(Hello World)

THE MAGAZINE FOR COMPUTING & DIGITAL MAKING EDUCATORS

REIMAGINING DIGITAL LITERACIES
Applying traditional literacy to digital literacy

BEYOND MOBILE PHONE BANS
Empowering students to critically navigate tech

DESIGNING A CURRICULUM
What can we learn from the Netherlands?

Issue 26 | Apr 2025 | helloworld.cc

PLUS **ESCAPE THE RUT** · BEBRAS · **TEACHER SYMPOSIUM ON TEACHING ABOUT AI** · DIGITAL ACCESSIBILITY · CS AT THE PRESCHOOL LEVEL · **DATA SCIENCE** · OAK CURRICULUM RESOURCES · **CS IN RURAL SCHOOLS** · **DIGITAL SKILLS FOR EDUCATORS** · NETWORKING 101 · **AI SAFETY RESOURCES** · BOOK REVIEW

Raspberry Pi Foundation

Teach and learn with the Raspberry Pi Foundation

Free for everyone anywhere in the world

Teachers' resources

Discover training, resources, and guidance to help you teach computing with confidence.

raspberrypi.org/teach

Project library

Browse 200+ online project guides that help young people create with digital technologies.

projects.raspberrypi.org

Research to practice

Explore our research into what works best in teaching school-age young people about computing.

raspberrypi.org/research

Coding at home

Watch our support tutorials and access engaging resources for your child.

raspberrypi.org/learn

Raspberry Pi Foundation, UK registered charity 1129409

HELLO, WORLD!

NEW PODCAST
TURN TO PAGE 43

The theme of this magazine issue — and of our new podcast miniseries — is digital literacy. We agree it's important for young people to have the ability to use digital technologies effectively, safely, and responsibly, but the term 'digital literacy' isn't clearly defined — that's something we explore in Hello World, alongside how to best teach these skills in the classroom.

In this issue, Gavin Davenport asks what would happen if we considered digital literacy in the same way as we consider traditional literacy (pages 36–37). Sourav Pattanayak shares more about tackling digital literacy in India (pages 26–27), and Sway Grantham highlights practical ways to grow your digital skills as an educator (pages 40–41). Beyond the theme of digital literacy, we have articles from educators about AI safety resources (pages 56–57), how to connect students to industry (pages 58–59), and tips for reigniting your passion for teaching (pages 72–75).

We asked for your thoughts on the podcast in our previous annual survey, and you kindly sent us lots of helpful feedback. Based on that, we're trialling new episode formats, welcoming additional hosts, and bringing in more expert voices from around the world. You can find all the links to the new audio and video podcast episodes on page 43.

I hope you find the Hello World magazine and podcast uplifting and useful, and that our content really helps you engage and educate young people in computer science!

Meg Wang
Editor

FEATURED THIS ISSUE

CHRIS LOVELL

Chris is the head of computer science at Thornton College, UK. He shares how to combine the micro:bit with micro:bit classroom tools to create games in Python on pages 60-61.

SANDRA HARTMAN

Sandra is a computer science and media design educator in Pennsylvania, USA. On pages 34–35, she discusses what needs to be done to improve digital literacy in the United States.

HALIMA BHAYAT

One of my favourite things about working on Hello World is hearing about you. Head of computing, Halima shares her inspiring journey in computer science on pages 76–77.

(HW)

Hello World is the official magazine of the Raspberry Pi Foundation

Raspberry Pi Foundation

EDITORIAL

Editor
Meg Wang

Contributing Editor
Dominick Sanders

Subeditors
Louise Richmond and Gemma Coleman

Subscriptions
Sean Sayers

Social Media
Sean Sayers

DESIGN

criticalmedia.co.uk

Designer
Lee Allen

Photography
The Raspberry Pi Foundation, Adobe Stock

Graphics
Rob Jervis

Cover
© Dutch Uncle

CONTRIBUTORS

James Abela, Rachel Arthur, Sophie Ashford, Pete Bell, Victoria Berkowitz, Halima Bhayat, Mac Bowley, Mark Calleja, Katharine Childs, Andrew Csizmadia, Katie Dahlman, Gavin Davenport, Zoe Davidson, Diane Dowling, Leah Dungay, Catherine Elliott, Gina Fugate, Tracy Gardner, Sway Grantham, Ben Hall, Sandra Hartman, Curt Hitchens, Laura Holborow, Doña Keating, Laura Kirsop, Anna Lahtinen, Henry Lieberman, Chris Lovell, Ian Needham, Antonia O'Connell, Alan O'Donohoe, Sourav Pattanayak, Becci Peters, Judith Ricketts, Sue Sentance, Jane Waite, Bobby Whyte

Contributing Partner

bcs Academy of Computing

CAS

(HW) CONTENTS

NEWS, FEATURES, AND OPINION

LEARNING

RESOURCES & LESSON PLANS

CONVERSATION

TEACHER SYMPOSIUM ON TEACHING ABOUT AI

What should we be teaching about AI in schools, and how?

Jane Waite

The term 'AI' has become a pervasive one that is heard in school staffrooms with trepidation, excitement, and often a furrowed brow. For educators, there is pressure to use AI applications for productivity — to save time, to help create lesson plans, to write reports, to answer emails, and so on. There is also a lot of interest in using AI tools in the classroom, for example to personalise or augment teaching and learning. However, without understanding AI technology, neither productivity nor personalisation are likely to be successful, as teachers and students alike must be critical consumers of these new ways of working if they are to use them productively.

In both England and globally, few new AI-based curricula are being introduced, and the drive for teachers and students to learn about AI in schools is lagging, with limited initiatives supporting teachers in what to teach and how to teach it. At the Raspberry Pi Foundation and the Raspberry Pi Computing Education Research Centre, we decided it was time to investigate this missing link of teaching about AI, and specifically to discover what the teachers who are leading the way in this topic are doing in their classrooms.

A day of sharing and activities in Cambridge

We organised a day-long, face-to-face symposium with educators who had already started to think deeply about teaching about AI, had started to create teaching resources, and were starting to teach about AI in their classrooms. The event was held in Cambridge, UK, on 1 February 2025, at the head office of the Raspberry Pi Foundation.

Teachers shared their knowledge of teaching about AI

Over 150 educators and researchers applied to take part in the symposium. With only 50 places available, we followed a detailed protocol, whereby those who had the most experience of teaching about AI in schools were selected. We also made sure that educators and researchers from different teaching contexts were selected, so that there was a good mix of education phases represented, from primary to further (ages 5–19). Educators and researchers from England, Scotland, and the Republic of Ireland were invited to share about their experiences. One of our main aims was to build a community of early adopters who have started along the road of classroom-based AI curriculum design and delivery.

During the day, educators were seated with peers who taught the same phase of school. This was to enable discussion about shared experiences with teachers of the same age group of learners. The teachers and researchers worked on activities in their phases, and then shared their collective views across phases. By sharing within and across phases, we started to get a sense of the concepts and learning objectives being taught, what progression might look like, what the challenges and opportunities are, what research informed the resources, and what research is needed to improve the teaching and learning of AI.

We organised a day-long symposium with educators and researchers

Inspiration, examples, and expertise

To inspire the attendees with an international perspective of the topics being discussed, Professor Matti Tedre, a visiting academic from Finland, gave a brief overview of the approach to teaching about AI and resources his research team have developed. In Finland, there is no compulsory distinct computing topic, so AI will be taught in other subjects, such as history. Also, in Finland there is a rich tradition of teaching through projects, where students discover in an informal way through discussion and making.

Attendees were asked to talk about, share, and analyse their teaching materials. To model how to analyse resources, Ben Garside from the Raspberry Pi Foundation modelled how to complete the activities using the Experience AI resources (**experience-ai.org**) as an example. The Experience AI materials have been co-created with Google DeepMind and are a suite of free classroom resources, teacher professional development resources, and hands-on activities designed to help teachers deliver AI lessons confidently. Aimed at learners aged 11 to 14 and grounded in real-world contexts, the materials are based on a set of design principles founded on leading-edge research on teaching about AI (**helloworld.cc/RPF-ai-design-principles**). We've recently released new lessons on AI safety, and we've localised the resources for

> WE DECIDED IT WAS TIME TO INVESTIGATE THE MISSING LINK OF TEACHING ABOUT AI

A FINNISH PERSPECTIVE ON TEACHING ABOUT AI

Professor Matti Tedre showcased tools and approaches developed by the Generation AI research programme in Finland (**generation-ai.eu**). You can read about the Finnish research programme and Matti's two-month visit to the Raspberry Pi Computing Education Research Centre here: **helloworld.cc/ai-gen-Finland**.

use in many countries across Africa, Asia, Europe, and North America. In a morning session, Ben exemplified how to talk about and share learning objectives, concepts, and research underpinning materials using the Experience AI resources, and in the afternoon, he discussed how he had mapped the Experience AI materials to the UNESCO AI competency framework for students (**helloworld.cc/ai-unesco-framework**).

Kelly Shiohira, from UNESCO, also kindly attended our session and gave an invaluable insight about the UNESCO AI competency framework for students (**helloworld.cc/unesco-AI-framework**). Kelly is one of the framework's authors, and her presentation helped teachers understand how the materials had been developed. The attendees then used the framework to analyse their resources, identify gaps, and explore what progression might look like in teaching about AI.

What did the teachers say?

We will share a report in due course, but here are some of the findings related to learning objectives identified by the primary teachers (teaching those aged 5–11) for their phase.

The primary-phase teachers proposed over 50 learning objectives. Other than changing them all to begin with 'I can' or similar, we report them here exactly as the objectives were recorded by the teachers, so there are some overlaps, and there is some inconsistency in the terms used. But the breadth of potential concepts to be covered is clearly vast already, at this earliest of phases. We have clustered some of the learning objectives to aid reading, and only present a subset of the objectives, to give a flavour of the work done.

One cluster relates to students and examples of AI applications:

- 'I know some examples of AI used in the real world.'
- 'I can identify real-life uses of machine

WHAT PRIMARY PHASE LEARNING OBJECTIVES MIGHT MEET UNESCO AI STUDENT COMPETENCIES?

UNESCO aspects	Level	Competency block	Competency	Student competency	Curricula goal code	Curricula goals	Key Stage 1 (ages 5–7)	Key Stage 2 (ages 7–11)
Human-centred mindset	Understand	4.1.1	Human agency	Students are expected to be able to recognise that AI is human-led and that the decisions of the AI creators influence how AI systems impact human rights, human–AI interaction, and their own lives and societies. They are expected to understand the implications of protecting human agency throughout the design, provision, and use of AI. Students will understand what it means for AI to be human-controlled, and what the consequences could be when that is not the case.	CG4.1.1.1	Foster an understanding that AI is human-led	I know I have to tell an AI what to do	I can give an AI tool commands to produce content
Human-centred mindset	Understand	4.1.1	Human agency		CG4.1.1.2	Facilitate an understanding on the necessity of exercising sufficient human control over AI	I know that AI tools are made by people	I know that output from an AI tool must be checked
Human-centred mindset	Understand	4.1.1	Human agency		CG4.1.1.3	Nurture critical thinking on the dynamic relationship between human agency and machine agency	I know an AI tool is not a real person	I can give examples of where people use AI

Figure 1 Primary teachers worked to develop potential learning objectives that might meet the UNESCO student competencies. Here, for one competency block, learning objectives for Key Stage 1 (students aged 5 to 7) and Key Stage 2 (aged 7 to 11) are presented. Research is needed to discover whether activities can be designed to teach these objectives to such young pupils, and what students might really understand by such activities. With thanks to Nic Hughes who created this mapping.

learning helping to detect patterns.'
- 'I can recognise the real-life applications of AI in the world.'
- 'I understand how AI can be used in the classroom.'

Just in this small cluster of learning objectives, there are nuanced differences, which could result in some students making more progress than others, but research is needed to compare the differences and look at how such differences might influence the mental models that children form.

A second cluster relates to how AI applications are different to humans, or different in stories about AI, and about the roles of humans:

- 'I understand that an AI tool [e.g. a chatbot] is not a person.'
- 'I can talk about whether I can trust a chatbot like a friend'.'
- 'I understand that a robot/computer story may be different from real life.'
- 'I know what the role of a human is within AI.'

The depth to which all children from 5 to 11 years old will be able to create knowledge, skills, and understanding related to these objectives requires careful consideration, as some of these learning objectives could also be imagined with much older learners.

A third interesting cluster starts to explore data, and the training of models:

- 'I can say what data/information is.'
- 'I can spot a pattern in data.'
- 'I know that AI models are trained using data.'
- 'I can collect fair data.'
- 'I understand that data can be biased.'
- 'I know how AI differs from traditional rule-based coding.'

The ways in which children might start to understand about data, patterns, models, training, fairness, and bias requires much careful consideration, as this is probably the key difference between traditional programming and an AI data-driven approach to problem-solving.

As well as devising learning objectives, some of the primary teachers went on to correlate the objectives with the UNESCO student framework competencies. In several instances, the teachers mapped a single learning objective to more than one competency, and also mapped a single competency to more than one learning objective. The aim of the activity was to help teachers think deeply, and it seemed from the long and interesting discussions that took place that this aim was achieved. One teacher responded to this complex retrofitting by starting with the UNESCO competencies, and thinking about what objectives might reasonably be taught and grasped by primary students. This teacher and Hello World writer, Nic Hughes, has kindly given us permission to share this work that he did during the symposium in **Figure 1**.

Kelly Shiohira, an author of the UNESCO AI competency framework for students (**helloworld.cc/unesco-AI-framework**), shared how the framework was designed

What next?

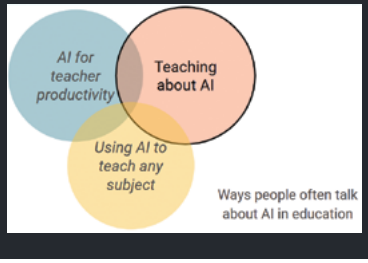
We are now analysing the vast amount of data that we gathered on the day, and we will share this with the symposium participants before we share it with a wider audience. What is clear from our symposium is that teachers have crucial insights into what should be taught to students about AI, and how, and we are greatly looking forward to continuing this journey with them.

As well as the symposium, we are conducting academic research in this area. You can read more about this in our Annual Report (**helloworld.cc/annual-report-2024**) and on our research web pages (**helloworld.cc/ai-ed-projects**). We will also be consulting with teachers and AI experts. If you'd like to ensure you are sent links to these blog posts, do sign up to our newsletter (**helloworld.cc/rpcerc**). If you'd like to take part in our research and potentially be interviewed about your perspectives on teaching about AI in the curriculum, contact us at: **rpcerc-enquiries@cst.cam.ac.uk**.

We also are sharing the research being done by ourselves and other researchers in the field at our research seminars. This year, our seminar series is all about teaching about AI and data science in schools. Please do sign up (**helloworld.cc/research-seminars**) and come along, or watch some of the presentations that have already been delivered by the amazing research teams who are endeavouring to discover what we should be teaching about AI, and how, in schools. (HW)

TALKING ABOUT TEACHING ABOUT AI

Using this simple diagram, we explained the different ways in which AI might be talked about in education, and urged teachers to spend time at the symposium talking about teaching about AI, rather than talking about productivity, or using AI to teach in general.



EMPOWERING EDUCATORS WITH A REVITALISED COMPUTING CURRICULUM

Free curriculum resources at Oak National Academy

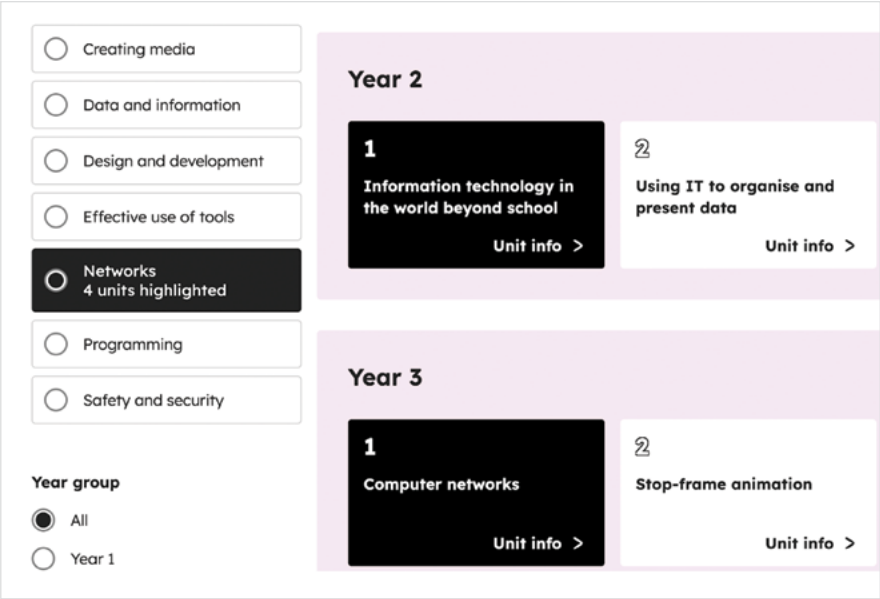
Laura Holborow

Oak National Academy (**helloworld.cc/oak-academy**) is a UK-based online platform that provides teachers with free, adaptable lesson planning and teaching resources, covering a broad range of subjects. During the Covid-19 pandemic, the Raspberry Pi Foundation partnered with Oak to support remote teaching. We have now renewed our partnership to deliver an updated, high-quality computing curriculum for Key Stages 1 to 4 (ages 5–16) in England that supports teachers by reducing the lesson planning workload, and improves pupil outcomes. This initiative builds on the well-established Teach Computing Curriculum (TCC), developed by the National Centre for Computing Education (NCCE), while also integrating teacher and pupil feedback, evolving subject developments, and recommendations from the Ofsted research review (**helloworld.cc/ofsted-computing-review**) and the SCARI computing project (**helloworld.cc/SCARI-report**).

Curriculum threads

The Oak curriculum will carefully integrate 'curriculum threads', designed to connect content and learning from primary to secondary stages. These threads, grounded in our taxonomy framework (**helloworld.cc/cs-taxonomy**), represent essential knowledge and skills for the subject:

- **Computing systems**
- **Networks**
- **Creating media**
- **Algorithms and data structures**
- **Programming**
- **Data and information**
- **Artificial Intelligence**
- **Effective use of tools**
- **Impact of technology**
- **Design and development**
- **Safety and security**



Oak National Academy's curriculum visualiser

With the Oak National Academy's curriculum visualiser, educators can easily track these threads, enabling them to locate resources quickly and efficiently that align with their learners' needs.

Design insights and choices

This collaboration with Oak National Academy offers a unique opportunity to refine our model for the English computing curriculum to have greater impact. Guided by subject experts and educator feedback, key planned improvements include:

- **Consistent unit lengths:** streamlining units for more effective lesson planning throughout the school year
- **Integrated impact of technology**

content: embedding discussions on technology's impact across units, ensuring consistent engagement, rather than limiting it to a single topic

- **Focus on emerging trends:** reflecting modern technological advancements like data science and AI in lesson content

Integration of the Code Editor

Any Python lessons created for the Oak National Academy Computing curriculum will model and use the Raspberry Pi Foundation Code Editor (**editor.raspberrypi.org**). When designing units focused on Python programming, we believe it is important to use a free, open-source, text-based code editor that teachers and learners can easily access. The Code Editor is designed to be simple and intuitive, and allows learners to download and save their project files for future use. Starter projects and completed solutions can also be shared easily to support the tasks set in a lesson.

To support young people's learning journeys with creating code, we've integrated the Code Editor into the Oak curriculum. In slide decks, we model and provide code snippets in the same format that learners will see in the editor; for example, the syntax highlighting is then replicated. This reduces the cognitive load for learners, as they can quickly see the links between the code snippets they see in the slide decks and those they are creating in the editor. It also may help them to spot and detect errors in their code.

> "THIS IS A UNIQUE OPPORTUNITY TO REFINE OUR MODEL FOR THE ENGLISH COMPUTING CURRICULUM

Starter code files and solutions to coding activities are directly linked to lesson resources, to enable teachers and learners to quickly access code files to support lessons. The Raspberry Pi Foundation Code Editor includes functionality for learners to save and download resources, so that they can easily save resources accessed within lessons.

```
3  if weather == "cloudy":
4    advice = "No sunglasses are needed."
5  elif weather == "rainy":
6    advice = "You need an umbrella."
7  elif weather == "snowy":
8    advice = "Gloves are needed."
9  else:
10   advice = "Enjoy the day!"
11 print(advice)
12
```

The Raspberry Pi Foundation Code Editor

Curriculum design principles

When developing any new curricula, we believe that these core principles should be applied to the resources we produce:

- **Adaptable**
- **Comprehensive**
- **Cohesive**
- **Credible**
- **Supportive**
- **Inclusive**
- **Relevant**

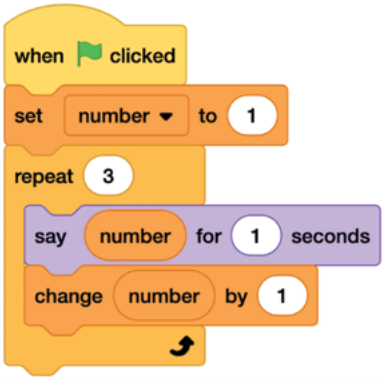
All the lesson content we are producing for the Oak National Academy project is fully adaptable, so teachers can amend the content to suit the needs of their learners and their context. For example, all code snippets used within the slide decks are presented as editable text within text boxes.

The content is intentionally crafted to minimise cognitive load by ensuring slide decks are clear, concise, and free from information overload. Simplified language is used, with subject-specific terminology explicitly highlighted and explained at a level suitable for the learner's age. Accessibility is a central design focus, with all content meeting Web Content Accessibility Guidelines' AAA standards. This includes the use of high-contrast Scratch code blocks to enhance usability and inclusivity.

What can you access now?

- A full sequence of units and the lesson titles (teaching resources will be released later this academic year)
- Unit descriptions and a 'Why this, why now?' to help you consider the sequence of your current planning
- Curriculum explainers, sharing the thinking, structure, and focus behind our plans to inspire your approach
- Downloadable curriculum plans, ready for when you need them most
- A selection of units for both KS3 and KS4 have been released (further units will be made available over the next few months)

To keep up to date with the development of these resources, sign up to Oak National Academy's newsletter (**helloworld.cc/oak-curriculum**) or keep an eye out for updates on the Raspberry Pi Foundation's blog (**raspberrypi.org/blog**). (HW)



High-contrast Scratch code blocks

Coolest Projects Ireland brought young makers together to exhibit their work in person

CELEBRATING YOUNG INNOVATORS

Coolest Projects 2024 and what's next

Sophie Ashford

Every year, the Raspberry Pi Foundation hosts Coolest Projects, a showcase that celebrates young digital creators and the amazing things they make with technology. There's a global online showcase as well as in-person Coolest Projects events taking place in several countries.

With Coolest Projects events for 2025 well underway, including the global online showcase; Foundation-led events in the UK, Ireland, the USA, and India; and partner events in countries such as Ghana, Belgium, and many more, we wanted to revisit some of the incredible entries from last year and share the impact that the showcase can have.

Online showcase

The 2024 Coolest Projects online showcase saw a remarkable turnout, with 7,197 creators participating from 43 countries, representing a 22 percent increase in participant numbers and an expansion from 37 countries in 2023. The event's livestream attracted 1,255 viewers, and 47 percent of the young innovators who took part identified as female. Creators ranged in age from 6 to 18 years old, with the average participant being just 13, highlighting the incredible talent emerging from this young, global community.

The Coolest Projects online showcase provided creators with a valuable platform to display their work, with 80 percent saying they were motivated by the opportunity to show their achievements. Mentors appreciated the event for several reasons: it's free to enter, welcomes creators of all experience levels, and allows participants to create any digital project based on their own interests. The event built a sense of pride among creators, as their projects were featured in an online gallery, and every participant received a certificate. Mentors also emphasised the importance of the showcase in helping young creators feel proud and connected to a global community.

UK and Ireland

The 2024 Coolest Projects in-person events brought together young innovators from

The team behind Flow Buddy, a website to help young women experiencing period poverty

across Ireland and the UK. In Ireland, 100 creators from 80 teams participated, while the UK event saw 71 creators from 37 teams. The average age of participants was 11, with 44 percent of creators in the UK and 33 percent in Ireland identifying as female. These gatherings celebrated the creativity and talent of young tech enthusiasts, providing a platform for them to showcase their impressive projects in a supportive and inspiring environment.

In post-event surveys, creators shared their excitement about the in-person Coolest Projects events. They highlighted that the best part was the opportunity to see other people's projects, meet like-minded individuals with similar interests, and create something they could be proud of to showcase to the world. These aspects made the experience both inspiring and rewarding for the young participants.

Meet the creators

With so many projects entered, and the level of creativity on show beyond impressive, we encourage you to check out the online gallery. Here are two entries from the in-person gathering in Bradford for Coolest Projects UK that truly captured the spirit of creativity and innovation.

Warden Warner by Donal in the UK

Donal developed Warden Warner, an AI-powered system designed to alert drivers when a parking warden is nearby. Built with a Raspberry Pi 3, TensorFlow, and a Python engine, his creation uses speech recognition, object detection, and image classification to identify wardens. When asked about the motivation behind his project, Donal clarified that it's meant as a safety net for forgetful moments, not as a way to dodge parking payments. He also shared that the idea was inspired by his dad's frustration when he received a ticket himself!

