

A CURIOSITY-LED APPROACH TO DATA LITERACY

Jasmeen Kanwal and the **Data Education in Schools** team share data literacy resources

In a village west of Edinburgh, students from Addiewell Primary School race around their local zoo, trying to decide which animal enclosure they think would be most interesting to compare to the environmental conditions in their own classroom. Much to the dismay of Tommy Lawson, who leads the Internet of Things (IoT) in Schools project installing smart sensors in schools across South East Scotland, they decide on the crocodile enclosure. Tommy must assist the zookeeper to carefully install a sensor identical to one the children have in their own classroom, without disturbing Bob and Bindi, the zoo's dwarf crocodiles.

The students had just completed a project investigating the ideal environmental conditions for learning in their classroom, and discovered that when CO₂ levels were too high, they felt sleepy, and that by adding plants to their classroom, they could lower the CO₂ levels. It had been their idea to explore next whether the optimal conditions for humans differed from those for other animals. The technology enabling these discoveries was given to the school by the IoT in Schools network, as part of a £9m investment that will see 500 schools in the South East Scotland region installed with cutting-edge data-gathering devices. This is part of a wider government-funded initiative

based at the University of Edinburgh — the Data Education in Schools project — which aims to promote data literacy across the Scottish curriculum by using a curiosity-led learning approach.

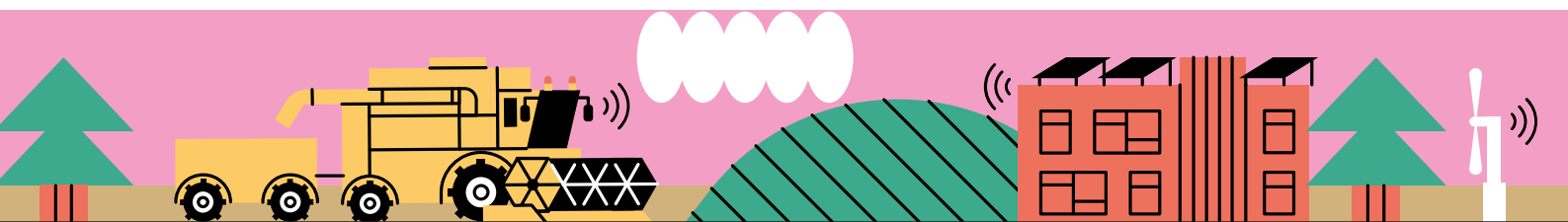
Creating empowered citizens

Data skills are to the twenty-first century what reading and writing were to the twentieth. The digital technology revolution has put data at the core of many things, from personal privacy and public health, to effectively running businesses and tackling the climate crisis. If we are to adequately equip all citizens with data skills, the school curriculum is a good place to start. Indeed, data literacy is considered to be one of the core foundations for the Organisation for Economic Co-operation and Development's (OECD) 2030 Learning Compass, alongside digital literacy, physical and mental health, and social and emotional skills, and is recognised as “essential for thriving in the 21st century” (helloworld.cc/oecdlearning).

Unlike the data education initiatives we are aware of in other countries, which tend to focus on teaching data science skills at the senior-secondary stage, the Data Education in Schools project aims to integrate data — and increasingly, AI — literacy across the entire curriculum for young people aged 3–18. Our goal is not just to upskill interested secondary-level learners who may then be inspired to pursue a career in data science, but rather to instil core data and AI literacy skills in all learners, whatever their future career paths, so that they can become informed



■ Tommy Lawson and students from Addiewell Primary School check their smart sensor placed inside the crocodile enclosure at Five Sisters Zoo in Scotland



RESOURCES

If you would like to learn more about data and AI literacy or make use of some of our resources, here are some good places to start. All of the resources can be found at dataschools.education/data-education-resources.

Early-years, primary, and early-secondary stages

- 'Teach Data Literacy: a guide for primary teachers' (dataed.in/teachdata) is a handbook developed to support teachers to enhance opportunities for all learners to build the skills and habits of mind relevant to data problem-solving. The guide offers practical guidance, links to resources, and a poster to support teaching data literacy skills and concepts across the primary and BGE curriculum.
- Data Explorer cards (dataed.in/explorer) introduce children and young people to a data problem-solving approach (PPDAC — Problem–Plan–Data–Analysis–Conclusion). The design builds on informal question-asking behaviours and supports learners' exploration of data in relation to the themes of Lego, Birds, Lost Property, Plastics, or a theme of their choosing.

