Barefoot

Recommended for
ages 7-8

2D Shape Drawing Activity

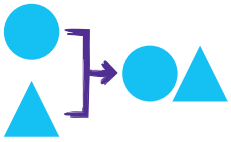
An introduction to debugging algorithms

Activity Duration: **40 minutes**

Principal partners

BT Computing at School

Concepts and approaches covered



Algorithms

Logic

Debugging

Collaborating

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Overview

In this activity, pupils will follow an algorithm to draw pictures constructed from 2D shapes. The algorithms they follow will include errors and pupils will use logical reasoning to detect and correct these.

Pupil objectives

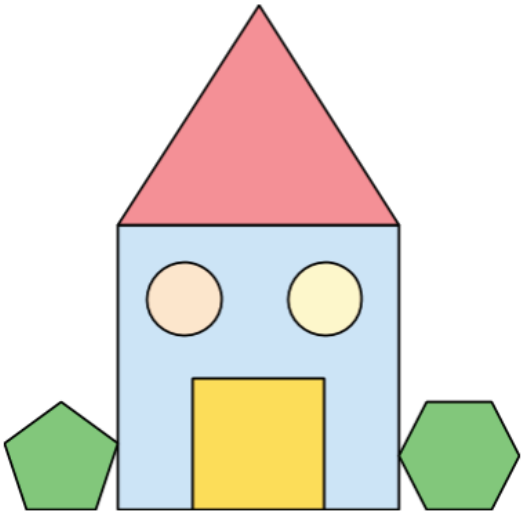
- [x] **I can use logical reasoning to detect and correct errors in an algorithm**

Introduction – whole class (5 mins)

- Write the word **algorithm** on the board and ask the pupils to recap what an algorithm is (an algorithm is a sequence of instructions or a set of rules to get something done) and share their own examples of algorithms, perhaps from previous work
- Explain they will be following algorithms made up of a sequence of instructions. These algorithms will include errors, and their task is to detect and correct the errors in the algorithm. Explain that this process is called **debugging**
- Explain that pupils will be using **logical reasoning** which allows us to us to 'think through' the steps in algorithms to determine their outcome. We can use logical reasoning to identify where errors might be happening and fix them

Introduction – whole class (5 mins)

- Display the 'Algorithm for drawing a house' (slide 3 on the board)

Algorithm	Desired outcome of algorithm
1. Draw a blue square in the centre of your page. 2. Draw an orange equilateral triangle with one edge aligned with the top of the square. 3. Draw two blue triangles inside the square. 4. Draw a yellow square with sides half the length of the first square, inside the first square. 5. Draw a green regular hexagon to the left of the square. The bottom of this shape should be inline with the bottom of the square. 6. Draw a purple regular pentagon to the right of the square.	

- Explain that on the left is an algorithm. This algorithm is made up of a sequence of instructions to create a picture of a house. On the right is how you would like the house to look. However, you suspect there might be some mistakes in the algorithm. The pupils' task is to use logical reasoning to work through this algorithm to detect and correct any errors – to **debug it**
- **Note:** the algorithm includes errors such as incorrect shapes or locations. Some steps of the algorithm are not sufficiently precise to specify where the shapes should be located or their size relative to others. When following through the algorithm, deliberately highlight this lack of precision by drawing huge/tiny shapes in strange locations on your board!
- Explain that to help you detect and correct any errors, you are going to draw out each step of the algorithm
- Read each step of the algorithm and draw this on a separate whiteboard
- After drawing each step, model the following process:
  - Check whether what you have drawn from the algorithm matches the picture
  - If it does then move on to next step; if it doesn't then debug the algorithm
- When debugging the algorithm we want to emphasise the use of logical reasoning to justify the changes we make. Model the process of (write these steps up on a board for pupils to refer to):
  - Identify the difference
  - Think what you need to change
  - Change the algorithm
- At each step, make any corrections by either the text on the IWB presentation using a different colour

Main task (20 mins)

- Give each pupil a copy of the worksheet. Explain that the main task for the lesson will be in two sections
- Firstly, pupils will have 10 minutes to create a simple drawing made from 2D shapes in the right hand part of the table and then write the algorithm for this drawing in the left hand box. Importantly, pupils should purposefully include three mistakes in their algorithm. An example is shown below:

Date:

Algorithm designed by: **Algorithm debugged by:**

Learning objective:
I can use logical reasoning to detect and correct errors in an algorithm.

Write your algorithm for this 2D shape picture in this box. (Remember to include 3 errors in your algorithm)	Draw your 2D shape picture in the box below.
Draw a small orange rectangle at the top of the page. Then add a green kite underneath. Next add a hexagon as a body underneath this. Add two wide blue trapeziums under the hexagon. Add a narrow blue kite to the right top of the hexagon. Add a narrow blue kite to the left top of the hexagon.	

Example of a pupil's 2D shape picture and algorithm with deliberate mistakes.

