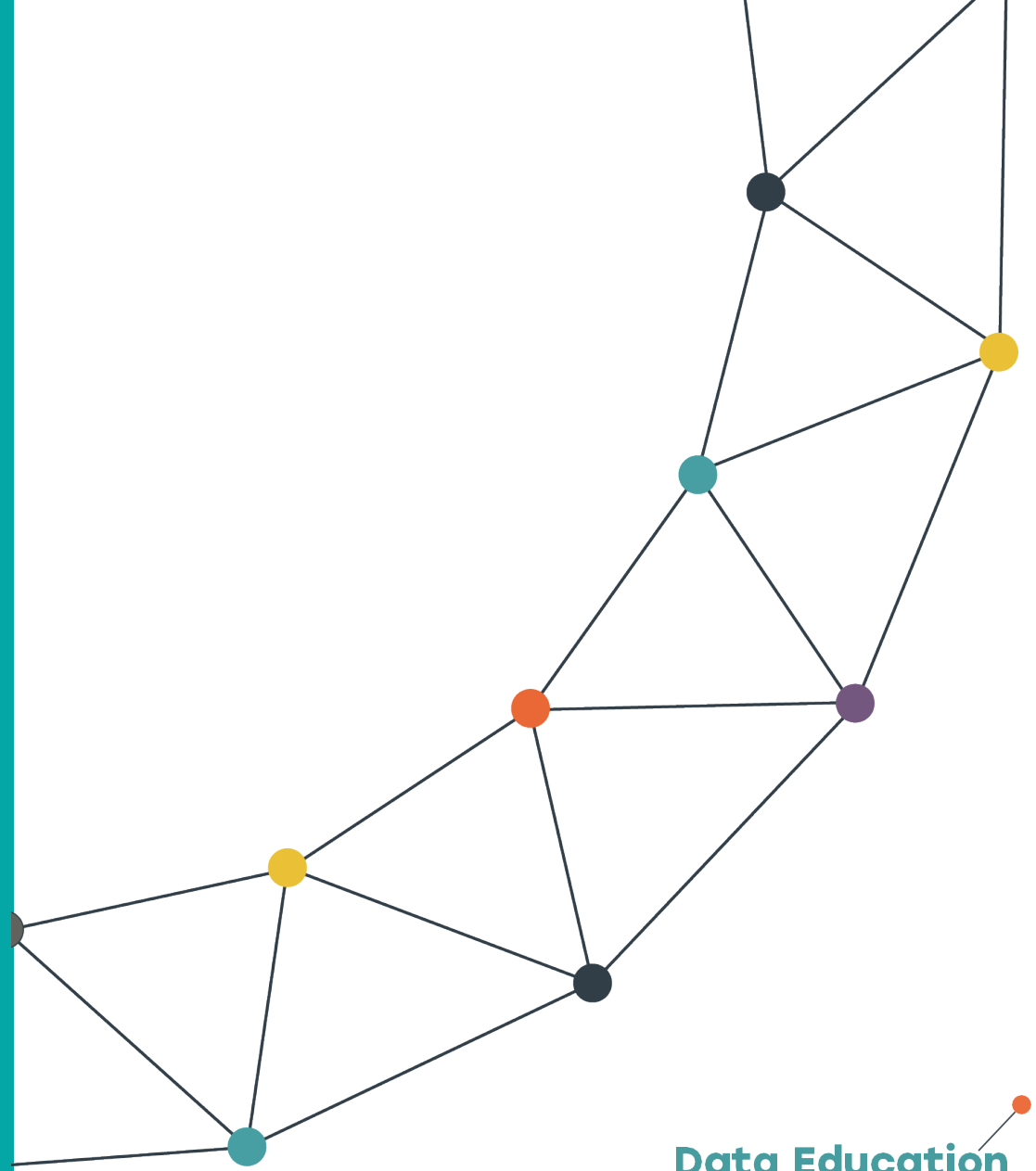
Computing, Data and AI Education in Scotland

