education

Department:
Education
PROVINCE OF KWAZULU-NATAL

Just-in-Time Training Workshop Term 1

Facilitators' Guide

Grade 4 – 7 Mathematics

Endorsed by:

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what I do matters

Programme

3 hours

Use the headings in the programme in the Participants' manual to introduce the workshop.

Your main purposes in this workshop:

- Check that participants can use the tracker.
- Help participants develop an overview of the progression of concepts in fractions and how important this topic is right through their schooling years.
- Help participants to realise that teaching rules for fractions without understanding the concepts can actually obstruct their learning!
- Help participants to develop an understanding of teaching fractions in a conceptual and progressive way.
- Help participants to apply the same conceptual ideas for decimal fractions and percentages.

Session 1:

Focus of workshop and a recap of using the trackers

1. Introduce yourself to the participants and explain the communication between subject advisors and writers of the materials. Use the Notes about training (participants' guide) If you need to, refer to the purposes of the tracker on page 4 and the copied page of the Tracker explained on page 5.
2. Use the questions to help participants who are unfamiliar with trackers to find their way around them effectively.
3. Participants may like the tracker because it helps to keep track of their work; it doesn't wait for learner or teacher to catch up; it provides all the references needed on the same page.
4. Remind participants about the importance of the progression of learning which is outlined by CAPS.

Session 2: Fractions according to CAPS

1. Year plans show that fractions have 16 hours, 15 hours, 31 hours and 18 hrs respectively for Grades 4, 5, 6 and 7. This shows that it is an important topic and there are enough hours to make sure that common fractions are well established and continue through to Grade 7; decimal fractions need plenty of time in Grades 6 and 7, with a bigger focus on percentages in Grade 7.
2. Key concepts are built up across the grades (see diagram). Concepts that are needed in order to understand fractions include Grade 3 fraction work, whole numbers, place value and later, multiples and factors.
   A foundation in fractions ensures success in key topics right through to Grade 12 that include algebraic fractions, simple and compound interest, measurement (mass, time, length, area)
3. This overview shows teachers how fundamental an understanding of fractions is to ensure success in all grades up to Grade 12. So their teaching can ensure improved learning through the FET stage and contributes to success in achieving a pass in matric!
4. Emphasise the points made at the end of page 6 of the participants' manual.
   a) Conceptual knowledge: this is emphasised in all grades. CAPS reminds teachers that the fraction concept must be firmly established in order to work with equivalence, comparing and calculations.
   b) Use of apparatus and diagrams is essential in Grades 4 and 5 and it is still encouraged in Grades 6 and 7. Diagrams of tenths and hundredths in Grades 6 and 7 help with a conceptual understanding of decimal fractions and percentages.
   c) Problem solving should be used from the start of each fraction topic – it is not an add-on after working with fraction symbols!
   d) Learners are not expected to learn rules! If this is the way teachers teach, then learners see this work as "magic" with rules that they don't understand. However, calculation techniques help to improve the learner's fluency in procedures after they fully understand the concepts.

By this stage of the workshop, teachers may well be unhappy! They have always used rules for fractions and many of them are not familiar with a conceptual way to teach fractions! This is the perfect time to introduce them to the case study of Mrs Pieterse.

Fractions, decimals and percentages – a completed progression of concepts

Maths needed for fractions, decimals, percentages:

- Grade 3 fractions (compare & order, diagrams, start to name, start equivalence)
- whole numbers
- sharing and grouping
- doubling and halving
- place value
- multiples and factors

Grade 4

- compare & order (halves; thirds, quarters; fifths; sixths; sevenths; eighths
- describe & compare diagrams
- equivalent forms of common fractions (one denominator is a multiple of another)
- adding with same denominators
- division same as fractions
- solve problems

Grade 5

- revision of grade 4 work
- counting forwards and backwards
- new fractions: up to twelfths
- subtraction with same denominators
- use mixed numbers in calculations
- fractions of whole numbers *(ie fractions of groups of objects)*

Grade 6

- revision of grade 5 work
- new fractions: tenths and hundredths
- equivalence including 2-digit denominators
- addition and subtraction including where one denominator is a multiple of another

Grade 7

- revision of Grade 6 work
- new fractions: thousandths
- addition and subtraction including where one denominator is *not* a multiple of the other
- multiplication of fractions, including mixed numbers
- calculation techniques that help with calculations *(converting mixed numbers to common fractions; using multiples and factors to simplify fractions)*

Maths that uses fractions, decimals, percentages:

- data handling especially pie charts
- algebraic fractions
- simple and compound interest
- problem solving with mass, time, volume, length, area.