Flow Buddy by Inioluwa, Michelle, Jedidiah, and Irioluwa in the UK

With one in ten women in the UK unable to afford period products, Flow Buddy was created to connect young women experiencing period poverty with charities

An AI-powered system to warn drivers when a parking warden is nearby

Meeting like-minded creators with similar interests is one of the best things about in-person events

that can support them. Inioluwa, Michelle, Jedidiah, and Irioluwa were driven by a desire to give back to their local community and raise awareness of this pressing issue. The team really played to their strengths, with Michelle and Jedidiah heading up research and Inioluwa taking the lead on coding. They are working towards launching their website for public use soon, while keeping their community informed through regular updates on social media.

How to get involved for 2025

Coolest Projects welcomes all digital tech projects, from beginner to advanced, and there are loads of great resources available to help you support the young people in your community to take part. Entries for the online global showcase and a number of in-person events worldwide are still open. Head to **rpf.io/cp-2025** now. (HW)

STEM SMART: WIDENING PARTICIPATION FOR DISADVANTAGED STUDENTS

A free 16-month programme to support students in raising their attainment and confidence

Diane Dowling

STEM SMART (Subject Mastery and Attainment Raising Tuition) is a widening-participation initiative from the University of Cambridge, designed and delivered by Isaac Physics and Ada Computer Science. It is aimed at students at state-funded UK schools who are considering applying to study a STEM subject at a top university and have either experienced educational disadvantage or belong to a group that is statistically less likely to progress to higher education.

The gap between graduates and non-graduates

The Sutton Trust reports that, while there have been substantial improvements in university participation among students from disadvantaged backgrounds in recent years, a significant gap remains between these students and their advantaged peers, particularly at the most selective universities (**helloworld.cc/25yrs-access**). UCAS (the UK's Universities and Colleges Admissions Service) figures show that the most advantaged applicants are six times more likely to enter a more selective institution than the most disadvantaged. Graduate earnings increase at a faster rate than those of non-graduates. Between the ages of 23 and 31, average earnings grow by 72 percent for graduates, compared to 31 percent for non-graduates. For those who were previously on free school meals, the average graduate earnings growth is 75 percent, compared to 26 percent for non-graduates (**helloworld.cc/uni-uk**). It is clear to see that the application deficit has important implications for the future earnings and employment prospects of disadvantaged students, and consequently for equity and social mobility.

STEM SMART students have the opportunity to participate in a four-day residential programme in Cambridge, UK

Research shows that, on average, getting a qualification in higher education (HE) or further education (FE) leads to better earnings. However, the benefits vary a lot depending on the subject. STEM subjects, economics, and law usually lead to higher earnings. In higher education, the type of university also matters. More selective universities, like the Russell Group (**helloworld.cc/russell-unis**), tend to offer greater earning potential, while less selective ones, such as those founded after 1992, offer less. But these top universities are often less accessible to students from lower socio-economic backgrounds, who tend to aspire to less selective schools and courses, even when they have similar grades to their more privileged peers.

Widening participation

STEM SMART is a free 16-month programme to raise students' attainment at school and develop their confidence to apply to study at top universities. The programme starts in the January of Year 12 (ages 16–17) and is split into three phases:

Cambridge students mentor STEM SMART students

Phase 1: consolidating knowledge and building problem-solving skills

This phase begins in January with an online launch event welcoming students to the programme. Each week, students will be assigned work that complements their school studies. An online group tutorial in each subject will be provided weekly to discuss the work. Additionally, students will be assigned a Cambridge student as a mentor, and they will meet them online once a fortnight to discuss various themes related to studying at university, such as university life and choosing courses.

For students who have demonstrated the most active engagement in Phase 1, measured by their weekly participation in assignments across all subjects, there is the possibility of earning a place on a four-day residential programme in Cambridge. Last year, over 400 students were given the opportunity to attend. They participated in subject masterclasses and received advice on applying to university, including guidance on entrance tests and interviews.

Phase 2: preparing for application to competitive universities

All students are encouraged to continue into Phase 2, from September to December of Year 13 (ages 17–18). Depending on the student's preference, weekly teaching in this phase can be in small- or large-group online tutorials in each subject the students are studying. Upon completing this stage, students will receive an award recognising their commitment to the programme and the STEM SMART work they have undertaken. They will also receive advice on describing the award in their UCAS personal statement for their university application.

> "THE PROGRAMME AIMS TO RAISE STUDENTS' ATTAINMENT AND CONFIDENCE

Phase 3: securing strong examination performance and achievement

The final phase of the programme runs from January to May of Year 13 (ages 17–18). The focus at this stage is on the finish line. This includes working with students to consolidate all their learning across their science and maths subjects, and helping them to secure the best possible grades in their public examinations and to meet their university offers. Weekly assignments continue to be set, and tutorials are provided in each subject every week.

The STEM SMART programme started in 2022 with its first cohort of maths, physics, and chemistry students. The following year, biology students were welcomed. In 2024, the first computer science (CS) students were recruited and over 500 eligible students enrolled on the CS strand. Applications for 2025 closed in October and we are delighted to see that applications by CS students have risen by 25 percent.

Mark your calendar

The STEM SMART programme measurably demonstrates that it is possible to improve access to higher education for students from disadvantaged backgrounds. By providing targeted support, we can help these students overcome the barriers they face and reach their full potential. Mark your calendar for September when the next STEM SMART applications open, and find out more at **helloworld.cc/stem-smart**. (HW)

ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING PROJECTS

The Raspberry Pi Foundation's AI project path shows young creators the foundational concepts of machine learning through creative and interactive projects

Pete Bell

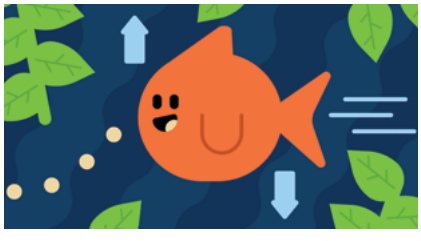
Our AI project path (helloworld.cc/ai-project-path) is designed to introduce creators to the fascinating world of artificial intelligence (AI) and machine learning (ML). These projects bring the latest technology to your Code Club or non-formal learning environment in fun and inspiring ways, making AI and ML engaging and accessible for young people.

The value of learning about AI and ML

By engaging with AI and ML at a young age, creators gain a clearer understanding of the capabilities and limitations of these technologies, helping them to challenge misconceptions. This early exposure also builds foundational skills that are becoming ever more important in various fields, preparing creators for future educational and career opportunities. Additionally, as AI and ML become more integrated into educational standards, having a strong base in these concepts will make it easier for creators to grasp more advanced topics later on.

What's included in this collection

We're excited to offer a range of AI and ML projects that feature both video tutorials and step-by-step written guides. The video tutorials are designed to guide creators through each activity at their own pace and are captioned to improve accessibility. The step-by-step written guides support creators who prefer learning through reading.



'Fish food' is a project that uses Machine Learning for Kids

Create a game using facial recognition in which players chomp the cheese with their own mouths

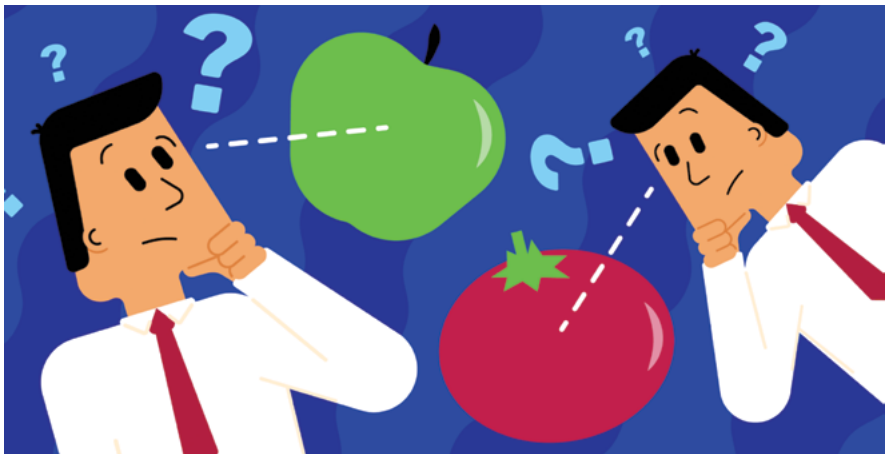
The projects are crafted to be flexible and engaging. The main part of each project can be completed in just a few minutes, leaving lots of time for customisation and exploration. This set-up allows for short, enjoyable sessions that can easily be incorporated into your activities.

The collection is organised into two distinct paths, each offering a unique approach to learning about AI and ML:

'Machine Learning with Scratch' (**helloworld.cc/scratch-ml**) introduces foundational concepts of ML through creative and interactive projects. Creators will train models to recognise patterns and make predictions, and explore how these models can be improved with additional data.

The AI toolkit (**helloworld.cc/ai-toolkit**) introduces various AI applications and technologies through hands-on projects using different platforms and tools. Creators will work with voice recognition, facial recognition, and other AI technologies, gaining a broad understanding of how AI can be applied in different contexts.

Inclusivity is a key aspect of this collection. The projects cater to various skill levels and are offered alongside an unplugged activity, ensuring that everyone can participate, regardless of available resources. Creators will also have the opportunity to stretch themselves — they can explore advanced technologies like Adobe Firefly, and practical



How would you train a model to differentiate between apples and tomatoes?

tools for managing Ollama and Stable Diffusion models, on Raspberry Pi computers.

Project examples

'Chomp the cheese' uses Scratch Lab's experimental facial recognition technology to create a game students can play with their mouths! This project offers a playful introduction to facial recognition, while keeping the experience interactive and fun.

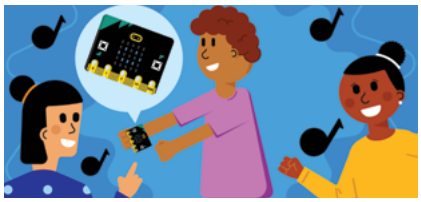
'Fish food' uses Machine Learning for Kids (**machinelearningforkids.co.uk**), with creators training a model to control a fish using voice commands.

In 'Teach a machine', creators train a computer to recognise different objects such as fingers or food items. This project introduces classification in a straightforward way using the Teachable Machine platform (**helloworld.cc/teachablemachine**), making the concept easy to grasp.

'Apple vs tomato' also uses Teachable Machine, but this time, creators are challenged to train a model to differentiate between apples and tomatoes. Initially, the model exhibits bias due to limited data, prompting discussions on the importance of data diversity and ethical AI practices.

> "EARLY EXPOSURE TO AI AND ML BUILDS FOUNDATIONAL SKILLS THAT ARE BECOMING EVER MORE IMPORTANT

'Dinosaur decision tree' is an unplugged AI activity



Use accelerometer data in the 'Dance detector' project

'Dance detector' allows creators to use accelerometer data from a micro:bit to train a model to recognise dance moves like floss or disco. This project combines physical computing with AI, helping creators explore movement recognition technology they may have experienced before in familiar contexts such as video games.

'Dinosaur decision tree' is an unplugged activity in which creators use a paper-based branching chart to classify different types of dinosaur. This hands-on project introduces the concept of decision-making structures, where each branch of the chart represents a choice or question leading to a different outcome. By constructing their own decision tree, creators gain a tactile understanding of how these models are used in ML to analyse data and make predictions.

These AI projects are designed to support young people to get hands-on with AI technologies in Code Clubs and other non-formal learning environments. Creators can also enter one of their projects into Coolest Projects (**coolestprojects.org**) by taking a short video showing their project and any code used to make it. Their creation will then be showcased in the online gallery for people all over the world to see.

With thanks to Amazon Future Engineer for supporting the development of this project path. (HW)

Get hands on with AI in the 'Teach a machine' project

ADDRESSING THE DIGITAL SKILLS GAP

A new self-paced course and certification

Rachel Arthur

The digital skills gap is one of the biggest challenges for today's workforce. It's a growing concern for educators, employers, and anyone passionate about helping young people.

Digital literacy is essential in today's world, whether or not you're aiming for a tech career. Yet too many young people are entering adulthood without the skills to navigate it confidently, and recent research shows that many young people finish school without formal digital qualifications (**helloworld.cc/scari-report**).

While this challenge is a global one, we are exploring solutions in England, where computing has been part of the national curriculum for a decade and the option of studying for a qualification (GCSE) in computer science is open to many 14-year-olds.

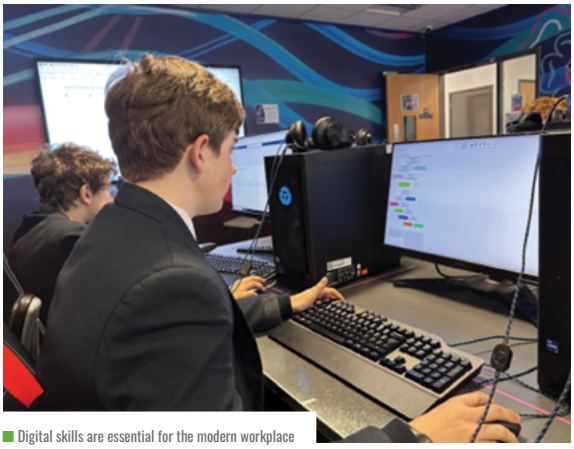
The SCARI (Subject Choice, Attainment, and Representation in Computing) report shows that GCSE Computer Science isn't available in every school in England, and even where it is available, only a fraction of students opt to study it. Where GCSE Computer Science is offered, the focus is not on broader digital skills, but more on programming and theoretical knowledge which, while important, don't support young people with the knowledge they need to succeed in the modern workplace.

The Greater Manchester Baccalaureate

At the Raspberry Pi Foundation, we're working with the Greater Manchester Combined Authority to tackle this challenge head-on. Together, as part of their Greater Manchester Baccalaureate initiative (**helloworld.cc/gm-bacc**), we're developing a self-paced course and certification to help tackle the digital skills gap.

The Raspberry Pi Foundation's Certificate in Applied Computing (**helloworld.cc/rpf-applied-cert**) is designed to be accessed by any pupil, anywhere. It includes a series of flexible modules that students can work through at their own pace. Targeted at ages 14 and up, the certificate covers three stages:

- **Stage 1:** students gain essential digital skills useful for a wide range of careers
- **Stages 2 and 3:** students dive into specialisations in key tech areas, building expertise aligned with in-demand roles



Digital skills are essential for the modern workplace

What we've learnt in Manchester so far

At Oasis Academy MediaCityUK, we held a workshop on digital skills and received input on the certificate. We welcomed educators and industry experts to share their insights, and their feedback has been invaluable.

Teachers pointed out a common challenge: while they see the importance of digital skills, they often lack the time and resources to add new material to an already packed curriculum. Offering the certification as bite-sized modules that focus on specific skills makes it easier to slot the content into the timetable, and helps students with limited access to school (due to illness, for example) engage with the course.

Educators were particularly excited about the opportunity for students to specialise in areas tied to in-demand job roles. Our goal is to make the qualification engaging and relevant, helping students see how their learning applies in the real world.

Next steps

We are currently piloting this qualification in schools throughout Manchester, gathering invaluable feedback from young people as they embark on this learning experience, which will help us refine the course.

Stages 1 and 2 of the qualification will launch later this year, and we can't wait to help students approach their futures with curiosity and confidence. (HW)

(Hello World) Podcast

HEAR MORE FROM SCARI REPORT RESEARCHER, JESSICA HAMER, ON OUR PODCAST, IN AUDIO AND VIDEO: helloworld.cc/pod-girls-in-computing

Raspberry Pi Foundation

Introduce the Code Editor into your school!

The Code Editor helps make learning text-based programming simple and accessible for children aged 9 and up.

> **"We have used it and love it, the fact that it is both for HTML/CSS and then Python is great as the students have a one-stop shop for IDEs."**
>
> - Lee Willis, Head of ICT and Computing, Newcastle High School for Girls

NEW school accounts:

- Create engaging coding lessons and share them with your students: Encourage your learners to get creative with Python, HTML, CSS, and JavaScript.
- Simple and easy classroom management: Organise students into classes and help them reset passwords quickly.
- Free now, free forever: Add an unlimited number of projects, teachers, and students.
- Safe and private by design: Visibility of work at all times and verified school accounts.

Find out more and register your school: **rpf.io/code-editor-hw26**

ESSENTIAL DIGITAL LITERACY FOR ALL

How can we, as educators, support the acquisition of digital skills by all?

Digital literacy is a key skill for the twenty-first-century learner, but not everyone has the opportunity to develop it to the same level. I have written about the importance of basic digital skills for learners with special educational needs and disabilities in a previous issue (helloworld.cc/16), but today I'm going to explore a wider definition of inclusion and the role of digital literacy.

The Nominet Digital Youth Index report for 2023 (**helloworld.cc/digital-youth-2023**) surveyed 4000 young people in the UK between the ages of 8 and 25. According to the data, 6 percent of the 8–15-year-olds surveyed had no access to a laptop, desktop computer, or tablet, and 19 percent of this age group had no access to home broadband. According to the Digital Youth Index in Children and Young People Now (**helloworld.cc/cypnow**), "Children and young people more likely to be left behind in the digital world are those without access to a laptop or desktop computer, those whose household does not primarily speak English or Welsh, those with special educational needs, receiving free school meals and being looked after by a single parent or caregiver."

In addition, a recent report from the King's Trust and Solutions Research (**helloworld.cc/Kings-Trust-2024**) found that over one in three young people between the ages of 16 and 20 in the UK are worried they don't have the digital skills to get a good job. Confidence to pursue a career involving digital skills was at its lowest among those who already faced disadvantage, such as those not in education or employment, or those with poor access to the internet. This all points to a digital skills crisis among our young people and a growing digital divide between those who are digitally connected and those who aren't.

What is digital literacy and why is it important?

I am using the British Computer Society's (BCS) working definition of digital literacy (**helloworld.cc/digital-literacy-bcs**): "Digital literacy encompasses the knowledge, skills and attitudes that underpin the ability to make confident, creative, and effective use of technologies and systems, and make well-informed critical judgements about the implications and impact of how digital technology is used." This encompasses both the basic skills required to use digital technology effectively and the knowledge and critical-thinking skills that are essential in staying safe, evaluating content, working with technology, and managing one's online life.

Lacking key digital literacy skills and knowledge can impact upon confidence, future careers and earning power, health and well-being, learning and development, and access to services. It can also lead to social exclusion. Children without these skills are more likely to be exposed to the risks of fake news, disinformation, and other online harms (**helloworld.cc/child-of-the-north-2024**).

What about AI and digital literacy?

The development of new technologies such as generative AI (GenAI) can also exacerbate any existing divisions. A report on AI tools and educational outcomes from the Tony Blair Institute for Global Change suggests that these technologies have the potential to enhance student learning outcomes by approximately 6 percent and will ultimately lead to an increase in GDP due to the boost in productivity of the future workforce (**helloworld.cc/ai-education-case**). However, technical factors such as technology availability, broadband speed, and computational data are crucial for the effective use of AI tools (**helloworld.cc/ai-equity-education**). Risks from online harms, misinformation, and bias are likely to increase exponentially as the use of GenAI increases and the outputs become more realistic. Teaching about

Catherine leads the Sheffield eLearning Service (**sheffieldclc.net**) and has spent a number of years working on ways to make computing accessible for all learners. She is co-chair of the CAS Include working group and specialist lead for the Gender & Inclusion Computing Hub as part of the NCCE.

Over a third of young people aged 16–20 in the UK are worried they don't have the digital skills to get a good job

AI in schools is varied, often depending on individuals with the interest and confidence to lead the way. One survey from 2023 showed that 18 percent of teachers in state-funded schools were unaware of ChatGPT, compared with 8 percent of those in private schools (**helloworld.cc/education-intelligence-2023**).

Any discussion around digital literacy must therefore include the risks and benefits of AI tools, and how we can help students develop skills to use the tools effectively and safely — not just where individual expertise and interest exist in a school, but across all settings.

What can we do as educators?

Although many of the digital-divide barriers faced by young people can't be addressed by schools, we can have an impact. Here are some questions you may wish to consider in order to improve access to technology and develop digital literacy skills and confidence in your learners:

1. Can your school provide devices to children and young people? A number of schemes were set up during the Covid-19 pandemic and continue to provide, for example, reconditioned laptops to families without access. Can you source devices from local businesses?

2. Can you provide access to technology at lunchtimes or during breakfast and after-school clubs? Learners could complete homework or develop key skills during this time, such as playing typing games.

3. Do you ensure that digital literacy is a key part of your curriculum offer from an early age? Where do children and young people develop their skills? Is it only in specific computing lessons, or can they practise across the curriculum? Is enough time dedicated to practising basic skills before moving on to more complex content?

4. Do you teach your students how to use the assistive technologies built into devices and software, in order to support access?

5. Can you offer family sessions, particularly in primary school, where parents and carers can develop digital literacy skills alongside their children?

6. To what extent are teachers and support staff within school supported to develop their own digital literacy?

7. Do you ensure that your learners are aware of the importance of digital skills for future careers, and do you provide them with a range of relatable role models?

8. What opportunities are there for students in secondary education to develop their digital literacy skills and complete relevant vocational qualifications?

9. Do you teach your students about AI? Do they understand the risks and benefits of the technology?

Ultimately, equipping all young people with basic digital skills and digital literacy is essential for their own individual success, but to do this we will need to address the inequalities and barriers that exist for some of our learners when accessing the digital world. (HW)

#INSIGHTS

EMPOWERING STUDENTS TO SOLVE REAL-WORLD PROBLEMS WITH DATA-DRIVEN PROGRAMMING

STORY BY Katharine Childs and Bobby Whyte

Data science skills are increasingly important in an age of the widespread adoption of artificial intelligence (AI). AI systems rely on large quantities of data, so an understanding of the role of data is necessary if we are to develop and use accurate and safe models. Researchers have argued that these competencies represent a paradigm shift in computing education, and that educators and resource developers should ensure students are being prepared for a data-driven future.

Data science education is growing globally, reflecting the importance of data literacy in modern society. Educational programmes often present data science as an interdisciplinary field, teaching students skills such as coding, database management, and statistical analysis, while also emphasising the ethical use of data. By connecting different disciplines, data science education aims to develop critical thinking, problem-solving, and collaboration skills, preparing students for diverse career paths.

In this article, we detail three case studies of research-informed teaching in data science in the computing classroom at primary, middle, and high school, demonstrating the breadth of data science across educational levels. We also provide practical strategies and tools for integrating data science activities into your lessons.

Primary school: teaching machine learning in elementary school

A 2024 study (**helloworld.cc/ml-elementary**) used a constructionist approach to data science and machine learning. The study took place in Israel with a small group of 12-year-old students, who were split into two groups. One group used a Single-Neuron toolkit, a programmable learning environment designed to help students construct simple artificial neural networks (ANNs). This toolkit enabled learners to engage with data collection, analysis, and interpretation, fostering an understanding of how machines learn from data. In the other group, the machine learning approach was opaque, and students focused on training and validating pre-existing machine learning systems.

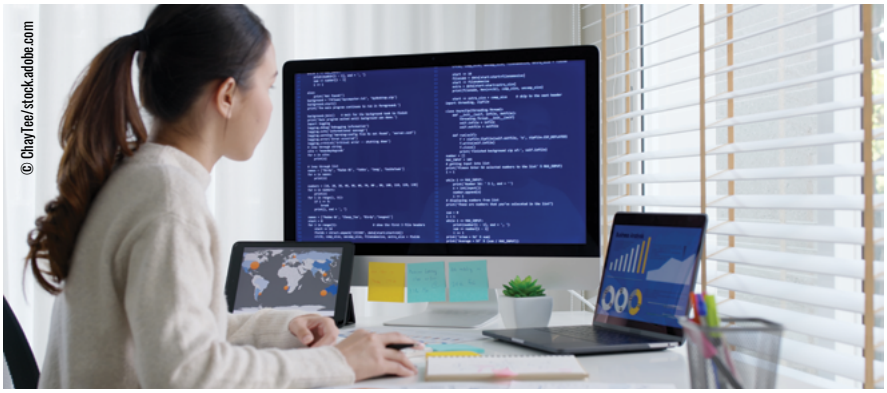
The results of the study suggested that students working with an opaque view of machine learning developed more skills in data handling, prediction, and evaluation. On the other hand, the students who worked with transparent machine learning to develop an ANN developed more perspectives about creating a good machine learning system.

Middle school: data detectives

A 2022 study (**helloworld.cc/data-detectives**) used a mathematical perspective to explore how middle-school students (ages 11–13) learn data science skills, through a study that combined non-programming activities with programming using the R language. The study activities, designed around a constructionist, learner-centred framework, aimed to introduce data science concepts and practices in an engaging and accessible way, aligned with the GAISE II guidelines (**helloworld.cc/GAISE-II**).

Students participated in activities including using Google Trends to explore and visualise search data, and analysing snack nutrition facts to understand data types, graphing, and basic statistics. They also learnt to use R programming to analyse and visualise movie data, and ultimately completed final projects using data sets of their choice.

An analysis of the participants' work



Data science education fosters critical thinking, problem-solving, and collaboration skills, preparing students for diverse careers

found that students were engaged in data science processes, such as formulating questions and analysing data, and practices such as identifying patterns and reasoning about relationships. They also developed a conceptual understanding of statistical concepts like plots, correlations, and effect size. However, learners also demonstrated misconceptions when interpreting findings from their analysis, as they did not always understand the data's context. This suggests that it is important to use real-world data sets which are rich in contextual information.

High school: API Can Code

API Can Code (**helloworld.cc/API-can-code**) is a research-informed data science curriculum for high schoolers (ages 14–18). The curriculum is designed to engage students to pursue personally meaningful questions based on their own interests. Students are then encouraged to collect relevant data using application programming interfaces (APIs) for popular services such as IMDb (Internet Movie Database). The curriculum uses a Use–Modify–Create approach, in which students first encounter prewritten programs before modifying them to collect alternative data, and then writing their own programs. Students then generate their own personally relevant questions, create a program to gather relevant data, cleaning and processing the collected data, and use appropriate visualisations to aid interpretation and analysis.

