FACILITATOR'S GUIDE

2016 TRAINING WORKSHOP NO.6

MATHEMATICS

FOUNDATION PHASE

PILO
IMPROVING LEARNER PERFORMANCE

education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Foundation phase
Just-in-Time Training Workshop 6
April/May 2016

Facilitator's Guide

Maths

Jika iMfundo
what I do matters

Endorsed by:

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Jika iMfundo
Foundation Phase JIT
Workshop 6 Mathematics: April/May 2016
Workshop guide for facilitators

In this workshop participants will find out more about problem solving strategies in the Jika iMfundo FP Maths materials. These strategies are part of the CAPS for FP. There are also activities on the teaching of data handling and time in the Foundation Phase.

Work in groups on all of the activity questions. Time guidelines are given and your facilitator will interact with you while you work. You will have many group discussions in which you can share what you have found. Suggested times are given below. If you have more time and want to continue the discussions for longer you are free to do so.

Workshop plan
8.00 – 8.30 – Arrival and distribution of materials for the workshop
8.30 – 10.30 – Session 1: Teaching Time and reflecting on practice (2 hours = 120 min)
10.30-11.00 – Break
11.00-12.30 – Session 2: More problem solving strategies for addition and subtraction (1 ½ hours = 90 min)
12.30 – 13.30 – Session 3: Data Handling (1 hour = 60 min)

Session 1: Teaching Time and reflecting on practice

Materials in the lesson plans in Term 2 on time:

- *Grade 2 Term 2 lessons 29 and 30*
- *Grade 3 Term 2 lessons 35 and 36*

In this discussion you will refer to the *Lesson Plans* doing hands-on activities related to the teaching of time in the FP. These will give you experience on how to work with the lesson plan activities relating to the teaching of time. You will make your own manipulatives using the cut-outs in the attached hand-out.

This activity involves sets of questions to guide the discussion for about 120 minutes. Your facilitator will guide you as you break into groups and have large group discussions throughout this time.

NB: The description of the lesson appears in the participant's guide.

Remind participants that reflecting on practice (**reflection**) gives insight into:

- the content being taught (curriculum coverage) and
- the way in which it is being taught (practice – including interaction with learners, teacher questioning and so on).

The purpose of reflection is to be critical about the way in which you have taught so that you can learn from your own experience and grow in strength as a teacher. The was a JIT session on error analysis – in this session participants were also called on to build their responsiveness to learners' thinking – in this case their errors, so that you can respond to them appropriately and effectively. Reflecting on the way you taught your lessons will help you to gain further insight into effective ways of communicating with your learners.

When you introduce the activity you need to go over the lesson information in the table (Grade 2 Lesson 30 on Time). Groups should read through the lesson description together and then work through the activity questions in discussion.

Some background information to teaching "telling the time":

Since there are 60 minutes in an hour children must be able to read and order numbers to 60 before they can read time on the digital clock. Since time is often referred to in fractional terms on analogue clocks it will be helpful if children have an understanding of halves and fourths/quarters. Direct learner's attention to the clock – try to have a REAL clock in your classroom when you do this discussion. How many big numbers are on the clock? Have learners point to the hour hand. Tell them that when the hour hand moves from one number to the next, one hour has passed. Talk about: *What can you do in an hour?*

Have students point to the minute hand. Tell them that when the minute hand moves from one tick mark to the next, one minute has passed. Talk about: *What can you do in a minute?*

Lead a discussion about different timepieces (clock, watch, timer, hourglass) and the energy sources required to run them (electricity, battery, wind-up movements). Have learners survey their homes and count the number of timepieces they find. Guide learners to design a chart or poster that reflects their findings (links to data handling topic).

Discuss: *You can tell what time it is in several ways: the position of the sun in the sky, the length of shadows, the activities people are doing, and clocks and watches.*

Activity 1

1. Did the teacher cover the curriculum content planned for this lesson? Discuss the lesson coverage in relation to the CAPS concepts for the day.
   The teacher covered the topic of telling the time in hours and half hours but she did not do the activity on calculating lengths of time. She did not necessarily teach this content in full, but this was just one lesson of two for term 2 and so there is other teaching time allocated to this topic.

2. The reflection notes below were made by the teacher in her tracker at the end of the week. Discuss the teacher's comments in relation to what value they would add if she were to go back to them when she had to teach the same lesson (on time) again in the following year.
   The comments made by the teacher are broad and vague (not just about the time lesson but about all of the lessons). They are not inaccurate, but they will not be very helpful to the teacher in relation to teaching the same lesson again apart from reminding her to pick up the pace (should that be possible).