Kate Farrell, University of Edinburgh



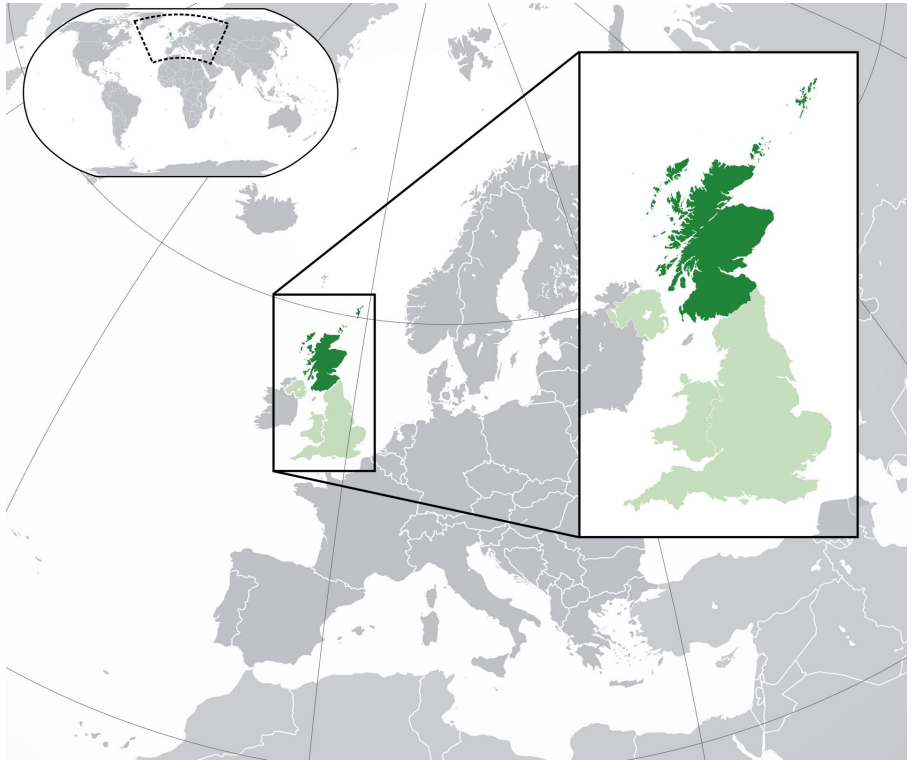
Data Education in Schools

Education in Scotland

- Early years education from 3-5 years
- Primary school (P1-P7, ages 5–12)
- Secondary school (S1-S6, ages 12–18)
- Subject choices for qualifications at age 16
- Mandatory education ends at age 16

- Free college and university education for most Scottish residents.

- Education is ‘devolved’ in Scotland – decided by the Scottish Government not the UK Government



Primary schools: 1978
Secondary schools: 360
Special schools: 107
Independent (fee-paying): 91

Curriculum for Excellence

- Languages and Literacy
- Religious and Moral Education
- Social Studies
- Expressive Arts
- Health and Wellbeing
- Sciences
- Technologies
- Mathematics and Numeracy

Computing Science within the National Curriculum

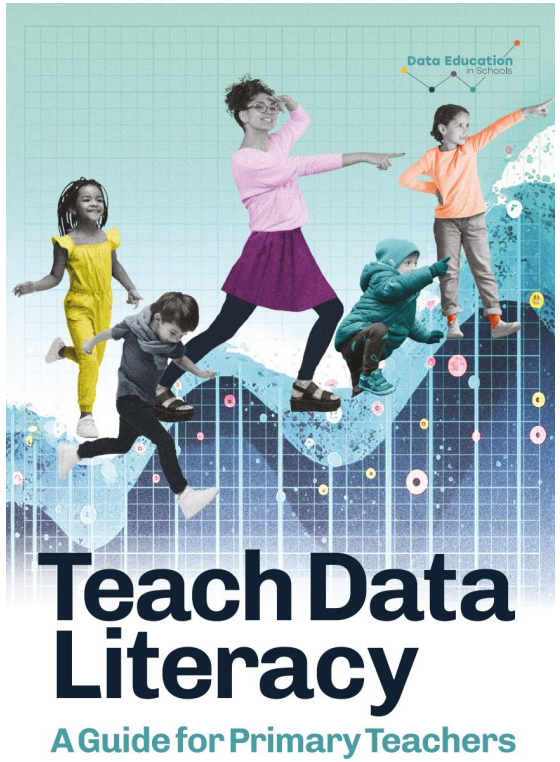
- CS taught in Secondary schools since 1980s.
- Ten years ago we updated the National Curriculum to include CS as an entitlement for all learners ages 3+
- Outcomes on CT concepts, understanding technology, and creating with computers.