The researchers piloted the curriculum with high-school students and their teachers. Using interview data, student project work, and lesson observation data, they found that students appreciated interest-driven activities and could gain an understanding of data science concepts, relevant computational practices, and experience using tools such as EduBlocks and CODAP (Common Online Data Analysis Platform). However, students still required some instruction when working with different data types (for example strings). The project demonstrates how an interest-driven approach can provide opportunities for students to engage with data science through authentic and personally meaningful activities.

Resources

Integrating data science starts with accessible, user-friendly tools that help students explore data and draw meaningful conclusions. When choosing a tool for your classroom, consider accessibility, ease of use, and alignment with your students' skill levels. It's also important to evaluate whether the tool offers opportunities to connect data science concepts with your curriculum goals and real-world applications that resonate with your students. Finally, consider what type of data the tool is collecting, and where that data will be stored; for example, will your learners be working with pictures, video, audio, or text data? Will the data be stored locally (for example on the school network) or in the cloud?

Some tools used in research studies are shared here as examples of how data science is being used with K–12 learners (ages 5–18):

1. Google Teachable Machine (**helloworld.cc/teachablemachine**) is a web-based tool for creating models using images, audio, or poses. It integrates with Google Drive, so data is saved in your own Google Drive.
2. ML-Machine (**ML-machine.org**) is a web-based tool for collecting data about movement using the accelerometer of the BBC micro:bit. Students can test their model by getting active with their micro:bit and seeing whether their movement is predicted correctly.

Practical strategies

The insights from these case studies can be adapted to your classroom, regardless of the age of your students:

1. Work with transparent machine learning to support students with developing perspectives about creating a good machine learning system
2. Provide real-world data sets to engage students in data science processes and to minimise misconceptions when students interpret findings
3. Use an interest-driven approach, with opportunities for pupils to engage with data science through authentic and personally meaningful activities

We encourage educators to explore data science education and to find ways of making data science relevant and engaging for their students. By doing this, we can help prepare learners for a future in which data is a powerful tool for understanding the world around us and solving real-world problems. (HW)

FURTHER READING:

Shapiro, R. B., Fiebrink, R., & Norvig, P. (2018). How machine learning impacts the undergraduate computing curriculum. *Communications of the ACM, 61*(11), 27–29. **helloworld.cc/Shapiro**

Tedre, M., Denning, P., & Toivonen, T. (2021). CT 2.0. *Proceedings of the 21st Koli Calling International Conference on Computing Education Research, 3*, 1–8. **helloworld.cc/Tedre**

DEVELOPING DIGITAL LITERACY IN THE UK

Becci Peters shares how Computing at School (CAS) is supporting digital literacy skills for students and educators

Digital literacy is now a fundamental priority in education across the globe and a vital part of the national curricula in all four UK nations. However, employers have voiced concerns to the House of Lords Select Committee on Digital Skills, reporting difficulties in finding these skills during recruitment. Currently, in the UK:

- **Around 11 million people lack the digital skills needed for daily life**
- **36 percent of employees lack core digital skills for the workplace**
- **Only 74 percent of people earning up to £13,500 a year possess essential digital skills for life, compared to 95 percent of those earning over £75,000**

■ Working collaboratively using digital tools, in person or online, is part of digital literacy

What is digital literacy?

The British Computer Society (BCS) offers a working definition of digital literacy that goes beyond the specific application skills outlined in the UK government's essential digital skills framework. Digital literacy is more than knowing how to use software. It refers to the knowledge, skills, and attitudes that allow people to use technologies confidently, creatively, and effectively, while making informed decisions about the impact of these tools. This broader view of digital literacy equips people with the essential skills needed to fully participate in our increasingly digital world.

More than just tech skills

This approach to digital literacy from the BCS covers both using digital technology and understanding how it works. It's about much more than knowing how to operate a tool or piece of software — it involves:

- Grasping the fundamentals of computer science and understanding how technology functions
- Developing literacy in data, media, and the implications of artificial intelligence for everyday life
- Building critical-thinking skills to evaluate both personal and external uses of digital technology
- Gaining the knowledge to work individually and collaboratively using digital tools

As technology becomes further integrated into our daily lives, digital skills become ever more crucial. They enhance learning, prepare students for the workforce, and help bridge the digital divide, ensuring everyone can adapt to a rapidly changing world.

Digital literacy for teachers

For teachers, digital technology offers opportunities to tackle the challenges of twenty-first-century education. It's now used to support learners, streamline teaching, and manage workloads. However, without sufficient support, developing digital literacy can feel like just another task on an already busy to-do list.

This is where Computing at School (CAS) steps in. It plays a pivotal role in promoting digital skills in education by supporting the teaching and learning of computing through resources, professional development, and building a community of practice (**computingatschool.org.uk**). CAS provides:

- **Curriculum development:** CAS has contributed to shaping the national

■ Teachers need to be able to interpret educational data to be effective in their roles

curriculum in computing in England, ensuring students receive an education in technology and computational thinking from an early age
- **Teacher training:** CAS provides training and resources for teachers, many of whom may not have a computing background, enabling them to confidently teach digital literacy
- **Community building:** CAS fosters a vibrant community by bringing together educators, industry experts, and academics to share advice and best practices
- **Innovation and research:** CAS drives research in computing education, keeping schools at the forefront of educational technology

Key areas of digital skills for teachers

Recognising the ongoing need for professional development in digital skills, CAS has developed a comprehensive checklist of digital skills that teachers need to perform their roles effectively. For example:

- **Basic digital literacy:** skills in using word processors, spreadsheets, and presentation software
- **Online communication:** proficiency in tools such as Google Classroom or Microsoft Teams for content creation, sharing, and engagement
- **Cybersecurity:** awareness of online safety protocols to safeguard personal and student data
- **Digital content creation:** skills to create and edit multimedia content
- **Data management:** competence in using tools to collect, analyse, and interpret educational data

By leveraging this checklist, teachers can conduct a thorough assessment of their current digital skills and identify areas for improvement. This structured approach ensures that their professional-development efforts are targeted and effective, ultimately leading to better teaching outcomes.

Implementing the checklist

The checklist is more than just a list of essential competencies; it is a roadmap for identifying and addressing continuing professional development (CPD) needs within schools. Here is a step-by-step approach to implementing the checklist:

1. **Self-assessment:** teachers assess their own digital skills using the checklist, helping them identify strengths and areas for improvement. To assist with this, we've created a form which you can copy to see staff responses (Microsoft version: **helloworld.cc/CAS-checklist-ms** or Google Forms version: **helloworld.cc/CAS-checklist-google**).
2. **Collaborative review:** organise staff meetings to discuss the assessment results, identify common areas for development, and share expertise.
3. **CPD planning:** use your assessment results to develop a tailored CPD plan, such as incorporating in-house training, external workshops, and online resources.
4. **Continuous support:** create a support system for ongoing skills development, such as through peer mentoring and online resources.
5. **Evaluation and feedback:** regularly evaluate the impact of your CPD activities and refine the plan based on teacher feedback.

In an increasingly digital world, digital literacy is no longer a luxury, but a necessity. CAS is committed to supporting educators in developing these vital skills, ensuring that both teachers and students can thrive in the digital age. (HW)

BECCI PETERS

Becci is the secondary computing lead at Computing at School (CAS). An enthusiastic educator and digital learning specialist, Becci is passionate about using technology to enhance student learning. As a computer science and IT teacher, Becci loved engaging students with innovative teaching strategies and helping them build their digital literacy.

DIGITAL LITERACY IN INDIA

Challenges, initiatives, and the path forward

In 2023, an initiative was introduced to bring IT and coding to grade 9 and 10 students (14–16-year-olds) in public schools across a state in India. This programme highlighted the challenges and opportunities in advancing digital literacy. A striking moment during the initiative was when a participating teacher froze during training. When we enquired, we found out that she had never used a mouse before. This incident underscores the broader challenges to digital literacy in India, and the steps required to address them.

How is digital literacy defined?

Digital literacy has been defined as the ability of individuals and communities to understand and use digital technologies for meaningful actions within life situations (the National Digital Literacy Mission or 'DISHA', **helloworld.cc/ndl-mission**).

In India, digital literacy skills vary widely across states, urban–rural divides, and genders. A 2021 government report (**helloworld.cc/india-mis-report**) indicates:

- 43 percent of youth (ages 15–24) can perform basic tasks like copying or moving files (49 percent of males and 37 percent of females; 63 percent of urban and 35 percent of rural youth)
- Only 2.2 percent of youth can write computer programs using specialised programming languages

Despite these challenges, ICT skills have grown considerably over the past two decades, driven by India's expanding digital footprint, including mobile subscriptions, internet usage, and digital payment systems.

The state of Odisha trained teachers through Code Clubs and later, an IT & Coding curriculum

In the formal space

Private schools, constituting 29 percent of India's 1.5 million schools, often include basic computer education. The Central Board of Secondary Education (**cbse.gov.in**) has been proactive in introducing initiatives such as:

- Coding modules (2021/22): developed with Microsoft for grades 6–8 (ages 11–14), featuring 12 hours of coding skill sessions
- AI skills curriculum: launched in partnership with Intel for grades 8–10 (ages 13–16) under the 'AI for Youth' programme
- Digital safety and augmented/virtual reality courses (2022): developed in collaboration with Meta, targeting 10 million students over three years

The greatest need for formal computer learning is in the state-run government schools. Most of India's 28 states do not have a formal ICT/computer learning component as part of their curriculum. In some states, it has been introduced in an elective format, while staying clear of including it in grade 10 (ages 15–16) — the year when students take their first board exams.

The state of Odisha has taken a fresh approach. As part of their High School Transformation Programme (**helloworld.cc/odisha-5t**), they have introduced new infrastructure (computers and smart boards for classrooms) to all 8000+ government high schools. They followed this up by partnering with organisations to pilot coding programmes in some of these schools. As part of their partnership with the Raspberry Pi Foundation, India, teachers were trained and Code Clubs were started in 1000 schools in 2022–23.

In the following year, the Odisha state government formalised an IT & Coding Curriculum, introducing the subject in grades 9 and 10 (ages 14–16) of all the 8000+ high schools. This reached up to 1.1 million students. The curriculum for grade 9 constituted digital literacy, data and data analysis, and coding units. It was a much-needed push to bring digital literacy to public schools, usually catering to economically and educationally disadvantaged students.

Similarly, as part of its Little KITEs programme (**helloworld.cc/kites**), the Government of Kerala, in partnership with UNICEF, has trained 4500 teachers to guide 1.8 million students on the Internet of Things, AI, robotics, 3D animation, multimedia, and mobile app development.

In the non-formal space

In the community space, many civil society organisations, both large and small, work in pockets to bridge the digital literacy gap among students and teachers.

One organisation with a strong ground presence in India is Pratham education foundation. Together with RPF India, they helped establish over 2000 Code Clubs reaching 10,000 students in villages.

Similarly, Welspun Foundation hires para-teachers from the community and supports their professional development so that they can hold digital literacy sessions for students in select schools.

Government initiatives

As part of the prime minister's vision for a digital India, under the National Digital Literacy Mission (**helloworld.cc/ndl-mission**), one person in every eligible household of select blocks (administrative units) in each state/Union Territory will be given computer skills training. The objective is to impart basic ICT skills that are relevant to the needs of the trainees, enabling them to use IT and related applications, participate actively in the democratic process, and improve their lives. These people will be able to access information, knowledge, and skills through the use of digital devices. This training programme, for ages 14–60, includes the following two levels:

Level	Eligibility
1 Appreciation of Digital Literacy	Non-IT literate - Illiterate and up to 7th standard pass
2 Basics of Digital Literacy	Non-IT literate with at least 8th standard pass

In addition, government initiatives such as Pradhan Mantri Gramin Digital Saksharta Abhiyaan (**helloworld.cc/pmgdisha**), focusing on training rural citizens in basic computer education and use of the internet, and DISHA (**helloworld.cc/ndl-mission**), where the government partners with various stakeholders, including NGOs, academic institutions, and private organisations, to promote skill development and digital literacy, have helped spread digital skills among citizens.

Key levers

When we look at digital literacy in Indian society, some of the key areas that need improvement are:

- There is a shortage of qualified teachers of computing and digital literacy to cater to India's student population
- More infrastructure is needed to support digital learning, especially in rural areas
- A common curriculum is required, to cater to the needs of India's diverse student populace

Improvements on these three fronts would significantly support the various digital skill-building initiatives of the government and help to get young people ready for their future careers.

Future hope

The hope for digital literacy in India lies with mobile phone and internet penetration. As of 2024, there were 954 million internet users in India, and over 95 percent of villages had access to the internet with 3G/4G connectivity. A lot of organisations are now leveraging this to come up with mobile-based solutions (like apps, chatbots, online webinars, YouTube channels, and WhatsApp or Telegram groups) to train teachers, young people, volunteers, and students.

This mobile revolution will be key to India's digital journey over the next decade. (HW)

■ The aim is for one person in every household to have computer skills training

SOURAV PATTANAYAK

Sourav manages formal and non-formal learning in Odisha, India. He loves nature, children, and stories, and wishes to improve education at the grassroots level.

WHAT CAN WE LEARN FROM DIGITAL LITERACY IN THE NETHERLANDS?

Sue Sentance examines changes to curriculum design in the Netherlands

I recently had the pleasure of attending the ISSEP (Informatics in Schools) conference, where a paper was presented by Nataša Grgurina and Jos Tolboom (helloworld.cc/digital-literacy-nl). Grgurina is a curriculum developer who is deeply involved in plans to update the digital literacy curriculum in the Netherlands.

In the Netherlands, the curriculum is being redeveloped for grades K–8 (ages 4–14). The government assigned the task of writing the curriculum for each subject to the Netherlands Institute for Curriculum Development (**slo.nl**), which then put together a team of teachers, curriculum developers, and education and informatics specialists.

Grgurina cited Gert Biesta's three aims of education as the philosophy underpinning this curriculum development (**helloworld.cc/Biesta**): qualification (developing knowledge that enables learners to 'do something'); socialisation (ways in which, through education, we become members of and part of particular social, cultural, and political 'orders'); and subjectification (the opposite of socialisation, meaning students' development as autonomous individuals).

Vertical and horizontal coherence

The Dutch team used a set of quality criteria in the curriculum design, including developing 'vertical coherence' (sequencing or spiralling the content through grades K–8 so that topics build on one another) and 'horizontal coherence' (ensuring that the curriculum aligns with other subjects). Hearing about horizontal coherence gave me food for thought. How much is this neglected when computing and digital technology are introduced? Do we know enough about the dependencies and opportunities within our subject to teach it discretely while also symbiotically linking to other curriculum areas?

■ What characterises a particular subject area? How do we describe the relationships with other subjects?

Back to the Netherlands. Grgurina and Tolboom described the guiding principles underpinning curriculum design as:

1. The learning area has specific knowledge and skills
2. The learning area offers opportunities for expression and creative design
3. The learning area has a reflective component
4. The relation between people and digital technology is reciprocal
5. Digital literacy is intertwined with other learning areas

Digital literacy

In total, 70 percent of curriculum time in grades K–8 in the Netherlands is focused on subjects, and 7 percent of that curriculum time is available for digital literacy. The content is divided into three domains: practical knowledge and skills; designing and making; and the interaction between digital technology, digital media, people, and society.

Given that this is a proposed new curriculum — there is an existing informatics curriculum for the secondary levels (**helloworld.cc/informatics-nl**) — it is interesting to see artificial intelligence and data taking their place among other, more expected, topics.

Technical knowledge is interwoven

with societal issues, demonstrating the interaction between society, technology, and the individual.

All too often, technical and societal aspects may be presented as different domains of knowledge, while learning about computer science principles is separated out from issues relating to the human and society. In my own research career, I've long been convinced by the work of Carsten Schulte from the University of Paderborn on the socio-technical approach to computing, and the way in which society influences technological advancement (**helloworld.cc/schulte-budde-2018**).

Designing and making

Returning to the Netherlands' curriculum plans, in their digital literacy domain of 'Designing and Making', we see a coherent and creative mix of developing digital products with programming. I found it quite refreshing to see programming explicitly included within 'Designing and Making', and that it included consideration of testing and the requirements of others. Schulte has more to say about the role of programming in the primary and secondary computing curricula, if you would like to read more about this topic (**helloworld.cc/schulte-programming**).

Terminology

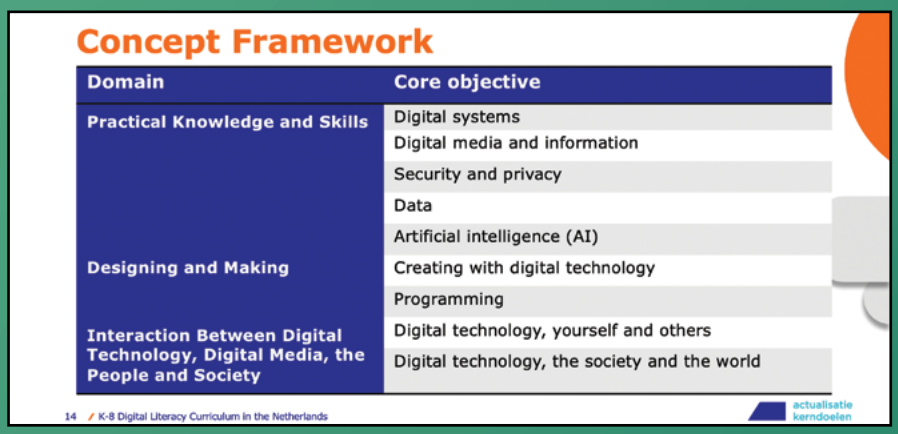
It is worth noting that the digital literacy curriculum being designed for the Netherlands includes artificial intelligence and programming, which highlights the fact that the term 'digital literacy' is being used much more broadly than in other countries. Similarly, the term 'informatics', used in many European countries, corresponds to 'computing' or 'computer science', and can be interpreted differently depending on the curriculum. I know of no other country that makes a distinction between computing and computer science in the way that England does, which makes some of the discussion around terminology in England very difficult to relate to internationally. This debate has become so hard-wired into our thinking that I believe it is creating a fixed mindset and causing division where there does not need to be any. Even without looking too far from England, Wales has called its equivalent subject 'Digital Competence' (**helloworld.cc/digital-competence**), and Northern Ireland offers a GCSE in 'Digital Technology' (**helloworld.cc/digital-tech**).

Questions to consider

Here, in short, are the questions I was left considering, and which I think are pertinent for the curriculum review in England and for any country reworking a curriculum in the areas of digital technologies/computing:

- Does your curriculum have horizontal coherence as well as vertical coherence? In other words, are you introducing topics in maths, science, literacy, and computing that complement each other? Are you ensuring that those topics do not depend on topics in other subject domains that haven't been taught yet?
- Can we view programming as part of designing and making, and not as a reflection of a mathematical endeavour?
- Are we ensuring that all children have an understanding of artificial intelligence, starting with data literacy?
- Can we integrate skills around digital media with computer science principles, rather than having a debate that leads to an either/or?
- Does what we call the subject really matter?

Grgurina and Tolboom's presentation can be found at **helloworld.cc/Grgurina**. If you are interested in how other countries in Europe teach computing, the European Commission's 'Informatics education at school in Europe' report details how computing is taught in 37 European countries (**helloworld.cc/informatics-eu**). (HW)



The three domains of digital literacy and nine associated topics from the planned K–8 curriculum for the Netherlands

SUE SENTANCE

Sue is the director of the Raspberry Pi Computing Education Research Centre at the University of Cambridge. Formerly a computing teacher, she leads a number of research projects relating to computer science and AI education, including programming pedagogy and physical computing.

DIGITAL NATIVE OR DIGITAL NAIVE?

Rethinking digital literacy

The term 'digital native', as defined by the Cambridge Dictionary, suggests an inherent proficiency with digital technologies among those who have grown up surrounded by them. This notion, however, warrants a critical examination. Merely growing up in the digital era does not equate to a comprehensive understanding of digital tools and platforms. This misconception mirrors the flawed assumption that native speakers of a language possess an innate understanding of its grammatical rules without formal education. The reality is far more complex, necessitating a nuanced approach to digital literacy, especially in educational contexts.

This article looks at insights gained from piloting a digital skills course as part of the Erasmus+ Digital Job Onboarding project (**helloworld.cc/djo**), uncovering a critical oversight in our assumptions regarding high digital literacy among youth in the setting of a work environment.

The myth of the digital native

The concept of the digital native has evolved alongside technological advancements. Initially, it described the millennial generation, who were the first to grow up with home computers and internet access. Today, it ostensibly applies to Generation Z and Generation Alpha, who are perceived as even more tech-savvy due to their upbringing amidst ubiquitous high-end technology. However, this generational familiarity with technology often masks a critical gap in understanding. Young people today may navigate smartphones and social media with ease, yet this surface-level engagement falls short of a deeper comprehension of digital tools and their potential applications.

Our experiences piloting a digital skills course for an Erasmus+ Digital Job Onboarding project revealed a significant oversight in our assumptions about digital literacy among young people. The course, designed for individuals aged 15 to 25, aimed to cover essential topics such as digital tool proficiency, online security, and professional conduct on social media. Contrary to our expectations, a familiarity

Educators can help bridge the gap by addressing foundational digital skills

THE DIGITAL JOB ONBOARDING PROJECT

Recognising the impact of missed opportunities for vulnerable target groups to gain digital skills during the Covid-19 pandemic, the Digital Job Onboarding project (**helloworld.cc/djo**) is a training programme that encompasses both digital and sustainability aspects. The curriculum focuses not only on technical skills, but also on a comprehensive digital transformation, encompassing technology, self-management, legal, ethical, and sustainability factors.

Jugend am Werk Steiermark GmbH in Austria (**jaw.or.at**) is a nonprofit organisation providing social services to support children, young people, and adults. Haaga-Helia University of Applied Sciences (**haaga-helia.fi**) is the second-largest university in Finland. They collaborated with partners from Cyprus, Finland, Italy, Czechia, and Austria on the Digital Job Onboarding project (**dj-training.eu**) led by Austria's FH JOANNEUM, to help bridge the digital divide for vulnerable young jobseekers, particularly those without academic qualifications.

■ Growing up in the digital era does not necessarily equate to being digitally literate

with daily technology use did not translate into a comprehensive understanding or skill set. This 'TV generation thinking error' assumes that exposure equates to expertise — a misconception dating back to the era when televisions entered our living rooms, and children seemed more adept at operating them than adults.

Bridging the digital literacy gap

The analogy of language learning is helpful for understanding the challenge at hand. Generation Z, much like A2-level language learners, may know how to 'speak' the digital language — using apps, navigating interfaces, and communicating online. However, without a foundational understanding of digital grammar — such as file management, software functionality, and internet safety — they are merely scratching the surface. Our educational efforts must therefore extend beyond mere usage, focusing on the rules and structures that underpin effective and secure digital engagement.

During the digital skills course, a simple task such as entering a URL into a browser's address bar highlighted the discrepancy between perceived and actual digital literacy. Many participants defaulted to using the search bar, revealing a fundamental gap in understanding. This moment underscored the necessity of foundational digital education, teaching not just how to use specific applications, but the underlying principles of digital technology. Basic programs like Microsoft Word and Excel serve as excellent starting points, as they encapsulate concepts that are applicable across numerous online tools.

The responsibility falls on educators, teachers, and vocational education and training (VET) professionals to help bridge this gap. We must recognise the limitations of the digital native label and ensure that our teaching strategies address foundational digital skills. This approach is particularly crucial for young people with varying educational backgrounds, including those classified as NEETs (Not in Education, Employment, or Training), who may lack access to comprehensive digital literacy education.

As technology continues to evolve, becoming increasingly user-friendly, it is tempting to overlook the importance of basic digital literacy. However, akin to ignoring the grammatical rules of a language, this oversight can lead to a superficial engagement with digital technologies. Educators, policymakers, and technology developers must work together to redefine digital literacy education, ensuring that it encompasses both the practical skills needed for today's digital tools and the critical thinking necessary to navigate the digital world responsibly and effectively.

In revising our approach to digital literacy, we not only empower the next generation to use technology more effectively, but also lay the groundwork for a more inclusive and digitally competent society. The journey from digital naivete to digital fluency requires a collective commitment to education that values the foundational over the flashy, the substance over the surface. (HW)

This article first appeared in eSignals, Haaga-Helia University of Applied Sciences' online journal.

ANTONIA O'CONNELL (NÉE PICHLER)

Antonia is the coordinator of psychosocial support services at Jugend am Werk Steiermark GmbH in Graz, Austria, following her studies in pedagogy and adult education.

ANNA LAHTINEN

Anna is a senior researcher at Haaga-Helia University of Applied Sciences in Helsinki, Finland, with a specialisation in the transformative effects of artificial intelligence on working life, businesses, and careers.

TEACHING DIGITAL LITERACY WITHOUT DEVICES

How to make the most of the available resources to teach digital literacy

A lack of devices presents teachers with challenges in any setting. In schools, money is often limited and technology can be pushed to the back of the queue when buildings need maintenance or libraries need replenishing. This issue is particularly important when the very subject you teach relies on and relates to devices which you may have limited or no access to. It must be frustrating for teachers in this situation to be on the receiving end of marketing campaigns from companies showing how their curriculum offering will utilise the very latest in robotics, AI, or media production, when their reality is that they don't have anything like the means or resources to deliver them.

