DIGITAL SCHOOLHOUSE together with NINTENDO SWITCH

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Teaching Guide.

AI unplugged

Introduction

Designed especially for the Hour of AI, this hour long lesson asks and answers the question 'How does generative AI work'. Through several unplugged activities, students learn how generative AI works by generating content based on a users prompt and how it learns by analysing training data. The lesson is completely unplugged, meaning it does not require the use of any digital technology, and is an ideal introduction to how AI works. If students are interested in learning more about AI, the iRobot or Part Baked Games: Knockout City Edition workshops are an ideal follow on from this lesson.

This lesson is designed for students aged 9+ (although it could be adapted for younger children).

ukie edu Electronic Arts CLASSVR XBOX

Contents

Learning Outcomes

1. Know that generative AI generates original content based on a prompt
2. Know that generative AI uses training data to learn

Files/Resources

U = Unplugged activity, B = Beginner activity, I = Intermediate activity, A = Advanced activity

Filename	Resource Type	Purpose/Description	Activity No
DSH-teaching-presentation-AI-unplugged	Teacher presentation	Presentation for teaching the AI unplugged Hour of AI lesson	All activities
DSH-worksheets-AI-unplugged	Student worksheets	Required for completing the collecting cats activity	3
Photocopier transparency sheets, plastic document wallets, or transparent windows from packaging	Activity resource	Required for the creating circles activity	2
Whiteboard pens	Activity resource	Required for the creating circles activity	2
Optional: OHP or visualiser	Activity resource	Required for the creating circles activity	2
Pen / pencil	Activity resource	Required for all activities	All activities

Plain or scrap paper	Activity resource	Required for all activities	All activities

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.

Lesson Overview

If you have access to an OHP or visualiser, set this up prior to the lesson.

Activity No	Session Content / Activity	Resources Used
	Introduce the learning objectives for the lesson to your students and then read the class the AI definition slide. Explain to your students that they will be learning about one type of AI, generative AI, in this lesson.	DSH-teaching-presentation-AI-unplugged – slides 1 – 3
	Move onto slide 4 and read IBM's definition of generative AI. Ask your students if they have used any of the generative AI tools given as examples. Allow time for students to share their use of generative AI.	DSH-teaching-presentation-AI-unplugged – slide 4
	Show slide 5 and ask students to tell you what they think generative AI does based on their own use of gen AI tools. Read slide 6 to your class to round up your students thoughts and provide a definitive answer to the previous question.	DSH-teaching-presentation-AI-unplugged – slides 5 – 6

1	Hand out plain / scrap paper and pens/ pencils. Show slide 7 and direct your students to take on the role of a generative AI and follow the prompt to 'create a line drawing of a bird wearing a top hat'. Give some time for your students to carry out the activity. Show slide 8 and explain that this is ChatGPT's response to the prompt. Then ask for volunteers to share their response. Compare your students responses to the one provided by ChatGPT – highlight similarities and differences.	DSH-teaching-presentation-AI-unplugged – slides 7 – 8 Plain / scrap paper Pens or pencils
	Show slide 9 and ask your students how they think generative AI knows what to generate. Give some time for discussion. You might like to ask your students how they knew what to draw in the previous task as a point of comparison between themselves and generative AI. Read slide 10 to provide a definitive answer to the previous question.	DSH-teaching-presentation-AI-unplugged – slides 9 – 10
2		DSH-teaching-presentation-AI-unplugged – slides 11 – 13

	Hand out photocopier transparency sheets / plastic document wallets / plastic transparent packaging windows and whiteboard pens. Tell your students that you will be taking on the role of a gen AI. Show slide 11 and explain that they are going to create a data model for a circle so you, as the gen AI, can respond to the prompt shown on the slide. Show slide 12 and direct your students to draw a circle on their transparent sheet. Collect the sheets in and, if you have access to one, show these on your OHP or under your visualiser. To do this, pile up the transparent sheets, lining up the circles on top of each other. If you have examples of circles that are a lot bigger or smaller than others, omit these 'outliers' from the pile that you are creating and displaying on the OHP or under the visualiser. If you do not have access to an OHP or visualiser do this on a table with a piece of white paper at the bottom and gather your students around you. Explain that you are building up a model of a circle where all the circles lay on top of each other. This model will be used by the gen AI to draw a circle each time it needs to – it will ignore the 'fuzzy' parts where there is only one line and will learn what a circle's shape is based on where there are multiple lines directly on top each other. Draw a circle on your board, making sure it matches the shape of the one created by your data model and explain that this is the circle	Photocopier transparency sheets / plastic document wallets / plastic transparent packaging windows Whiteboard pens

