

# Teaching Guide.

Crazy Graphics: Art in a way you've never seen it before!

## Introduction

This workshop enables pupils to lift the lid of computer graphics and explore how computers deal with the visually rich world around us. During this day pupils cover not only computational concepts, but also enable opportunities for coverage of programmes of study for Art, whilst building in numerical skills and understanding required for the Maths curriculum.

Pupils begin the day by studying the work of famous artists, and how the colour and tones can affect the mood of the painting. They then move onto digitally enhancing and editing images of famous works of art. This is used as an introduction to how computers represent graphics.

Pixels and binary are introduced through the use of spreadsheets; pupils use conditional formatting to change the colour of cells depending on the binary value they input. Using formulae they are then able to estimate potential file size for the graphic they created. Colour depth is introduced by adding an extra bit to each pixel allowing the pupils to add colour to their images. Pupils end the day by undertaking a series of challenges to investigate the difference between bitmap and vector graphics and file types.

# Computing Programmes of Study Links

- 2.6 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
- 3.6 understand how instructions are stored and executed within a computer system; understand how data of various types (including text, sounds and pictures) can be represented and manipulated digitally, in the form of binary digits
- 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

IT = Information Technology: Pink, Yellow, Blue

### Reference

PI1	Uses software under the control of the teacher to create, store and edit digital content using appropriate file and folder names.
YI3	Uses a variety of software to manipulate and present digital content: data and information.
YI4	Shares their experiences of technology in school and beyond the classroom.
BI1	Makes judgements about digital content when evaluating and repurposing it for a given audience.

DDR = Data & Data Representation: Pink, Yellow, Blue, Purple

### Reference

PD1	Recognises that digital content can be represented in many forms
YD2	Appreciates that programs can work with different types of data.
BD1	Performs more complex searches for information e.g. using Boolean and relational operators.
PuD1	Knows that digital computers use binary to represent all data.
PuD2	Understands how bit patterns represent numbers and images.
PuD4	Understands the relationship between binary and file size (uncompressed)

# Computational Thinking Strands

## AB – Abstraction

Ref. Activity

- |     |  |
|-----|--|
| Ab1 | Choosing a way to represent artefacts (whether objects, problems, processes or systems) to allow it to be manipulated in useful ways |
| Ab2 | Hiding the full complexity of an artefact, whether objects, problems, processes, solutions, systems (hiding functional complexity)   |

## EV – Evaluation

Ref. Activity

- |     |  |
|-----|--|
| E1  | Assessing whether an algorithm does the right thing (functional correctness);                          |
| E11 | Using rigorous argument to check the usability or performance of an algorithm (analytical evaluation); |

## GE – Generalisation

Ref. Activity

- |    |   |
|----|---|
| G1 | Adapting solutions or parts of solutions so they apply to a whole class of similar problems |
| G2 | Transferring ideas and solutions from one problem area to another                           |

# Learning Outcomes

1. Understand that artefacts such as paintings can be digitised
2. Understand, that digital graphics can be easily edited
3. Understand the difference between editing a digital image and a 'real' painting
4. To effectively use a search engine to find an image of a famous painting
5. To be able to import an existing image into a graphics package
6. To be able to adjust the colour settings and options, such as colour balance, brightness, saturation for an existing image.
7. To be able to apply filters within a graphics package to an existing image
8. To be able to 'experiment'/'explore' a range of features available within a graphics package to see the effect of it on an image
9. To be able to share the results of their 'experimentation' with their peers
10. To be able to export an image as a .jpeg of varying qualities
11. Understand the concept of 'resolution' in the context of graphics and pixels
12. Understand that a lower resolution results in a less sharper/clearer image, but that this also reduces its file size
13. Understand that images are made up of pixels.
14. Understand how bits are allocated to pixels and how this determines file size.
15. Understand that the more bits dedicated per pixel, the wider the range of colours that can be represented
16. Be able to change the row/column height/width settings in a spreadsheet
17. Be able to use and customise conditional formatting within a spreadsheet, using multiple conditions
18. Be able to use binary representation to create black and white pixelated graphics within a spreadsheet
19. Be able to use binary representation to create a four colour (using 2 bits) pixelated graphic in a spreadsheet
20. Understand that images are represented in binary, and that this data is used to create the image
21. Understand that binary is represented by using 1's and 0's
22. Understand that 8bits equal 1 byte, and 1024 bytes equal 1 kilobyte and so on
23. Understand the relationship between bits and pixels in a graphic to be able to calculate file size
24. Understand the difference between bitmap and vector graphics
25. Understand the rudimentary concept of compression by converting a single image into .bmp and .jpeg format