Fortunately there are solutions that can help. In this article, I will outline some of the ways the Raspberry Pi Foundation is working with teachers worldwide to make the teaching of computing less resource-heavy and more accessible and equitable.

Kenya: a case study

Our work in Kenya has brought this issue into sharp focus. We are currently in the process of developing curriculum resources to deliver the Kenyan curriculum to schools in Mombasa and the Frontier Counties. There are big contrasts both between and within these two areas of the country. Some schools are well equipped with up-to-date technology, while others have very little access to any computing devices, and smartphones play a crucial role in these schools.

With that in mind, we have developed curriculum resources which contain suggested class activities that maximise limited devices, such as the use of projected demonstrations. We have also provided a step-by-step guide to computing tasks with

There are apps that provide a similar experience to that of using a Bee-Bot floor robot

accompanying screenshots, to guide learners through the tasks conceptually. This approach ensures they understand the process, allowing them to apply the knowledge practically when they gain access to the necessary devices.

We make resources available online and in downloadable documents. This means the resources can be taken offline and taught in places where there is no reliable internet connection. We are also careful to limit file sizes, to make downloads more accessible. Wherever possible, we make our resources device-agnostic, so that they can be accessed on a wide range of devices, including personal devices such as mobile phones.

As well as curriculum resources, the Raspberry Pi Foundation has also adapted training to make it more accessible for those with less experience using computing devices. For example, during a recent project coaching community trainers in Mombasa, we increased the prominence of activities involving improving digital skills on a variety of devices. This meant that when passing the training on to other teachers, the community trainers had a broader set of skills across a wider range of devices.

Unplugged activities

Even computing-specific concepts such as a programming construct can, to a degree, be taught with very limited access to devices. Unplugged activities, where no digital technology is required, can be used to introduce fundamental concepts such as sequencing and repetition. You can ask students to recognise patterns in repeating sequences of colours, and identify how you could describe them without having to repeat the colours many times. While it is recognised as good practice to then link the learning back to a plugged activity in which the student can apply the unplugged learning, there will still be a benefit to the student when that is not possible.

Emulators

There are also a significant number of devices which provide online emulators that mirror the functions of a physical device.

■ Providing a range of activities, both plugged and unplugged, equips community trainers with a wider skill set

Consider Bee-Bot floor robots, which can be relatively expensive to purchase and are often broken or damaged in a classroom environment. If you are unable to get hold of the physical device, there are apps which provide a similar experience (**helloworld.cc/beebot-emulator**). Similarly, the micro:bit, a really versatile microcontroller, can be emulated in the MakeCode programming environment. This emulator enables you to mimic the use of all the onboard buttons and sensors on the physical device. There are also numerous emulators which enable you to make and test your own circuits using a variety of hardware platforms.

What do you actually need?

Sometimes it can be helpful to consider the devices you actually need — they might not be as expensive as you think. General-purpose, small-board computers such as the Raspberry Pi can be bought new for as little as £25, and more powerful models still under £50. Similarly, microcontrollers such as the Raspberry Pi Pico, micro:bit, or Crumble, range from about £5 to £20 per device, with accessories such as LEDs, jumper leads, motors, and buzzers also reasonably priced. This can represent a relatively low-cost entry into physical computing and robotics, especially if you pair them with craft materials or share devices between students.

Make the most of it

However limited your access to devices is, I encourage you to think about how you can make the most of what you have. Look out for partners or solution providers who prioritise inclusivity and accessibility in their resources. Consider how you can make activities accessible on a wider range of devices, to make the most of what students may already have, or use unplugged activities and relate them back to plugged devices. Finally, check out devices which might be more affordable than you realised. Good luck! (HW)

BEN HALL

Ben is a senior learning manager at the Raspberry Pi Foundation, where he develops training resources to support computing educators worldwide.

FROM CLICKS TO COMPETENCE

Rethinking digital literacy in US schools

Have you ever heard someone say, 'These kids are on their phones all the time — they're way more tech-savvy than me'? While today's students may excel at using apps, social media, and video games, that does not equate to digital literacy. Digital literacy is the ability to use technology effectively, responsibly, and critically. It includes not only foundational skills like navigating the internet, managing emails, and using productivity software, but also advanced competencies like coding, cybersecurity, and content creation.

Unfortunately, many schools have yet to fully integrate digital literacy into their curriculum. This gap affects not only students, but also teachers. Some educators avoid teaching digital skills because they lack training or confidence. Schools often provide limited professional development on technology, or they schedule training at inconvenient times. This creates a disconnect at multiple levels (district policies, school leadership, and classroom instruction). The inconsistency leads to students entering middle and high school without fundamental digital skills, putting them at a disadvantage in academic and professional settings.

Addressing the gaps in digital education

To truly prepare students for a digital world, we need a structured approach to teaching digital literacy. Schools must set clear expectations and provide systematic training, starting as early as kindergarten (age 5). Districts should not just mandate technology plans, but also assess whether their teachers have the knowledge and resources to implement them effectively.

> "SCHOOLS MUST SET CLEAR EXPECTATIONS AND PROVIDE SYSTEMATIC TRAINING

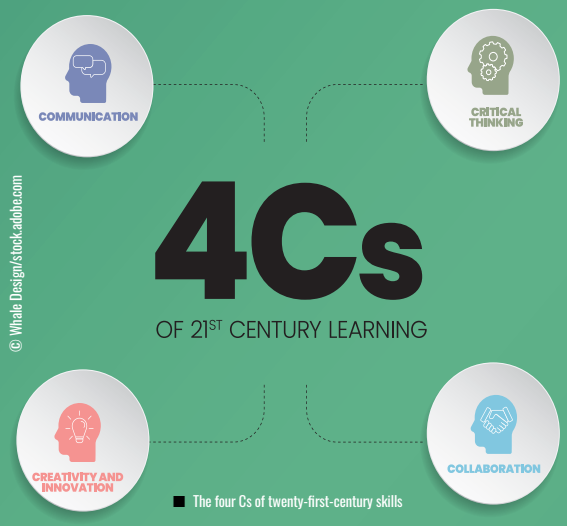
Teachers need hands-on access to the technology they are expected to teach. Many educators struggle because they don't receive adequate training on the tools their students are required to use. A well-designed teacher induction programme should include digital literacy training during the school day, not just as optional after-hours workshops. If teachers feel comfortable using technology, they will be more likely to integrate these tools into their instruction, benefiting students in the long run.

Students also experience disparities in access to technology. Those who grow up with personal computers at home have a clear advantage over those who do not. Schools must build programmes that ensure all students have the opportunity to develop basic digital skills, regardless of their backgrounds. Additionally, students with special educational needs and disabilities need access to assistive technology such as immersive readers and speech-to-text software to support their learning.

Beyond school, digital literacy has real-world implications. Employers increasingly expect job candidates to possess essential technology skills. Without adequate training, students may struggle in higher education and the workforce. That is why we must prioritise digital literacy.

Building digital literacy from the ground up

Foundational computer skills like mouse-control and keyboarding should be introduced as early as kindergarten (age 5). It's concerning that many eighth-grade students (13–14-year-olds) still struggle



© Whale Design/stock.adobe.com

■ The four Cs of twenty-first-century skills

with basic tasks like typing efficiently or saving files. By the time students are in middle school (ages 11–14), they should be proficient in essential productivity tools and responsible digital communication.

As educators, we emphasise the Four Cs of twenty-first-century skills — communication, collaboration, critical thinking, and creativity. These skills must be embedded into digital literacy instruction:

- **Communication:** students should learn to draft professional emails, create digital presentations, and use collaboration tools. Elementary students (5–11-year-olds) can start by writing structured emails, while middle- and high-school students (11–18-year-olds) can develop digital presentations using tools like Canva and WeVideo.

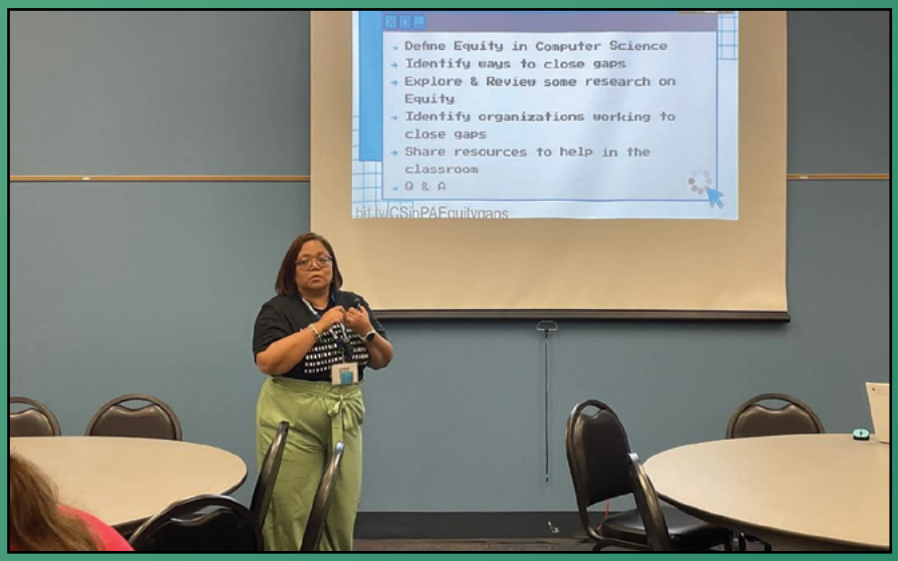
- **Collaboration:** students need to work together using digital platforms. They can participate in online discussions, contribute to group projects, and even engage in real-world competitions that require teamwork.

- **Critical thinking:** the ability to evaluate digital content critically is essential. Students should be taught to differentiate between credible and unreliable sources, recognise misinformation, and understand digital ethics.

Teachers need hands-on access to the technology they are expected to teach

- **Creativity:** digital literacy is not just about consuming information — it is also about creating content. Students should explore video editing, digital storytelling, and coding to develop their problem-solving skills and foster innovation.

Finally, staying current with emerging technologies is crucial. Digital literacy is not a one-time lesson, but an evolving skill set. As educators, we must always keep the mindset of lifelong learning, so we can equip students to navigate new technologies confidently and responsibly. Becoming 'tech-savvy' isn't enough — students need digital literacy skills to succeed in an increasingly digital world. (HW)



Sharing your knowledge fosters the mindset of lifelong learning

SANDRA HARTMAN

Sandra is a computer science and media design educator at Lehman Intermediate School in Pennsylvania, USA. She teaches digital citizenship, robotics, and digital media design. A Computer Science Teacher Association (CSTA) Equity Fellow alumna and advocate for inclusive STEM education, she empowers marginalised students through tech. She loves American football, pop culture, and family time.

REIMAGINING DIGITAL LITERACIES

What if we applied what we know about traditional literacy to digital literacy?

Digital literacy is a contested term whose meaning has expanded far beyond Paul Gilster's 1997 definition as an ability to understand and use information when it is presented via computers (helloworld.cc/Gilster). It is not just an awareness of digital media, or e-safety, or an easily encapsulated set of competencies.

What if we considered digital literacy more like traditional literacy? What if it could encompass media, software, and hardware in a more unified way?

Text types and comprehension

Let me suggest that we think of software, hardware, and media as texts. When we pick up a novel or read a web page, we bring with us a host of skills: not only the ability to decode at a textual level, but an awareness of genre and of textual conventions. We can make inferences and we have expectations of format, which enable us to adapt to new elements. Each of these is informed by the texts we have engaged with before. Understanding textual conventions unlocks our comprehension. With comprehension, we are empowered to move towards critical literacy.

Similarly, both software and hardware design take the best of what has gone before and accommodate our prior experience. Underlying conventions repeat across applications (for example, pinch to zoom on touchscreens or Ctrl+C, V, or X to copy, paste, and cut in your desktop applications). These are second nature to many of us, but we rarely teach these conventions when we deliver digital literacy lessons.

As the conventions of the QWERTY keyboard enable us to type, so knowing the rules of the game enables digital fluency

Users who are unaware of these conventions can find themselves disoriented. We often let the conventions be absorbed, though, rather than teaching them explicitly. Learning them brings reading the intended text closer to automatic. How much more powerful could my teaching be if I spent time checking understanding of, and teaching the conventions of, the applications pupils use?

Knowing the underlying rules of the game enables digital fluency — but often, learners are not equipped with knowledge of these. I regularly encounter teachers who are amazed that the same tricks work across library searches, Google, AI prompts, and eBay! The most digitally literate people you know understand the rules, and can apply them across a host of contexts.

Textual orientation

As a reading interventions teacher, one of the first tests I used when diagnosing issues was physical orientation. Did a struggling reader know that the text ran left to right, and top to bottom? Did older readers know the conventions of a non-fiction text, or a graphic novel? These presumptive basics were often signposts to deeper barriers, and cues for a range of intervention strategies.

What might this mean for digital literacy? Could we begin by abandoning the assumption that students already know the underlying rules of hardware or software? If we begin with an agreement that software has genres with generic rules, we have a starting point. Could we then craft specific interventions that would level the playing field for digital literacy?

Writing for an audience: reading for pleasure

Once pupils are equipped with knowledge of the rules, there are implications, not only as users (readers) of these texts, but also

as creators (writers). They now know that audiences expect certain things — such as menu layout, keyboard shortcuts, and search operators — and can adopt these in making new 'texts'.

They know that gamers expect certain things to be certain ways in a given genre. They know that there are software design clichés to be adopted or avoided. Understanding these structures and formulae could later lead to an understanding of code libraries and standard structures.

Often, the narrative around the delivery of high-quality computing in schools is one about access to services and work as future adults. While we emphasise reading and writing skills in literacy lessons, schools also invest heavily (and rightly) in encouraging reading for pleasure. Do we as computing educators do the same?

> "DIGITALLY LITERATE PEOPLE UNDERSTAND THE RULES AND CAN APPLY THEM

We often also neglect the most engaging element of children's experience of technology: play. Could we embrace the 'reading for pleasure' model and share the creative value of digital play which students often bring with them to the classroom?

Many primary teachers have their 'I am currently reading' display on their classroom door, to share their identity as readers. Can we similarly display our 'I am currently playing' or 'I am currently making', to share our playful technological identities with pupils? For me, this has been the gateway to successful and meaningful professional relationships with pupils who were often hard to reach.

Home experience and digital poverty

We can also anticipate why some people might develop lower levels of digital literacy than others. There is a question of exposure — we know what it means to grow up without exposure to books and the implications for literacy and attitudes (**helloworld.cc/unicef-literacy**). A lack of exposure to a range of digital experiences means that these phenomena exist in the digital space too. This blocks opportunities for repetition, to see similarities between texts, and to develop schemata.

Fluent literacy comes from repeated exposure to a wide range of text types. A rich digital life is not reliant on a single device type, or a single type of application. We game, communicate, consume media, shop, and read. We make, paint, improve, and write. The greater the range of devices and activities, the broader our digital literacy will become.

But this is the experience of privilege. Access to a phone, a tablet, a games console or two, and a laptop can sometimes be taken for granted. This device plurality means that children observe, intuit, and understand many uses for technology. They move naturally to and from play to communication or creation, with the scaffolding of good teaching. But what if there is not this embodied cultural capital within the home? Many primary-age children have no access to digital devices in the home at all, beyond shared and borrowed time on an adult's phone.

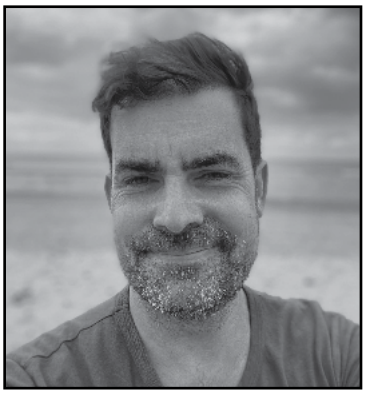
During the Covid-19 pandemic, I experienced first-hand the barriers for disadvantaged primary pupils accessing online learning. Organisations tried to close this gap by providing devices for learning, but it became apparent that play was neglected. The devices provided were often policed to avoid access to playful technology use, insisting on formal learning, meaning that the development of digital literacies remained unequal.

A mini manifesto

What, then, can we take with us into the classroom to nurture a rich digital literacy?

- Share the conventions and audience expectations of a range of generic hardware and software types
- Diagnose issues around technological textual orientation
- Encourage computing for pleasure, and share your playful and creative identity with your pupils
- Acknowledge gaps in experience, and provide a rich and varied diet, including play in school
- Apply digital poverty intervention strategies that address computing for pleasure in the home

If we consider digital literacy in the same way as we consider actual literacy — a model where software and hardware are considered as texts around which we develop fluency and inference skills as both readers and writers, or users and content creators — we can encourage students to develop a rich digital literacy. (HW)



GAVIN DAVENPORT

A games developer before working for several years as a primary teacher and literacy intervention specialist, Gavin is now a lecturer in primary teacher education and computing at Edge Hill University in the UK. He is a Fellow of the Royal Society of Arts, an NCCE Senior Professional Development Lead, and executive committee member of the Technology, Pedagogy, and Education Association (TPEA).

BEYOND PHONE BANS: EMPOWERING STUDENTS TO CRITICALLY NAVIGATE AND REIMAGINE TECHNOLOGY

How computing educators can guide students in critically understanding technology design — and create collaborative phone policies

2024 was the year the tide turned against smartphones. Across the world, parents, teachers, and governments highlighted the risks of excessive phone use among young people. In the UK, the 'Smartphone Free Childhood' movement emerged, quickly growing to 100,000 members who advocate for keeping smartphones away from children due to concerns about addiction, harmful content, and mental health. Jonathan Haidt's global bestseller, *The Anxious Generation*, has further fuelled the movement, linking smartphone use to adolescent mental-health issues and recommending phone-free schools. Meanwhile, countries including England, France, and Finland have urged schools to adopt strict phone bans, hoping to reduce classroom distractions and enhance student safety. Despite widespread support, academic research on phone bans remains limited and inconclusive. Given this situation, computing educators are uniquely positioned to offer an alternative approach.

Evaluating evidence on phone bans

The rapid spread of school smartphone bans is a straightforward response to complex issues around personal technology use in education. Teachers and parents frequently view phones as inherently disruptive, a perspective supported by studies that show phones can impair students' focus and engagement in lessons. Concerns about cyberbullying and addiction contribute to this view, with many educators seeing bans as a practical solution to mitigate risks. Surveys in England reveal that nearly half of all secondary schools now enforce all-day bans. This trend was supported by teachers in my own master's research, who see these policies as necessary to reduce distractions and maintain control in the classroom.

Yet calls for outright bans may oversimplify the conversation, limiting opportunities to examine both the benefits and the risks of smartphone use in schools. Evidence on the impact of phone restrictions is mixed (**helloworld.cc/smartphone-evidence**): while some studies suggest restrictions may benefit learning, especially for students who struggle

Photo by Katerina Holmes from Pexels

■ Guiding students to explore why phones are designed to capture our attention can equip them with critical skills

the most, others indicate no significant impact on academic outcomes. Additionally, recent findings show that cyberbullying is not directly linked to time spent online, with traditional bullying still more prevalent in schools. Even the narrative around smartphone addiction is contested, with some researchers suggesting that concerns about addiction may be overstated.

As the debate over smartphone bans continues, educators have an opportunity to move beyond restrictions and engage students in understanding the technology that shapes their lives. This is where computing educators can really make a difference. How can they guide students to understand why technology is designed to capture attention and what lies behind these design choices? We will now explore the role of computing educators in helping students think critically about technology design.

> “ COMPUTING EDUCATORS ARE UNIQUELY POSITIONED TO LEAD THE CHARGE

Understanding and questioning the design of technology

School smartphone bans can feel like a hopeless act that suggests phones and social media are inherently incompatible with learning and student well-being. This approach assumes the only solution is to remove them, rather than considering how these technologies might be better managed or reimagined to support young people. What if, instead of banning phones, educators worked with students to explore why they are so captivating and how they could be designed differently? Computing educators can lead this exploration. With digital literacy as part of their curriculum, computing teachers can help students question the motives behind their devices, fostering a critical understanding of the forces shaping their digital world.

At the heart of how social media platforms are designed is their business models. Tech companies rely on features such as notifications, autoplay, and infinite scrolling to maximise user engagement and revenue. This is part of what the writer Shoshana Zuboff calls “surveillance capitalism”, where companies gather vast amounts of behavioural data by keeping users engaged on their platforms for as long as possible (**helloworld.cc/surveillance-capitalism**). In the classroom, educators can open discussions with students on the motives behind technology design, exploring questions such as why platforms want users to stay engaged, and what data they are collecting. Activities might include analysing popular apps to identify which features encourage prolonged use, or debating how social media could be designed to prioritise user well-being. By critically examining these design choices, students can better understand the forces driving their digital interactions and consider ways in which technology could be reimagined to serve them, rather than just profiting from them.

Collaborative policymaking

Once young people understand why phones and social media are designed the way they are, educators can work with students to create phone policies that reflect shared values and goals. This collaborative approach encourages students to take ownership of their technology use, and computing teachers, drawing on their knowledge of technology design and digital literacy, are ideally positioned to facilitate these discussions.

Research suggests that policies developed with student input are more effective, as they foster responsibility and engagement (**helloworld.cc/student-voice-guide**). By involving students in policymaking, educators can encourage them to consider how phones could support rather than hinder learning. For example, students might agree that phones should stay off during certain times, or in certain spaces, but that they might be useful in other scenarios where access benefits learning. This kind of flexibility ensures that phones are used thoughtfully, allowing for both practical boundaries and opportunities for educational use.

Conclusions

As debate around smartphone use in schools continues, academic research remains inconclusive on the effectiveness of phone bans. This uncertainty presents computing educators with an opportunity to move beyond restrictive policies and foster deeper understanding. By guiding students to explore why phones and social media are designed to capture attention, we can help to equip them with the critical skills needed to navigate their digital world thoughtfully. Involving students in crafting flexible, meaningful phone policies reinforces this understanding, giving them a sense of agency in shaping technology’s role in their lives.

Computing educators are uniquely positioned to empower students, not just as users, but as active challengers of technology design norms. Embracing a collaborative approach allows computing educators to inspire students to envision a future where technology genuinely serves their growth and their learning, rather than commercial interests. (HW)

LAURA KIRSOP

Laura is a primary educator, Code Club volunteer, and director of product management at the Raspberry Pi Foundation. She recently completed a master’s in the sociology of education at UCL, and her dissertation focused on smartphone policies in schools.

GROWING YOUR DIGITAL SKILLS AS AN EDUCATOR

Top tips to grow your skills, whatever your confidence level

Trying to keep up with the digital world can be overwhelming; there seem to be new apps, trends, and features every day. However, the online world is also full of rich learning experiences — you just have to know how to make the most of them. Here, I list four tips to grow your digital skills and unlock even more online learning opportunities. Your time is precious, so each suggestion is something that could make your life easier, help you learn even more new things (like buy one, get one free … except they're all free!), and save you time once you've mastered them.

Everyone's computer is set up differently, so the purpose of this article is not to tell you the specifics of how to do these things, but to plant curiosity in you to explore what you don't know and want to find out. If you don't know how to do something, there are plenty of videos, blog posts, and tutorials which can be found using your favourite search engine.

1. **Get to know your browser.** Your browser is what you use to access the World Wide Web — it's your gateway to all the knowledge locked within. Common browsers are Google Chrome, Firefox, and Safari.

   The first skill you need is to make sure you're comfortable opening, and using, multiple tabs and windows in your browser — and this includes how to undo closing a tab or window that you did not mean to close!

   If you're more confident with your browser, I suggest you explore the world of extensions. Extensions add next-level personalisation to make the browser work in a way that is convenient for you — this could be anything from adding a password manager to exploring tab-management tools.

   As a bonus in browsers, I would recommend using the 'read later' function available in most browsers, to save articles you don't have time to read now, without trying to remember NOT to close that tab.

2. **Learn productivity hacks for office tools.** The most commonly used pieces of software are office tools — things like documents, slides, and spreadsheets. These are often designed to be simple to use, yet most people underuse them and don't learn new skills as the products iterate. Are you still using documents in the same way as you were a decade ago?

   The 'getting started' option here is ensuring you know how to use the formatting toolbar, and how to save and share documents. If you're still sharing documents by saving them and attaching them to an email, there's likely a better way — document sharing and collaboration has changed a lot in the last decade.

   For those who already have those tools sorted, you could then consider version control, including named versions; smart blocks; or custom blocks for common features such as adding dates, names, email templates, etc. The document structure is provided for you to fill in the blanks.

© dragreez/stock.adobe.com

Being curious about your own digital skills is about exploring what you don't know and what you want to find out

ONLINE COURSES

Online courses are a convenient way to upskill. Here are some courses to try. Make sure to set time aside, and try engaging with your cohort online. Commenting or asking questions can lead to unexpected learning!

- **Teach teens computing: understanding AI for educators**
  Discover the world of AI, and how it is set to change the ways we teach and learn. Gain valuable experience discussing and using AI tools with your learners (**helloworld.cc/teach-teens-ai**).
- **Teach teens computing: impact of technology**
  Learn how to keep 14–16-year-old students engaged while teaching computer science. This course is useful professional development for teachers who are looking to improve their skills and put them into practice (**helloworld.cc/impact-tech**).
- **Teach kids computing: programming**
  Increase your programming knowledge and develop effective lessons to teach programming to pupils aged 5–11 (**helloworld.cc/teach-kids-programming**).

3. **Use new tools/software/features every six months.** No one wants to keep changing how they're working every week. However, challenging yourself to try a new tool, piece of software, or software feature every six months keeps you practising your digital skills and ensuring you're not wasting time when a new feature could make your task easier.

