centre of the page.

Later on in the day, gather a group of your learners at a table and remind them of the discussion about the word you were discussing. Point to the display of the word. Then take the big mind-map which you made of their suggestions, and read them aloud. Tell the group that you want to make a Maths Word Book for the class, and that you want to start with the word which you were discussing. Then ask each child in the group to choose a word from the mind-map (or any other relevant word they think of) and to draw a picture of that word for the class Maths Word Book. Set aside time to do this with all your learners.

When all your learners have had a chance to make a picture to illustrate the word you are focusing on, sit down with all their drawings and the big book that you have made. Probably, you will be able to fit about 20 drawings on a double-page spread. You may decide to include just a selection of your learners' drawings in the book, and to display the rest on one of the classroom walls.

When you have selected the drawings you wish to include in the Maths Word Book, lay them out on the double-page spread. Take some time and trouble to make a satisfying arrangement, with enough space under each illustration to write an appropriate sentence or phrase, and the artist's name. Remember, when you are arranging the pictures that the space between the pictures is very important. Don't crowd the page.



If you decide to put up some of your learners' pictures on the wall, take the same trouble to make a pleasing arrangement. Remember to leave enough space between each drawing. You will also need to leave enough space underneath each picture so that you can add a separate label to each one. The labels for these pictures need to say something like, *Nomvu drew a nose with two nostrils.* Or *Vusumzi drew a chicken with two legs.* You may even choose to add some of your learners' drawings to the Maths display.

After about a week, you can make another Maths display of another Maths word. Then you can work in the same way to discuss what you have put out on the table. From your learners' suggestions, you can make a new mind-map of words and phrases which have something to do with this word. Again, you can work with one group of learners at a time to make pictures of the words and ideas which they have suggested. Each time, try to include pictures by different children so that quite quickly every child

At the moderation at the end of this year, we will be very interested to see the Maths Word Book you have made, or are busy making, with your learners. It is important that they are aware that this is a long-term project, and not something that they just work on for a short time.

will have a drawing in the class Maths Word Book. This will give each child a sense of ownership.

Continue to work in this way throughout the year. You will find that your learners will catch on to the idea quite quickly, and will be anxious to bring in items and pictures to add to each display. If everybody is involved, they will be enthusiastic and develop confidence in themselves. They will also develop their understanding, awareness and use of mathematical words and phrases (in other words, their meta-linguistic awareness).

Activity 7 - Making a Maths Word Book

Option B - Working with older learners

Preparation

You will need to do some preparation first so that your learners can make either their own Maths Word Books, or group Maths Word Books. There are a number of possibilities. We have some suggestions, but you will probably think of others as well.

For example, you could get your learners to take any old exercise books which have some unused pages and they could use these unused pages to make their Maths Word Books. Alternatively, you could get some blank paper and each learner, or group of learners, could make small books rather like the big book we suggested in Umthamo 9, on pages 43 and 44. You will also need to cut lots of small rectangles of paper approximately 3.5cm x 5cm (or 5cm x 7cm), for your learners to draw on.

This will mean that if they are unhappy with their drawings, they can have another 'go' at getting their pictures to look they way they want them to before they paste them into a book.

Introducing the idea

Set aside some time for a discussion with your learners. (This could be as a whole class, or with one group at a time.) Make sure that you have some large sheets of paper on which you can record the discussion.

Start the discussion by telling your learners that you want them to make Maths Word Books. Then ask them what they think they could put in a Maths Word Book. It's important to get your learners' ideas, especially if they are going to make their own. They may mention numbers. Or perhaps they'll think of signs like the addition and subtraction signs, or the multiplication and division signs, or the sign we use for "equals".

When your learners have made a number of suggestions, summarise or re-cap the discussion by drawing a mind-

You have been collecting words and phrases that your learners frequently use in mathematical contexts, as well as outside school. We suggest that you start working with those words first. But you know your learners. You know which word might be the best word to start with. Trust your instincts. We can make suggestions, but we don't know your learners as you do.

map of their suggestions on one of the sheets of newsprint. Then get them to agree on one particular suggestion, and ask them to think of ways they could represent that idea, word, or sign in a picture or drawing. Suggest that they turn to the person next to them to talk of ways that they could represent that sign, word or idea in a picture or drawing.

As they talk, watch them carefully. Notice their body language. Who is participating? Is anybody passive? Why do you think this is? Are your learners excited? Why? Does it take a little while for them to start talking? Or do they begin straight away?

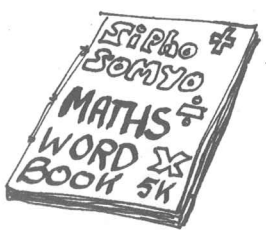
Allow them to talk to their partners for about 5 minutes and then stop them. Write the agreed word, idea, sign in the middle of another large sheet of paper, and then invite your learners to share their ideas. Record their ideas on the sheet of paper in the form of a mind-map.

When you have written up a number of ideas, get each one of your learners to commit themselves to making a drawing. There should be enough ideas so that they don't all draw the same thing. Encourage them to think of other ideas, and tell them that you want a variety of pictures, as the word, sign or idea can mean different things, depending on the particular situation in which it is used.