26. Be able to work in a group to summarise their learning into 10 key points and then share this with their peers.

# Session Overview

## SESSION 1

Session Content / Activity	Resources Used	Prog. Pathway	Comp. Thinking	Computing POS Link
Welcome and settle the class. Introduction to procedures and schedule for the day	DSH_WelcomeIntroduction.pptx			
First starter activity – have you ever visited an art gallery? This is a think/pair/share activity enabling pupils to discuss or share their experiences. This may be a useful opportunity to raise the topic of any artists that they have been studying in their art lessons at primary school.	Crazy Graphics.pptx	<u>IT</u> Y14	Ab1, Ab2, G1, G2	2.6, 3.8
Second starter activity – examine the mood of the paintings. Flick through slides 3 – 11 asking pupils how they feel about each painting. Does the second set of images differ from the first in the ‘mood’ that they portray? These images may be replaced with ones that are more relevant to the pupil’s current context of study in their art lessons.	Crazy Graphics.pptx	<u>IT</u> P11, Y13, Y14, B11	Ab1, Ab2, G1, G2	2.6, 3.8
Slide 12 – how were we able to get the same image look so completely different? Another think/pair/share activity. Encourage and prompt pupils to begin to consider aspects and benefits of digital graphics. More able pupils may begin to suggest binary, pixels etc. within their answers. Build on this if they do. Move onto slides 14 and 15 to discuss the differences between ‘real’ and digital paintings, with potential benefits of each.	Crazy Graphics.pptx	<u>IT</u> P11, Y13, Y14, B11	Ab1, Ab2, G1, G2	2.6, 3.8
Slide 16 – find a famous painting. This is a good opportunity to work with students to suggest and establish good search criteria. Work with pupils to	Crazy Graphics.pptx	<u>IT</u>	Ab1, Ab2, G1, G2	2.6, 3.8

<p>refine their search criteria to get a good set of results; consider Boolean criteria such as AND/OR. Perhaps finding the painting of a known artist. Or a particular subject by a range of artists.</p>		<p>PI1, YI3, YI4, BI1</p>		
<p>Slides 17 – 20: Editing the image</p> <p>This is a good opportunity to promote independent experimentation and creativity. Allow pupils to ‘explore’ the various features and see what changes they can make to their graphics. Encourage them to consider exactly what each feature has done to their image (i.e. darken image, or remove the blues from the image) and then to explain and share this with their partner/peers. Exactly what editing is done is not important, the key learning here is the fact that images can <i>be so easily changed</i>.</p> <p>The screenshots in the accompanying PowerPoint slides are taken from GIMP (free to download from <a href="http://www.gimp.org/">http://www.gimp.org/</a>). However, the same activities can be carried out with whatever graphics package that the school has available.</p>	<p>Crazy Graphics.pptx</p>	<p>IT</p> <p>PI1, YI3, YI4, BI1</p>	<p>Ab1, Ab2, G1, G2</p>	<p>2.6, 3.8</p>