teachCS.scot

Data Literacy across the National Curriculum

- Data literacy outcomes identified across the existing National Curriculum.

- Project in South-east Scotland to improve data literacy has had impact across Scotland and in 117 countries worldwide.



Dataschools.education

Data literacy is already in the curriculum!

Outcomes for **learning** core data literacy concepts include:

Technologies

Numeracy and Maths

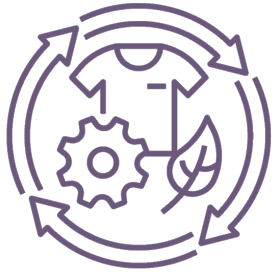
Literacy

Social Studies

Applying data skills across the curriculum

The journey of food, and calculating food miles

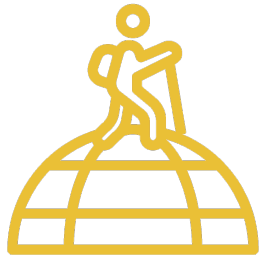
More physical activity, better sleep and nutrition



Energy use and conservation of materials

Water pollution and water conservation

Using sensors to monitor plant growth

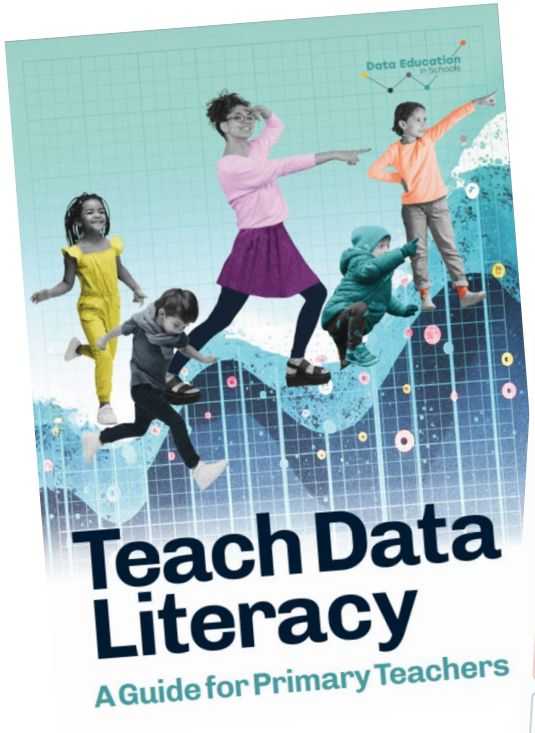


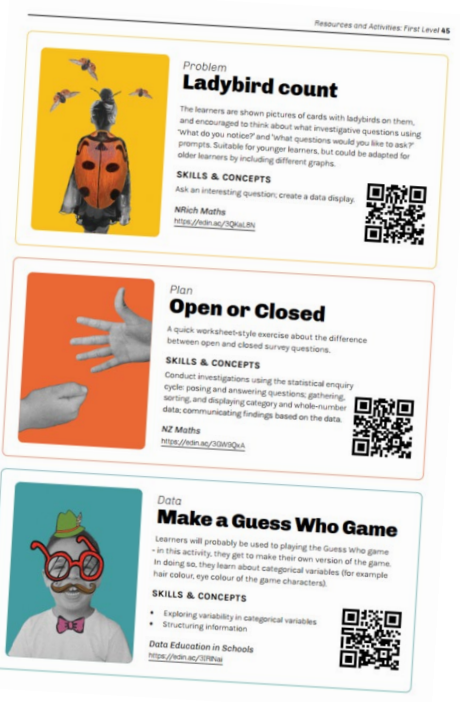
Environment and sustainability

Weather and climate

Journeys, travel and trade

Guide for Primary Teachers



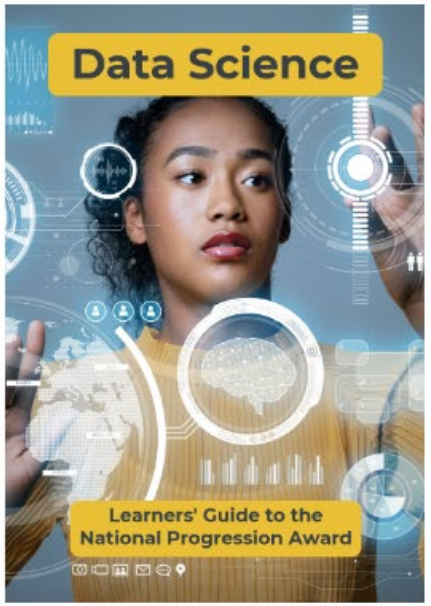


dataed.in/TeachData

Data Education in Schools

National Qualifications in Data Science

Educators Guide to the NPA in Data Science



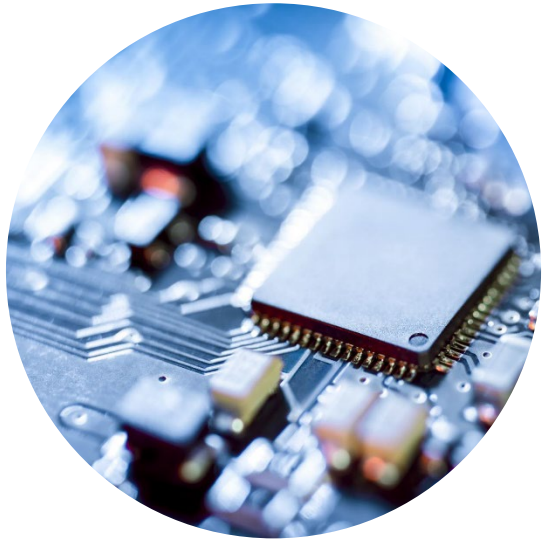
Learners Guide to the NPA in Data Science

