Day 5 Session 15 — 80 minutes

The interactive whiteboard

Objectives

By the end of this session teachers will:

- have viewed and discussed some ICT resources;
- have discussed the benefits of interactive teaching programs and specialist software.

Resources

For the trainer

- Computer with data projector, Microsoft PowerPoint and Presentation 15.ppt
- Whiteboard or flipchart
- Interactive whiteboard
- Software for the interactive whiteboard, e.g.
  Mult-e-Maths
  (see www.cambridge-hitachi.com/products/primary/multemaths/)
  interactive teaching programs (download free from
  www.standards.dfes.gov.uk/primary/publications/mathematics/itps/)
- Trainer resource 15.1 (see end of this session)

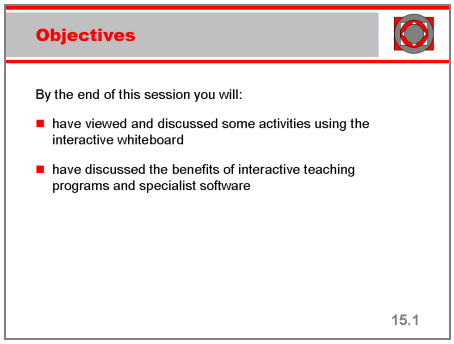
Session outline

Introduction Slides 15.1–15.3	Whole group presentation	10 minutes
Using an interactive whiteboard Trainer resource 15.1	Whole group presentation and discussion	65 minutes
Conclusion	Summary of points raised in workshop	5 minutes

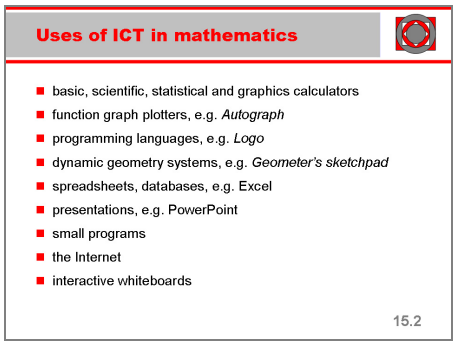
Introduction

10 minutes

Explain that the penultimate session of this five-day workshop provides an opportunity to look at the use of the interactive whiteboard. Show **slide 15.1** to introduce the objectives for the session.

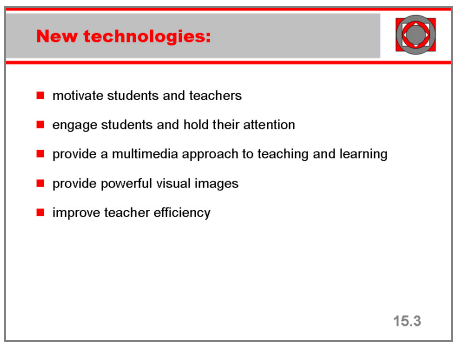


Show **slide 15.2**. Summarise briefly the range of applications of ICT in mathematics.



Say that during the workshops several sessions have focused on the use of ICT to support the teaching and learning of mathematics. This session is looks the use of the interactive whiteboard. An interactive whiteboard is merely a hardware device. It combines the functions of the screen and the keyboard of a computer. It acts as a large display and is touch-sensitive. Information can be entered by touching specific areas of the screen, sometimes with the special pen that is provided with the board.

This unique technology is relatively new in schools and has been found to have a positive impact on both teachers and students. Use **slide 15.3** to outline the benefits of new technologies.



Before the session starts, brief any interpreter about the key points of the session.

Set up the interactive whiteboard.

Load **Presentation 15.ppt**.

Using an interactive whiteboard

65 minutes

Use the main part of the session to demonstrate a range of resources using the interactive whiteboard.

For example, use **Trainer resource 15.1** and demonstrate the interactive teaching program *Number grid*. Ask teachers to act as your 'class'. Explain that these programs are interactive animated teaching aids that can be used with a computer and data projector or with an interactive whiteboard.

After going through the activity, point out that it links to division, problem solving and the use of ICT, three of the main themes of this workshop. Discuss with the group questions such as:

- What grade would these activities be suitable for? Which standards would they support?
- What advantages does the use of the interactive teaching program have over conventional teaching and learning resources for the same objectives?
- What teaching and learning strategies do they promote?

