

Teaching Guide.

Let's Doodle: What will you create?

Introduction

This is a computing lesson with a difference. This cross-curricular workshop developed with 3Doodler involves no programming, but covers every strand of the Computational Thinking Framework and allows pupils to accelerate and work towards Key Stage 3 strands in the Programmes of Study. The new Design & Technology Programmes of Study are also partially covered at both Key Stage 2 and Key Stage 3.

Pupils begin the day by constructing simple models with Playdough before manipulating them to cover decomposition and algorithmic thinking in the Computational Thinking Framework. Pupils quickly move onto developing their skills with the 3Doodler and begin by creating 2D models using stencils. Once pupils are comfortable with the use of the pen, they then move onto freehand and putting together 3D models both with and without the use of pre-developed stencils.

There is flexibility in how this workshop can be delivered, according to the nature and ability of the group of pupils. The second half of the day sees pupils developing their own ideas, carrying out algorithmic thinking by designing, testing and evaluating their own stencils before making an object that they have designed. Pupils then evaluate the success of their work before identifying patterns and using generalisation to adapt their stencil and models to create 'similar but different' creations that they can then take home at the end of the day.

Computing Programmes of Study Links

- 1.1. use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and programs
 - 1.2. understand computer networks including the internet; how they can provide multiple services, such as the world wide web; and the opportunities they offer for communication and collaboration
 - 1.3. use search technologies effectively, appreciate how results are selected and ranked, and be discerning in evaluating digital content
 - 1.4. select, use and combine a variety of software (including internet services) on a range of digital devices to design and create a range of programs, systems and content that accomplish given goals, including collecting, analysing, evaluating and presenting data and information
2. Pupils should be taught to:
- 2.1. design, use and evaluate computational abstractions that model the state and behaviour of real-world problems and physical systems
 - 3.7. undertake creative projects that involve selecting, using, and combining multiple applications, preferably across a range of devices, to achieve challenging goals, including collecting and analysing data and meeting the needs of known users
 - 3.8. create, re-use, revise and re-purpose digital artefacts for a given audience, with attention to trustworthiness, design and usability

Progression Pathway bands covered

Write band abbreviation, full name followed by coloured levels/paths i.e.

ALG = Algorithms: Pink, Yellow, Orange, Blue

Reference

PA1	Understands what an algorithm is and is able to express simple linear (non-branching) algorithms symbolically.
PA3	Demonstrates care and precision to avoid errors
YA3	Uses logical reasoning to predict outcomes.
YA4	Detects and corrects errors i.e. debugging, in algorithms.
OA2	Uses diagrams to express solutions.
OA3	Uses logical reasoning to predict outputs, showing an awareness of inputs.
BA1	Shows an awareness of tasks best completed by humans or computers.

BA2	Designs solutions by decomposing a problem and creates a sub-solution for each of these parts.
BA3	Recognises that different solutions exist for the same problem.

IT = Information Technology: Pink, Yellow, Orange, Blue

Reference

PI5	Talks about their work and makes changes to improve it.
YI5	Talks about their work and makes improvements to solutions based on feedback received.
OI1	Collects, organises and presents data and information in digital content.
OI3	Makes appropriate improvements to solutions based on feedback received, and can comment on the success of the solution.

C&N = Communication & Networks: Pink, Yellow, Orange, Blue

Reference

PC1	Obtains content from the world wide web using a web browser.
YC1	Navigates the web and can carry out simple web searches to collect digital content.
OC1	Understands the difference between the internet and internet service e.g. world wide web.
OC2	Shows an awareness of, and can use a range of internet services e.g. VOIP.
BC1	Understands how to effectively use search engines, and knows how search results are selected, including that search engines use 'web crawler programs'.
BC2	Selects, combines and uses internet services.