   To get you started, if you don't know how to find new features, take some time to click on a menu, for example 'tools', that you do not visit regularly. Are there any tools that you don't know how to use? Choose one that sounds interesting and try it. There is usually a 'help' menu if you're unsure how to use a tool.

   For those who are more confident, or wishing to move between software, I am a big proponent of top lists, even if I eventually end up disagreeing with them! These could look like a search for 'Top five to-do list apps for Android' or 'Best mail-merge extensions'. Reviewing these types of lists gives me a place to start looking. I can then use my own judgement to decide which app, software, or feature I want to try or which one I like best.

4. **Be a digital citizen — engage, don't lurk!** This skill is noticeably different to the others, but is by far the most common challenge I see for people trying to grow their digital skills and learn online. As educators, we know that just reading something is not enough to learn it, even if you're reading alongside doing it. To properly learn something, you need deeper engagement. We know that being a digital citizen is more than just consuming content.

   If you're new to sharing online, it does not mean you have to produce your own blogs or YouTube videos. However, when reading something, leave a comment, ask a question, or engage with another educator in conversation. Most blogs, courses, and forums have these features.

   Those who are used to sharing online, consider what you're sharing and how. Are you adding to the learning experience of yourself and others? Could a poignant question or reflection you've had help someone else? While these suggestions may seem altruistic, and may seem like they'll take more time than you have, this higher level of engagement with online material will ensure you have a deeper level of learning, meaning it's more likely to stick.

Tips for success

Finally, I want to end with some suggestions that will increase your success with learning online when your time is already so full, so that you can put these tips to good use.

Firstly, declare your intent. This sounds very grand, but by giving yourself a goal — no matter how small — you are much more likely to find the time. Writing the goal somewhere and tracking against it will give you accountability. For example, 'I will learn one new digital thing each month' or 'I will spend ten minutes learning a month.' Then list the months underneath and add a tick emoji when you have completed each one.

Secondly, set time aside. One of the biggest challenges of online learning is that because it can happen at any time, you never really get to it. Decide when is a good time for you — when you're sitting in the car waiting for your kids at football practice? During Friday lunchtime for ten minutes, instead of marking? Choose whatever works, but make a choice!

Lastly, lots of people worry about where to find their learning experiences. I would say focus on what you want to learn instead. Of course, we should always be critical and aware of misinformation, but the digital skills discussed here are about you making the most of the tools that you have. Help can be found in many places. (HW)

SWAY GRANTHAM

Sway is a senior learning manager at the Raspberry Pi Foundation, where she leads the educator development team developing resources and training for computing teachers around the world (**@SwayGrantham**).

WHAT DO WE EVEN MEAN BY DIGITAL LITERACY?

Rachel Arthur explores what digital literacy means in today's classroom

'Digital literacy' is a term that seems to pop up everywhere. In the early 2000s, it was the next big thing; some even suggested it might replace traditional literacy and numeracy. But, like many educational trends, it soon faded from the spotlight, and became something that schools should do, or something left to the poor teacher who had been handed the role of IT coordinator.

For many teachers, digital literacy meant booking a set of laptops (and hoping the last class had remembered to charge them) and ticking off history learning objectives by making a PowerPoint about Henry VIII's wives. It became a bit of an afterthought.

> DIGITAL LITERACY ISN'T JUST ABOUT EMPLOYABILITY; IT'S ALSO ABOUT FAIRNESS

More recently, digital literacy seems to have been rebranded as 'digital skills', often framed as the capabilities young people need for the workplace of tomorrow. But I don't think that tells the full story.

Digital literacy isn't just about employability; it's about fairness and access. It's about ensuring that all young people have the knowledge and confidence to navigate the digital world we live in today. It's more than just learning to use spreadsheets (though my love for Excel remains strong).

Digital literacy is about understanding the digital tools we rely on every day, securely accessing online banking, making informed decisions about sharing personal information, and critically evaluating the endless stream of news and misinformation online.

It's also about AI; not just playing with the latest tools, but understanding how they work, the biases built into them, and the ways they shape our lives.

True digital literacy empowers young people to engage with technology thoughtfully, critically, and confidently. And that's something worth making space for. To truly ensure that young people have fair access to the digitally enabled world we live in, we must equip them with the skills to understand and use technology effectively. This means making space for digital literacy within the curriculum and ensuring that all teachers feel confident in delivering it.

Every teacher has a role to play in helping students develop these essential skills. This requires high-quality curriculum resources that integrate digital tools meaningfully into different subjects, as well as comprehensive teacher training to ensure every educator feels empowered to teach digital literacy as part of their everyday practice.

So, let's not treat digital literacy like that forgotten box of tangled charging cables in the staffroom (important, but nobody is quite sure what to do with it). Instead, let's make it a core part of teaching, just like reading, writing, and knowing how to keep a straight face when a student asks if they really need to save their work.

If we get this right, we're not just preparing young people for the jobs of tomorrow, we're making sure they can navigate today's digital world safely, confidently, and with the critical-thinking skills to tell fact from fiction (because let's face it, the internet isn't exactly short on absolute nonsense).

Now, who's up for making a PowerPoint on Henry VIII's wives? (HW)

RACHEL ARTHUR
Rachel is chief learning officer at the Raspberry Pi Foundation. She is responsible for developing learning experiences and products, and supporting the professional development of computer science teachers all over the world (**@rarthurtweets**).

HEAR MORE FROM RACHEL ON OUR PODCAST IN AUDIO AND VIDEO
helloworld.cc/pod-girls-in-computing

(Hello World) Podcast

NEW PODCAST SERIES

Watch or listen to our new Hello World podcast series:

- Teacher tips to improve digital literacy in your classroom (**helloworld.cc/pod-teacher-tips-digital-literacy**)
- How can we empower girls in computing? (**helloworld.cc/pod-girls-in-computing**)
- Are young people tech-savvy or tech-dependent? (**helloworld.cc/pod-digital-native**)

Subscribe to the podcast!

- YouTube **helloworld.cc/yt-pod**
- Apple Podcasts **helloworld.cc/applepod**
- Spotify **helloworld.cc/spotifypod**
- Amazon Music **helloworld.cc/amazonpod**

SCAN ME

PHYSICS, VIDEO GAMES, AND THE LARGE HADRON COLLIDER

Engaging young people with particle physics through the lens of video games

The Large Hadron Collider (LHC), located at CERN in Geneva, Switzerland, is the largest science experiment in the world. Showcasing the work that takes place within the LHC and its detectors, such as the ATLAS detector, is challenging due to its location deep underground, its sheer scale, and the often tricky subject matter of particle physics.

It is also difficult for CERN's researchers around the world to communicate their work to local audiences and explain the connection between their cities and the LHC. Dr Kristin Lohwasser of the University of Sheffield, UK (which is a member of the ATLAS collaboration at CERN) was interested in engaging new local audiences with the particle physics research taking place in Sheffield and at CERN. She reached out to me at the National Videogame Museum with the idea of collaborating on a project exploring video games and physics.

Together, we created a 360° tour of the ATLAS detector and a workshop that introduces CERN, particle physics, physics in video games, and physics engines to students aged eleven and above. In the workshop, students take part in a mini game jam to design a video game inspired by CERN, which utilises their knowledge of physics in creative ways.

Our aim was to engage with families and school groups visiting the museum, and hopefully use video games as a lens to get young people interested in and thinking creatively about particle physics. After successfully receiving funding from the Science and Technology Facilities Council public engagement fund, Dr Lohwasser began to develop a 360° virtual reality (VR) tour of the ATLAS detector. At the same time, I began researching the role that physics plays in video game development.

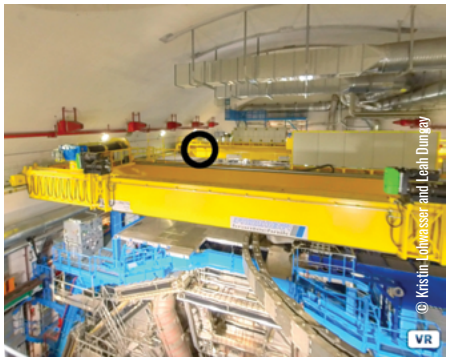
Creating the virtual tour

We wanted to create a low-cost and accessible VR tour of the ATLAS detector. Dr Lohwasser created the tour using 360° photographs taken with an Insta360 X3 camera. Over 200 photographs were taken, and 24 were selected to form the virtual tours. These photographs were then compiled into static scenes to create four different tours, which could be viewed on a web browser or on a VR headset.

Although it is possible to use a more expensive VR headset to view the tour, we chose to use Google Cardboard™ headsets at the museum and in our school workshops. These are relatively easy to purchase and only require a mobile phone to use. For this, we were able to purchase inexpensive older mobile phones which were the correct size for the headsets and had a gyroscope sensor.

While there are many resources, photographs, videos, and VR models of the LHC already, we wanted to create something complementary to these that focused on the ATLAS detector, with which Dr Lohwasser

Our tour, using Google Cardboard™ VR headsets



The view over the top of the ATLAS detector

works. We believed that a VR tour would most effectively communicate the scale of the detector and allow students to explore it at their own pace. Each scene of the tour has a portal to the next scene in the form of a sphere. Viewers can select this sphere to progress to the next scene by using the button on the side of the headset.

Exploring physics and video games

So why choose to explore physics and video games? At CERN, Dr Lohwasser is testing our theoretical understanding of the real world, how it all works, what it is made up of, and how that all interacts. When we create video games of any kind, developers get to determine those rules, sometimes by recreating simulations of real-world physics that are as accurate as possible, or by creating their own laws of physics in imaginary worlds.

Video games have changed significantly since games such as Pong (1972) were released. Even Pong, though, has a basic set of rules determining how its players move through the game and interact with the in-game objects. Sometimes this can be as simple as a few lines of code, or it can be so complex that it requires a physics engine. Through these concepts, we can discuss key terms such as 'software' and 'middleware' and what they mean, and why some video game developers may use an existing physics engine while some create their own.

Within the workshop part of the project, we explore this through two examples: FIFA 14 (2013) and Gang Beasts (2014), which are both playable in the museum. FIFA 14 is a football simulation game, so we expect the players and the football to move in a similar way to our real-world physics. When this doesn't happen, it can affect our enjoyment of the game and cause frustration.

In comparison, students discuss playing Gang Beasts, made by the developers Boneloaf. This is a multiplayer game, where players brawl as gelatinous beasts, aiming to be the last one standing. In this game, players will notice the unsteady and unpredictable movement when controlling, or trying to control, the beasts. The physics of this in-game world is clearly different to our own, but unlike FIFA 14, this does not make for frustrating gameplay. Instead, it adds to the fun, as each game is different and watching the chaotic outcomes of each battle is a large part of the enjoyment.

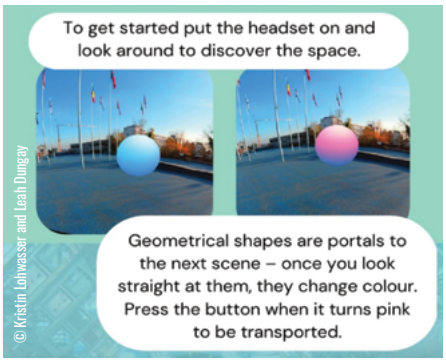
To conclude the workshop, students are put into groups for a short game jam where they design a concept for a new video game. In our first workshop, we asked each group to use the ATLAS detector within the VR tour as inspiration for the environment. They then rolled a dice to decide the genre and aim of the game. Finally, we added that they had to consider how the physics within the game would work. Would it emulate our real-world physics, or behave in an entirely different way? At the end of this activity, each group presented their ideas to the class, which resulted in many unique game concepts that included their current understanding of games, physics engines, and their new knowledge of the ATLAS detector and particle physics. The games included:

- Race to the Collider, a racing game through the tunnels at CERN, where playing as different particles alters the physics in various ways.
- CERN Escape, a survival game where players must escape the LHC after a malfunction, using realistic physics and a complex physics engine.
- Particle Rush, a multiplayer game where players become particles and must survive waves of particles trying to collide with them inside the beam pipes. Each particle they encounter behaves in different ways according to real-world physics.

Outcomes of projects

During our collaboration, we have been able to use the VR tour of the ATLAS detector within the National Videogame Museum; at open days at the University of Sheffield; for public talks; at national and international conferences; and at student workshops in outreach sessions. Over 3000 people have participated in these events so far, and the low-cost and mobile VR tour has made it easy to bring to events and outreach sessions.

From the feedback, we have found that combining physics subjects with video games in the activities has kept students engaged in new ways. It has made them consider the ways in which physics plays a role in their favourite video games and their development, as well as understanding the connection between their home city and the worldwide endeavour taking place at CERN. Students were able to witness first-hand physics engines and the link between physics, computing, and video games.



Each scene of the tour has a portal to the next scene in the form of a sphere

The workshop 'Exploring Physics, Videogames and the Atlas Detector' is available to book for visiting school groups at the National Videogame Museum, and will continue to be used in outreach at the University of Sheffield. Read our paper at **helloworld.cc/ATLAS-videogame** or visit **helloworld.cc/nvm-cern**. (HW)

LEAH DUNGAY

Leah is the learning officer at the UK's National Videogame Museum. She is an experienced museum educator and outreach professional specialising in STEM, history, and performance. Leah was co-recipient of the award for Best Website Activity from Kids in Museums' Family Friendly Museum Award in 2020.

COMPUTER SCIENCE OPPORTUNITIES IN RURAL SCHOOLS

Curt Hitchens shares how CEISMC and STEM@GTRI are providing computer science opportunities to rural middle and high schools in Georgia, USA

In 2022, the Georgia General Assembly in the USA saw the need for more computer science opportunities for rural schools and students. They felt that Georgia Tech's CEISMC (Center for Education Integrating Science, Mathematics, and Computing) and STEM@GTRI, an outreach programme for students aged 5-18 at the Georgia Tech Research Institute, would be ideal partners.

Using $600,000 in funding from the General Assembly, CEISMC and STEM@GTRI created the Rural CS Initiative (**helloworld.cc/rural-Georgia**). The first cohort consisted of eleven schools in eight different school districts in Northwest and Southeast Georgia. Over the last two

CURT HITCHENS

Curt teaches computer science at Saddle Ridge Elementary and Middle School in Rock Spring, Georgia, USA. He has been a computer science teacher since 2018 and currently serves as a virtual CS specialist for the Georgia Department of Education (**@CurtHitchens**).

Eighth-graders (aged 13–14) completing the 'Intro to Robotics' module with a STEM@GTRI staff member and their teacher, Curt Hitchens

years, the Rural CS Initiative has received millions of additional dollars in funding, and the number of participating schools and districts has increased dramatically, with 39 schools in 24 districts, located throughout the state.

From the beginning, the Rural CS Initiative has worked to achieve the following goals:

- Increase awareness and knowledge in key areas in the field of computer science among middle- and high-school students (aged 11–18)
- Inspire students to persist in the study of computer science
- Create a learning community among the participating educators
- Increase the capacity of rural school districts to offer innovative computer science content

Understanding the initiative

Teachers who participate in the Rural CS Initiative visit Georgia Tech twice a year. They take part in networking opportunities, professional development sessions, and computer science programmes that exist on campus. Teachers also receive instructional resources and ongoing support from CEISMC and STEM@GTRI staff. Students get to tour the Georgia Tech campus and participate in modules that focus on coding, robotics, website design, sensors and data collection, cybersecurity, data science, and artificial intelligence. CEISMC and STEM@GTRI staff provide five days of instruction via Zoom. Teachers help to facilitate the lessons, answer questions, and troubleshoot problems within their classrooms. During the second week of each module, students are challenged to create a product or complete a project using the skills and tools they learnt about during the previous week.

Curt's students learn about problem-solving, computational thinking, and other foundational computer science skills

How rural students benefit

At Saddle Ridge Elementary and Middle School, where I teach, agriculture has a big presence in our community and school. But there are other workforce needs in our region and state, and we have tried to address those needs by creating a middle-school computer science pathway. Sixth- and seventh-grade students (aged 11–14) can take 'Foundations of computer programming' and 'Foundations of interactive design'. When these students reach eighth grade (aged 14–15), they can take a high-school credit computer science course called 'Intro to software technology'. One of the highlights of this class is the opportunity to participate in the Rural CS Initiative. Students get to interact with staff members from CEISMC and STEM@GTRI. They also get exposed to resources like EarSketch, micro:bits, Maqueen robots, and Microsoft MakeCode. Our school district's mission is to ensure that all students are ready for college, work, and life when they graduate. Participating in the Rural CS Initiative is helping us to accomplish our mission. (HW)

Saddle Ridge Elementary and Middle School is located in Northwest Georgia, just south of the state of Tennessee

(Hello World) Podcast

HEAR MORE FROM CURT ON OUR PODCAST, IN AUDIO AND VIDEO
helloworld.cc/pod-teacher-tips-digital-literacy

MODULES THAT STUDENTS CAN TRY

Introduction to software technology

- **Introduction to coding with EarSketch:** this module serves as an introduction to some of the major concepts in coding. Concepts covered include variables, loops, and the use of documentation in the API (applied programming interface). This module is taught in the Blocks mode of EarSketch.
- **Introduction to robotics:** this module introduces students to the major coding concepts of conditionals and functions. This module is taught in the Block mode of MakeCode.
- **Website design:** during this module, students engage in developing their own website using HTML5, CSS3, and JavaScript.
- **Sensors:** this module focuses on the use of sensors deployed in an agricultural setting, in collaboration with an Arduino.

Computer science principles

- **Intermediate coding:** students begin to learn to code using either Python or JavaScript. During this module, the focus is on the development of variables and loops in these languages.
- **Intermediate robotics:** students will begin to learn to code using either Python or JavaScript. In this module, the focus is on the use of conditionals and functions in these languages.
- **Cybersecurity:** students are exposed to fundamental principles in cybersecurity (defence, confidentiality, integrity, availability, think like an adversary, layering, least privilege).
- **Data science:** students have the opportunity to use collected data to test a hypothesis and use visualisation techniques to determine whether the hypothesis is supported. Students use first-hand data collected via environmental sensors.

THE POWER OF PROVENANCE: WHY OUR LIVES DEPEND ON TRUSTED INFORMATION

James Abela argues that to achieve veracity in the future, students are going to need the competencies of digital archaeology, linguistic analysis, and algorithmic prowess

When asked who wrote *Romeo and Juliet*, many people would say William Shakespeare, but that is not the true origin of the story. He got the story from Arthur Brooke, who translated it from the work of Italian author Matteo Bandello (*Book 2, Novella IX*), which itself followed the plot of a novella by Luigi Da Porto (helloworld.cc/true-romeo-juliet). Shakespeare added some humour and the character Mercutio.

The provenance of information is hardly a new problem, but the scale of the issue has become huge. Many students already see Google and Wikipedia as original sources, even when these sites clearly acknowledge where their information came from.

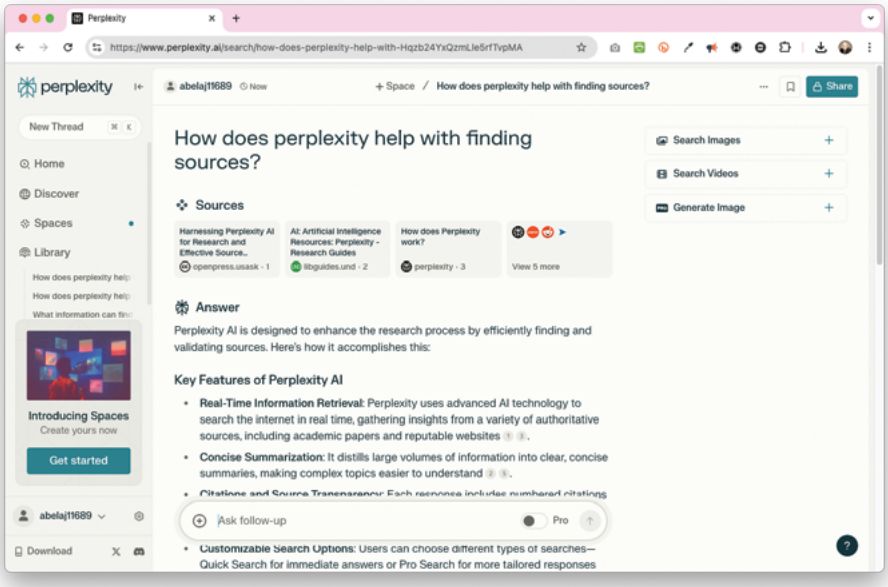
The problem is massively amplified by chatbots, which could be said not to include sources because of the massive additional overheads of producing a large language model (LLM). Many of these bots give convincing answers, and in my article in the last issue (**helloworld.cc/25**, pages 34–35), I discussed how they would also give the wrong answers with great confidence. These LLMs are designed to have conversations and mimic all that they have read on the internet. Apple recently found that bots' actual mental reasoning was relatively low, and a few synonyms were enough to throw them off their pace (**helloworld.cc/gsm-symbolic**).

Why care about provenance?

I have known English teachers to argue that *Romeo and Juliet* is only a story, and that it does not matter who originally wrote it. Of course, there is an ethical argument that we should respect intellectual property and give appropriate credit to all who were involved in a creation. More than this, though, we need students to understand the reliability of a source, and this can't be done if the original source is unknown.

There are now chatbots that include the sources of their information. One such bot is Perplexity. Instead of presenting a list of links, Perplexity generates concise, informative responses that include citations from trusted sources. Its "ability to provide real-time, credible, and sourced content makes it a valuable resource for both casual learners and serious researchers in the scientific community" (**helloworld.cc/perplexity-science**).

In Hannah Fry's book *Hello World: How to be Human in the Age of the Machine*, Fry describes a life-threatening situation where people's ability to get access to



Perplexity is a chatbot that includes its sources

Credit: *Romeo and Juliet Farewell* by Eleanor Fortescue-Brickdale

Does it matter who originally wrote *Romeo and Juliet*?

medical treatments was being decided by an algorithm. However, the medical aid team refused to describe their algorithm, and it was generally believed to be an AI or some beautiful mathematical process. It was, in fact, an Excel spreadsheet, and a poorly constructed one at that (**helloworld.cc/Hannah-Fry**). The ability to get to sources is important. Until we dig that deep, we will not be able to see the levels of transparency or bias, or even the scope of any research.

Synthetic information

As we look towards the future, the internet will become layers of information. There will be layers of first-generation, human-created information, and on top of that, layers of AI-generated information. This could become a recursive circle where more and more synthetic information is loaded on top of itself. Students will need to dig deeper to find original information, and understand what algorithms might be doing to process that data. This conundrum brings us back to the old problem of garbage in and garbage out. Students will need to become digital archaeologists looking for the gem underneath layers of digital slime.

Thankfully, people are beginning to realise that general LLMs will not necessarily provide companies with a competitive advantage, nor ensure that they are getting reliable information. We are now seeing the rise of smaller models that use the processing abilities of larger LLMs, but also use hand-picked documents as 'sources of truth'. We can see this in Perplexity, which has both internal and external models, and Google NotebookLM, which focuses on documents provided.

Future skills

Students are likely to find future employment in the intersection between linguistic analysis and algorithmic prowess. Students need to be able to analyse the words being used, where they are likely to have come from, and whether they are likely to be factually accurate. This is made more challenging as the more synthetic information is out there, the more people will read and write like AI, and the more AI tools will learn and attempt to sound more human! In many cases, the answer might be unclear and demand further research.

Primary research is likely to become more focused on analysing data for value, training AI tools using languages like Python, and then testing and validating the results. It is also where future politicians and lawyers will need to ensure fairness for all. (HW)

> "STUDENTS WILL NEED TO LOOK FOR GEMS BENEATH LAYERS OF DIGITAL SLIME

JAMES ABELA

James is director of digital learning and entrepreneurship in Garden International School in Kuala Lumpur, Malaysia. He is founder of the South East Asian Computer Science Teachers' Association and author of *Parenting and Teaching in the Age of AI* (**@eslweb**).

EMPOWERING INCLUSION IN COMPUTER SCIENCE EDUCATION

Gina Fugate weighs up the cost of exclusion versus the power of inclusion

What if there were no automatic doors, ramps, or elevators? Features like these, originally designed to meet specific accessibility needs, have become so integrated into daily life that we often take them for granted. Imagine the barriers their absence would create — not just for people with disabilities, but for parents with strollers, travellers with luggage, workers transporting goods, or anyone juggling a busy lifestyle. Similarly, digital accessibility and usability standards, initially conceived to support specific populations, enhance the experience for all users.

In 2024, the US Department of Justice (DOJ) updated Title II of the Americans with Disabilities Act (ADA) to require that public entities provide accessible digital tools. This ruling has significant implications for schools, libraries, and other educational institutions, ensuring accountability for equitable access to technology (US DOJ, 2024). These requirements align with existing guidelines such as the Web Content Accessibility Guidelines (WCAG), which define best practice for creating accessible digital content.

These mandates emphasise that accessibility and usability are not merely technical challenges — they are ethical and academic imperatives gearing towards essential career skills. As Stefik et al. (2019, p. 53) highlight, technologies designed to be "born accessible" save time, money, and effort by avoiding costly retrofits. Similarly, Ladner (2015) underscores the value of inclusive practices, noting that "some of the best work comes when there are people with disabilities on the design and development team, contributing to all aspects of the design and implementation, not just as participants in user studies".

Elevators are vital for accessibility reasons, but they are useful to everyone

By teaching accessibility as a core component of computer science education, educators prepare ALL students to create technologies that serve diverse user needs, fostering both innovation and inclusivity.