Draw out that the activities support the standards for *properties of numbers and number sequences*. Some of the advantages of the program over conventional displays of number grids are:

- the suitability of the program as a tool for modelling, and the ease and speed with which accurate displays can be drawn;
- the flexibility that allows options such as the number of columns to be changed at the touch of a button;
- the way in which the program encourages students to hypothesise, test predictions, question, discuss and explain, since it is quick and easy to check if their predictions are correct.

Stress that the use of an interactive teaching program can be followed up with further tasks, activities or exercises based on conventional resources.

Conclusion

5 minutes

Summarise the main points raised in the main part of the session.

Using the program Number grid

Trainer resource 15.1

Activity A

This is a simple introductory activity for those who have no experience of the use of whiteboards.

Set the number of columns to 10. Demonstrate how any number can be lit up and switched off. Ask a participant to 'light up' the numbers 1, 3, 5, 7.

Q What will be the next number that we light up?

Establish that the next number will be 9.

Q Why will the next number we light up be 11?

Take explanations and ensure that everyone understands the pattern.

Invite another participant to continue the pattern up to 19.

Point to the third row and ask teachers to write down all the numbers that will be lit up in this row. *(Say that with a real class you would ask students to do this on their mini-whiteboards, then to hold these up and show you.)*

Confirm that the numbers will be 21, 23, 25, 27, 29. Light up these numbers.

Q Which numbers will be lit up in the fourth row?

Establish the numbers to be lit, and invite a participant to do this. Point to the number 67.

Q If we continue the pattern, will 67 be lit up? Why?

Take teachers' responses and explanations.

Q How does the pattern tell us that 67 will be lit up?

Make sure that everyone can see the pattern as a set of columns. Invite other teachers quickly to complete the sequence of numbers on the grid.

Using the grid, get teachers to chant the pattern. At each number, switch off that number. Repeat, going backwards and forwards, lighting up and switching off.

Change the grid to 9 columns. Ask a participant to highlight the numbers 1, 3, 5, 7.

Q If we continue this sequence, will the pattern be the same as before? Why not?

Take teachers' responses and continue the sequence up to 27.

Q How can we describe this pattern?

Discuss the pattern and establish that it is different from the one before. Introduce 'diagonal' as a descriptor.

Point to the number 63.

Q Will this number be lit?

Establish that the number will be lit.

Q Does the pattern help us to decide if the number will be lit?

Show teachers how the number of columns can quickly be changed. Ask teachers to discuss in pairs what patterns the sequence makes on other sized grids. *(Say that with a real class you would ask students to explore the grids interactively using the program.)*

Q What patterns would be made on grids of other sizes?

Establish that for any sized grid there are only two different patterns that can be made for the sequence of odd numbers. Demonstrate this by highlighting the sequence and then changing the number of columns.

Q How can we tell from the number of columns if the pattern produced will be columns or diagonals?

Activity B

Reset the number of columns to 10, with a start number of 1. Ask a participant to highlight multiples of 3 by setting the controls. Point out that the multiples of 3 are red.

Q How can we describe this pattern?

Establish that the pattern slopes from the right at the top to the left at the bottom.

Q Why is the pattern like this on a grid with 10 columns?

Ask teachers to discuss this question in pairs for a minute, then ask for their conjectures. Establish that three multiples of 3 are highlighted in the first row, with one square on the right 'left over', because 10 ÷ 3 = 3 R 1. This means that in the second row the highlighted multiples will be one place to the left of the top row and, because 20 ÷ 3 = 6 R 2, two squares on the right are 'left over'

Write this division table on the flipchart:

10 ÷ 3 = 3 R 1
20 ÷ 3 = 6 R 2
30 ÷ 3 = 10 R 0
40 ÷ 3 = 13 R 1
50 ÷ 3 = 16 R 2
60 ÷ 3 = 20 R 0

Point out that the numbers underlined correspond to the number of highlighted numbers up to that point. So there are three highlighted numbers (multiples of 3) in the first row, six in the first two rows or 20, 10 in the first three rows or 30, and so on. Ask:

Q What do you notice about the remainders?
Q What do you notice about the numbers underlined?

Point out that as 10 is added for each new row, a cycle of remainders is produced: 1, 2, 0, 1, 2, 0, … There is also a pattern in the units digits of the numbers underlined: a cycle of 3, 6, 0, …

Q What would the next four lines in the table be?