	that the gen AI would draw based on the circle data model that the class have created. Move onto slide 13 and show your students ChatGPT's response to the same prompt.	
	Show slide 14 and ask your students to help you to debrief the activity. Read the statement at the bottom of the slide and ask your students to explain how they trained the gen AI to draw a circle. As they explain the process they went through, show the three pieces of animated text on the slide: ...collected training data ...created a data model for a circle ...used this model as the basis for generating a drawing of a circle	DSH-teaching-presentation-AI-unplugged – slide 14
3	Move onto slide 15, tell your students that the data model they created for a circle is very simple and that the new prompt on slide 15 would require a more complex data model. Hand out the collecting cats worksheet.	DSH-teaching-presentation-AI-unplugged – slides 15 – 18 DSH-worksheets-AI-unplugged – page 2 Pens / pencils

Show slide 16 and explain that they will use the collecting cats worksheet to help to build a more complex data model so the gen AI can create a line drawing of a cat. Direct your students to fill in the worksheet with keywords while thinking about the 'create a line drawing of a cat' prompt.

If students are struggling to fill in the sheet, you might find it useful to use these question prompts for each section:

Body structure

How many legs does a cat have, and how are they positioned?

What is the general body shape (slender, stocky, flexible)?

What shape is the head (round, triangular)?

What shape are the ears (pointed, upright, rounded, tufted)?

How long is the tail, and how is it held (straight, curled, fluffy)?

Facial features

How large are the eyes compared to the head?

What shapes can cat eyes take (round, almond)?

What colours can cat eyes be (green, yellow, blue, multi-coloured)?

What is the shape of the nose?

Where are whiskers placed, and how long are they?

What is the shape of the mouth and chin?

Fur and patterns

What fur textures exist (short, medium, long, hairless)?

What coat colours appear (black, white, grey, ginger, cream, multicoloured)?

What patterns exist (tabby stripes, solid, calico, tuxedo, spotted)?

How does fur length affect body outline?

Poses and movement

How does a cat look when sitting, lying, standing, stretching, or walking?

What are common playful postures (pouncing, crouching, curled up)?

If you are running this lesson with younger students, this activity can be adapted to have students draw on their sheet rather than write keywords.

Give your students some time to complete the worksheet.

Draw your class back together. Show slide 17 and explain that to build a more complex data model, gen AI uses probability (estimating or calculating the chance of a particular outcome occurring). Tell your class that to do this

	they will work out which of their keywords (or pictures if working with younger students) are the most probable way of describing a cat. Working though each section of the worksheet, ask your students to share the keywords they have written down and fill in the table on slide 17 with their keywords. As a new keyword is added to the slide, ask your students to put their hands up if they have used the same keyword on their worksheet. Count the number of students that have written the same keyword and add this number next to where you have written the keyword on slide 17. Still on slide 17, choose the top 3 keywords in each section and circle them. Tell your students that these words will form the data model for responding to the cat prompt. Draw a picture of a cat on your whiteboard based on the circled keywords and then show slide 18 to illustrate how ChatGPT has responded to the same prompt. Spend some time discussing whether your students think the model that they created matches the one that would have been used by ChatGPT to generate its output. Encourage your students to think about how and why it might be different.	
	Show slide 19 and ask your students to help you to debrief the activity. Read the statement at the bottom of the slide	DSH-teaching-presentation-AI-unplugged – slide 19

	and ask your students to explain how they trained the gen AI to draw a cat. As they explain the process they went through, show the three pieces of animated text on the slide: ...collected training data ...created a data model for a cat based on probability ...used this data model to generate an output based on the cat prompt	
	Read slide 20 to round up what your students have learnt about generative AI in this lesson. Show slide 21 to recap the learning objectives from the beginning of the lesson.	DSH-teaching-presentation-AI-unplugged – slides 20 - 22

Digital Schoolhouse Progression Matrix

The Digital Schoolhouse progression matrix is a simplified mechanism for measuring pupil progress. It stretches from base level understanding at the beginner level to introducing GCSE content at the advanced level. The shaded statements reflect skills and concepts covered in the workshop, these have been cross referenced to specific activities in order to reflect both their level of complexity and provide a guideline on which to measure progress.