Next you will need to discuss with your learners how they can actually make their books. Ask them for their ideas. Wait until they have given you their suggestions, before you add your own. You may find that some of them come up with the same ideas that you have thought of.

Depending on the amount of time you have set aside, you will need to decide whether you want your learners to make their pictures at this point, or whether you will save this activity for another more appropriate time. If you decide to postpone the drawing activity, make sure that you have a good idea who is going to make which picture.

Then show them the small pieces of paper you have prepared. Tell them that if they draw on these small pieces of paper they can then stick their individual drawings into their Maths Word Books. When they get to this stage, they will need to think of how they want to arrange their drawings. This will depend, to some extent, on the size of their Maths Word Book. But they will also need to think about how they can arrange their pictures so that the book is attractive and logical.



Allow a special time to work with each group to get them to think about how they arrange their pictures in their books. When a group, or an individual, has selected the drawings they wish to include in their Maths Word Book, they will need to lay them out on a double-page spread. They will need to take some time and trouble to make a satisfying arrangement, with enough space under each illustration to write an appropriate sentence or phrase, and the artist's name. They need to remember that when they arrange their pictures, the space between pictures is very important.

At the moderation at the end of this year, we will be very interested to see the Maths Word Books your learners have made, or are busy making. It is important that they are aware that this is a long-term project, and not something that they just work on for a short time.

Conclusion

We hope you have found this umthamo interesting, and that you enjoyed the Key Activity, as well as discovering something more about your learners. We know that if you continue to have regular Maths conversations with your learners, both you and your learners will benefit. You will be giving attention to something in your classroom that is also getting the attention of progressive primary school teachers in many parts of the world. By focusing on the language of Maths, your children will find the Maths in school more meaningful. You will develop a better knowledge and understanding of the way they think mathematically. You will also learn more about what they already know. And your learners will have opportunities to share and build on their mathematical knowledge and experiences, whether these are from school, or their daily lives.

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Appendix – Content Audit

Don't forget to go through the two mind-maps of the Maths content related to this umthamo. We suggest that you study these two mind-maps carefully. Work in the same way that we suggested in Umthamo 5. **Circle** any aspects that you are uncertain about. Then find out about those aspects.

- You could do your own research using school text-books
- Or you may consult other teachers in your school
- Or you may want to consult another teacher in your area who has other Maths qualifications.
- As a last resort, remember that the learner support system and your Centre Co-ordinator should be there to help you.

It is up to you to fill in the gaps in your background knowledge of Maths.


FRACTIONS
* Vulgar / Common Fractions could be considered out of date
* Calculators + Computers do the work today
"There is less use for Fractions in society today!"
* Fractions needed today are more simple for everyday use
- halves
- Thirds
- quarters
- fifths
* The metric system and the use of decimal notation lessens the need to learn the technical skills of calculating with complex common fractions
* A clear grasp of the basic principals is the most important thing!
Kinds of
• Decimal - tenths, hundredths etc. 0,625
• Percentages 45%
• Ratios 3:5
• Mixed Nos 3 4/5
• Improper 7/5
• Proper 2/3
• Unit 1/3
• Simplest 2/3
3/4 of a shape
3/4 of a no
Think - what counts as the whole
EXPRESS Part to Whole relationship
Notation 2/3
- numerator
- denominator
• represent part of a whole or unit
• " part of a set.
• as a model for Division.
• as a ratio.
NB!
OPERATIONS → on whole Nos and Fraction
leads to Algebra
Things to do with Fractions
Sort and Order
Compare
Addition
different ways to make one
1/2 + 2/4 = 1, 1/3 + 1/6 + 1/6 + 2/6 = 1,
Subtraction
dealing with different denominators
need for LOWEST COMMON MULTIPLE
using
leads to
Equivalent Fractions
Sequences of Equivalent Fractions
1/2, 2/4, 3/6, 4/8, 5/10, 6/12 ......
* Multiplying
using of
Finding
* Dividing
- Reciprocals
Converting common ⇄ decimal
Difficulties
So - to develop a good conceptual understanding of Fractions needs lots of first hand concrete experience with shapes, objects, pictures, drawings etc.
① Experience with whole Nos doesn't match experience with Fractions
* so contradictions 8 > 3 but 1/8 < 1/3
* and 2 × 3 = 6 - answer is bigger than both
6 × 1/3 = 2 - answer is less than original No.
* and 6 ÷ 1/3 = 18 answer is bigger?
* and a half divided by a half is one
1/2 ÷ 1/2 = 1
* and a half of a half is a quarter?
1/2 × 1/2 = 1/4

*Today calculators can make all this a whole lot easier!!!!!!!!!!!!!!