Computational Thinking Strands

AL – Algorithmic Thinking

Ref. Activity

- | | |
|-----|---|
| A1 | Writing instructions that if followed in a given order (sequences) achieve a desired effect |
| A6 | Grouping and naming a collection of instructions that do a well-defined task to make a new instruction (subroutines, procedures, functions, methods); |
| A13 | Creating algorithmic descriptions of real world processes so as to better understand them (computational modelling); |

AB – Abstraction

Ref. Activity

- | | |
|-----|---|
| Ab2 | Choosing a way to represent artefacts (whether objects, problems, processes or systems) to allow it to be manipulated in useful ways; |
| Ab3 | Hiding the full complexity of an artefact, whether objects, problems, processes, solutions, systems (hiding functional complexity); |
| Ab5 | Identifying relationships between abstractions; |

EV - Evaluation

Ref. Activity

- | | |
|-----|--|
| E1 | Assessing that an algorithm is fit for purpose; |
| E2 | Assessing whether an algorithm does the right thing (functional correctness); |
| E7 | Assessment of whether a system is easy for people to use (usability); |
| E12 | Using rigorous argument to check the usability or performance of an algorithm (analytical evaluation); |
| E13 | Using methods involving observing a system in use to assess its usability or performance (empirical evaluation); |

GE - Generalisatoin

Ref. Activity

- | | |
|----|--|
| G1 | Identifying patterns and commonalities in problems, processes, solutions, or data. |
|----|--|

- G2 Adapting solutions or parts of solutions so they apply to a whole class of similar problems;
- G3 Transferring ideas and solutions from one problem area to another

DE - Decomposition

Ref. Activity

- D1 Breaking down artefacts (whether objects, problems, processes, solutions, systems or abstractions) into constituent parts to make them easier to work with
- D2 Breaking down a problem into simpler but otherwise identical versions of the same problem that can be solved in the same way (Recursive and Divide and conquer strategies)

Learning Outcomes

1. Understand the term modelling and be able to construct simple models using Playdough
2. Be able to reflect on the difference between creating models in playdough and with 3Doodler.
3. Be able to generate and give simple sequential instructions to modify the facial features of an emoticon made in playdough
4. Be able to use a 3Doodler safely
5. Be aware of the different types of plastic and when to use them
6. Be able to draw simple 2D models with 3Doodler
7. Be able to draw 3D doodles with the 3Doodler in freehand
8. Understand that objects can be decomposed into smaller shapes and components
9. Understand how using certain shapes in the construction of a model can make it more robust
10. Be able to examine a 3D object and decompose it into its component parts
11. Be able to use their decomposition of an object to create a stencil
12. Be able to adapt their stencil to create a modified object (i.e. adapt a stencil for a pair of earrings, to produce earrings of a different design)
13. To be able to independently (or in a group) plan and design a new object for construction
14. To be able to accurately draw a stencil for their planned object.
15. To be able to apply logical reasoning to predict whether a stencil will produce the desired outcomes
16. To be able to provide and make use of peer feedback when evaluating the accuracy of a stencil
17. To be able to create a 3Doodled object based upon a stencil that they have created
18. To be able to evaluate the success of their object by comparing it against their intended outcomes.
19. To be able to collaborate with their peers to suggest possible improvements/modifications to their creation
20. To be able to collaborate and communicate with their peers and use digital technology to present their evaluation to the rest of the group to showcase their work.

Session Overview

SESSION 1

Session Content / Activity	Resources Used	Prog. Pathway	Comp. Thinking	Computing POS Link
Welcome, introductions and outline for the day	DSH_WelcomeIntroduction.pptx			
Starter: working with playdough. Ask pupils to recall models they used to make with playdough. Then give them 3 mins to quickly create a model of any object that comes to mind, or possibly their favourite.	Lets Doodle.pptx Playdough	<u>ALG</u> PA1, PA3, YA3, YA4, OA2, OA3, BA1, BA2, BA3	AB2, AB3, AB5	3.1
Slide 3: Ask pupils to reuse the playdough to reproduce one of the emoticons on screen. Then, to introduce the pupils to algorithms ask them to give verbal/written instructions to their partner to modify the facial features on the emoticon in order to change their mood/expression. A lot more work can be done here if appropriate/required. It is possible to begin talking about the precision required in their instructions. Begin a discussion with the pupils about how many of them had to 'change' their instruction in order to get their partner to create the face they wanted.	Lets Doodle.pptx	<u>ALG</u> PA1, PA3, YA3, YA4, OA2, OA3, BA1, BA2, BA3 <u>IT</u> PI5, YI5, OI1, OI3	A1, A6, A13, AB2, AB3, AB5, G1, G2, G3, D1, D2	2.3, 3.1
Through discussing the benefits and limitations (robustness and longevity) of playdough introduce the 3Doodler. Videos have been included as part of the material within this pack which can be used here.	Lets Doodle.pptx 3D sketch with 3Doodler.mp4 Fun with the 3doodler.mp4	<u>IT</u> PI5, YI5, OI1, OI3	A1, A6, A13, AB2, AB3, AB5, G1, G2, G3, D1, D2	2.3, 3.1
Use the video on slide 10 to help pupils set up their 3Doodler pens. Ensure clear warnings are given	Lets Doodle.pptx	<u>IT</u>	A1, A6	2.3, 2.6, 3.1, 3.7