Inclusion is a skill for all learners

Inclusion is not a niche consideration; it is a universal skill that every learner must develop to meet the diverse needs of our world. Purposefully teaching inclusion fosters empathy, creativity, and critical thinking — skills that are essential in both technology and life. By integrating lessons on accessibility and usability into computer science curricula, educators equip all learners to identify barriers, design solutions, and approach challenges with a fairness mindset.

Understanding accessibility standards, such as the ADA Title II updates or the principles of Universal Design for Learning (UDL), helps all learners to design technologies that are usable by the widest

■ Tools like LEGO™ SPIKE™ Prime and BirdBrain Technologies' Finch Robot 2.0 have specific design support for assistive technologies for Quorum and Python; all students may benefit from learning about and using these tools, which support CSTA Standard 2, 'Equity and Inclusion'

possible audience. In doing so, educators prepare their students to meet both the ethical demands of inclusive technology and growing legal requirements.

Strategies to enhance learning for all

Incorporating inclusive practices into computer science education benefits all learners, not just those with disabilities. Strategies such as using alt tags for images, pairing visual movements with audio feedback, and incorporating tactile resources enhance accessibility while enriching the learning experience. For example:

- **Hands-on learning with robotics:** robotics allows students to engage with programming in a tangible way, reinforcing abstract concepts through real-world application
- **Unplugged computer science:** activities like using LEGO™ bases and bricks to design app interfaces or simulate algorithms can make learning accessible to students who benefit from tactile and visual aids
- **Alt tags and audio feedback:** teaching students to add alt tags to images and to pair actions with audio feedback reinforces inclusive design principles while preparing them for real-world development challenges

By learning to identify and address barriers, students of all abilities have the opportunity to develop a sense of responsibility and agency, and an understanding that their work can help create opportunities for others.

Preparing the next generation of inclusive technologists

The updated legal requirements for accessible technology signal a turning point for computer science education. Educators must rise to the challenge, teaching accessibility and usability as essential components of programming.

By integrating Quorum and Python with tools such as BirdBrain Technologies' Finch Robot 2.0, and emphasising inclusive strategies such as hands-on learning and unplugged activities, educators can create a learning environment that empowers all students. As Ladner (2015) notes, the most innovative solutions emerge when a range of diverse perspectives contribute to all stages of development.

This approach not only addresses the legal and ethical imperatives, but also prepares students to design solutions that serve everyone, helping to ensure a more inclusive future. (HW)

FURTHER READING:

Cobo, A. E. (2023). Creating pathways to inclusion in K–12 computer science education: A case study on the Scratch Educator Meetup. [Doctoral dissertation]

Ladner, R. (2015). Design for User Empowerment. *Interactions, 22*(2), 24–29. **(helloworld.cc/Ladner)**

Stefik, A., Ladner, R. E., Allee, W., & Mealin, S. (2019). Computer science principles for teachers of blind and visually impaired students. ACM Inroads, 10(2), 50–57. **(helloworld.cc/Stefik)**

Computer Science Teachers Association. (2017). *CSTA K–12 Computer Science Standards.* Retrieved from **csteachers.org/standards**

US Department of Justice. (2024). Final rule on web and mobile app access for public entities under ADA Title II **(helloworld.cc/ada-web-rule)**

GINA FUGATE

Gina is a computer science and technology teacher with substantial experience, ranging from serving as an itinerant teacher of the visually impaired in Kentucky and Tennessee, USA, to working in the Maryland School for the Blind in Baltimore. She is a lifetime learner dedicated to her students. Her learners have shaped her career by helping her to keep on learning more about autism, assistive technology, educational technology, rural areas, poverty, and urban areas (**ginafugate.com**).

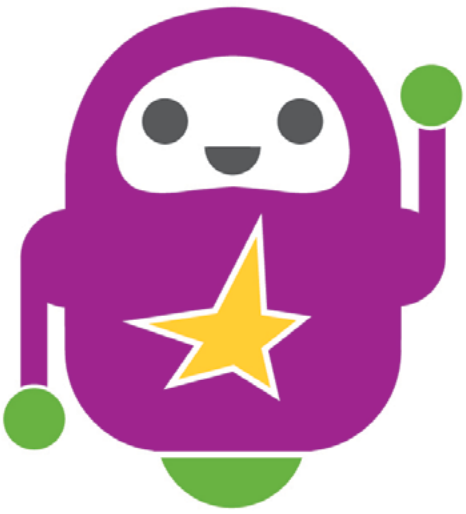
TECH, TINKERING, AND TEAMWORK

Katie Dahlman shares her algorithm for preschool computer science

Computer science education often centres on older students. However, even our youngest learners can grasp the fundamental concepts of computer science through computational thinking. By introducing these foundational principles early, we empower young people to become innovative problem-solvers. In this article, I will share my journey and provide a practical algorithm for jump-starting computer science education at the preschool level.

First, do your research

When I embarked on this journey, my knowledge of computer science was limited. I turned to Barefoot Computing, using their early years materials on computational thinking skills (**helloworld.cc/barefoot-early-years**). This invaluable resource provided clarity on the 'what' and 'why' of each skill and offered a computer science perspective tailored to young learners. Additionally, I sought guidance from experienced computer science experts within my district. Collaborating with these knowledgeable individuals proved instrumental in advancing my work.



Glitch is our school district's computer science mascot

Next, reflect on what's important

I pondered how to translate my new-found knowledge into practical application, keeping in mind my school district's programme values of skills, equity, and joy. A key insight emerged: computer science skills can seamlessly integrate into preschool classrooms, addressing multiple developmental areas. At the heart of preschool lies tinkering — a process of play, exploration, and problem-solving. Children naturally engage in this process, experimenting with toys and objects, asking questions, and persisting through challenges.

Computational thinking skills, such as perseverance and collaboration, align with social and emotional learning. By encouraging children to tackle difficult tasks and work cooperatively, we foster essential social skills. As a preschool computer science educator, I believe it's crucial to introduce computer science vocabulary to both students and teachers. Building a shared understanding of terms like 'algorithm' and 'decomposition' empowers young learners and creates a foundation for future exploration.

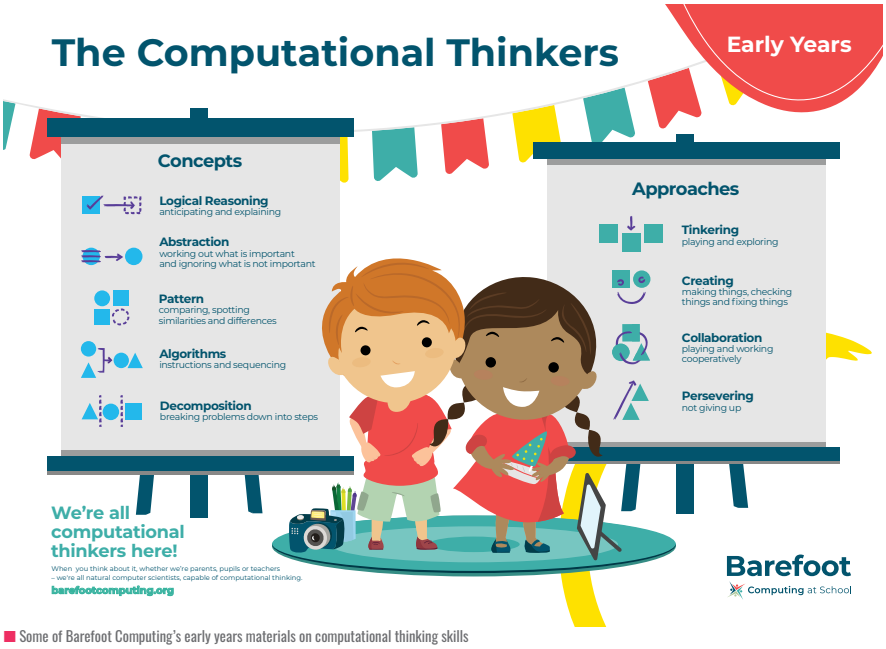
Beginning computer science education in preschool promotes equity by providing all students with equal opportunities to develop essential skills for the future. Early exposure to these concepts can help bridge digital inequality and ensure that all students, regardless of their background, have the tools they need to succeed. Moreover, computer science activities align perfectly with the playful nature of preschool. Computer science brings joy! Children can express their creativity, solve problems they care about, and innovate in ways that are fun. In preschool, this may look like creating a boat that will float, or making their own hopscotch code.

Finally, it's important to redefine the concept of technology. Technology isn't solely about screens and digital devices. Simple tools like pencils, paintbrushes, and blocks can also be considered technology. When children use these tools, they are learning problem-solving, creativity, and perseverance — essential skills for future technological endeavours. By focusing on unplugged activities, we can build a strong foundation for digital literacy and computational thinking. As children grow older, they can transition to more complex digital tools.

Then, build the foundation

Equipped with a focused approach, the next step in my journey was to build a strong foundation for a preschool computer science curriculum. This included developing engaging and age-appropriate activities to introduce fundamental concepts like patterns, sequencing, and problem-solving through unplugged activities. By laying this groundwork, we can prepare our learners for a seamless transition to the K–5 (ages 5–11) computer science curriculum, where they will learn coding and digital literacy.

Our preschool uses The Creative Curriculum from Teaching Strategies (**helloworld.cc/the-creative-curriculum**), which features different 'studies' that teachers dig into with students to learn



Some of Barefoot Computing's early years materials on computational thinking skills

more about clothing or buildings or pets. To effectively integrate computer science into this play-based curriculum, I selected one or more computational thinking skills for each study. For instance, during the 'Building' study, I incorporated tinkering and collaboration. Children tinkered in open-ended construction with K'NEX and KEVA blocks, fostering creativity and problem-solving. In a collaborative lesson, students paired up to build structures with LEGO™ bricks, emphasising teamwork and communication. For our 'Pets' study, we explored algorithms using Coding Critters. Children experimented with sequencing and debugging as they programmed their critters. In the 'Insects' study, we focused on decomposition, breaking down the process of drawing a butterfly into smaller steps.

As a way to continue the conversation outside of school, we gave students stickers featuring the computational thinking skill of the day, and provided families with a follow-up note about what we learned and how they could extend the learning at home.

Our district's computer science mascot, Glitch, adds an extra layer of excitement and engagement. Glitch, a friendly robot, helps introduce computer science concepts in a relatable and memorable way. By embodying the spirit of our computer science programme, Glitch fosters a sense of community and reinforces the importance of computational thinking.

Last, teach and continue to grow

While I have the privilege of visiting numerous classrooms to introduce computer science to four-year-olds, other districts may not have a similar resource. However, every educator can incorporate these ideas into their daily routines. Simply by naming and explaining computational thinking vocabulary, you can lay a strong foundation for future learning. For example, when discussing algorithms, you can relate them to everyday routines like getting ready for school or following a recipe. By connecting these abstract concepts to familiar experiences, you can make computer science accessible and engaging for young learners.

> AT THE HEART OF PRESCHOOL LIES TINKERING – A PROCESS OF PLAY

Teaching computer science is truly rewarding. Witnessing the joy on students' faces as they bring their code to life or persevere through challenges is incredibly inspiring. As a computer science educator, I'm constantly seeking new ways to integrate computer science into early childhood education. By staying curious and embracing opportunities for growth, I aim to ignite a passion for learning in every child. A willingness to evolve and adapt is essential for advancing computer science education at the preschool level.

Bloomington Public Schools embraces a 'computer science for all' vision. This commitment is evident in our district's investment in early childhood computer science education. Let's work together to promote computer science skills, equity, and joy, using this algorithm for computer science in preschool. We can build a future where every child, regardless of age, has the opportunity to explore the exciting world of computer science. (HW)

KATIE DAHLMAN

Katie is an early childhood educator with over 16 years of experience. For the past five years, part of Katie's role in Bloomington Public Schools, Minnesota, USA, is as a digital learning specialist. She has dedicated herself to developing engaging computer science lessons for young learners.

(Hello World) Podcast

HEAR MORE FROM KATIE ON OUR PODCAST, IN AUDIO AND VIDEO
helloworld.cc/pod-teacher-tips-digital-literacy

I DO, WE DO, YOU DO

Reflections on the use of signature pedagogies in the UK's intensive training and practice programmes

As part of the changes to teacher training from 2024, the UK's Department for Education has introduced the concept of intensive training and practice (ITAP) experiences. This element of teacher training seeks to integrate expert input from the training provider with practical school-based sessions to focus on particular aspects of professional practice (helloworld.cc/itap-training). Over a year, trainees are expected to participate in 20 days of ITAP covering several areas of practice.

At Leeds Trinity University, ITAP experiences take place in two parts. The focus of this article is on the second ITAP experience, delivered on signature pedagogies. At this point, trainee teachers are in the early stages of their school experience, where they will start to teach around two to four lessons a week.

Signature pedagogies

The concept of signature pedagogies is adapted from Shulman (page 52, **helloworld.cc/professions**). These are the unique ways in which people are enabled to learn about particular practices. Each school subject will have its own signature pedagogies which enable pupils to learn that subject effectively. These signature pedagogies are effectively collections of pedagogical content knowledge. Shulman identifies three key features of signature pedagogies that new teachers need to consider:

Surface structures

- Approaches being used in teaching and learning (ways of teaching, resources, etc.)
- The learning that can be observed in the classroom
- The ways in which learning is monitored

Deep structures

- Assumptions about how substantive and disciplinary knowledge should be taught
- Decisions about the most appropriate ways of teaching content
- Critical evaluations of the best approaches for delivering content

Implicit structures

- Moral dimensions of learning about the subject
- The tensions between what pupils could learn and what they can learn within specific contexts

What is the signature pedagogy focus in computing?

Effective pedagogy is at the heart of good teaching and learning; successful computing teachers combine their knowledge of the subject with evidence-based teaching practices. The approach taken was to research current thinking on effective pedagogy

The 'I do, we do, you do' method of modelling

Trainee teachers are expected to do 20 days of intensive training and practice (ITAP) each year

for computing and make use of the pedagogies outlined in the pedagogy section of **teachcomputing.org** and *The Big Book of Computing Pedagogy* (**helloworld.cc/bbcp**). These included semantic waves, Predict–Run–Investigate–Modify–Make (PRIMM), storytelling, and modelling. The trainees then used this knowledge as an observation focus in school and discussed the different approaches with colleagues, before designing and delivering a learning episode of their own.

Given the stage of the trainees' careers and the limited topics being taught, modelling emerged as the most frequently investigated pedagogy, and in particular, the use of the 'I do, we do, you do' approach (**helloworld.cc/i-do-model**). This breaks down as follows:

I do

The teacher introduces new content, and demonstrates ideas and techniques. No questions are asked at this stage; rather the teacher explains their thinking and decision-making process.

We do

Students imitate and practise the concept under supervision. This phase involves a lot of repetition and guided practice. At this stage, targeted questioning is used to ensure understanding.

You do

Students work independently, applying what they have practised. The teacher provides support and observation.

Feedback and reflection from trainees

A key part of the ITAP was the opportunity for trainees to reflect on their experience, individually and as a cohort. The feedback from trainees was overwhelmingly positive. The 'we do' part of the modelling process was found to be of paramount importance. Some trainees either observed lessons, or delivered lessons using the 'I do' and 'you do' parts and left out the 'we do' part. This often resulted in the need for further demonstrations and teacher intervention. It was clear that when the 'we do' part was correctly applied, learners made more progress.

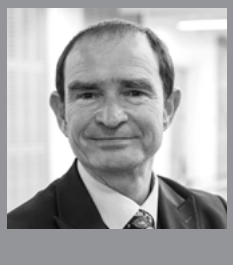
Other notable feedback included the importance of a structured approach to modelling, so that tasks were broken down sufficiently to ensure engagement through each step of the process. The use of scaffolding allowed pupils to visualise each stage of the problem-solving process and enabled the responsibility of the task to be gradually released from the teacher to the pupils.

> THERE ARE BENEFITS TO TAKING TIME TO LOOK DEEPLY AT ASPECTS OF PROFESSIONAL PRACTICE

The trainees often changed their view of modelling, from being a simple process of demonstration, to actively involving pupils in the process. This included the need for careful dialogic talk, which helps with engagement, behaviour management, and pupil resilience.

Concluding thoughts

The ITAP demonstrated the benefits of taking time to look deeply into an important aspect of professional practice. It enabled the trainees to absorb the evidence from research, plan and deliver lessons using modelling, and reflect on how they can further improve their teaching. The ITAP also helped to bring consistency to the work done in both university and school. (HW)



IAN NEEDHAM

Ian is a senior lecturer in education at Leeds Trinity University, responsible for delivering the PGCE in Computer Science with ICT. He also works as a lead facilitator for the NCCE and has authored and delivered several courses.

HELPING YOUNG PEOPLE NAVIGATE AI SAFELY

Mac Bowley introduces Experience AI's latest offering, a suite of AI safety resources

As our lives become increasingly intertwined with AI-powered tools and systems, it's more important than ever to equip young people with the skills and knowledge they need to engage with AI safely and responsibly. AI literacy isn't just about understanding the technology — it's about fostering critical conversations on how to integrate AI tools into our lives while minimising potential harm, otherwise known as 'AI safety'.

The UK's AI Safety Institute defines AI safety as: "The understanding, prevention, and mitigation of harms from AI. These harms could be deliberate or accidental; caused to individuals, groups, organisations, nations or globally; and of many types, including but not limited to physical, psychological, social, or economic harms" (**helloworld.cc/uk-ai-safety**).

MAC BOWLEY

Mac is a computing educator who has worked in almost every context imaginable: after-school clubs, holiday camps, enrichment days, and teaching students aged 14–16. Mac is passionate about empowering people to use technology to solve problems that matter to them.

■ The 'Media literacy in the age of AI' session provides important information about generative AI and its potential to produce inaccurate content

As a result of this growing need, we're thrilled to announce the latest addition to the Raspberry Pi Foundation's AI literacy programme, Experience AI — 'AI Safety' (**helloworld.cc/exp-ai-safety**). Co-developed with Google DeepMind, this suite of free resources is designed to empower 11–14-year-olds to understand and address the challenges of AI technologies. Whether you're a teacher, youth leader, or parent, these resources provide everything you need to start the conversation.

Linking old and new topics

AI technologies provide huge benefits to society, but as they become more prevalent, we cannot ignore the challenges they bring with them. Many of the challenges are not new, such as concerns over data privacy or misinformation, but AI systems have the potential to amplify these issues.

Our resources use familiar online safety themes — such as data privacy and media literacy — and apply AI concepts to start the conversation about how AI systems might change the way we approach our digital lives.

Each session explores a specific area:

- **Your data and AI:** how data-driven AI systems use data differently to traditional software and why that changes data privacy concerns
- **Media literacy in the age of AI:** the ease of creating believable, AI-generated content and the importance of verifying information
- **Using AI tools responsibly:** encouraging critical thinking about how AI is marketed and understanding personal and developer responsibilities

Each topic is designed to engage young people to consider both their own interactions with AI systems and the ethical responsibilities of developers.

Designed to be flexible

Our AI safety resources have flexibility and ease of delivery at their core. Each session is built around three key components:

1. **Animations:** each session begins with a concise, engaging video introducing a key AI concept using sound pedagogy, making it effective and easy to deliver. The video then links the AI concept to the online safety topic and opens threads for thought and conversation, which learners explore through the rest of the activities.
2. **Unplugged activities:** these hands-on, screen-free activities — ranging from role-playing games to thought-provoking challenges — allow learners to engage directly with the topics.
3. **Discussion questions:** tailored for a variety of settings, these questions help spark meaningful conversations in classrooms, clubs, or at home.

Experience AI (**experience-ai.org**) has always been about allowing everyone — including those without a technical background or specialism in computer science — to deliver high-quality AI learning experiences, which is why we often use videos to support conceptual learning.

In addition, we want these sessions to be impactful in many different contexts, so we include unplugged activities that you can run without a computer room! There is also advice on shortening the activities or splitting them so that you can deliver them over two sessions if you want.

The discussion topics provide a time-efficient way of exploring some key implications with learners, which we think will be more effective in smaller groups or more informal settings. They also highlight topics that we feel are important but may not be appropriate for every learner — for example, the rise of inappropriate deepfake images, which you might discuss with a 14-year-old, but not an 11-year-old.

A modular approach for all contexts

Our previous resources have all followed a format suitable for delivery in a classroom, but for these new resources, we wanted to widen the potential contexts in which they could be used. Instead of prescribing the exact order in which they should be delivered, we encourage educators to mix and match activities that they feel would be effective for their context. We hope this will empower anyone, no matter their surroundings, to be able to have meaningful conversations about AI safety with young people.

The modular design ensures maximum flexibility. For example:

- A teacher might combine the video with an unplugged activity and follow-up discussion for a 60-minute lesson
- A club leader could show the video and run a quick activity in a 30-minute session
- A parent might watch the video and use the discussion questions during dinner to explore how generative AI shapes the content their children encounter

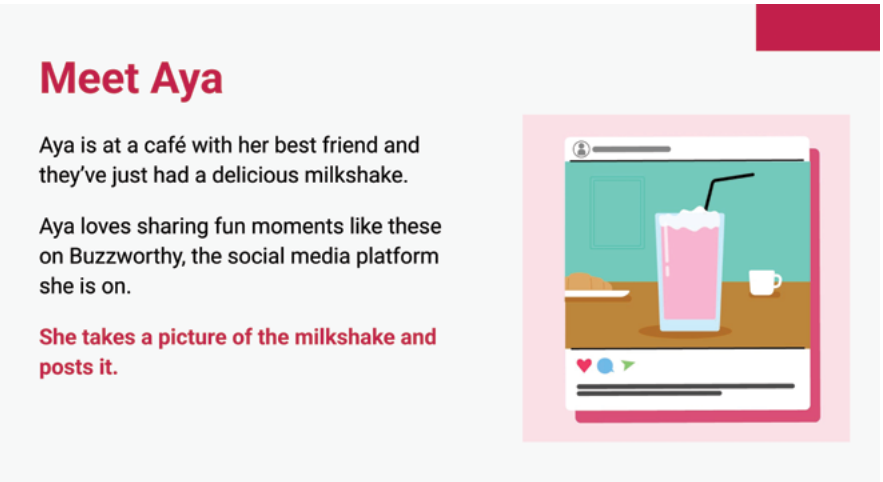
The importance of AI safety education

With AI becoming a larger part of our daily lives, young people need the tools to think critically about its use. From understanding how their data is used to spotting misinformation, these resources are designed to build confidence and critical thinking in an AI-powered world.

> AI TECHNOLOGIES PROVIDE HUGE BENEFITS, BUT WE CAN'T IGNORE THEIR CHALLENGES

AI safety is about empowering young people to be informed consumers of AI tools. By using these resources, you'll help the next generation not only to navigate AI, but also to shape its future. Dive into our materials, start a conversation, and inspire young minds to think critically about the role of AI in their lives.

Ready to get started? Together, we can empower every child to thrive in a digital world. Explore our AI safety resources today: **helloworld.cc/exp-ai-safety**. (HW)



Unplugged activities, like this one in the 'Your data and AI' session, offer thought-provoking challenges to engage learners

NETWORKING 101

Building bridges from school to industry

As a teacher, one of my main goals is to prepare my kids for the real world. I keep up to date with real-world practices, I try simulating job roles through interactive activities, and I constantly research salaries and the most-wanted jobs in my discipline.

Even with all of this, it always feels like I fall short. No matter how much I tell my kids what skills are marketable, how much money they can make, or how interesting different jobs are, they will not believe me. Why? Well, because I am their teacher. Some kids don't believe that teachers exist outside of their classrooms, and this makes it hard for some of us to be persuasive when speaking about the real world. What I have found does get through to my kids is actually connecting them with the real world: taking them out to see what careers and employers exist, and bringing in guest speakers to talk about their passions. I may have said some of the exact same things my guest speakers did, but I promise you that only the guest speakers got the oohs and ahhs.

Creating networking opportunities for students

Actually connecting your kids to the real world is challenging because there is no playbook to follow. I built this experience for my learners through trial and error and continuous improvement. Don't get me wrong, every event was worthwhile, but I did learn some tips along the way that make for a better experience. Part of this is knowing my kids, and their level of expertise and interests.

I started off with guest speakers. I tried to find people with careers at least somewhat related to what I teach. I reached out to old college friends, using LinkedIn for my reconnaissance. I emailed people who work for the companies that my school partners with for its IT and cybersecurity. I also asked my own students about what their parents do. Parents are usually very excited to visit or help facilitate a guest speaker from their company. I even sent out a blast in my current master's programme to see who would be willing to speak. I found that the people who loved their jobs could easily fill a period talking about their work, and the passion for their profession shone through.

After hosting guest speakers, I decided we should venture into the real world. Some events have included visiting Zebra, a mobile computing company (**zebra.com**) for a career day; taking public transport to the FBI Headquarters to hear about cybersecurity opportunities; and visiting a local college to take a tour and learn about their dedicated cybersecurity programme. What I learnt from planning these excursions is that you should not be afraid to ask colleges or companies if they would open their event up to high-schoolers (they are typically designed for undergraduates). I also learnt to keep in touch with your students about the cool things they are doing. One of my learners planned the FBI field trip with me for his quarterly project. Another visited a local college we are going to and shared all the resources he gathered. It really takes a village! I encourage you to be open-minded and see if you can go cross-disciplinary as well.