Algorithms

	Beginner	Activity No	Intermediate	Activity No	Advanced	Activity No
Understanding	Understands what an algorithm is		Understands that algorithms are not the same as programming		Understands that different algorithms exist for the same problem	
Writing	Represents algorithms using graphical notation such as pictures		Represents algorithms using structured notation such as flowcharts		Represents algorithms using pseudocode	
Limitations	Understands that computers need precise instructions	3, 4	Can identify tasks best completed by humans or computers		Understands that some problems cannot be solved computationally	
Planning	Can identify the steps needed to solve a problem	2, 3	Can identify the programming constructs needed to solve a problem (pattern recognition)		Can identify the modules needed to solve a problem e.g. top down design	
Tracing	Uses logical reasoning to predict outputs and show an awareness of inputs	1, 2	Uses logical reasoning to explain how an algorithm works		Evaluates the effectiveness of algorithms and models for similar problems	3
Designing	Designs solutions (algorithms) that use sequence, selection i.e. if, then and else and iteration		Designs solutions by decomposing a problem and creating a sub-solution for each of these parts		Designs a solution to a problem that uses generalization to create objects and classes (OOP)	

Programming

	Beginner	Activity No	Intermediate	Activity No	Advanced	Activity No
Writing	Can create a simple program in an environment that does not rely on text e.g. programmable robots etc		Has practical experience of a high-level textual language, including use of standard libraries		Has experience of designing programs that include a graphical user interface	
Program flow	Understands that programs execute by following precise instructions		Understands how modular programs work using sub-routines		Appreciates the effect of the scope of a variable e.g. a local variable can't be accessed from outside its function unless passed as a parameter	
Selection	Uses selection statements in programs, including an if, then and else statement		Understands the difference between, and appropriately uses if and if, then and else Statements		Uses nested selection statements	
Iteration	Uses loops, within programs		Understands the difference between, and uses 'while', 'until' and 'for' loops		Uses nested iteration and recursion	
Debugging	Detects and corrects simple semantic errors i.e. debugging, in programs		Detects and corrects syntactical errors		Applies a modular approach to error detection and correction	
Program design	Creates programs that implement algorithms to achieve given goals		Can design a program based on an algorithm		Designs modular programs using a range of methodologies e.g. RAD, waterfall	
Data types and structures	Declares and assigns variables		Selects appropriate data types		Understands and uses one and two dimensional data structures	
Operators	Uses arithmetic operators		Uses a range of operators and expressions e.g. Boolean		Understands and uses negation with operators e.g. not equal to	

Data

	Beginner	Activity No	Intermediate	Activity No	Advanced	Activity No
Representation	Recognises that digital content can be represented in many forms	2, 3	Understands how bit patterns represent different forms of data e.g. character sets, sound, numbers and images		Understands how the same bit patterns can be used for different forms of data e.g. metadata	
Transfer	Knows that data can be transferred from one computer to another		Knows that computers transfer data in binary		Understands and can explain the need for data compression, and performs simple compression methods	
Types	Recognises different types of data: text, number		Defines data types: string, integer, real and Boolean		Understands how different data types can be used within data structures e.g. arrays must be made up of the same data type whereas lists can use several	
Binary	Can carry out simple binary to decimal conversions		Performs operations using bit patterns e.g. binary addition, conversion between binary and hexadecimal, binary subtraction etc		Understands the relationship between binary and electrical circuits, including Boolean logic	
File Size	Understands that data takes up space on a computer		Understands the relationship between binary and file size (uncompressed)		Knows the relationship between data representation and data quality e.g. resolution and colour depth etc, including the effect on file size	
Data and Information	Understands the difference between data and information		Recognises that poor-quality data leads to unreliable results, and inaccurate conclusions		Understand the mechanisms used to cleanse data e.g. validation, range checks etc	
Searching	Can sort data, use filters and perform single criteria searches for information	3	Queries data on one table using a typical query language, including more complex searches for information e.g. using Boolean and relational operators		Queries data on multiple tables using a typical query language	
Structure	Recognises that data can be structured in tables to make it useful	3	Understands that all the data about a person or thing can be stored as a record		Knows what a relational database is, and understands the benefits of storing data in multiple tables	

Hardware and Software

	Beginner	Activity No	Intermediate	Activity No	Advanced	Activity No
Processing	Understands that computers have no intelligence and that computers can do nothing unless a program is executed		Knows that programs are executed by the processor i.e. the CPU		Understand that processors can work in different ways e.g. multitasking, scheduling	
Software	Recognises that all software executed on digital devices is programmed		Knows that there is a range of operating systems and application software for the same hardware		Understands the concept of proprietary and open-source software including how this relates to licencing	
Devices	Recognises that a range of digital devices can be considered a computer		Understands why and when computers are used		Understands how technology has developed e.g. Moore's Law	
Components	Recognises and can use a range of input and output devices	1	Recognises and understands the function of the main internal parts of basic computer architecture		Knows that processors have instruction sets and that these relate to low-level instructions carried out in the main internal parts of a computer	
Operating systems	Understands that the operating system is software that specifies the function of a computing device		Understands the main functions of the operating system		Understands that there are different types of operating system and some of there common uses e.g. real time on auto pilot systems on a plane	
Data transfer	Knows that data is transferred around a computer system using input devices, sensors and application software		Knows that data can be transferred between computer systems using physical, wireless and mobile networks		Knows how data can be transferred between computer systems e.g. packet and circuit switching	
Architecture	Understands the difference between hardware and software		Understands how hardware uses software to execute instructions e.g. the fetch-execute cycle		Understands computer architecture in relation to the fetch execute cycle, including how data is stored in memory	