3. Pretend that you taught the lesson yourself. Answer each of the tracker reflection prompts in relation to the lesson as it is described above:
   a. ***What went well?***
   Followed the lesson plan as closely as possible – going through most activities and doing them interactively Used a clock for demonstrations and carefully showed the positions of the hands when showing different times on the clock. Did many different times to allow children several opportunities to see where the hands are positioned when they indicate different times on the clock. Kept to the time of the lesson (90 min) and did not waste time of other lessons. Allowed learners to use the cut-out clock face to show times – interactive and concrete activity.
   b. ***What did not go well?***
   Too many activities for one lesson – but time was wasted on mental maths and counting (took 25 min instead of 10 min). Felt under pressure and so did not ask many learners to participate. Need to give more learners the chance to show times etc. Was rushed for time and did not give enough explanations of terminology. Ended off the lesson a bit abruptly (feeling under pressure).
   c. ***What did the learners find difficult or easy to understand or do?***
   Not all learners were able to show the times on their cut-out clocks – were chanting out the times but not showing them. This could be a sign they did not understand. One learner did ask about how the clock arms move around the face of the clock – sign that he did not

understand.

d. ***What will you do to support or extend learners?***
Need to answer key questions – such as the one about how the arms move around the clock face. Extension not really possible in this lesson – there was no time. All learners were busy for the whole lesson, so maybe extension on this topic would be needed in the next lesson on time. For support I could maybe re-phrase some of the questions using different words – and also link the times to the position of the arms more/very clearly. I must make sure I explain all lesson vocab.

e. ***Did you complete all the work set for [this lesson]? If not, how will you get back on track?***
Not quite all. Had to leave out one activity (on calculating lengths of time) – need to allocate more time this week to this topic – push into the "free" Friday time to do this.

f. ***What will you change next time? Why?***
Will bring a REAL clock to the lesson so that learners can see how the arms move in relation to each other. The paper clocks can't really show the real way the arms move, a bit difficult on paper. Will not end so abruptly – will wrap up key concepts and make sure learners are able to go and finish at home. Need to keep my eye on the clock so there is time for a less abrupt ending to the lesson. Will move more quickly on mental maths and counting to save time for core concept teaching in the lesson. Will call on more different learners to give answers and participate. When asking where the arms are on the clocks at certain times I will emphasizes both the position of the arms and the actual time so that learners can consolidate what the time is when the arms are in a certain place on the clock face. In the ANA learners often have to show the position of arms – but they need to know this in relation to given times. Need to explain the relevance of the activity of counting in 5s – because this helps learners to see how the clock arms move around the whole clock face in 60 min (1 hour).

4. The tracker allows for weekly reflection. You have reflected on just ONE lesson using the prompts. Do you think it is useful to reflect on a lesson in detail? Why?
   Gives real insight into how the teaching of the day went. Informs future teaching of the same lesson. The plan is given but it can be used in many different ways – reflecting on how the lesson went will allow teachers to use the plans much more effectively. If you are able to do things differently next time, then you have learned from reflecting on a lesson, and there is always room for improvement if we think deeply about it.
5. How do the Jika iMfundo mathematics lesson plans allow/encourage teachers to reflect daily on their teaching?
   At the end of each daily maths lesson there is a prompt to reflect on the lesson.
6. Refer to the attachment with further reflection prompts.
   a. How will the questions help you to reflect on your curriculum coverage? Which questions will be most helpful?
      Individual and group responses will differ – this is a personal interpretation of what will be useful from the additional prompts. Make sure you take time to read through the additional prompts to find some that you find valuable and then bear hem in mind when you reflect on your next lesson. Keep a separate notebook to record reflection notes that you think are worth remembering for the future.
   b. How will the questions help you to reflect on your lessons? Which questions 5 key would you use to help you to reflect on your lessons?
      Again responses will differ. Take time to choose your personal key questions and use them when you reflect.

Session 2: More problem solving strategies for addition and subtraction

Materials in the lesson plans in Term 2 on problem solving strategies:

- *Grade 1 Term 2 lessons 19 and 20*
- *Grade 2 Term 2 lessons 9, 10, 11 and 12*
- *Grade 3 Term 2 lessons 6, 7, 8, 9, 10 and 11*

In this discussion you will try out some more different strategies for doing calculations when solving problems.