teachdata.science

Can be taught by a range of teachers

Maths

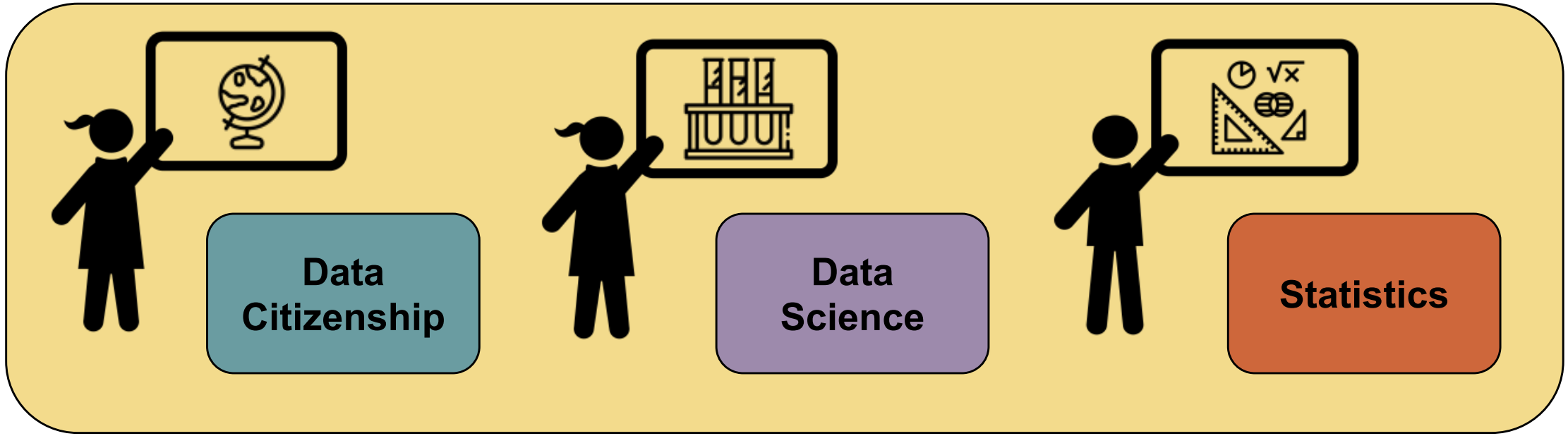
Geography



Computer Science

Modern Studies

Designed for interdisciplinary delivery



AI Literacy ...across and beyond the National Curriculum

AI literacy outcomes created based on the existing National Curriculum outcomes.

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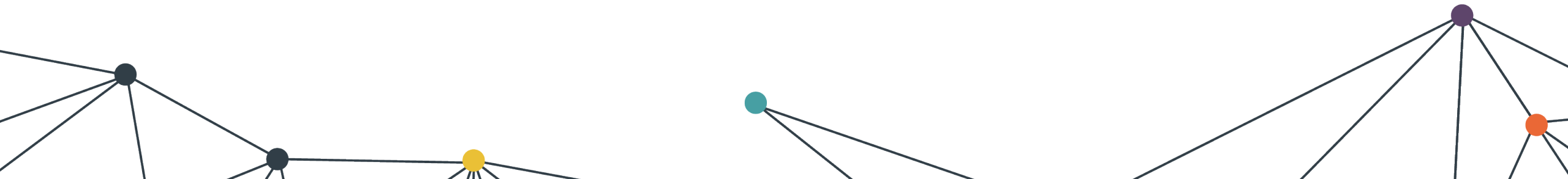
Scottish Government
Riaghaltas na h-Alba
gov.scot

SQA

Education Scotland
Foghlam Alba

Teaching Responsible AI Literacy in Schools

TRAILS.scot



Young people want to learn about AI

> **AI Should be in the curriculum.** AI will be in all our lives, so we need to learn and understand what it means before we grow up.

> **The more we learn about AI, the more we'll know how to keep ourselves safe.**

doi.org/10.1145/3754508.3754519

(RESEARCH FROM CHILDREN'S PARLIAMENT AND ADES/HORIZON)

Explain **AI basics** in schools

Teachers should learn about AI and children's rights to support children's learning and help to keep them safe.

More discussion in schools about **safe usage** and **ethical issues**

Opportunities to **practice and play** with AI

Teachers can use AI systems to help make learning fun – **children learn better when it's fun.**

Immersive **AI experiences:** games, tutors, historic tours

TRAILS.scot

CHILDREN'S RIGHTS & AI USE IN EDUCATION

A GUIDE FOR TEACHERS & SCHOOLS

RIGHT TO BE HEARD

ARTICLE #12

Children have the right to express their views, feelings and wishes in all matters affecting them and to have their views considered and duly weighted in decision making.

GOOD PRACTICE: A school uses an anonymous feedback box to gather learners' opinions on AI software used in classrooms, and school policies on acceptable AI use.

FREEDOM OF EXPRESSION

ARTICLE #13

Children have the right to freely express their thoughts, ideas, and feelings.

This includes communicating in ways that suit their preference and needs - through speech, writing, art, or other forms. It also includes the right to express themselves with or (if they prefer) without the help of AI tools in educational settings.

GOOD PRACTICE: A teacher shows their learners how to use GenAI tools to formulate and express their ideas more clearly by suggesting edits to make text more readable. They illustrate how to overcome writer's block by asking a GenAI tool for a range of suggestions of what might happen next in a story. The teacher works with the class to write prompts and draw sketches as input to an age-appropriate image-generation tool, moderating the output before showing it to the class.