Session 3:
What you teach is not always what is learnt!

Different kinds of knowledge

Emphasise the following:

- *Physical knowledge* of fractions through apparatus and diagrams is a necessary step in establishing a good understanding of fractions.
- *Social knowledge* of fractions includes knowing how to write fractions and decimal fractions, identifying the numerator and the denominator, the percentage symbol. The rules so often taught are not social knowledge, but they are taught as if they are, as if they must just be remembered. Learners who don't understand the "rules" taught, begin to make their own rules about when and what to multiply or add.
- *Conceptual knowledge (logico-mathematical knowledge*): Emphasise the quote at the end of page 12 of the participants' manual.

Case study: Adding fractions in Grade 6

- Read the explanation Mrs Pieterse gives and if possible, write her calculations on a board or a flipchart as you read. Read it seriously, as if this is a recommended way of teaching.
- Give participants a chance to look at the answers given by learners A, B and C.
- Then participants discuss the questions in groups of 4 – 6 people.
- Mrs Pieterse's answer is correct and she has followed CAPS requirements of using mixed numbers and denominators that are multiples of each other. However, she has ***not*** complied with the clarification note:

  It is not expected that learners know rules for simplifying fractions or for converting between mixed numbers and fraction forms (CAPS, page 226)

Each learner has made their own rules:

$$2\frac{3}{5}+1\frac{7}{10}=\frac{6}{5}+\frac{7}{10}$$
$$=\frac{12}{10}+\frac{7}{10}$$
$$=\frac{19}{20}$$

She multiplies the whole number by the numerator and leaves the denominator as it is. In the second step, she correctly uses equivalent fractions to get $\frac{12}{10}$. In the third line, she adds the tops and the bottoms of the fractions separately.

$$2\frac{3}{5}+1\frac{7}{10}=\frac{11}{5}+\frac{17}{10}$$
$$=\frac{22}{10}+\frac{17}{10}$$
$$=\frac{39}{10}=3\frac{9}{10}$$

Learner B multiplies the top and the bottom by the whole number, adds correctly in the second line and then converts $\frac{13}{10}$ to $10\frac{3}{10}$.

$$2\frac{3}{5}+1\frac{7}{10}=\frac{6}{10}+\frac{7}{10}$$
$$=\frac{13}{10}$$
$$=10\frac{3}{10}$$

Learner C multiplies top and bottom by the whole number and adds these together, keeping the same denominator. Notice that this actually gives him one correct part to his calculation, even though his method is wrong: $\frac{17}{10}$. The other steps of his calculation are correct!

- Give groups a chance to discuss the misconceptions and a more conceptual way to teach fractions. The next activity will be showing them things to avoid when teaching fractions and ways to teach the concepts. Suggest that teaching rules in an isolated way like Mrs Pieterse can actually do harm to the learners' understanding and it is difficult to "undo" their misconceptions. So teachers need to teach concepts through apparatus and diagrams and using problems right from the start!
- We will return to the question Mrs Pieterse asked to see another way of teaching it.

This activity should make many of the teachers want to know another way of teaching and they are ready for the next activity, "What learners understand about fractions".
Work through the table from left to right in each column.

- The second column shows what kind of misconceptions learners develop, even though this is not directly what you taught!
- The third column suggests a way of teaching that encourages conceptual understanding and does not limit the learners.

Session 4: Solve problems without using rules

At the beginning of this session, you can demonstrate a method based on concepts for answering Mrs Pieterse's questions:

$$3\frac{2}{3}+2\frac{5}{6}=5+\frac{2}{3}+\frac{5}{6}$$
$$=5+\frac{4}{6}+\frac{5}{6}$$
$$=5+\frac{9}{6}$$
$$=5+\frac{6}{6}+\frac{3}{6}$$
$$=5+1+\frac{1}{2}$$
$$=6\frac{1}{2}$$

This is one suggested method. You can use other ways, so long as you letting learners think about concepts and not teaching rules!