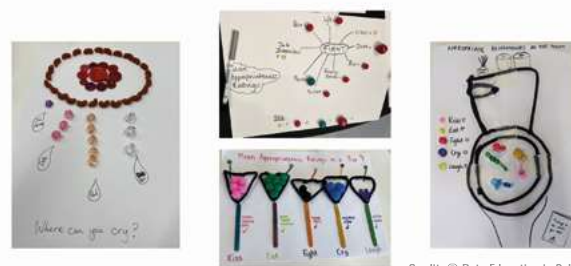
Interpreting and creating data visualisations

- Weaving Data (dataschools.education/resource/weaving-data) is an award-winning unplugged activity in which learners use strips of material woven into a fence or other large frame to display data, creating a collaborative art installation that is both eye-catching and conversation-sparking.
- Dear Data (dataschools.education/resource/dear-data-6-lessons) is a set of six STEAM lessons which teaches learners to gather and use data about themselves and their interests through different drawing and visualisation techniques, bringing together art and information in a gentle and beautiful way.
- Fizzy Data (dataschools.education/resource/fizzy-data) is an activity in which learners create a fun, physical representation of a provided data set using the materials and tools available.
- Data Viz Quiz (dataschools.education/resource/data-viz-quiz) introduces learners to ten different types of charts and graphs. The challenge is a ten-question quiz that can only be answered by understanding the information visualised in them.



- Data Explorer cards introduce children and young people to a data problem-solving approach

You could draw a data viz...



Credit: © Data Education in Schools

- Fizzy Data is zero-waste data physicalisation — representing data with objects that can be easily disassembled and used again and again

Learning through gamification

- Become a trainee secret agent and solve our data-themed escape room puzzles (dataschools.education/escape). Trainee agents will have to use graphs, charts, maps, and logic to uncover the plots and crack the secret codes. Along the way they are introduced to the basics of internet infrastructure, data centres, cybersecurity, and other digital and data skills topics.
- Solve problems and explore ethical conundrums using data by playing our interactive live lessons (cyberskillslive.com/data), which have now been played by over 40,000 learners across the world.

Learning with tech

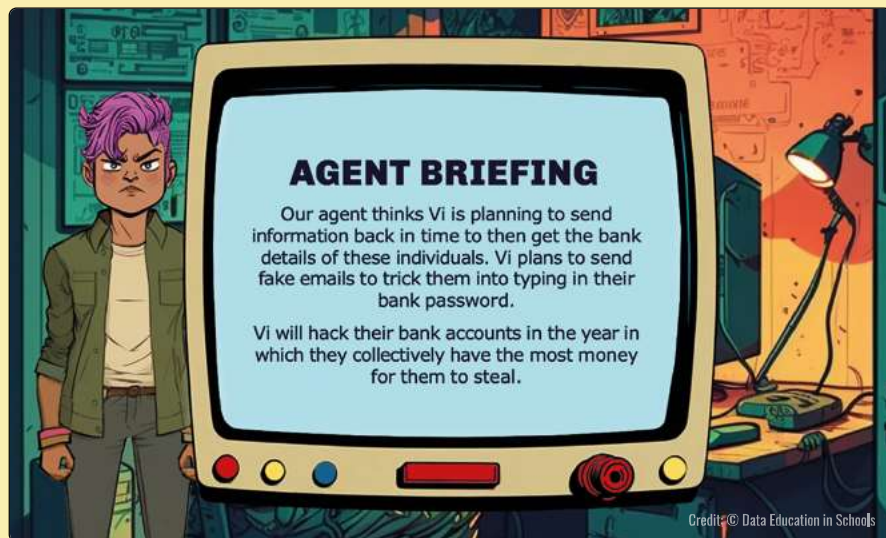
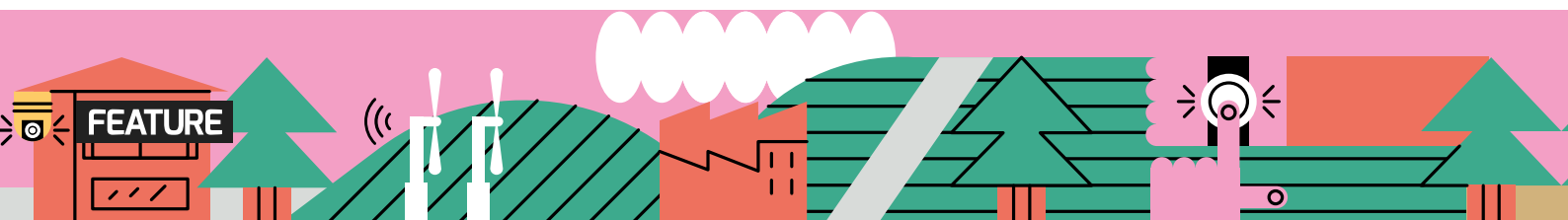
With Micro-bit Data Monsters (dataed.in/monsters), use your classroom micro-bits to create data-gathering monsters who will help you investigate temperature around your school. Check out the BBC micro-bit playground survey (helloworld.cc/microbitsurveys) for more data-themed activities using the micro-bit, with the bonus of incorporating outdoor learning.