This activity involves sets of questions to guide the discussion for about 90 minutes. Your facilitator will guide you as you break into groups and have large group discussions throughout this time.

NB: The extracts from the lesson plans appear in the participant's guide.

- *Grade 1 Term 2 lessons 19 and 20*

In Grade 1 calculation strategies involve:

- using concrete aids to count out and calculate answers;
- drawing diagrams to represent the solutions to problems;
- writing out calculations using numbers and symbols (+ , - , =).

Before we can introduce our learners to the operations, we need to be sure that they have a good concept of number, because the operations all work on numbers. Imagine trying to add 5 to 7, if you are still a little uncertain about exactly how much these symbols represent.

When we operate on numbers, we get new numbers, depending on the operation performed. In order to get the correct new number, we need to have the correct understanding of the operation – this is what we first teach our learners, so that they will know what to do when called on to add or subtract. We must teach them the terms, concepts, symbols and methods which are involved in each of the operations.

The goal is to develop conceptual understanding of the operations (addition and subtraction) and to consolidate the skill of writing out the symbolic representation of the calculation correctly. The concrete aids and drawings of counters are used to provide a means for the learners to move towards conceptual understanding of the operations. The aim should be to write out the calculation using number and operation symbols. Teachers should encourage learners to use numbers and symbols as soon as they are able to and should give them lots of practise in doing so. You should continuously be checking that learners understand what they are writing and can explain to you in words what they have written, to make sure that their conceptual understanding is developing.

Activity 2

1. Work through the lesson activities briefly together as a group.
   Use this as an opportunity to revise the teaching of addition and subtraction and some of the different strategies for doing the calculations.

2. How does the lesson plan above build up the conceptual understanding of Grade 1 learners?
   Allows opportunity for consolidation of concepts using concrete (counters) and semi-concrete (drawings) aids. The concept is the idea – the two concepts being dealt with here are addition and subtraction.
   - *The **concept of addition** involves putting together certain amounts, to find out how much we have altogether. This amount is called the sum. You should try not to use the word "sum" incorrectly, to avoid unnecessary confusion for the learners.*
   - *The* concept of subtraction *involves taking a given amount away from another given amount, to find out the difference between the two amounts.*
   - *You should notice that subtraction "undoes" what addition "does". Because of this*

*relationship between the two operations, they are known as **inverse** operations. The first activity in this lesson extract demonstrates this inverse property.*

3. How does the lesson plan above build up the operational skills of Grade 1 learners?
   It gives multiple opportunities for learners to DO calculations and write down the solutions.

4. What is the purpose of the remediation and when would the teacher do this work with learners?
   Further opportunities for practise and consolidation – but with the help of the teacher talking through solutions with the learner.

- *Grade 2 Term 2 lessons 9, 10, 11 and 12 (Excerpts below are from lessons 9 and 11.)*

In Grade 2 calculation strategies involve:

- using concrete aids to demonstrate calculation of answers (e.g. base ten blocks);
- drawing diagrams to represent the solutions to problems (e.g. number lines);
- writing out calculations using numbers and symbols (+ , - , =).

In Grade 2 learners bridge ten and start to learn the basic number bonds. There has been some debate about whether or not conscious drilling of basic number facts is needed. It is now generally accepted that learners who do not have a good grasp of all the basic number facts will be disadvantaged. Addition and subtraction of all the single digit numbers, which can be extended to addition and subtraction of bigger numbers, is what we need to focus on. Drill sessions can be made into fun experiences for the children involving games, activities or competitions in groups or for the whole class. Drill must not be done in such a way that it puts the learners off learning, but rather in a way which excites them and assists them to learn and remember the essential number facts which they need to have at their fingertips.

An example of a more active drill activity involves using a bean bag (or a ball). Throw the bean bag around the class (learners seated on the floor if possible) and each child who catches the bean bag answers a number bond question.

Activity 3

1. Work through the lesson activities briefly together as a group.
   Use this as an opportunity to revise the teaching of addition and subtraction and some of the different strategies for doing the calculations.

2. What terminology is used in the lesson activities?
   Number line, family facts, base ten blocks, flard cards, place value cards, break down, etc.

3. What different strategies are covered in the excerpts from the lesson plans above?
   Using a number line to represent a solution, using base ten blocks to show how to subtract by breaking down a number, using place value cards to show subtraction. Notice that teachers will need to show learners how to work with number lines correctly – they need to know how to label number lines and use different scales on number lines.