Our classes at the FBI Headquarters

A student looking at a 3D-printed model at Zebra

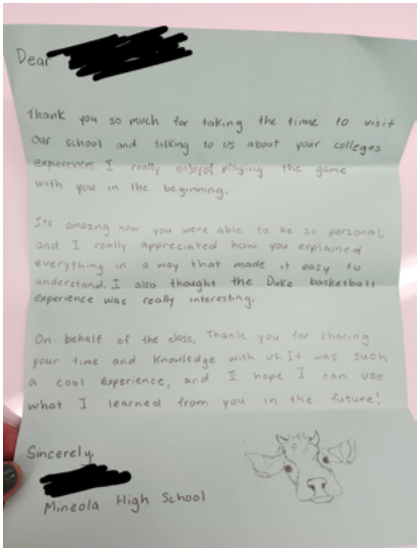
I realised through this process that my students were now networking. They may not have known it, but they were building professional relationships with industry experts! This prompted me to have them create LinkedIn accounts, as my Google Sheets list of connections was not going to be as useful to them as tangible connections. They took time to create accounts by studying some excellent ones and critiquing their own. It was an awesome

A guest speaker (CTO of his own cybersecurity company) in our class

experience watching some of my students approach a guest speaker at the end of class and ask to connect on LinkedIn.

What were the results?

Besides finally accepting all the things I have been saying about the real world, my students really began thinking about their careers. I have had many comments about how studying cybersecurity is one thing, but seeing how it is used in different roles made students feel like my class was less of an elective and more 'core' because of the potential impact it has on their lives. My learners are also building professional relationships before they go to college. This is a huge achievement, particularly as I remember initially creating a LinkedIn account and having to network — it felt daunting and exhausting. I can also see that my learners have a better insight into job applications. Hearing CEOs and managers talk about desirable skills and how to get your foot in the door really stuck with them, and they had so many questions about internships and how to get experience. I also found that learners had increased buy-in to our computing units because they had heard industry professionals talk about how they use Linux command line, or how their day-to-day work involves interacting with databases. Overall, they became better prepared for the real world — my main goal.



A thank you letter written from a student to a guest speaker

Tips for successful networking

I would like to share these tips with you, which I have gathered from many guest speakers and various field trips.

1. Prepare your kids to ask questions. You can ask them to create two questions as the exit ticket from the class (you get out as much as you put in).

2. Get your kids to help you plan a trip, or even plan a trip themselves! They are the ones who will be experiencing the trip, so they will think of what they want, and it will take some burden off you. Make sure to give them boundaries.

3. Write thank you letters. Handwritten and mailed ones are even better. This is a great way to show your appreciation (and get your guest speaker to show off to their boss and get the OK to return).

4. Have your kids make LinkedIn accounts so they can connect with your guest speakers and carry these connections through their professional careers. (You should do this, too!)

5. Do a quick game at the beginning of a speaker visit, such as 20 questions. This will help everyone get comfortable, help the room become more open to conversion and questions, and improve engagement.

6. Be diverse and match your guest speakers to your kids' interests. Hearing from a cybersecurity special agent who also loves cheerleading, and from a CTO who also loves boxing, really helped my kids connect and understand that they can continue to do what they love.

7. Try to run in-person speaker events. If they can't come to you, try asking to visit them. (Field trip, anyone?) If not, make the interaction as engaging as possible and become the emcee for the session!

8. Get your kids to ask your guest speakers for field trips. (Speakers don't always say yes, but it is so worth it when you get one who does!) (HW)

VICTORIA BERKOWITZ

Victoria is a software developer turned computer science teacher. She works at Mineola High School in the USA, where she teaches GameMaker, robotics, AP CS principles, and cybersecurity. She loves all things teaching, whether it be in public schools, volunteering, or children's ministry (**@v_berkowitz**).

USING MICRO:BIT CLASSROOM TOOLS TO CREATE GAMES IN PYTHON AND ENGAGE LEARNERS

Chris Lovell shares how he uses the micro:bit, micro:bit classroom tools, and PRIMM pedagogy to teach his students how to code in Python

I recently had the privilege of leading a workshop at Python in Education Day, hosted by Science Oxford (scienceoxford.com). My audience included passionate educators and industry professionals dedicated to igniting a love of STEM in young minds through coding and creative exploration. In my workshop, I demonstrated how I use the micro:bit and its classroom tools to transform the Python learning experience. Here is how you can do the same.

CHRIS LOVELL
Chris is the head of computer science at Thornton College, UK, and a micro:bit champion (**@mrlovellcomp** on X, BlueSky, and Threads).

micro:bit as a handheld game machine

With its built-in LED screen, speaker, accelerometer, and buttons, the micro:bit is a powerful and versatile tool for teaching children how to code and create games. Its compact size makes it easy to use in the classroom, and the Micro:bit Educational Foundation's coding tools (**microbit.org**) allow young people to get started with programming quickly and easily.

In my lessons, I've found that using the micro:bit to create games is a highly effective way to engage children aged 11–14 and support them to develop their coding skills. By creating their own games, children can apply their learning in a fun and creative way, and they can also explore the core concepts of computer science, such as sequence, selection, and iteration.

Once children are comfortable with the basics of coding the micro:bit, they can start to create more complex games, such as number-guessing games or reaction games. This process not only helps them develop their coding skills, but also encourages them to think critically and problem-solve.

micro:bit classroom's differentiated coding support

I use micro:bit's classroom tool (**classroom.microbit.org**) to support learning in my school. The classroom tool provides a powerful platform for differentiated instruction in coding. This innovative tool allows teachers to tailor support to individual learners' needs, ensuring that everyone in the classroom can succeed in their coding journey. Its features and benefits are:

> "GAME-MAKING ENCOURAGES STUDENTS TO THINK CRITICALLY AND PROBLEM-SOLVE

- **Differentiated support:** teachers can provide scaffolded code to students who require additional assistance, while also allowing more advanced learners to explore the coding tools independently. This ensures that all students are challenged at their appropriate level.
- **Efficient classroom management:** the tool enables teachers to monitor student progress in real time, identify those

```
#If shaken, have micro:bit generate a random pattern
#and show on the LED display
if accelerometer.was_gesture('shake'):
    for i in range(3):
        randomNum = random.randint(1,3)
        microGo.append(randomNum)
    for i in range(3):
        display.scroll(microGo[i])
#If three guesses have been made, run the array check
#and display well done, or try again, based on the result.
if guessCount == 3:
    for i in range(3):
        if microGo[i] == playerGo[i]:
            guessCorrect = guessCorrect + 1
    if guessCorrect == 3:
        display.scroll("Well Done!")
    else:
        display.scroll("Try again!")
    #Now reset the variables and clear the arrays for another go
    guessCount = 0
    guessCorrect = 0
    microGo.clear()
```

Figure 1 This example code creates a simple 'Simon Says' game on the micro:bit

who may be struggling, and provide timely support. This maximises learning efficiency during lessons.

- **Seamless lesson continuity:** with the ability to save and resume class progress, teachers can easily pick up in the next lesson where they left off, ensuring a smooth and continuous experience.
- **Extensive resources:** the tool offers a comprehensive library of coded examples, guides, and tutorials, providing teachers with ready-to-use materials and inspiration for their lessons.
- **Multi-language support:** the classroom tool is available in 33 languages, ensuring that all students, regardless of their first language, can thrive.

The micro:bit classroom tool is a full-featured Python integrated development environment (IDE). You can find tutorials that explain how teachers can get started with it here: **helloworld.cc/microbit-teaching-tools**.

Classroom pedagogy

I use a combination of live coding and the PRIMM approach (Predict–Run–Investigate–Modify–Make) to teach coding in my classroom. Here's how it works:

- **Live coding:** I project my screen and code in real time, thinking out loud as I go. I even make mistakes on purpose! This shows students that errors are normal and helps them learn how to debug.
- **PRIMM:** students predict what the code will do, run it to see if they are right, and then investigate, modify, and make their own versions.

This approach helps students learn to code incrementally, building confidence and understanding along the way. They see that coding is a process of trial and error, and they develop the skills to create their own games on the micro:bit.

I use the micro:bit classroom tools to provide differentiated levels of support to all my students:

- **For students who need support:** I can easily send them code to get them started or to help them overcome challenges.
- **For students who are ready to explore:** I make sure they know how to use the built-in documentation. This allows them to experiment, learn independently, and personalise their games.

Making a 'Simon Says' game

In two one-hour lessons, learners create a 'Simon Says' game where the micro:bit will show a pattern that the player must reproduce to progress. The example code uses arrays to store the patterns produced by the micro:bit and the player, and a counting loop to check the contents of these arrays.

The example code in **Figure 1** shows a three-item pattern that the player has to copy.

To make the game more challenging, students can build their own ideas into their games, for example using the micro:bit's motion sensor to create unique patterns.

In my lessons, learners are reminded that the goal is to make a fun and engaging game. I have observed learners drawing inspiration from games like 'bop it!' (**helloworld.cc/bop-it-wiki**) by creating physical gestures for the player to copy, or creating their own exciting patterns in their games using the micro:bit's LEDs and speaker to create expressive lights and unique sounds.

I believe that every learner deserves the opportunity to explore the exciting world of computer science in a fun and engaging way. By creating games on the micro:bit, and by using the micro:bit's classroom tools to differentiate learning for all students in my classroom, I make sure every student gets the support they need to succeed.

More games in Python

I have created teaching guides for game-making in Python with learning objectives, step-by-step activities, code examples, and challenges for pupils. Access them here: **helloworld.cc/microbit-python-games**. (HW)

Step-by-step activities in Python

COLLABORATING WITH LLMS

Level up from centaur to cyborg

In today's work environment, integrating large language models (LLMs) isn't just a passing trend; it's essential for staying competitive. Yet many of us still feel hesitant to use LLMs in our daily tasks. They are often viewed as threats to our jobs or shortcuts that undermine our skills. But here's the truth: when we learn how to work alongside LLMs — and especially when we understand the difference between centaur tasks and cyborg tasks — we can transform these powerful tools into valuable partners.

This article serves as a follow-up to my previous Hello World article outlining effective prompting strategies for educators. Check out the article on pages 32–33 of **helloworld.cc/25** for a straightforward framework to follow to make your interactions with LLMs more effective.

Centaur versus cyborg tasks

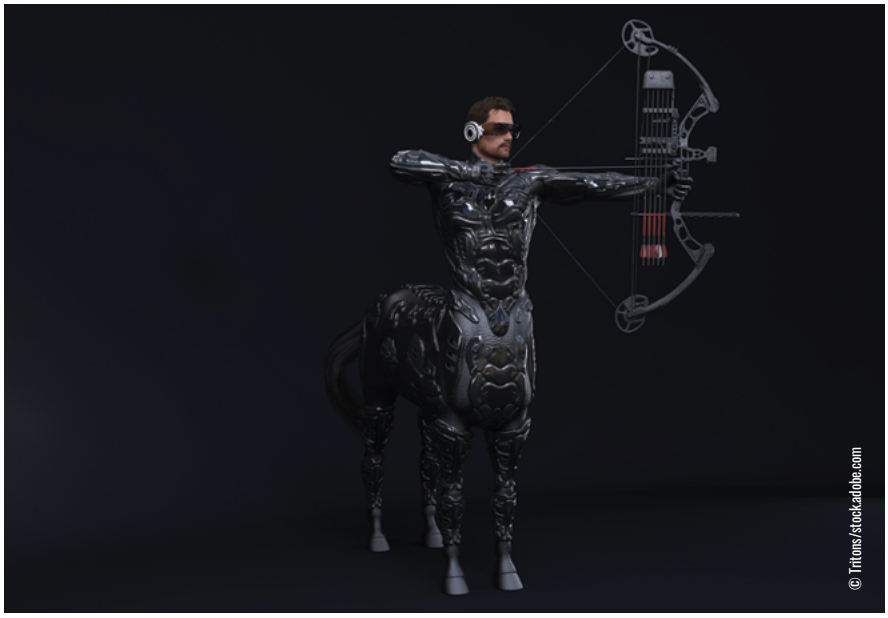
So, what's the difference between centaur and cyborg tasks when using LLMs?

Centaur tasks

Think of a centaur task as a classic collaboration. In such a situation, you're in the driver's seat, while the LLM takes care of the more repetitive or data-heavy parts of the job. Like the mythical half-man, half-horse, there's a clear division between the two parts.

For example, consider a team member at the Raspberry Pi Foundation working on a curriculum for a new developing market. They might brainstorm key learning objectives and structure, while using an LLM to help generate lesson plans or suggest coding activities. The LLM serves as a helpful assistant, allowing the educator to focus on tailoring the content to their audience. Here are some example centaur personas and accompanying prompts:

1. **Supportive curriculum developer:**
   - **Prompt**: "Behave as a supportive curriculum developer. Help me generate lesson plans and coding challenges for a new workshop on [topic]."
2. **Insightful community-outreach coordinator:**
   - **Prompt:** "Behave as an insightful community-outreach coordinator. Assist me in compiling feedback from workshop participants and summarising key insights."
3. **Engaging workshop facilitator:**
   - **Prompt:** "Behave as an engaging workshop facilitator. Generate interactive activities that can be included in our Code Clubs on [topic] to enhance student participation."
4. **Resourceful technical writer:**
   - **Prompt:** "Behave as a resourceful technical writer. Help me draft clear and concise documentation for this GitHub repository [URL]."



This cyborg centaur was, surprisingly, not made with AI

Cyborg tasks

Now, let's talk about cyborg tasks. In these tasks, the LLM isn't just an assistant; it becomes an extension of your capabilities, actively enhancing your work process.

Consider a community-outreach coordinator preparing a report on the effectiveness of workshops in local schools. They could feed the LLM data from participant surveys and workshop feedback. The LLM could then analyse this information, summarising key trends and insights

that the coordinator could use to inform future workshops. Taking that analysis, the coordinator then writes their report and asks the LLM to check it over to make sure it is accurate and that the language is effective and appropriate, before sharing it with the wider team.

Additionally, think about a team working on a new educational resource. They could use an LLM to brainstorm lesson ideas based on specific topics or age groups. The LLM could generate multiple options for interactive activities or projects, giving the team a diverse range of ideas to choose from. The team could discuss and iterate these options in collaboration with the LLM, using it to weigh in on ideas and their possible outcomes and implementation. This collaborative brainstorming not only saves time but also sparks creativity, making the development of educational materials more efficient and engaging.

In these examples, LLMs become essential partners in both the creative and analytical processes, empowering team members to achieve more than they could alone. The LLM enhances what you can accomplish, making collaboration seamless and effective. Cyborg tasks blur the lines between human and artificial intelligence work, resulting in a dynamic partnership where both parties contribute equally.

Cyborg prompts: sparking creativity and innovation

An exciting benefit of working with LLMs is their potential to boost creativity and innovation through structured engagement.

Critical-thinking mode

Let's explore critical-thinking mode. In this mode, the LLM acts like a mentor, asking questions that help you pull out your best ideas. Instead of giving you answers, it prompts deeper thinking.

- **Prompt:** "I want your help to create [content] for [context]. We are going into critical-thinking mode now. Please ask me only questions that challenge my thinking, without giving me the answers. Your role is to gather information without providing any answers. From now on, ask me only one question at a time and wait for my response before proceeding."

Interview mode

Another effective approach is interview mode, in which the LLM interviews you to gather insights and create content based on your responses. This personalised approach can lead to richer results.

- **Prompt:** "I want your help to create [content] for [context]. We are going into interview mode now. Please interview me with relevant, insightful questions that will help me articulate my thoughts and ideas. Your role is to gather information without providing any answers. From now on, ask me only one question at a time and wait for my response before proceeding. When I am ready, I will instruct you to create some content from my answers."

Tackling common misconceptions

As LLMs become more widespread in the workplace, it is crucial to address some common misconceptions:

LLMs as cheating

One frequent concern (which I have sensed, rather than heard directly) is that using LLMs is cheating. This is an unnecessarily limiting view. If I gave you an umbrella to shield you from the rain, but you insisted on not using it, that would be a bit baffling, right? Instead of seeing LLMs as shortcuts, let's embrace them as tools that can enhance our skills. The goal isn't to replace us, but rather to amplify our contributions.

LLMs as risky business

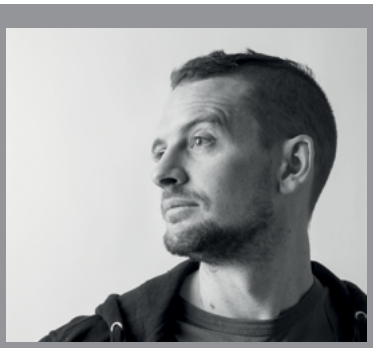
Another worry is that LLMs are inherently risky or dangerous. While these concerns can be valid, responsible use revolves around principles of fairness, accountability, transparency, and privacy. When we understand how to use LLMs ethically, they transform from sources of anxiety into reliable partners in our work. By addressing these misconceptions, we can shift our mindset from fear to empowerment.

Important note: remember to review the terms of service for any LLM you choose to use. Additionally, unless you are using a corporate account with privacy safeguards built in, be aware that any data you input may be used by the provider for training and refining their models, so avoid inputting personal details or names. Always consider your school's data policies when using these tools.

Embrace experimentation

The path to effective LLM integration starts with a willingness to experiment. You should definitely explore both centaur and cyborg tasks in your daily routines. Start small — maybe use an LLM to help you draft emails or analyse data. As you become more comfortable, you might discover innovative ways to leverage LLMs in your projects.

Let's embrace LLMs not as a threat, but as helpful collaborators in our pursuit of success. Together, we can redefine what's possible in the workplace, one innovative idea at a time. (HW)



MARK 'MR C' CALLEJA

Mr C is a teacher, hacker, surfer, D&D Dungeon Master, thrower of bladed implements, and maker of useful things. During the day he makes educational resources for the Raspberry Pi Foundation, which you can find on the Foundation's website.

LESSON PLAN

IS IT REAL?

Explore how images can be changed, and develop an awareness that not all images are real

The following lesson plan is taken from the 'Creating media' unit of The Computing Curriculum (TCC), written by the Raspberry Pi Foundation. It is aimed at learners aged six to seven, and introduces the concept that images can be changed for a purpose. Learners are introduced to a range of images that have been changed in different ways and through this, develop an awareness that not all images they see are real.

ABOUT THE COMPUTING CURRICULUM

Raspberry Pi Foundation

The Computing Curriculum is the Raspberry Pi Foundation's bank of free lesson plans and other resources that offer educators everything they need to teach learners aged five to sixteen. It covers the full breadth of computing, including computing systems, programming, creating media, data and information, and societal impacts of digital technology.

Every unit of work contains a unit overview; a learning graph to show the progression of skills and concepts in a unit; and lesson content, including a lesson plan, slides, and formative assessment opportunities. Find them when you sign up for a free account at **helloworld.cc/tcc**.

AGE RANGE

6–7 years

OBJECTIVES

- Apply a range of photography skills to capture a photo
- Recognise which photos have been changed
- Identify which photos are real and which have been changed

This is the last lesson in The Computing Curriculum's 'Digital photography' unit. Learners are introduced to a range of images that have been changed, and through this, develop an awareness that not all images are real. (HW)

ACTIVITY 1: TAKING YOUR OWN PICTURE

15 minutes

Ask learners to share what they should think about when taking a photo using **Figure 1**.

Tell learners that you would like them to capture a photograph of their favourite part of the classroom. Give them a few minutes to discuss and plan their ideas for how they might go about this.

Explain that they will need to take three photos. Remind pupils that if the photo they are taking is of somebody else, they must first ask for their permission. They may also need to check for children in the background.

After the learners have all taken their photographs and chosen their favourite one, they should use the 'Photography review' handout (**helloworld.cc/isitreal-lesson**) or ask learners to check the photographs they have taken, considering the following:

- Whether they have used the best format (landscape or portrait)
- How well it is framed
- Use of lighting — is the photo clear?

Figure 1

ACTIVITY 2: PHOTOS CAN BE CHANGED 10 minutes

Explain to learners that sometimes you will see a photo and not know if it has been changed (**Figure 2**). Can learners suggest any reasons why someone might change how a photo looks after it has been taken? They could say something like:

- To change how a photo 'feels', to make it seem spooky or happy, or cold or warm
- To make it more of a piece of art
- To make a picture look more interesting or exciting
- To pretend the picture was taken somewhere that it wasn't, e.g. if I made it look as if I was on the moon

Explain to learners that one of the images in **Figure 3** is the original, and the other three have been changed. Can they work out which ones have been changed?

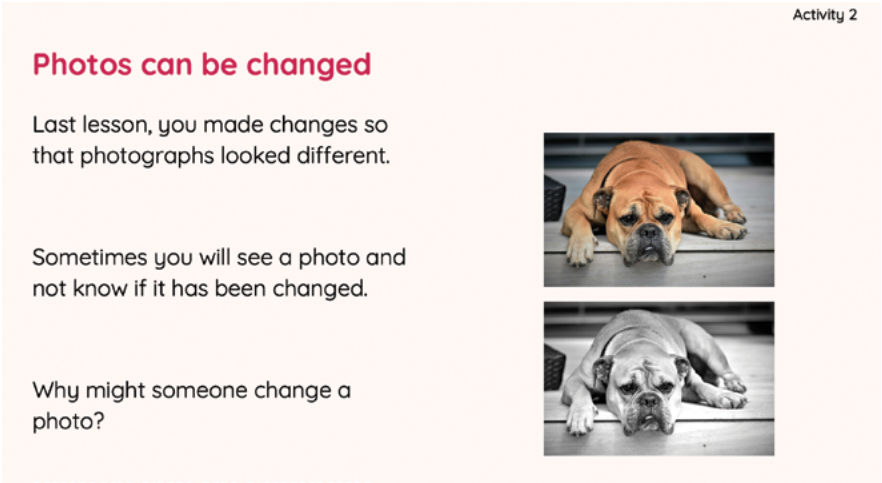


Figure 2

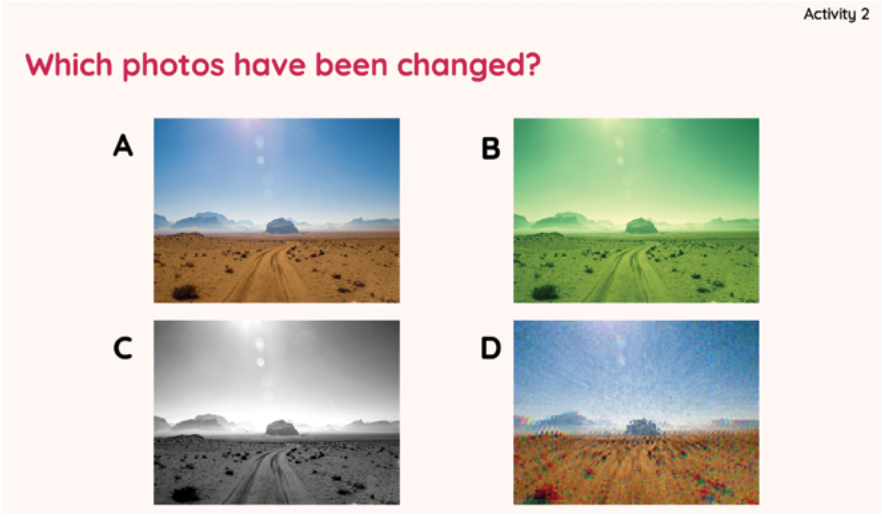


Figure 3

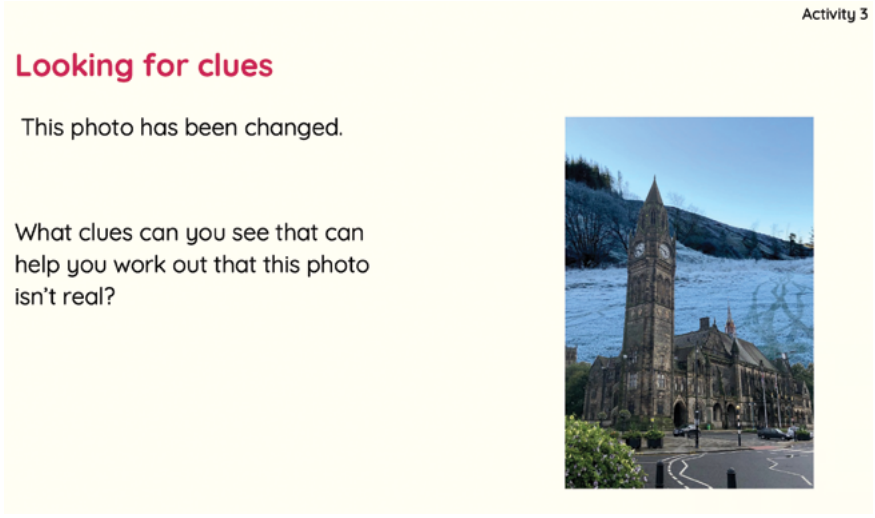


Figure 4

ACTIVITY 3: LOOKING FOR CLUES 10 minutes

Show the image in **Figure 4** and explain that it has been changed, but in a different way to the images they saw before. Can they notice any clues that make the picture seem a bit odd?

Point out the following clues:

- There's snow in the background, but not on the town hall or the road
- It looks like spring or summer in the bottom part of the photo, and winter in the top part
- It looks like there's a big hill in the background, but the town hall is taller than it

RELEVANT LINKS

TCC 'Is it real?' lesson:
helloworld.cc/isitreal-lesson

PLENARY: ARE THERE ALWAYS CLUES? 5 minutes

Explain that even adults can make mistakes when trying to work out if an image is real.

Show **Figure 5**. Ask learners to write A, B, C, and D on a whiteboard or a piece of paper. Ask them to write next to each letter if they think the image is real or fake.

Go through the answers:

A. **Real:** this is a photo of a dog that befriended a baby giraffe in South Africa

B. **Fake:** the moon has been copied into this photo so that it appears to be held up by the building

C. **Fake:** this is two images combined; the whales are too big relative to the size of the bridge

D. **Real:** this is a hotel in South Korea that has been built to look like a cruise ship on land

Remind learners that this activity shows that it can be really difficult to spot fake images, and reminds us to always ask the question 'Is it real?'