about health and safety and not touching the tip. Have a brief discussion about plastic selection (or you can choose ABS plastic for them). Documents have been provided which outline health and safety and setting up tips that the pupils can reference.	Getting started with the 3Doodler.mp4	PI5, YI5, OI1, OI3		
Demonstrate the 3Doodler and then allow them to practice creating objects using the 3D stencils provided. A number of 3D stencils have been provided with this pack. It is recommended that they are laminated before being given to pupils as that will prevent the plastic from sticking to the page. Vary the stencils according to pupils ability, ensure they start with the simple ones first.	Lets Doodle.pptx	<u>ALG</u>	A1, A6, A13, AB2, AB3, AB5, G1, G2, G3, D1, D2	2.3, 2.6, 3.1, 3.7
	Stencils sub-folder	PA1, PA3, YA3, YA4, OA2, OA3, BA1, BA2, BA3		
Show the video on slide 14. It is worth showing this in segments. For example, show the first minute or so, then part way and then skip to the 4 th min to show how the person creates the 3D tree. This video is very good for highlighting the need for practice. Reinforce to pupils to be 'creative' and not worry about 'getting it wrong'.	Lets Doodle.pptx	<u>ALG</u>	A1, A6, A13, AB2, AB3, AB5, G1, G2, G3, D1, D2	2.3, 2.6, 3.1, 3.7
	Fun with the 3Doodler!.mp4	PA1, PA3, YA3, YA4, OA2, OA3, BA1, BA2, BA3		
Encourage freehand drawing with slide 15 and once pupils have had practice of this; move onto slide 16 to show the video of the convertible car. Once again the entire video does not need to be shown, it is worth selecting key segments here. Ensure that pupils are able to see how the final car is actually built up from a simple frame and developed from there. The designer uses shapes to add stability to the object.	Lets Doodle.pptx	<u>ALG</u>	A1, A6, A13, AB2, AB3, AB5, G1, G2, G3, D1, D2	2.3, 2.6, 3.1, 3.7
	3D Sketch with 3Doodler (convertible car).mp4	PA1, PA3, YA3, YA4, OA2, OA3, BA1, BA2, BA3		
Use slides 17 – 19 to move on from discussing how objects can be built up using key shapes to introduce the pupils to decomposition of an object. For the activity on slide 19, it would be beneficial if actual physical objects could be given to the pupils for them to explore and decompose. However, failing that a document has been	Lets Doodle.pptx	<u>ALG</u>	A1, A6, A13, AB2, AB3, AB5, G1, G2, G3, D1, D2	2.3, 2.6, 3.1, 3.7
	Decomposing Objects.docx	PA1, PA3, YA3, YA4, OA2, OA3, BA1, BA2, BA3		
	Decomposing Objects.pdf			

provided (“Decomposing Objects”) which can be printed and given to the pupils to use instead.