4. How do the activities in the lessons build up the operational strategies of Grade 2 learners?
   They give learners opportunities to do calculations using different methods.

5. Discuss the different methods and how a teacher could use them.
   The explanations that are given are detailed and yet they might still be difficult to understand. This difficulty arises because these are informal and not formal methods and so there is not one very clear way to set them out. Yet there is still value in demonstrating them. Teachers need to work through all of the lesson plan activities BEFORE they teach them so that they are confident themselves to explain the methods and make up their own additional questions of the same type in case learners want to do more examples in order to fully grasp the method.

- *Grade 3 Term 2 lessons 6, 7, 8, 9, 10 and 11 (Excerpts below are from lessons 9 and 10).*

In Grade 3 calculation strategies involve:

- using concrete aids to demonstrate calculation of answers (e.g. base ten blocks);
- drawing diagrams to represent the solutions to problems (e.g. number lines);
- writing out calculations using numbers and symbols (+ , - , = ,). □

The goal is to develop conceptual understanding and procedural fluency in doing calculations. All of the operations are known as **binary** operations because they are performed on two numbers at a time. For example, 3 + 4 = 7. If we need to operate on a string of numbers, we actually break the string up into pairs in order to do so. For example, 2 + 6 + 4 + 5 = 8 + 9 = 17. (The way in which we pair the number could be different.) By the end of Grade 3 learners need to be able to operate competently and efficiently on pairs of up to 3-digit numbers (for addition and subtraction). Teachers will have worked through several different algorithms but they need to be sure that each learner is able to use at least one competently and efficiently. The standard vertical algorithm is the most efficient and works on number of any size. This is the algorithm that learners will use ultimately and they need to know how to use it with understanding of place value. The vertical algorithm is the formal name for the standard "column" method of calculating, with which most of us are familiar. All of the alternative algorithms are designed to provide alternatives in order to ensure that learners understand how to operate on numbers – using place value. This means that when you explain any algorithm you need to be sure to explain using correct number names and place values as you work through the steps in the calculation.

Activity 4

1. Work through the lesson activities briefly together as a group.
   Use this as an opportunity to revise the teaching of addition and subtraction and some of the different strategies for doing the calculations.

2. How do the activities in the two lessons above develop the skill and understanding of Grade 3 learners?
   They give learners opportunities to do calculations in two consecutive lessons using number lines in both lessons. This will consolidate the learners' knowledge and understanding. The ways in which the calculations are recorded will consolidate written calculation methods. Notice that counting up is often shown above the number line while counting down is shown below the number line. This is common practice but learners can show the jumps along the number line above or below the number line as they choose. Notice also that there are different ways of jumping/hopping along the number line – you should allow learners to do their own jumps as long as they are correct.

3. Discuss the value of foundation phase learners developing a working knowledge of several different calculation strategies?
   Many different strategies are used in the FP. This should build a solid understanding of how the operations are done using ever increasing number values. The variety appeals to different learner mind-sets and enables deeper understanding because of the more varied explanations that would be given while the different calculations are being done. The variation in strategies also allows for consolidation of number concept as a sound knowledge of number and place value is necessary for skilful manipulation of numbers using different strategies.

Activity 5

1. Grade 1 learners use counters when they need them to do operations. Draw displays and talk about how learners might work with these displays at different levels of understanding. Use the following two examples (or others):
    a. 3 + 5 =

    When a learner first does this he/she might lay out 3 counters and 5 counters, then put them all in one group and count how many counters there are in the one big, new group. This learner is "counting all".

    They will count the group in 1s from 1 up to 8.

    When a learner has realised he/she can count on from one number to get to the sum, they could ***count on****, either from 3 or from 5.*
    They might count on from 3 – saying 3: 4, 5, 6, 7, 8 or from 5, saying 5: 6, 7, 8.

     count on 5…  to get 8

     count on 3…  to get 8.

    b. 6 – 4 =

     take away 4 leaves  - that is 2.

    Learners should be allowed to talk as they do this to develop their knowledge and understanding.