## SESSION 2

Session Content / Activity	Resources Used	Prog. Pathway	Comp. Thinking	Computing POS Link
<p>Slide 21 – 23: trying something different. Exporting to .jpeg to reduce quality. The process for doing this may vary according to the graphics package that you use. However, the key thing here is to ask pupils to save/export their image (preferably a photograph of some type; this may involve another search, or use the samples in the folder) into different jpeg qualities. Each one will be saved with a different resolution. It is possible to adjust the resolution without exporting the image; however, the students may find it useful to have the various resolutions saved for further reference later on.</p> <p>The key learning here is to enable pupils to see the effect of changing the resolution on the quality of the image. Lower quality/resolutions will result in smaller file sizes and more pixelated graphics when zoomed in. One way of delivering this could be simply ask pupils to save/convert to different resolutions without telling them what the effects are. Let them discover the outcomes for themselves and then feedback in groups or to the class.</p>	Crazy Graphics.pptx	<u>IT</u> PI1, YI3, YI4, BI1  <u>DDR</u> PD1, YD2, BD1, PUD1, PUD2, PUD4	Ab1, Ab2, G1, G2	2.6, 3.6, 3.8
<p>Use slides 24 – 26 along with class discussion to explain what the pupils have observed. Explain the concept of resolution, pixels and the relationship between them. You may wish to leave the discussion of binary until they have carried out the next activity</p>	Crazy Graphics.pptx	<u>DDR</u> PD1, YD2, BD1, PUD1, PUD2, PUD4		2.6, 3.6, 3.8
<p>Use slides 27 – 29 to explain the next activity. Pupils set up a spreadsheet, and enter a 1 to format the cell as black. Encourage them to add '0' to leave it blank. Or</p>	Crazy Graphics.pptx	<u>IT</u> PI1, YI3, YI4, BI1	Ab1, Ab2, G1, G2, E1, E11	2.6, 3.6, 3.8



<p>add conditional formatting to turn the text white. A sample spreadsheet has been included. Encourage pupils to adopt the challenge on slide 29. Electronic communications to help the pupils share their 'instructions' or data can be used here.</p>	<p>Pixelated.xls</p>	<p><u>DDR</u> PD1, YD2, BD1, PUD1, PUD2, PUD4</p>		
<p>Use slides 30 – 37 to explain the concept of binary. Explain that this is what the 1's and 0's are, and that this is how computers represent all data internally. When an image is transferred from one computer to another, then it is a set of 1's and 0's that is effectively being transferred (similar to the activity they just carried out with their peers).</p> <p>Slide 37 – encourage them to work out the file size for their own image (i.e. rather than manually count the cells, introduce the <code>=count(xx:xx)</code> formula in the spreadsheet)</p>	<p>Crazy Graphics.pptx Pixelated.xls</p>	<p><u>IT</u> PI1, YI3, YI4, BI1  <u>DDR</u> PD1, YD2, BD1, PUD1, PUD2, PUD4</p>	<p>Ab1, Ab2, G1, G2</p>	<p>2.6, 3.6, 3.8</p>
<p>Slide 38 – how about colour? Pupils should revisit their spreadsheet, and remembering that a computer will only understand binary, modify their spreadsheet to include colour in their image. Encourage pupils to share their solutions with their peers/class. Some pupils may benefit from this being a paired/group exploration.</p>	<p>Crazy Graphics.pptx</p>	<p><u>IT</u> PI1, YI3, YI4, BI1  <u>DDR</u> PD1, YD2, BD1, PUD1, PUD2, PUD4</p>	<p>Ab1, Ab2, G1, G2, E1, E11</p>	<p>2.6, 3.6, 3.8</p>

## SESSION 3

Session Content / Activity	Resources Used	Prog. Pathway	Comp. Thinking	Computing POS Link
Discuss the results of the exploration from the previous session. Introduce the concept of colour. The more bits dedicated per pixel, the greater the range of colour that can be represented.	Crazy Graphics.pptx Pikachu.xls	<u>DDR</u> PD1, YD2, BD1, PUD1, PUD2, PUD4		2.6, 3.6, 3.8
Slide 42 – pupils now adapt their spreadsheet to incorporate 4 colours as suggested. They create an image of their choosing and then find a way to send the data to their friend. Can their friend accurately recreate their image? Pupils should participate in paired discussion to evaluate the effectiveness of their work.	Crazy Graphics.pptx Pikachu.xls	<u>IT</u> PI1, YI3, YI4, BI1  <u>DDR</u> PD1, YD2, BD1, PUD1, PUD2, PUD4	Ab1, Ab2, G1, G2, E1, E11	2.6, 3.6, 3.8
Use slides 43 – 46 to move the discussion onto ‘true colour’	Crazy Graphics.pptx	<u>DDR</u> PD1, YD2, BD1, PUD1, PUD2, PUD4		2.6, 3.6, 3.8
Slides 47 – 51 – the difference between vector and bitmap. If there is time, allow pupils to explore the vector graphics tool within the graphics package (or edit clipart).  A good activity to highlight the differences between the two is:  Ask pupils to create a very simple small graphic/doodle in paint and to then to insert this into a Word or PowerPoint document. They should then add a typical clipart image, or insert/edit an object from the ‘shapes’ option. With both images on the same page, pupils should then resize and significantly enlarge both images.	Crazy Graphics.pptx	<u>IT</u> PI1, YI3, BI1  <u>DDR</u> PD1, YD2, BD1, PUD1, PUD2, PUD4	Ab1, Ab2, G1, G2	2.6, 3.6, 3.8