- Once pupils have completed this, ask pupils to swap sheets with their partner
- Pupils then have 10 mins to use logical reasoning to detect and correct the errors in their partner's algorithm: they will **debug it**. To help them do this, they should use whiteboards or paper to draw out each step. Remind pupils of how you modelled this process and draw their attention to the 'Identify, Think, Change' steps you have written on the board. Pupils should edit the algorithm using a coloured pencil to indicate the changes that they have made

Plenary (5 mins)

- Once pupils have completed the activity, they should feedback to their partner the errors they detected and corrected. For each correction, they should explain:
  - What the error was they identified
  - How they knew it was an error
  - How they have corrected the error
  - How they knew their correction would work
- Their partner should then confirm if they found all the deliberate errors
- Pairs should then also discuss whether their partner changed any errors they made unintentionally and therefore improved their algorithm!

Differentiation

Support:

- Pupils requiring more support may work in a small group with an additional adult. A 2D shape drawing and algorithm (with errors) can be pre-prepared and pupils can work as a group to detect and correct the errors

Stretch & Challenge:

- Challenge pupils to spot if there is a **pattern** in the information that is required in each step of the algorithm. For example, for each step we require information about the shape's size, location, orientation etc

Assessment opportunities

- Informal teacher assessment of progress during main task, class discussions and plenary. Focus on how pupils use logical reasoning to identify and fix errors in the algorithm
- Formal, summative assessment of debugging sheets if required

Teaching notes

Concepts and approaches:

- Pupils write an **algorithm** for their drawing and deliberately include errors in this
- Pupils use **logical reasoning** to identify errors in the algorithm

- As pupils identify an error they change the algorithm. This process is called **debugging**
- In this activity, pupils **collaborate** by working in pairs

Curriculum links

Computing

- KS2: use logical reasoning to detect and correct errors in algorithms

Maths

- Year 3: draw 2D shapes

Resources

- An interactive whiteboard to display the activity presentation (see the download link at the bottom of this webpage)
- A whiteboard to draw the 2D shape house on
- Word file for editing the house algorithm using track changes, or for printing for use under a visualiser (see the download link at the bottom of this webpage)
- Pupils' worksheets (see the download link at the bottom of this webpage)
- Whiteboards and pens for pupils
- Colour pencils for making corrections to partner's algorithms and shading drawings

Taking this further

Pupils could have a go at replicating their drawings in **Scratch** using the pen commands. These can be used to write a program which will trace out a drawing when run. In doing so, pupils can learn how to implement the algorithms they have written as a program using the commands available in Scratch.

Related activities

KS1 Understand what algorithms are activities
KS2 Logical number sequences activity

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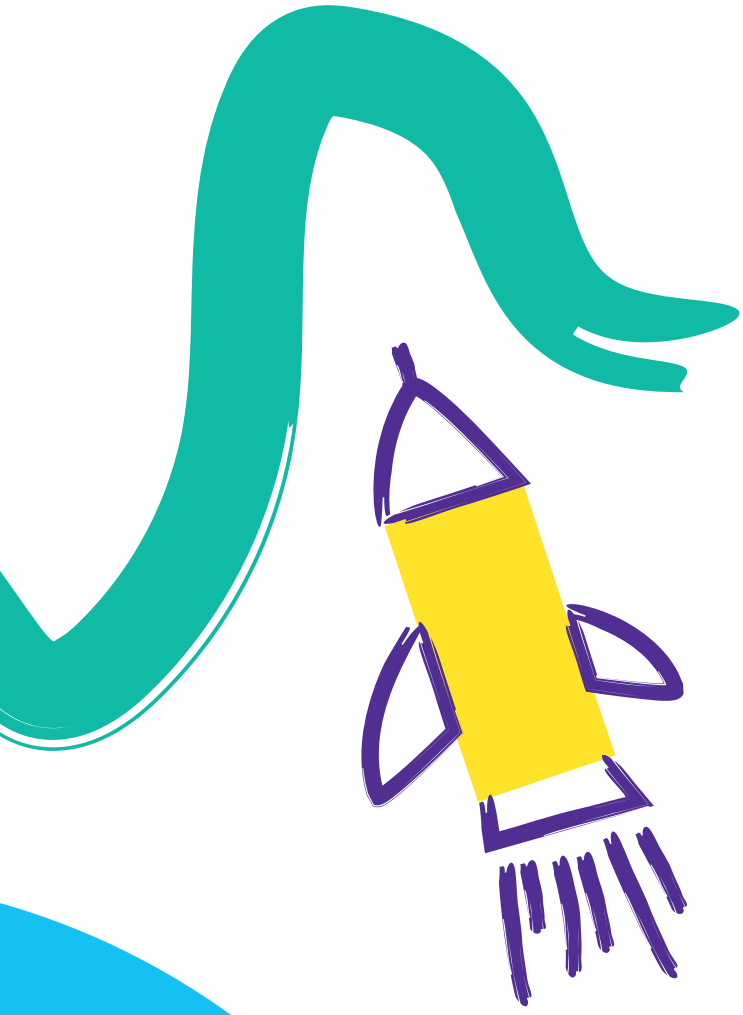

Have you had a great Barefoot workshop, or delivered a fun computer science lesson? Send us your comments and pictures via our social channels to help get more teachers involved!

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Version 1118 Expires Dec 2021