    In Grades 2 and 3 learners start to develop different strategies for doing calculations. The difference is that Grade 2 learners work with up to 2-digit numbers while Grade 3 learners need to be able to work with up to 3-digit numbers. Show how you could calculate each of the following using a number line, base ten blocks, base ten number cards (flard cards) or different written algorithm strategies:
    Teachers should experiment with the different methods as they prefer. Not all the workings are shown here – you will do them together in your groups and discuss. You should find the correct answers – use these to check your own solutions.

2. Addition
    a. 23 + 15 = 38
    b. 361 + 236 = 597
    c. 67 + 18 = 85
    d. 449 + 387 = 638
    e. Discuss the difference between questions (a and b) and questions (c and d).
    (a and b) do not require grouping ("carrying") but to do (c and d) you need to group and "carry".

3. Subtraction:
    a. 75 – 34 = 41
    b. 428 – 126 =302
    c. 54 – 39 = 15
    d. 275 – 199 = 76
    e. Discuss the difference between questions (a and b) and questions (c and d).
    (a and b) do not require breaking down ("borrowing") but to do (c and d) you need to break down before you can subtract in certain places.

Session 3: Data Handling in the Foundation Phase

Materials in the lesson plans in Term 2 on Data Handling:

- *Grade 1 Term 2 lesson 21*
- *Grade 2 Term 2 lesson 34*
- *Grade 3 Term 2 lesson 34*

This activity involves sets of questions to guide the discussion for about 60 minutes. Your facilitator will guide you as you break into groups and have large group discussions throughout this time.

In the Foundation Phase learners are introduced to the terminology, knowledge and skills of Data Handling. Data Handling lends itself to **group work and to projects** – it is useful to remember this when you plan your work.

Learners will start by sorting data. They will then begin to organise it and represent it. At all stages, learners will be able to analyse the data they have worked with. They do this by answering questions/thinking about the data set that they have worked with.

First, let us have a look at some important statistical terminology. You need to be sure that you know the meaning of the terms described below. Examples are given for each term, but an example for you to work through (relating to each of the terms) is given after all of the terms have been explained.

Data
This is information collected relating to a given topic. For example, at a certain pet shop there are 205 goldfish, 6 puppies, 15 kittens, 37 budgies, 17 hamsters and 4 cockatiels.

Raw data
Raw data is data which has been collected but not yet sorted out in any way, such as into categories. For example, you might want to find out information about birthdays of the learners in your class. You could use a class list to do so – as you ask each person what day their birthday will fall on this year, you record the day next to their name. All you then have is a list of names with the corresponding days on which their birthdays fall, for example, Luthando – Thursday, etc. You cannot easily tell from just looking at the list if more birthdays fall on a Wednesday (or whatever other day) since you have not yet counted up the number of birthdays which fall on each day of the week. Raw data needs to be sorted.

Tally
This is a very common method used to sort through data. You could use tallying to sort the data in the raw data example given above. To do so, you would write a list of the days (Monday to Sunday) on a page, and then go through the class list, making a mark next to the correct day for each name on the list. The tallies could then be counted up.

Frequency
The totals that you get when you add your tallies give you the frequencies for the particular data collected. You could check that the total number of children in the class is the same as the total you get if you add up all of the frequencies, to be sure that your tallying has been correct.

The kinds of representations of data used in the FP are pictographs and bar graphs.

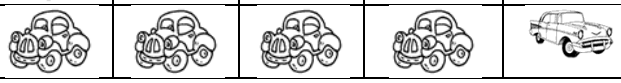
- A **pictograph** uses simple pictures or symbols to show data. A pictograph gives you a quick impression of the given information. Pictographs are often used in newspapers, magazines, books and on television because comparing data in a pictograph is easy; just compare how many pictures each item has.
- A **bar graph** uses bars to display data. The length of the bar stands for the size of the data it represents. This makes the data easy to compare. Just compare the lengths of the bars. The bars can be drawn horizontally or vertically, and gaps are left between the bars.

Pictographs

A pictograph looks and functions a bit like a bar graph does. The difference is that the bars are made up of little icons (pictures) which represent certain numbers of things as is indicated in the key, which must accompany the pictograph. The picture usually relates in some way to the data being represented. Below is a frequency table for the number of cars passing through various tollgates on 24 September in a certain year.

