Unit 4E Modelling effects on screen
Adapted from QCA IT Unit 4E

ABOUT THE UNIT

In this unit children learn to enter instructions to control a screen turtle and will compare the operation of the screen turtle with a floor turtle. They learn how to write a procedure that 'teaches' the computer a new word and will be asked to write short sequences to produce particular shapes on screen. They understand that screen steps are smaller than floor turtle steps and will be asked to repeat procedures to produce 'crystal flowers' by rotating the screen turtle through 360 degrees.

Children will be able to apply what they have learnt in this unit when working with shapes and space in mathematics.

WHERE THE UNIT FITS IN

Builds on Unit 2D 'Routes: controlling a floor turtle'.

This unit assumes that children:

- understand numbers larger than 100
- know that degrees measure turns and understand that 90, 180 and 360 degrees are quarter-, half- and full turns.

TECHNICAL VOCABULARY

- procedure
- repeat
- penup
- pendown
- clear

RESOURCES

- rLOGO, which includes the commands clear, penup and pendown
- word processor for editing procedures
- worksheets of sequences
- 1cm x 1cm graph paper

EXPECTATIONS

at the end of this unit

most children will:	create a 'flower' using one shape and rotating it; use the repeat instruction to duplicate the shape; change the angle of turn
some children will not have made so much progress and will:	work from an example 'flower' and change the procedure to create their own 'flowers'; make mistakes and need to amend their work
some children will have progressed further and will:	create 'flowers' using more than one shape and rotating them; use the repeat instruction to duplicate shapes; investigate more complex shapes and sizes; change the angle of turn

LEARNING OBJECTIVES CHILDREN SHOULD LEARN	POSSIBLE TEACHING ACTIVITIES	LEARNING OUTCOMES CHILDREN	POINTS TO NOTE
SETTING THE SCENE			
• **key idea:** that the screen turtle can be moved on screen • **technique:** to "translate" an idea into the restricted language of LOGO	♦ Remind the children of the work they did with a floor turtle at the infant school. ♦ Ask children to give instructions to me to move from the door to Computer 3. Tell them that they need to work out which instructions I will respond to. ♦ Explain that LOGO is a computer programming language that can control a floor turtle or a "turtle" on the computer screen; that the computer already "knows" some words but that they can "teach" it some more. ♦ Introduce the children to the screen turtle. ♦ Ask them to experiment to find out what they can make it do. ♦ After an opportunity to explore and experiment: talk as necessary about the direction the turtle is facing and how it moves. Type in some instructions to show the turtle moving. Discuss spaces between command and number, and the use of the return key. ♦ Introduce them to the clear screen command. ♦ Ask the children to make the turtle draw a square and then draw a smaller square. If necessary type in the instructions for drawing a square, but use forward 100 instead of 4. ♦ Discuss with the children the different step size that a screen turtle uses. Discuss the differences between using a floor turtle and a screen turtle. ♦ Remind the children that instructions are relative. Explain to them that they are going to make the screen turtle follow a number of instructions.	• should recognise that a computer language is used to programme a screen turtle • know that LOGO can also be used to control a floor turtle • recognise that the size of numbers used for distance is different	Children will need to relate the horizontal plane of the floor turtle to the vertical plane of the screen turtle. They will naturally want to use 'up' and 'down'. Single instructions typed into a screen LOGO will be obeyed immediately, unlike the floor turtle which will not obey instructions until the 'go' button is pressed.

LEARNING OBJECTIVES CHILDREN SHOULD LEARN	POSSIBLE TEACHING ACTIVITIES	LEARNING OUTCOMES CHILDREN	POINTS TO NOTE
SHORT FOCUSED TASKS			
• **key idea:** that the screen turtle obeys the same language commands as the floor turtle • **technique:** to type commands in immediate mode	♦ Prepare a worksheet with a few simple sequences on it. These could include: – forward 100, right 90, forward 100, left 90, forward 100, right 90; forward 100, left 90, forward 100, right 90, forward 100, left 90; – forward 150, right 90, forward 150, right 90, forward 150, right 90, forward 150, right 90; – right 90, forward 50, left 90, forward 50, left 90, forward 50, right 90, forward 50, right 90, forward 50; – forward 200, right 120, forward 200, right 120, forward 200, right 120. Ask the children to predict what will appear on screen when these instructions are entered and give them a chance to work in pairs at the computer to test their hypotheses. Remind them to send the turtle 'home' before beginning each set of instructions.	• recognise that commands typed in LOGO are in the same language as they have been using with the floor turtle • recognise that the screen turtle reacts with the same movement that is shown by the line it draws	Children will need to think about a starting point and the orientation on the screen. Children will need to know about the correct spacing and spelling of commands. Children may make typing mistakes that result in error messages. They will recognise the frustration in having to repeat all the commands again to achieve their results. The work could be extended to allow pupils to change the numbers and find out what happens.