CHILDREN'S BEST INTERESTS

ARTICLE #3

The child's best interests are a primary consideration in any decisions that apply to them.

WATCH OUT FOR: When considering whether to adopt an AI tool to save teachers time, consider whether it is in the learners' best interests. AI-generated feedback or lesson plans may contain mistakes or be of poorer quality than the teacher would normally provide.

GOOD PRACTICE: A teacher uses an GenAI tool to produce a lesson plan suitable for their class and suggestions for differentiated activities. They check the output carefully for errors. The teacher informs the learners that they used GenAI for this purpose.

EDUCATION

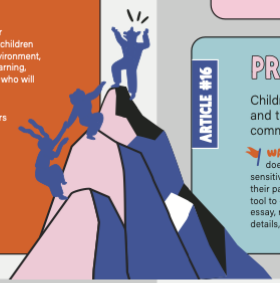
ARTICLES #28 & #29

Children have the right to a good education that helps them to reach their full potential.

Children's education should help them use and develop their personality, talents and abilities. Education should also help children learn to live peacefully, develop children's respect for the environment, and others. AI has the potential to help children with their learning, but it is not a replacement for highly skilled human teachers who will always be central to children's education.

GOOD PRACTICE: Schools work together (with learners and parents) on a clear policy about GenAI usage so everyone understands acceptable uses of AI to support learning. The teachers guide the learners in using AI tools to help them with learning tasks such as ideas generation, text editing, revision, or practising language skills.

They teach learners how to use AI tools critically and explain the basics of how AI technology works. The learners discuss ethics and the societal implications of AI.



ACCESS TO INFORMATION

ARTICLES #17 & #13

Children have the right to access reliable information from diverse sources, especially information that promotes their well-being, understanding, and development. GenAI tools can be a useful information source but should be used with care.

WATCH OUT FOR: Make sure your learners know that GenAI tools often produce output which is incorrect.

GOOD PRACTICE: A teacher works with her class to explore how GenAI tools can help summarise information from diverse sources in easy-to-understand language. They learn how to fact-check GenAI output and compare it to other information sources, such as encyclopedias and search engines.

PRIVACY

ARTICLE #16

Children have the right to privacy, and their personal data and communications must be protected.

WATCH OUT FOR: Ensure that any AI tool does not have access to learners' personal or sensitive data without consent from the child and their parents. For example, if using a GenAI writing tool to give personalised feedback on a student's essay, remove the student's name and any identifying details, ensuring the child's privacy is respected.

RIGHT TO BE KEPT SAFE

Children have the right to be protected from harm, being hurt and mistreated, in body or mind.

WATCH OUT FOR: Check the age-rating for any GenAI tool you use in school. Many image-generation tools are intended for a general audience, and although they often have guardrails to prevent inappropriate images, this can't be guaranteed. Also check that they don't suggest inappropriate images in recommended related content e.g. "if you like this image, you will also like these".

GOOD PRACTICE: A local authority installs AI-powered content filters to block harmful or inappropriate material in all schools to help children explore diverse topics safely. The content filters have school-level and parental controls to ensure that humans can appropriately intervene. The school staff are trained to watch for signs that children may be upset by encountering inappropriate AI-generated material.

ARTICLE #19

NON-DISCRIMINATION

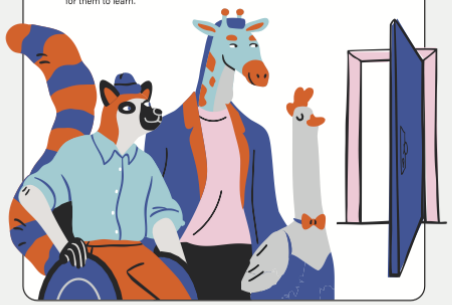
ARTICLE #2

All children's rights apply to every child equally, regardless of their differences and they should be able to exercise their rights without discrimination.