Bonds – **Combining**

Put on weight

Price increase

goes up by

adding on extra

Counting on to get the answer

Putting things Together

Boys and Girls together

total cost

Add to · total · More than · sum · Plus

Addition

Multiples + factors

Patterns

Repeated Building on

total cost of buying a certain number of items at unit cost

R15.45 x 10

multiplication tables

so many sets of: 5 x 5 = 25

so many lots of: 10 x 3 = 30

times · Multiply · of · double

Multiplication

Making Bigger By

- 10x more than before
- twice as big
- treble your money

*Rectangular Array

4 x 3 = 12

3 x 4 = 12

Algorithms*?

OPER. # ATIONS

Subtraction

take away · differ · less · Minus

Partition

What remains after removing some quantity

Reduce

(opposite of adding on)

reduced by

eg cost of Petrol goes down by

- Counting back

Compare

to find the difference

- How much more?
- How much less?

opposite of Add

what must be added to a number to get a certain total?

Division

halve · group · Share · divide

inverse of multiplying a number

Grouping

How many groups of 4 can be made from 20?

20 ÷ 4 = 5

Equal Sharing

What share will each one get?

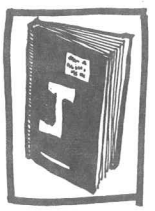
20 ÷ 4 = 5

Ratios

also for comparing

- **Remainders**
- **Rounding off** decimal Fractions

* An algorithm is a formal step-by-step procedure to calculate and get an answer (+ alternative methods + short cuts?)

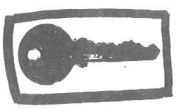


Journal

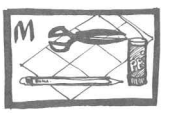
Thinking and Reflecting

Written Report

Classroom or School



Key Activity



Making materials

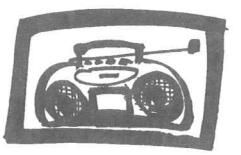
Reading and Thinking

Discussion

Face-to-face umkhwezeli

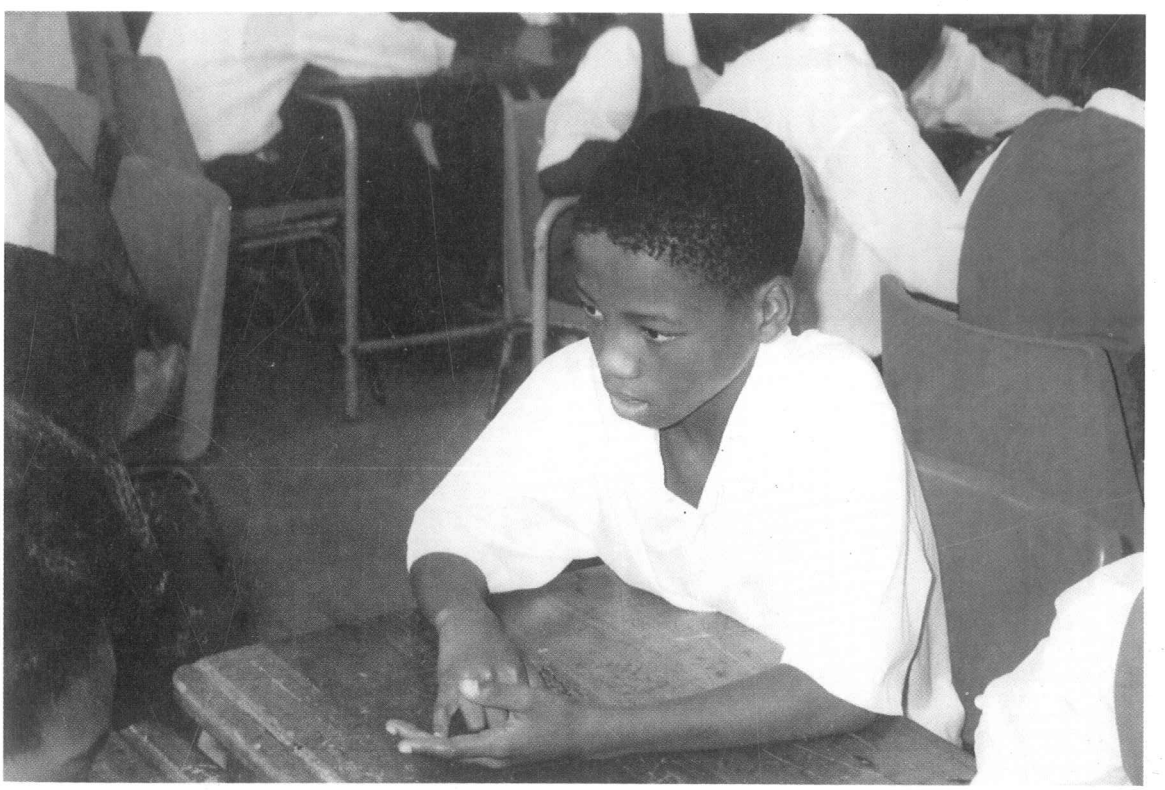
Concertina File for Portfolio

Time



Tape-recorder

Multigrade



UNIVERSITY OF FORT HARE
DISTANCE EDUCATION PROJECT

CORE LEARNING AREAS CORE COURSE
Mathematical Literacy, Mathematics and Mathematical Science

Umthamo 3 - Maths - Language
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Nompumelelo Primary School

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