LEARNING OBJECTIVES CHILDREN SHOULD LEARN	POSSIBLE TEACHING ACTIVITIES	LEARNING OUTCOMES CHILDREN	POINTS TO NOTE
• **key ideas:** that the screen turtle can be given commands to produce a specific shape on screen • that the turtle can be moved before it starts drawing • **techniques:** to write a list of commands to produce a pre-drawn shape • to use pendown and penup to move the turtle	♦ Provide two examples of letters (eg E or M) that can be drawn with the screen turtle using only 45 or 90 degrees; use graph paper ($1cm^2$) to draw the letters. Show the class how to draw the two letters and explain how each square on the graph paper measures 50 screen turtle steps. Demonstrate how to write instructions to produce the two letters on screen. ♦ Ask children to draw the first letter of their name on a piece of graph paper and get them to write the instructions for the screen turtle. When children have completed their sequences produce the example letters, but use penup and pendown to move the turtle to the left of the screen before doing the first letter and then to the right of the screen to do the second letter. ♦ Show the children how to print their work. (N.B. rLogo does not have a PRINT function. The children will be shown how to use the “Print Screen” key and copy the resulting screen dump into MS Paint and print from there after cropping as necessary.) ♦ Divide the children into pairs and ask each pair to create their initials on screen and print the results.	• produce two shapes on screen and learn to move the screen turtle without drawing a line	

LEARNING OBJECTIVES CHILDREN SHOULD LEARN	POSSIBLE TEACHING ACTIVITIES	LEARNING OUTCOMES CHILDREN	POINTS TO NOTE
• **key idea:** that instructions can be repeated • **technique:** to use the repeat command	♦ Prepare a worksheet with a few simple repeat sequences on it. These could include: repeat 4 [forward 100, left 90]; repeat 3 [forward 150, right 120]; repeat 6 [forward 100, right 60]; repeat 360 [forward 1 right 1]; repeat 10 [forward 50, right 36] Discuss with the children their previous experiences with a repeated sequence and demonstrate the instruction: repeat 5 [forward 80, right 108]. Ask the children how many sides they think the shape will have. Type the instruction into the computer and show the children what happens. ♦ Using the prepared worksheet when the instructions are entered ask the children to predict what will appear on screen and give them a chance to work in pairs at the computer to test their hypotheses.	• learn to use the repeat instruction and will predict what will happen	Children will need to be shown how to type in the instructions, for example, where the spaces need to go, which set of brackets to use or how a repeat sequence is put together in the particular version of LOGO being used. The worksheet should reflect the version of LOGO being used in the classroom. The work could be extended to allow pupils to change the numbers and find out what happens.

LEARNING OBJECTIVES CHILDREN SHOULD LEARN	POSSIBLE TEACHING ACTIVITIES	LEARNING OUTCOMES CHILDREN	POINTS TO NOTE
• **key idea:** that groups of instructions can be named • **technique:** to use and change a pre-written procedure	♦ Write the following procedures into the computer and save them: square, equilateral triangle, staircase, pentagon. Give the procedures arbitrary names, such as 'Pooh', 'Tigger', 'Eyore' and 'Piglet'. All these sequences have been used in previous lessons. ♦ Show the children the screen turtle drawing a square, without using the procedure you have written. Then move the turtle using penup and pendown and repeat the square. Explain how it would make things easier if the turtle could learn a word to draw a square. Tell the children that you have taught the turtle four new words and demonstrate the one that draws the square. Show them how they could change the numbers in the procedure to make a bigger square. Divide the class into groups and let them test all four procedures. Ask them to try changing the size of the sides and the steps.	• learn that sequences of instructions can be named and edited	Children should see that the name of a procedure could be anything – they are 'teaching' the computer a new word for the turtle. They should understand that the computer does not know the word 'square', for instance, until the procedure has been written.

• **key idea:** that procedures can call other procedures • **technique:** to write a procedure that uses other procedures to produce a result	Use the procedures from the last task to write a new procedure called 'hum'. Use the square (Pooh) and the triangle (Tigger) and penup and pendown to draw a simple house. You will need to rotate the turtle by 60 degrees before 'putting' the roof on (although this can be avoided if the square is based on: repeat 4 [forward 100, right 90] and the triangle is based on: repeat 3 [forward 150, left 120] i.e. the "turn" in the two procedures are in opposite directions with – in rLogo – there being a right turn to make the square and a left to make the triangle). ♦ . Show the children that every time you type 'hum', the house appears. Divide the children into pairs and ask them to write their own version of 'hum', maybe changing the size of the square and the triangle. When they have done this ask them to use 'hum' to create a number of houses and ask them to print their results.	• learn how to combine procedures to form a new procedure	Children will need to be able to edit their procedures when they make mistakes. Children who find the work difficult may be given a copy of the 'hum' to work from. Children who find this easy could be asked to create 'hums' for different sized houses.

LEARNING OBJECTIVES CHILDREN SHOULD LEARN	POSSIBLE TEACHING ACTIVITIES	LEARNING OUTCOMES CHILDREN	POINTS TO NOTE
INTEGRATED TASK			
• to write repeating procedures to produce a desired outcome	♦ Explain to the class that they will create a number of 'crystal flowers' on screen. Tell them that they will need to write a number of procedures, such as square, rectangle, triangle, pentagon, and that they will combine the shapes into a larger procedure; the larger procedure will allow them to rotate the shapes 360 degrees and produce a flower. An example procedure might be: repeat 36 [square, right 10] which would produce 36 squares with a rotation of 10 degrees in between, producing a flower effect. ♦ Ask children to work in pairs to create their own flowers and get them to print out their work. They could colour in their flowers and produce a garden display for the classroom.	• learn how to write procedures using standard commands • learn to combine procedures to produce a desired outcome	Extension work could include using more than one shape to produce a flower, for example a square and a triangle rotated. Some children may need example 'flowers' to get them started. Further extension could include making a procedure called "plant" to produce a flower on a stalk with a leaf. They might them be able to produce "garden" – a row of plants! Children will need to know that 360 degrees produces a full turn.