WATCH OUT FOR: If choosing an AI tool for personalised learning, ensure that it doesn't use biased racial or socio-demographic data to predict students likely to be "at-risk" for poor exam performance.

WATCH OUT FOR: If your school is considering purchasing 'AI detection software', be aware that such technology is currently not very effective and is more likely to incorrectly accuse people with poorer English writing skills of cheating with AI. This could potentially discriminate against students with English as a second language or those with neurodevelopmental disabilities.

WATCH OUT FOR: When choosing speech recognition tools, check whether they work well with diverse accents. If not, it would make it harder for some students to use voice-activated features effectively, potentially reducing their participation and making it harder for them to learn.



DISABILITY

ARTICLE #23

Children have the right to special education and care if they have a disability, as well as all the other rights so that they can live a full life. Although AI as a concept may be beyond the cognitive capacities of some learners, this does not mean they should be excluded from experiences that use AI to enhance learning.

GOOD PRACTICE: An ASL teacher uses AI tools (assistive technology) to help children with diverse needs and abilities express themselves and engage in learning activities in school. She also gives her learners with neurodevelopmental disorders extra support to understand how AI-generated pictures and images might be biased.

EVOLVING CAPABILITIES

ARTICLE #5

Children grow and develop at different paces, influenced by their age, experiences, and circumstances. Parents should guide and support children in making decisions that respect their agency and evolving capacities. Teachers also apply their expertise in children's development to guide appropriate AI usage.

GOOD PRACTICE: A primary teacher guides children in using GenAI tools by showing them how to use them effectively for tasks like brainstorming or editing. He initially starts by modelling how to use GenAI tools so that children do not use GenAI unsupervised. He and his colleagues provide close, step-by-step support for students and encourage critical thinking about GenAI output. As children's skills and maturity grow, the teachers in the school cluster plan to gradually reduce support and foster independence, aligning with the learners' experiences and evolving capacities.

PROTECTION FROM EXPLOITATION

ARTICLES #32–#36

Children have the right to protection from exploitation, including commercial exploitation. This could include software tools which profit from their data.

WATCH OUT FOR: Be careful not to use commercial GenAI tools that collect and use children's data to improve their models or services for companies' own profits without the children's or parents' consent.

If you're choosing AI-driven assessment/ marking software, be careful that children's work and exams (without their consent) aren't used to improve new versions of the software without their consent.

FREEDOM OF THOUGHT

ARTICLE #13

Children have the right to their own thoughts and beliefs and to choose their religion with guidance from their parents, consistent with their evolving capacities. This includes the right to views about AI and beliefs about how humans should use it.

GOOD PRACTICE: A young person does not want to use a GenAI tool for her school work because she believes it is morally wrong to use a tool that profits from the theft of copyrighted material and harms artists. Her teacher supports her in carrying out the task without using AI but ensures that she still learns about how AI works.

USEFUL LINKS & SOURCES

Remember: there are many more examples than we could fit on this poster! You probably have already developed good practice in your own school. For more information and resources, follow the QR code.