Senior-secondary phase: the NPA Data Science

In 2018 we worked with the Scottish Qualification Authority (SQA) to develop qualifications in data science aimed at school and college learners. These awards are National Progression Awards (NPAs) which are aimed at assessing a defined set of skills and knowledge in specialist vocational areas and can be offered by either schools or further education colleges. The NPA Data Science is designed to be taught by teachers across a range of different school subjects, from maths or computer science, to earth, life, physical, and social sciences. Learn more at teachdata.science. Ready-to-use lessons using either Excel or Python are available at learn-data.science.

AI literacy

We have a web page (dataschools.education/ai-literacy) and Trello board (dataed.in/ailinks) where we pull together curated resources for teaching AI literacy from across the web, as well as some we have created ourselves. These are constantly updated as more resources become available.



■ Learners will become trainee agents as they solve puzzles using graphs, charts, maps, and logic to defeat the evil time-travelling villains

► and empowered citizens able to navigate a rapidly changing, data-rich world. To echo the United Nations Convention on the Rights of the Child, young people must not be mere passive observers — they need to be able to participate meaningfully in societal discussions about the impacts, ethics, and design of new technologies, including ChatGPT and other emerging data-driven AI technologies,

focus is on conceptual understanding and critical thinking, rather than teaching the use of any particular tech tools.

We understand how overloaded the curriculum is, and how great the teacher workload. It is important to note that data literacy is already in the Scottish school curriculum, though scattered loosely across a range of different subject areas. The aim of our project is not to add yet more to the

approaches and share them with their peers, not just during the course, but throughout their subsequent careers. We cannot overstate the importance of providing teachers with adequately funded, protected time for this type of professional development, which is critical if we want learning in schools to keep pace with societal and technological change.

From crocodiles to the classroom

Meanwhile, back in South East Scotland, the students at Addiewell Primary show a Scottish Television news crew the live data feed from their classroom sensors, side by side with the feed from the crocodile enclosure at Five Sisters Zoo. They explain the differences between the environments in the average levels of CO₂, temperature, and humidity. They point out a few spikes in the motion sensor graphs, explaining their theories about why the crocodiles move less frequently than the children. Their curiosity is still ablaze, and the question is, which animal enclosure will they investigate next? [\(HW\)](#)

“ YOUNG PEOPLE MUST NOT BE MERE PASSIVE OBSERVERS, BUT MUST BE ABLE TO PARTICIPATE MEANINGFULLY IN DISCUSSIONS ”

Teaching data literacy

But what is data literacy, and how can we teach it? A definition we like to use is that 'data literacy is the ability to ask questions, collect, analyse, interpret, and communicate stories about data'. Using the PPDAC data problem-solving framework (Problem–Plan–Data–Analysis–Conclusion), learners can identify and investigate real-world problems that are meaningful to them. At the early years and primary stages, we focus on unplugged activities, gradually introducing more tech as learners progress to the secondary stage. Throughout, however, the

endless to-do pile, but to inspire teachers and learners with a fresh pedagogical approach to the curriculum through the lens of data literacy, which by its nature leads to interdisciplinary and curiosity-led learning.

In addition to developing classroom activities that teachers can use out of the box, our key mode of delivering data literacy is through teacher professional learning (helloworld.cc/DataEducationLearning). We run in-depth courses over multiple days, with a mix of in-person, hybrid, and online delivery to widen access, supporting teachers to co-create new pedagogical



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