First think about how big you expect the answer to be. It will be bigger than 5 and probably bigger than 6. Add the whole numbers as you know how to do this. Use a fraction wall or diagram to work out that $\frac{2}{3}=\frac{4}{6}$. 4 out of 6 parts and 5 out of 6 parts gives us 9 out of 6 parts. We know that $\frac{6}{6}=1$, so there are $\frac{3}{6}$ left and you can work this out to be a half.

***There is an example of subtracting fractions on page 227 of CAPS where you need to use one of the whole numbers to help with subtracting the fractions.

Participants work in pairs to solve problems that they choose from page 16. These are taken from the problem types presented in CAPS for Grades 4 – 6. If they have brought along textbooks, they should also look for problems like these types in their textbooks.

This session provides participants with a chance to practise a conceptual way of teaching fractions and to "undo" their own habits of just following rules.

The **diagnostic test** on page 19 does not need to be completed by teachers. Suggest that they use it in a diagnostic way to assess how much their learners understand about fractions before your teaching starts.

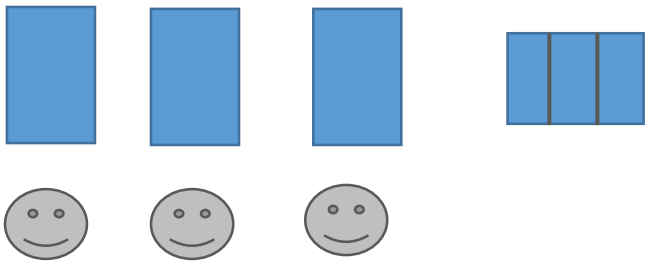
Session 5: Sequence of activities

Solutions are provided below.

Diagnostic test for fractions

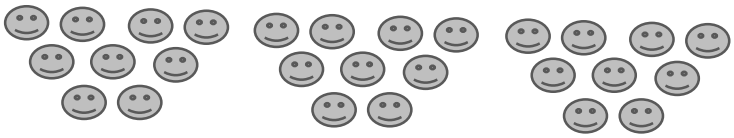
When you start teaching fractions in Grades 5, 6 or 7, use questions like these as a diagnostic tool to see what your learners understand about fractions. Grade 4 teachers can use this as an assessment task.

1. a) Learners can use any drawing that shows how they share the chocolates. The one below is just an example.

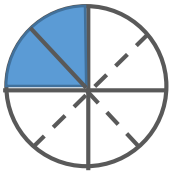


b) Each friend gets 1 and 1 third of the chocolates.