https://trails.scot

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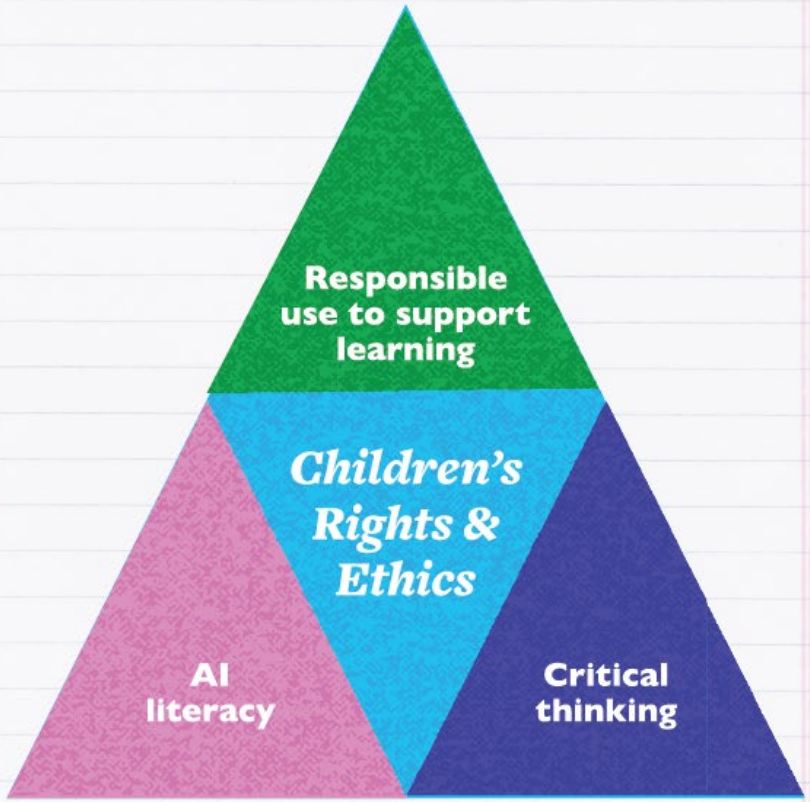
This poster was created by Ayça Atabey, Judy Robertson and Elspeth Maxwell.

Thanks to Kevin Mcphee, Gregory Metcalfe and Kay Tisdall for their help.



A draft AI curriculum framework for Scotland

We are seeking feedback from educators, AI experts, policymakers and other stakeholders to help us develop an updated version. If you would like to give feedback, please complete this form:

https://edin.ac/4kos03l

Teach AI Literacy

A Guide for Teachers

work-in-progress

Free download of our published books

What do you think?

TRAILS.scot

AI Teachers-in-Residence

Adam Llewelyn
Modern Studies, Falkirk

Ewen Glen
RMPS & Digital, Edinburgh

Anonymous
Biology/Science, Edinburgh

Matthew Mackie
Computing, Perth & Kinross

Kevin McPhee
ASN, Edinburgh

Louis Girvan
Music, Dumfries & Galloway

Learning about AI

A selection of **fun, low-tech, accessible activities** for **any Secondary teacher** introducing concepts in artificial intelligence

- Different types of AI systems and how they work
- Critical thinking skills
- Ethics, bias and sustainability issues

TRAILS.scot/resource

An AI sustainability board game!

Run a data centre without running out of power or water

'Choose Your Own Discussion' follow up activity

Choose your own discussion...

- **How much power** does an AI server need?
- **Swimming pools** heated by servers? Really?!
- Do we need to use **so much data**
- **Where** does the data come from?
- **Where** should we put data centres?
- Should we **use AI**?
- Do AI servers really need **that much water**?
- Who **owns** the data?
- Is **nuclear** power safe?
- Should governments **restrict** the use of AI?
- Do **undersea data centres** exist?
- How much **data** do AI systems need?
- Is **Atlantis** real???
- Where can we get the **power** for AI and data centres?
- Why can't we use **sea water**?

Who owns the data?

Who is the 'creator' of a work generated by AI?

Is it the the original authors, artists and creatives of the training data?
Is it the developers of the AI systems?
Is it the people writing the AI prompts?

Has your data been used for training AI systems?

Have I Been Trained website for searching popular AI training datasets

Scientific American article on personal data in training AI

12 min video on who owns AI art

How much **data** do AI systems need? | **Where** does the data come from? | Should we **use AI**? | Back to the questions

Swimming pools heated by servers??

Yes! Octopus Energy have been trialing server cooling equipment that heats up the water in swimming pools in the UK.

BBC article on heating pools

See servers heating UK pools (3 min)

BBC Click: servers heating Danish homes (4 min)

Paris data centres heating the Olympic pool and growing fruit! (10 min)

Do **undersea data centres** exist? | Do AI servers really need **that much water**? | Why can't we use **sea water**? | Back to the questions

Digital Education and AI Thematic Hub

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