Communication

	Beginner	Activity No	Intermediate	Activity No	Advanced	Activity No
WWW	Accesses content using a web browser		Understands that web pages are created using HTML and CSS		Understands how dynamic web pages use the client-server model and that web servers process and store data entered by users	
Online safety	Understands why and how to keep personal information private and knows what to do when concerned about something online		Has an awareness of a range of online harms and demonstrates responsible use of technologies and online services in order to protect themselves		Understands how and why online threats are carried out and how to protect against them	
Search engines	Navigates the web and can carry out simple web searches to collect digital content		Understands how to effectively use search engines e.g. Boolean, advanced search functions etc		Knows how search results are selected and ranked, including that search engines use 'web crawler programs'	
Networks	Understands the difference between the internet and internet service e.g. world wide web		Understands data is transmitted between digital computers over networks, including different topologies e.g. ring, star, mesh		Knows the names and purposes of network components and protocols	
Internet services	Shows an awareness of, and can use a range of internet services e.g. email	1	Selects, combines and uses internet services		Uses internet services to work collaboratively	

Digital skills

	Beginner	Activity No	Intermediate	Activity No	Advanced	Activity No
Invention	Uses software under the control of the teacher to create, store and edit digital content		Uses and selects internet services, digital devices and application software to create, store and edit digital content		Evaluates the appropriateness of digital devices, internet services and application software to achieve given goals	
Audience	Understands what an audience is		Recognises the audience when designing and creating digital content		Undertakes creative projects that are tailored to meet the needs of an audience	
Purpose	Can talk about how they use computers	1	Can talk about how other people use computers	1	Can discuss the issues around how other people might use computers e.g. Data Protection Act, Computer Misuse Act, Copyright etc	
Evaluation	Can comment on the success of their solution	2, 3	Designs and uses criteria to critically evaluate the quality of solutions		Documents user feedback, the improvements identified, and the refinements made to the solution	
Content	Can gather content	2, 3	Makes judgements about content when evaluating and repurposing it for a given audience	2, 3	Evaluates the trustworthiness of content, considers the usability of visual design features and properties of media when designing and creating digital artefacts	

Computing Programmes of Study Links

1.5 recognise common uses of information technology beyond school

2.3 use logical reasoning to explain how some simple algorithms work and to detect and correct errors in algorithms and programs
2.5 use search technologies effectively, appreciate how results are selected and ranked, and be discerning in evaluating digital content
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

3.5 design, use and evaluate computational abstractions that model the state and behaviour of real-world problems and physical systems
3.6 understand several key algorithms that reflect computational thinking [for example, ones for sorting and searching]; use logical reasoning to compare the utility of alternative algorithms for the same problem
3.11 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

4.1 develop their capability, creativity and knowledge in computer science, digital media and information technology

4.2 develop and apply their analytic, problem-solving, design, and computational thinking skills

Computational Thinking Strands

AL – Algorithmic Thinking

Ref.	Activity
A1	Formulating instructions to achieve a desired effect

DE – Decomposition

Ref.	Activity
D1	Breaking down artefacts into constituent parts to make them easier to work with
D2	Breaking down a problem into simpler versions of the same problem that can be solved in the same way (recursive and divide and conquer strategies)

GE – Generalisation

Ref.	Activity
G1	Identifying patterns and commonalities in artefacts
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

AB – Abstraction

Ref.	Activity
Ab1	Reducing complexity by removing unnecessary detail
Ab2	Choosing a way to represent an artefact, to allow it to be manipulated in useful ways
Ab3	Hiding the full complexity of an artefact (hiding functional complexity)
Ab4	Hiding complexity in data, for example by using data structures
Ab5	Identifying relationships between abstractions
Ab6	Filtering information when developing solutions

EV – Evaluation

Ref.	Activity
E1	Assessing that an artefact is fit for purpose
E2	Assessing whether an artefact does the right thing (functional correctness)