TOLL GATE	**NUMER OF CARS PASSED THROUGH**
Mooiriver	40 500
Grassmere	52 000
Kranskop	43 000
Middelburg	32 000
Kroonvaal	40 500

Below is a pictograph representing the number of cars passing through the tollgates:

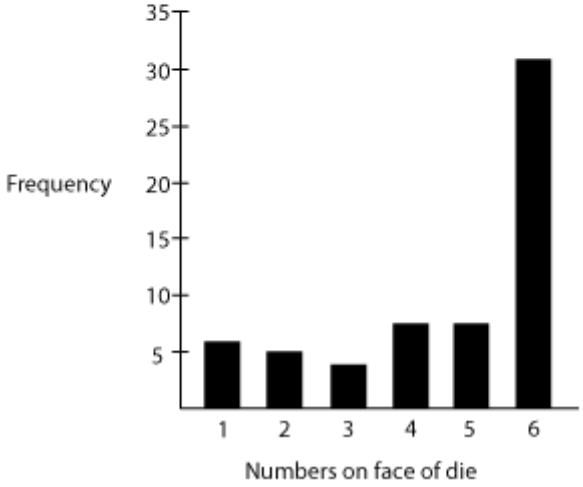
Tollgate	
Mooiriver	
Grassmere	
Kranskop	
Middleburg	
Kroonvaal	

KEY	
	Represents 10 000 cars
	Represents 1000 cars
	Represents 500 cars

Bar graphs

A bar graph is a graph made of vertical columns. (When the bars are right next to each other, the graph is called a histogram.) Here is an example of a bar graph to represent the data from the following table.

Occurrance of the numbers thrown with a die	
Number	Frequency
1	6
2	5
3	4
4	7
5	7
6	31



This activity allows participants to try out three data handling lessons from the Term 2 lesson plan set and comment on them in relation to the curriculum. The lessons present a good variety of activities and curriculum content and hence allow for learning about the teaching of FP Data Handling.

NB: The extracts from the lesson plans appear in the participant's guide.

- *Grade 1 Term 2 lessons 21*

Activity 6

1. Work through the lesson activities briefly together as a group.
   Use this as an opportunity to revise the data handling content and think about the way in with this Jika iMfundo lesson plan presents it.

2. What is the core skill/knowledge being taught in this Grade 1 lesson?
   Sorting and organising data. Analysing (discuss) data.

3. What CAPS content is present in this lesson?
   5.1. Collect and sort everyday physical objects.
   5.3 Discuss and report on sorted collection of objects.

4. How are learners asked to analyse what they have done in the activity?
   How did you sort your items? (Discuss all possible answers for ways of sorting.)
   Ask the learners to explain what they notice about their groupings. Discuss all possible answers.

5. What variation is provided in activity 1?
   Ask the learners to sort their items again in a different way.

- *Grade 2 Term 2 lessons 34*

Activity 7

1. Work through the lesson activities briefly together as a group.
   Use this as an opportunity to revise the data handling content and think about the way in with this Jika iMfundo lesson plan presents it.

2. What is the core skill/knowledge being taught in this Grade 2 lesson?
   Sorting, organising and representing data. Analysing data.

3. What CAPS content is present in this lesson?
   5.4 Collect and organise data
   5.5 Represent data: Pictographs
   5.6 Analyse and interpret data.

4. How does the activity allow independent activity on the part of the learners?
   The learners collect and cut out pictures – they are doing their own data collection for the activity.

5. What variation is provided for in the activity and how are the teachers expected to deal with it?
   Learners collect their own pictures and they might not all have the same numbers of pictures. The constant is that they should each collect 20 pictures. This is still controlled by the teacher who has set the total number of pictures at 20.

- *Grade 3 Term 2 lessons 34*

Activity 8

1. Work through the lesson activities briefly together as a group.
   Use this as an opportunity to revise the data handling content and think about the way in with this Jika iMfundo lesson plan presents it.

2. What is the core skill/knowledge being taught in this Grade 3 lesson?
   Sorting, organising and representing data. Analysing data.

3. What CAPS content is present in this lesson?
   5.4 Collect and organise data
   5.5 Represent data: Pictographs
   5.6 Analyse and interpret data.

4. What is the focus of the lesson?
   Drawing and working with a bar graph based on data sorted and counted up at the beginning of the lesson.

5. What skills/knowledge are being consolidated in the lesson?
   Sorting and organising data.

6. What CAPS content items were not covered in the three lessons that you have analysed?
   Pictographs, tallies and tally tables.

Acknowledgement: The following resource was used in the preparation of this workshop. Sapire, I. (2010). *Mathematics for Primary School Teachers*. Saide and the Wits School of Education, University of the Witwatersrand, Johannesburg.