Encourage teachers to use the patterns to predict the next four lines. Write them quickly on the flipchart as teachers call them out.

70 ÷ 3 = 23 R 1
80 ÷ 3 = 26 R 2
90 ÷ 3 = 30 R 0
100 ÷ 3 = 33 R 1

Q If we change the number of columns in the grid, could we produce the same pattern as we have on the grid with 10 columns?

Allow a minute for the pairs to discuss this question, then draw out a conjecture that grids with 4, 7, 10 or 13 columns would produce the same pattern, since they all leave remainder 1 when divided by 3, but that other numbers of columns would have a different pattern. Test this theory by demonstrating 7 columns and 13 columns, using the controls to change the number of columns.

Q How many columns do we need to produce a pattern of vertical lines?

After a few seconds for discussion, agree a conjecture that the number of columns would need to be a multiple of 3, so that no squares are 'left over' in each row. Confirm by demonstrating a grid with 12 columns.

Point out that this activity has links to both division and problem solving, the two main themes of the course.

Reset the number of columns to 10, with a start number of 1. Ask another participant to highlight multiples of 4 by setting the controls.

Q Is this the same pattern as for multiples of 3? (no)

Q How would we need to set the grid to produce a pattern that slopes from the right at the top to the left at the bottom?

Ask teachers to discuss this question in pairs for a minute or so. Invite someone to alter the number of columns to produce the required pattern: for example, to 9 columns.

Q What is the explanation for that pattern?

Agree that because:

$9 \div 4 = 2$ R 1
$18 \div 4 = 4$ R 2
$27 \div 4 = 6$ R 3
$36 \div 4 = 9$ R 0 …

the pattern will be similar to the pattern of threes on the grid with 10 columns. Point out that this time the cycle of remainders is 0, 1, 2, 3, …

Q Are there any other possibilities for the number of columns?

Establish the conjecture that when the number of columns leaves a remainder of 1 when divided by 4 (i.e. it is a number in the sequence 5, 9, 13, 17, …), the same pattern will be produced.

Invite a participant to test what happens when the number of columns changes to 5, and then to 13.

Q How could we produce a pattern for multiples of 4 that slopes the other way, from the left at the top to the right at the bottom?

Give the pairs a minute or two to discuss this question, then ask for their suggestions. Invite those who offer a hypothesis to test it.

Q Are there any other possibilities?

Again, invite those who offer a hypothesis to test it. Continue until the group is convinced that when the number of columns leaves a remainder of 3 when divided by 4 (i.e. it is a number in the sequence 3, 7, 11, 15, …), the same pattern will be as required.

Q What is the cycle of remainders this time?

Establish that this time the cycle begins 3, 2, 1, 0, …

Reset the number of columns to 10, with a start number of 1. Use the controls to highlight the multiples of 3 (in red), then the multiples of 4 (in green). Explain that this is what you have done. Point out that some numbers are a 'muddy green'.

Q What are these numbers?

Agree that the numbers are multiples of both 3 and 4: that is, they are multiples of 12, the lowest common multiple of 3 and 4.

Ask everyone to focus on the 'muddy green' multiples of 12.

Q What pattern will these multiples produce if we change the number of columns to 11?

Give the pairs a minute or so to come up with a hypothesis. Then ask two more questions, again allowing a minute or two for discussion.

Q What pattern will the multiples of 3 make on a grid with 11 columns?

Q What pattern will the multiples of 4 make?

Test their hypotheses by changing the number of columns to 11. Confirm that the patterns slope from the left at the top to the right at the bottom. Point out that the patterns for 3 and 4, both factors of 12, are parallel to the pattern for 12.

Q What is the explanation for these patterns?

Agree that since for the first row $11 \div 12 = 0$ R 11, the first highlighted multiple of 12 will be in the first square of the second row. Because $22 \div 12 = 1$ R 10, the next highlighted multiple of 12 will be in the second square of the third row, and so on. In each subsequent row, the highlighted multiple will be one place to the right of the highlighted multiple in the row immediately above.

Q If we add multiples of 6 to the grid with 11 columns, what will the pattern look like?

Test teachers' hypotheses by adding multiples of 6 to the grid.

Q What patterns will the multiples of 3, 4, 6 and 12 make in a grid with 12 columns?

Agree that the patterns will be vertical lines. Confirm by changing the number of columns to 12.