SESSION 2

Session Content / Activity	Resources Used	Prog. Pathway	Comp. Thinking	Computing POS Link
<p>Use the pupils shape outlines from the end of the previous session to introduce them to the idea of stencils. Ask them what key information is missing from their own sketches to enable them to become an accurate stencil/set of instructions for their peers. Use slides 21 and 22 to enable the pupils to spend some time looking at existing stencils and then comparing these with their own sketches.</p> <p>Reinforce the idea of accuracy and precision; discuss with pupils the details on slide 22. If necessary, allow them to use what they have learnt to convert their sketches into accurate stencils.</p>	Lets Doodle.pptx	<p><u>ALG</u></p> <p>PA1, PA3, YA3, YA4, OA2, OA3, BA1, BA2, BA3</p> <p><u>IT</u></p> <p>PI5, YI5, OI1, OI3</p>	A1, A6, A13, AB2, AB3, AB5, G1, G2, G3, D1, D2	2.3, 2.6, 3.1, 3.7
<p>Pupils will now begin to plan and design the construction of their own object. Introduce this activity to pupils using slide 23. Allow pupils to use the internet as a resource to help them generate ideas and plan their object. If required this can be carried out as a group activity, with each member of the group taking responsibility for a different part of this object. (see variations below).</p> <p>This is a good opportunity to discuss with pupils effective search techniques, and briefly how</p>	Lets Doodle.pptx	<p><u>ALG</u></p> <p>PA1, PA3, YA3, YA4, OA2, OA3, BA1, BA2, BA3</p> <p><u>C&N</u></p> <p>PC1, YC1, OC1, OC2, BC1, BC2</p>	A1, A6, A13, AB2, AB3, AB5, G1, G2, G3, D1, D2	2.3, 2.4, 2.5, 2.6, 3.1, 3.7, 3.8

search engines work to enable them to carry out effective searches.

Each pupil draws a stencil for their object (or their part of the object). Once pupils have had the opportunity to draw these, allow them to swop stencils or consult within their groups to identify possible flaws. For example, if separate members of a group are constructing different parts of a whole object, then it will be important to make sure everyone's measurements are accurate. Encourage peer feedback and refinement here.

Lets Doodle.pptx

ALG
 PA1, PA3, YA3, YA4, OA2,
 OA3, BA1, BA2, BA3

A1, A6, A13, AB2,
 AB3, AB5, G1, G2,
 G3, D1, D2

2.3, 2.6, 3.1,
 3.7, 3.8

IT

PI5, YI5, OI1, OI3

Provide time and support to enable each pupil to use the 3Doodler to create their object.

Lets Doodle.pptx

ALG
 PA1, PA3, YA3, YA4, OA2,
 OA3, BA1, BA2, BA3

A1, A6, A13, AB2,
 AB3, AB5, G1, G2,
 G3, D1, D2

2.3, 2.6, 3.1,
 3.7, 3.8

IT

PI5, YI5, OI1, OI3

SESSION 3

Session Content / Activity

Resources Used

Prog. Pathway

Comp. Thinking

Computing
 POS Link

Allow pupils to complete the creation of their objects.

Groups reconvene to compare their final product with their designs and stencils. Encourage them to refine and modify as required. If pupil's outcomes are accurate, then ask them to consider ways their object could be modified. For example, varying designs and styles.

Lets Doodle.pptx

ALG
 PA1, PA3, YA3, YA4, OA2,
 OA3, BA1, BA2, BA3

A1, A6, A13, AB2,
 AB3, AB5, G1, G2,
 G3, D1, D2, E1, E2,
 E7, E12, E13

2.3, 2.6, 3.1,
 3.7, 3.8

IT

PI5, YI5, OI1, OI3

<p>Pupils will end the day with a showcase of their work, where they will present their completed object to the class and discuss/present their group evaluations. Allow pupils the freedom to plan and choose how they will do this for themselves. For example, pupils can do a 'show and tell' style, i.e. show their object and provide verbal feedback. Other groups may wish to create a digital presentation of some kind to support what they are going to do. Allow groups to be creative and independently choose their own method. Encourage them to decide specifically what they will say, and who will be saying it.</p>	<p>Lets Doodle.pptx</p>	<p><u>ALG</u> PA1, PA3, YA3, YA4, OA2, OA3, BA1, BA2, BA3 <u>IT</u> PI5, YI5, OI1, OI3</p>	<p>E1, E2, E7, E12, E13</p>	<p>2.3, 2.6, 3.1, 3.7, 3.8</p>
<p>Pupils showcase their work to the class.</p>	<p>E1, E2, E7, E12, E13</p>			

Files/Resources

Filename	Resource Type	Purpose/Description
e.g. CAD Helpsheet.pdf	Helpsheet	A pdf file providing guidance on how to use the environment

PLEASE NOTE: The activities outlined in this workshop pack are a suggested outline of how the workshop can be delivered. It is envisaged that teachers will adapt the resources and the organisation of them according to the needs of their class.