The bitmap graphic will become pixelated, whilst the vector graphic will remain clear.

Slide 52 & 53 – File size challenge. Pupils should revisit their spreadsheet and using the formulae introduced earlier in the day aim to accurately calculate an estimated file size for their coloured graphic.

Crazy Graphics.pptx

IT

Ab1, Ab2, G1, G2

2.6, 3.6, 3.8

PI1, YI3, YI4, BI1

DDR

PD1, YD2, BD1, PUD1,  
PUD2, PUD4

Slide 54 & 55 – File type challenge. Pupils have worked with both file types during the day. However, what's the difference? The answer? The .jpeg is actually a compressed bitmap, so it has a smaller file size because it stores the image data more effectively. Great amounts of detail are not needed here. Encourage pupils to revisit their existing images, or export new ones. If they are struggling to discover the difference, give them hints directing them to judge differences in the file explorer.

Crazy Graphics.pptx

IT

Ab1, Ab2, G1, G2

2.6, 3.6, 3.8

PI1, YI3, YI4, BI1

DDR

PD1, YD2, BD1, PUD1,  
PUD2, PUD4

Slide 56 – Final summary. A lot of key information will have been delivered to the pupils at the end of the session. This is a good opportunity for an unplugged summary. Give pupils large sheets of paper (A3) and in their pairs/groups encourage them to summarise what they've learnt that day into 10 key points. These could be illustrated as diagrams or written as text in bullet points.

Crazy Graphics.pptx

IT

Ab1, Ab2, G1,  
G2, E1, E11

2.6, 3.6, 3.8

PI1, YI3, YI4, BI1

Large blank paper

DDR

PD1, YD2, BD1, PUD1,  
PUD2, PUD4

Once pupils have completed their own summary, encourage them to circulate around the room to view each other's summaries. Perhaps making comments/additions where they have felt other groups have left out key information? They should then return to their own table to see what's been left by the others. An alternative would be to ask pupils to present/display their summary sheets to the class.

The summary sheets can be taken back to the primary school and used as a basis for a design for a poster or other such work.

# Files/Resources

Filename	Resource Type	Purpose/Description
DSH_WelcomeIntroduction	PowerPoint	Introductory schedule for the day
Crazy Graphics.ppt	PowerPoint	Main teaching PowerPoint resource for the day
Pikachu.xls	Spreadsheet	Sample resource
Pixelated.xls	Spreadsheet	Sample resource
Image_representation_CSUnplugged	PDF	A PDF outlining the CS Unplugged resource for teaching graphical representation and compression
Modified	Sub-folder	Containing modified images
FloatingLogo.xcf	GIMP File	Editable file for the GIMP format
Claude-monet-san-giorgio	Image	Sample image
fallingWater-lloydWright	Image	Sample image
lloydsBuilding	Image	Sample image
Monalisa1	Image	Sample image
Monalisa2	Image	Sample image
Monet1	Image	Sample image
Monet2	Image	Sample image
Monet-pond	Image	Sample image
Monet-pond2	Image	Sample image
Shard	Image	Sample image
starryNight	Image	Sample image
stPauls-christopherwren	Image	Sample image
vanGogh-resized	Image	Sample image

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.