2. There are 9 children in $\frac{1}{3}$ of this class.

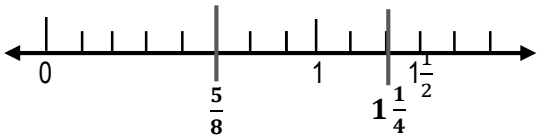


3. With a diagram, it is easy to see that each child gets $\frac{1}{8}$ of a pizza.

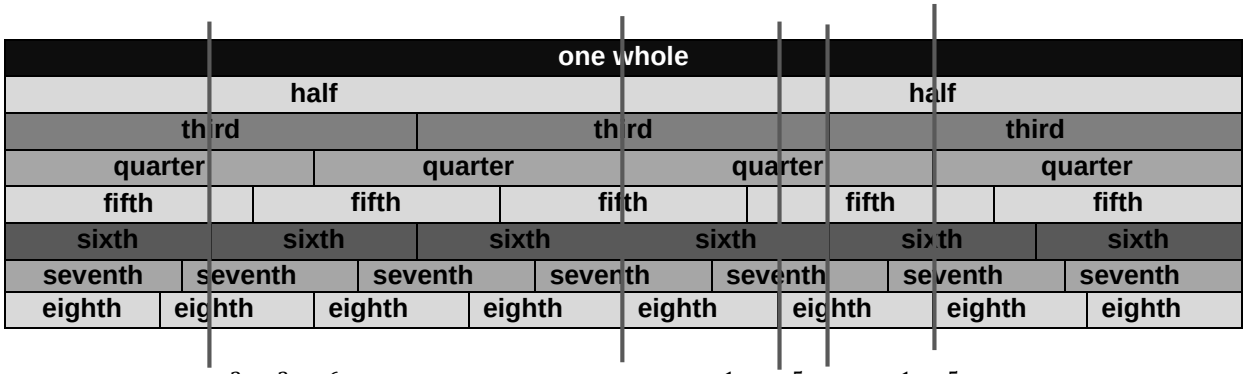


4. There are 8 intervals between 0 and 1. So $\frac{5}{8}$ is 5 intervals from 0.

$1\frac{1}{4}$ is halfway between 1 ½ and 2



5. Use a ruler or draw lines down the fraction wall to show each fraction. $\frac{1}{6}; \frac{1}{2}; \frac{5}{8}; \frac{2}{3}; \frac{3}{4}$



Calculate: a) $\frac{3}{4} + \frac{3}{4} = \frac{6}{4}$

$= \frac{4}{4} + \frac{2}{4}$

$= 1\frac{2}{4} = 1\frac{1}{2}$

b) $3\frac{1}{6} + 2\frac{5}{6} = 5 + \frac{1}{6} + \frac{5}{6}$

$= 5 + \frac{6}{6} = 6$

Sequence of activities

Each of these kinds of activities are important to development a good fraction concept in learners. The sequence is built up progressively as learners become more confident.
Grade 5, 6 and 7 teachers need to establish how far their learners have progressed with fractions and decide how much time they need to spend on strengthening the fraction concept before doing equivalence and calculations.
Participants can work through these in groups, or you may decide to present them to the whole group. It is not necessary to work out the answers to examples. The sequence is presented to show teachers how to build an understanding of fractions by introducing new ideas one at a time. These experiences of fractions prepare learners for working with equivalence, adding and subtracting, multiplying and dividing fractions.

Notes:
The first few activities do not require learners to name parts or to write answers as symbols (in fraction notation). Step 3 teaches

Decimal fractions

The notes provided give teachers a summary of the most important concepts for teaching decimal fractions. They should still use diagrams to illustrate tenths and hundredths and link tenths and hundredths to their place values in the decimal system.

Percentages

As for decimal fractions, the notes provided give teachers a summary of the most important concepts for teaching percentages. Learners need to know that percentage *means* "out of 100" and that any percentage given is the number given out of 100.

So 53% means 53 out of 100 which $\frac{53}{100}$. This is the *social knowledge* that must be understood. Percentages can be taught conceptually (see the notes) and teachers do not need to revert to rules without understanding.

Percentage questions for Grade 7

1. a) I score 40% for my maths test. If the test is out of 30 marks, what is my mark?
   b) I get 24 out of 30 for my maths test. What percentage do I get for the test?
   c) 25% of the learners at the camp are boys. There are 60 learners at the camp. How many are boys?
   d) I win R1 000 and decide to give 15% of this to my brother. How much money does my brother get?
   e) I took 14 litres from a water tank. This is 20% of the water in the water tank. How much water is left in the water tank?
   f) The price of milk increases from R10 to R11,90. By what percentage does the price of milk increase?
   g) The number of people who attend a clinic monthly drops from 40 to 16. By what percentage does the number of people attending the clinic drop?
   h) A shirt cost R600. I get 20% discount. How much do I pay?
   i) The price of a car is R150 000 without VAT. What is the price when 14% VAT is added?

Session 6: Reflection and evaluation

Participants' summaries of key learnings from the workshop

Take a few minutes to reflect on what you have discussed, read, presented, and listened to in this workshop.

5. What aspects of teaching fractions am I doing well?
6. Which aspects of teaching fractions do I need to change and improve?
7. What are the possible effects on the learner's understanding when I use rules?

Think of one statement that you can write down to state your commitment to change in your approach to teaching fractions (common, decimal or percentage)

Make a summary of what you have learnt and what you would like to implement in your classroom.

Learning about fractions	**Action plan for me:**
Did you learn something new about fractions, decimals or percentages that you did not know before? What are the key things to remember about teaching fractions to young learners?	*[eg read the workshop material and the Tracker carefully; make enough fraction strips for groups in my class; buy fraction pieces; finish the fraction lesson plans by _____ (date)]*