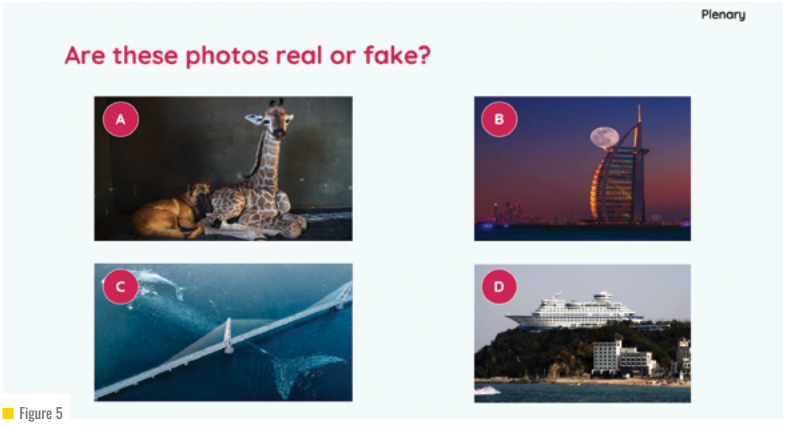


Figure 5

THE BEBRAS PUZZLE PAGE

Each issue, **Andrew Csizmadia** shares a computational thinking problem for your students based on the work produced by the International Bebras Community

ABOUT BEBRAS

Bebras is organised in over 90 countries and aims to get students excited about computing and computational thinking. Last November, 467,000 students participated in the UK annual challenge. Our archived questions let you create your own automarking quizzes at any time during the year. To find out more and to register your school, head to **bebras.uk**.

THE PROBLEM: PASSCODE

DOMAIN

Interactions, systems, and society

SKILLS

Decomposition and evaluation

AGE

10–16 years

DIFFICULTY RATING

Ages 10–12 hard
Ages 12–14 medium
Ages 14–16 easy

Beaver Daniel has received a chest of gold. It is locked with an electronic lock that can be opened with a nine-digit code.

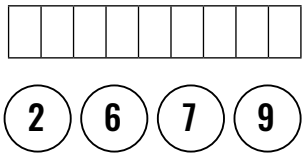
Daniel has received the following hints about the nine-digit code:

1. The only digits in the code are 2, 6, 7, and 9
2. The digit with the highest value is used the lowest number of times
3. The digit with the lowest value is used the highest number of times
4. The code looks the same in reverse
5. All consecutive digits are different
6. The last digit entered is odd

Task

What is the passcode that needs to be entered into the electronic lock in order to unlock the chest?

Electronic lock



Explanation

While this task originally appears not to give you enough information to work out the code, it turns out that if you take small steps, looking at the hints, you actually have enough information, and you don't have to try out all of the different combinations!

Computational thinking is about analysing problems and trying to think of a way to find a solution. You could just have a computer try out all possible combinations, and then check whether each possible combination follows the hints given. But if you do some logical thinking, you will see that you can reason your way to a single solution.

The reasoning you do here is known as knowledge-based reasoning. You have some knowledge, and with that knowledge, and your reasoning skills, you are able to infer new facts and solve the problem.

This Bebras puzzle was originally written by the Bebras team from Malaysia and modified by members of the Bebras community. The solution is on page 79.

KEYWORD SPOTLIGHT: DECOMPOSITION

Decomposition is a way of thinking about artefacts in terms of their component parts. The parts can then be understood, solved, developed, and evaluated separately. This makes complex problems easier to solve, novel situations easier to understand, and large systems easier to design. For example, making breakfast can be broken down, or decomposed, into separate activities such as make toast, make tea, and so on. Each of these could also be broken down into a set of steps. Through decomposition of the original task, each part can be developed and integrated later in the process. Consider developing a game: different people can create the different levels independently, provided that key aspects are agreed in advance. A simple arcade level might be decomposed into several parts, such as the lifelike motion of a character, scrolling the background, and setting the rules about how characters interact. (HW)

Regular meetings for mentors, whether in person or online, help create a supportive community

SUPPORTING CODE CLUB MENTORS

Ideas for demonstrating appreciation and keeping volunteers engaged

Code Clubs thrive on the energy and dedication of volunteer mentors. These amazing individuals generously give their time and expertise to inspire the next generation of coders. But even the most enthusiastic volunteers need support! Here are some ideas of ways to show your appreciation and keep your mentors engaged.

Recognise and appreciate

There are some easy ways to show how much you value the support of the mentors at your Code Club:

- **Regular shout-outs:** publicly acknowledge mentors' contributions during club sessions, in newsletters, or on social media.
- **Small gestures:** a simple thank you goes a long way. Why not suggest that the young creators code a thank you card for their mentors? Use our 'From me to you' Scratch project to create a personalised thank you card (**helloworld.cc/from-me-to-you**).
- **Celebrate milestones:** mark anniversaries of mentors' involvement — for example, after they've been volunteering for six months. Celebrate their successes, too — this could be when a mentor has supported a creator to enter Coolest Projects (**coolestprojects.org**) or with sending their code to space with the European Astro Pi Challenge (**astro-pi.org**).

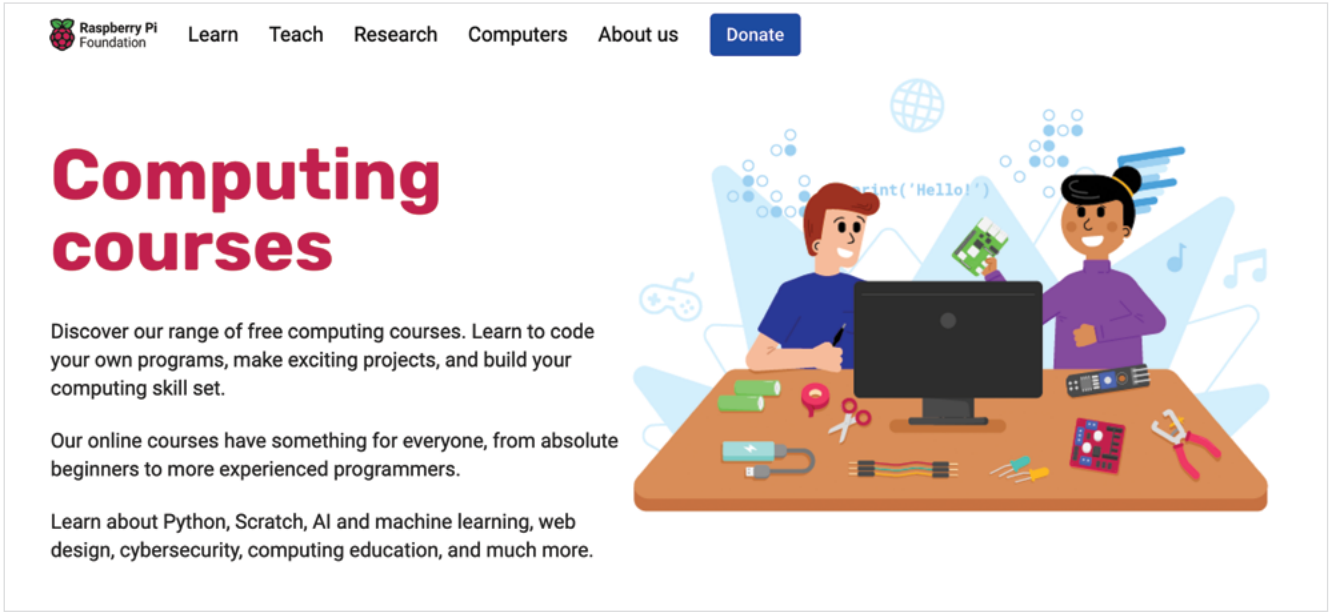
ZOE DAVIDSON

Zoe is the community engagement manager for Code Club. She is the voice behind the Code Club newsletter and blog, and you can meet her at the Code Club coffee and conversation chats online.

Provide ongoing training and development

Not all mentors will come from a coding background. You can show your support and make them feel like valued members of your Code Club by helping them gain new skills and confidence:

- **Workshops and webinars:** encourage mentors to take advantage of the many online workshops and webinars offered by Code Club (**codeclub.org**). Interested mentors can learn new coding languages, programming concepts, and mentoring techniques in a supportive, friendly environment.
- **Peer mentoring:** pair experienced mentors with newer ones for guidance and support.



Point volunteers to free resources like the Raspberry Pi Foundation's online courses, to help mentors gain new skills and confidence

- **Access to resources:** point mentors towards the Raspberry Pi Foundation's bank of free courses (**raspberrypi.org/courses**). If there's an article or book you've found helpful, share it with them. Everyone loves a recommendation!

Create a supportive community

When we create a supportive community, we provide a space for mentors to share experiences, challenges, and successes with others. There are some easy ways to do this:

- **Regular meetings:** organise regular meetings for mentors to connect, share ideas, and discuss challenges.
- **Online communication:** all mentors can join our Code Club Slack instance (**rpf.io/slackinvite**). In this online forum, mentors can chat to each other, get inspired, and find answers to a range of questions from our friendly global community.
- **Coffee and conversation:** encourage mentors to sign up for Code Club online meetups (**codeclub.org/events**). There's no agenda at these meetups — they are just a space for mentors and club leaders to share ideas, ask questions, and collaborate.

Value their time and expertise

No matter your mentors' backgrounds, they have something to offer your Code Club! Make sure you value their time and set clear expectations from the beginning. This will help with volunteer burnout and ensure everyone has a rewarding experience:

- **Clear expectations:** communicate clearly about the time commitment and responsibilities involved in being a mentor at your club
- **Flexibility:** be flexible with scheduling and allow mentors to contribute in ways that suit their skills and availability
- **Listen to feedback:** actively seek and respond to mentors' suggestions for club improvements

These tips will help create a positive and inclusive Code Club environment where all mentors feel welcome and valued. (HW)

WEST SOUND CODERDOJO TURNS TEN

Meet **Doña Keating**, co-founder of West Sound CoderDojo in Seattle, USA

Informal spaces for learning how to code provide young people with opportunities for creativity, collaboration, learning, and fun. CoderDojos are part of the Code Club community, and with a decade of shaping tomorrow's makers behind them, we wanted to ask the co-founder of the West Sound CoderDojo about their success.

We leave it up to attendees to explore whatever they are inspired to try

Did you have a background in computer science?

I had a career in broadcast journalism and law before launching my management consulting firm in 1995. I've always been an interested STEM practitioner, and becoming a founding member, and later president, of West Sound Technology Association (WSTA) in 2000 was a manifestation of that. My interests are broad and diverse, and I'm an intensely and naturally curious individual.

What made you start your club?

Once I had a child, I began to nurture her own STEM curiosity and skill set. This led me to research STEM movements and initiatives, which led me to the CoderDojo in Seattle. After our first session in 2015, I immediately started forming West Sound CoderDojo (WSCD), and I then urged WSTA to host it under its umbrella and pursue Licensed Regional Group status.

DOÑA KEATING
Doña is President and CEO of Professional Options LLC, a strategic leadership and management consulting firm. She is also a co-founding member of West Sound Technology Association and co-founder of West Sound CoderDojo.

What does a typical session at your club look like?

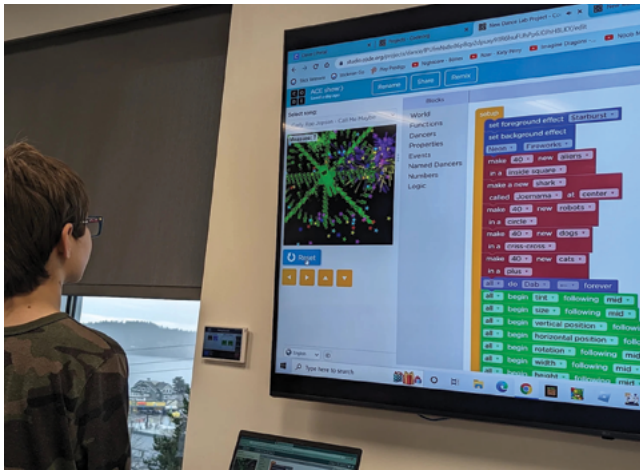
We generally propose a few beginner, intermediate, and advanced projects using a variety of website portals (Code.org, CoderDojo, Raspberry Pi, Scratch, Coursera, edX, NASA, and more). Overall, though, we leave it up to attendees (or 'Ninjas') to explore whatever they are inspired to try. If they have a question or issue, we prefer that they first ask a peer to troubleshoot or collaborate. If that's not preferred or successful, we have mentors who help them problem-solve in a facilitative (rather than a teaching) manner. There are nearly always snacks, and invariably someone wants to feature what they've been working on during the session. We keep the two-hour session fun, free-form, unbuttoned, and inclusive.

How would your students describe your CoderDojo?

Most of them consider it fun, interactive, and the opposite of how they learn in school. Some like to work alone or quietly, and that's OK too.

What excites your coders about coding?

When they are able to create something, or see their own progress unfold. They enjoy coding for the pure sake of learning, not because they feel they need it for a job (although of course it doesn't hurt if it helps them to get one).



Ninjas enjoy coding for the pure sake of learning

What growth have you noticed since your first session?

Ninjas, parents, senior citizens, and mentors have all grown, not only in their coding skill set, but also in their leadership skills. Spreading the word about the non-traditional pedagogy and how it promotes engaged learning has also become easier or more fluid to communicate. My own coding skills have grown exponentially.

What have you learnt from running a CoderDojo?

Outreach and sustaining the CoderDojo — in terms of both financial and human capital — can be a challenge. We need more mentors, and expanding it to other regional locations takes ongoing effort. There's a perception that it's something that needs to be brought to other regions, as opposed to an ownership and build-up using

> WE LEAVE IT UP TO ATTENDEES TO EXPLORE WHATEVER THEY ARE INSPIRED TO TRY

their own resources. Covid-19 has made it much more difficult to regain our footing and see the crowds we used to attract. That it's free means establishing and reaffirming the value proposition. Otherwise, it's a very intuitive and straightforward endeavour.

Tell us about some of the highlights of running your CoderDojo — any standout memories or moments, either with young people or volunteers?

Some highlights include appearing on Bremerton Kitsap Access Television (BKAT) and creating a video. Three of us also attended DojoCon 2016 in Ireland, where I presented. And one of our mentors attended and presented at the Clubs Conference in 2023 in Cambridge, UK. There are so many other memories, however — including partnered events such as our AI mini-conference, Changemakers Summit with Girls Ignited, and West Sound STEM Showcase. Our annual Two Hours of Code, Raspberry Pi Jam, and Scratch Day events are always blowout celebrations. We've done fun NASA projects, Inventr.io's '30 Days Lost in Space' projects, and building and coding on Kano kits. As for attendees and volunteers, we shifted to accepting all ages a few years back, and seeing adults code alongside younger members is a brilliant experience.

Our long-time board member and mentor (William 'Bill' Huckabee) passed away unexpectedly in August 2023. He was quite special and this was a devastating loss, as he had been with us for over 23 years. We recently launched a STEM scholarship in his name, and we look forward to awarding a recipient soon. To be clear, though, all of our mentors and volunteers over the years have been much appreciated. One of WSTA's board members started mentoring at our Dojo when she was ten, and now she's an adult and serving on our board. Two other adults started as WSCD mentors and are now serving on WSTA's board. It's a special group.

What encouragement would you give to someone who is interested in starting a club, but is nervous?

Just jump in. It doesn't have to be perfect. There will be learning and growth. Be patient and persevere. And remember to keep it loose and fun.

What's one thing you're looking forward to in your CoderDojo?

I always enjoy the launch of a new season. It brings both new and returning participants, and I like the process of fishing around for new ideas, projects, and events to fold into our offerings.

To find out more about what West Sound CoderDojo is up to, visit **westsoundcoderdojo.com**. (HW)

Our two-hour sessions are fun, free-form, unbuttoned, and inclusive

ESCAPE THE RUT

Practical strategies to reignite your teaching passion

Last year, 40,000 UK teachers left the profession for reasons unrelated to retirement — 9 percent of the workforce (DfE, 2024). This startling figure underscores a profession under strain. For many, the passion that once fueled their teaching journey has been overshadowed by endless admin and a relentless focus on exams and assessments.

The daily rhythm of teaching has its comforts: the predictability of timetabled lessons, familiar faces, and the sense of routine. But over time, even this can morph into a stifling cycle, leaving you drained and questioning whether you can — or even want to — continue.

If this resonates, you're not alone. The good news? There are ways to rekindle the spark that first led you to the path of teaching. You don't have to make drastic changes to rediscover the joy and fulfilment in teaching.

To ensure this advice is grounded in real-world experience, I approached other teachers for their insights. Their suggestions fell into four broad recommendations.

Find your tribe

A supportive environment is essential for teachers to thrive — it's the foundation for growth, creativity, and job satisfaction. Yet, for some, the reality is far from ideal. Sandra Kaine, a teacher with years of experience, offers a reminder that resonates: "You will find a school to be happy in." This journey can take time — many teachers work in two or three schools before finding the right fit — but the final destination is worth the effort.

ALAN O'DONOHOE

Alan has over 20 years' experience teaching and leading technology, ICT, and computing in schools in England. He runs **exa.foundation**, delivering professional development to engage digital makers, support computing teaching, and promote the appropriate use of technology (**@teknoteacher**).

Negativity in the workplace often stems from colleagues who are overwhelmed by their own stress. Unfortunately, this can create a toxic atmosphere where trust and appreciation are scarce. The strain of just surviving in such an environment can weigh heavily on teachers and, ultimately, on students. Children are remarkably perceptive; they sense tension and disengagement, which can affect their learning experience.

For some, the answer is clear: start afresh. As teacher Adrian Cottle advises, "Find another school that does value you." While transitioning to a new school may feel daunting, it's also an opportunity to reclaim your sense of purpose. Moving to a workplace that genuinely appreciates your contributions can be a powerful catalyst for reigniting your passion for teaching.

Gavin Craddock, another teacher who has been through this process, shares an uplifting perspective: "Change schools. You'll find your tribe somewhere. There are some brilliant, supportive schools out there." It's about finding a community that aligns with your values, supports your growth, and reminds you why you fell in love with teaching in the first place.

Make a change

Have you ever considered taking a completely different career track? Back in 2010, after 15 years of teaching IT, I felt I was done with teaching. My lessons had become a monotonous cycle of teaching children email etiquette and how to create PowerPoint presentations, leaving both me and my classes yawning. A friend, a manager at Northern Rail, convinced me to consider a career change as a train driver, and I started planning my great escape.

During the application process, as I was preparing to trade my classroom for a train carriage, fate intervened. Our school's leadership announced plans to phase out IT from the curriculum entirely. As the head of IT, I couldn't let this happen. My wife reminded me, "Alan, I thought you were swapping teaching for trains?" But I replied, "Maybe so, but I'm not going to simply stand by and let them take my subject away. Not without a fight!"

In a desperate move — somewhere between stubbornness and stupidity — I proposed replacing IT lessons with an entirely new subject: computer science. There were a few hitches, the biggest

A potential career change as a train driver helped me rediscover my passion for computer science

being that I had no prior qualifications in computer science, no degree, and no experience!

What followed was a whirlwind of late nights and weekends spent learning programming, hastily piecing together a curriculum, and plenty of moments where I felt completely out of my depth and would gaze wistfully out of the window at passing trains. But amidst the chaos, something incredible happened. I rediscovered my passion for teaching; I felt I had to relearn how to teach. Developing strategies to support my students to tackle complex concepts, develop algorithms, and surprise themselves with their abilities was utterly exhilarating.

That leap into the unknown taught me a valuable lesson: change, no matter how daunting, can reignite your enthusiasm.

Whether it's embracing a fresh role, tackling a new challenge, or stepping slightly beyond your comfort zone, the results can be transformative. And as for train driving? Let's just say the classroom still feels like the right track for me. Besides, these days, I travel plenty on trains — but only as a passenger.

Accentuate the positive

In the hustle and bustle of daily teaching — amidst the marking, lesson planning, and inevitable classroom challenges — it's easy to overlook the incredible difference you're making. Yet, in the small moments of connection, joy, and accomplishment lies the heart of teaching. Taking time to recognise and celebrate these small wins is essential for maintaining your motivation and reminding yourself of the meaningful work you do every day.

Keep a gratitude jar (or folder): follow the advice of teacher Paula Bailey, of collecting positive feedback and heartfelt notes from students, creating your own gratitude jar or folder. Fill it with thank you notes, uplifting comments, or notes about moments that brought a smile to your face. Whenever you feel down, revisit these mementos to remind yourself of the powerful, lasting impact you have on your students. Each note, no matter how small, is a testament to your dedication.

Reflect on your daily wins: start reflecting on your daily successes. Before leaving school, make a habit of writing down three things that went well that day — no matter how small they may seem. It could be a student grasping a challenging concept, a lesson that went smoothly, or even a meaningful conversation with a colleague. These small victories, when accumulated over time, create a picture of your remarkable impact.

> “ A LEAP INTO THE UNKNOWN TAUGHT ME THAT CHANGE CAN REIGNITE YOUR ENTHUSIASM

Celebrate student successes: remember, your influence reaches far beyond the classroom. Celebrate a range of students' successes — whether it's showing kindness, growing in confidence, or taking on a challenge. Stay in touch with past students and take pride in their achievements, big or small — some will go on to be teachers themselves. Their journeys reflect your hard work and dedication, and the positive mark you've left on their lives.

Share your wins with colleagues: don't sit on your successes — share them with your colleagues! By celebrating each other's wins, you help build a positive, supportive school culture where

everyone's contributions are valued. Offer encouragement, acknowledge one another's hard work, and recognise the collective effort to shape students' lives. By lifting each other up, you foster a community in which everyone feels appreciated and motivated.

Remember, teaching is a journey made up of thousands of small yet significant moments. By focusing on the small wins, you not only protect yourself from burnout, but also reinforce the immense impact you have, both on your students and your colleagues. Every breakthrough, every smile, and every thank you note is evidence of the difference you make. So, take time to celebrate the wins, big or small, and know that your work is shaping lives in ways you may not even realise.

Prioritise self-care

Teaching is a marathon, not a sprint. To remain energised, passionate, and effective in the long run, it's essential to prioritise self-care. Finding a sustainable balance between your dedication to your students and your own well-being is crucial to maintaining your passion for teaching over time.

Start the conversation: self-care looks different for everyone. A great starting point is to have regular dialogues with colleagues about their self-care practices. Find out what works for them. How do they recharge and create separation from work? Sharing insights and experiences can provide fresh ideas and help you develop a self-care routine tailored to your own needs.

Set clear boundaries: establishing clear boundaries between your work and your personal life is a key part of self-care. Setting rules such as 'no work goes home' or designating certain evenings as 'no marking nights' can help protect your personal time. Experiment to see what feels right for you, ensuring you can give your best to your students without sacrificing your own well-being.

Seek external perspectives: it's difficult to objectively assess your own work–life balance. Asking trusted friends or family for their honest feedback can be a valuable exercise, although you might not like what they tell you! They may offer helpful insights into areas where you could improve your balance, helping you to better prioritise your well-being without compromising any of your professional commitments.

> "FOCUS ON THE SMALL WINS TO REINFORCE THE IMMENSE IMPACT THAT YOU HAVE ON YOUR STUDENTS

Small changes, big impact: sometimes, small changes can have a big impact. Even something as simple as taking a walk outside during a lunch break or scheduling time for activities you love — whether it's reading, spending time with family, or indulging in a hobby — can recharge your energy and refresh your mind. These small steps can help reset your perspective and improve your overall well-being.

Teaching is a journey of thousands of small yet significant moments

Reconnect with why you entered this profession in the first place

Reconnect with your 'why': when the demands of teaching begin to feel overwhelming, take a moment to reconnect with your 'why'. Remind yourself why you entered this profession in the first place. Reflect on the positive influence you have on your students and the difference you're making in their lives. Reconnecting with your purpose can reignite your motivation and provide the renewed energy needed to keep pushing forward.

Be kind to yourself: teaching is an incredibly demanding profession, and it's important to remember that you don't have to be perfect. Give yourself permission to rest, make mistakes, and take breaks when needed. A well-rested and balanced teacher is not only more effective but also more passionate, empathetic, and connected with their students. Self-compassion is a crucial element of sustainable success in teaching.

Organisations offering support to teachers

For additional support, here are three UK-based organisations that offer valuable resources and assistance to teachers and education-support staff:

- **Education Support Partnership** (**educationsupport.org.uk**) provides confidential support, a 24/7 helpline, online resources, and financial assistance for teachers and education staff
- **National Education Union** (**neu.org.uk**) is the UK's largest education union, offering legal advice, workplace representation, and resources on well-being and mental health
- **Now and Beyond** (**nowandbeyond.org.uk/support-for-teachers**) offers mental health support, career guidance, and professional development for teachers and education staff

Remember, reaching out for support is a sign of strength, not weakness. These organisations and resources can provide valuable guidance and assistance to teachers navigating the challenges of the profession while prioritising their well-being. (HW)

REKINDLE YOUR PASSION THROUGH CHANGE

As my near-transition from teacher to train driver demonstrated, a jolt to the system can be exactly what we need to reignite our passion for teaching. Introducing change has the potential to breathe new life into your career and enrich the learning experience for your students. What challenges could rekindle that spark?

1. Embrace new areas of expertise

Venturing into unfamiliar territory can be both daunting and exhilarating. Take inspiration from David Hillyard, who, after years teaching IT, transitioned to teaching A-level Computer Science. Along the way, he reignited a childhood love of retro games by exploring a game-development platform, Defold, and sharing this passion with his students.

Why not explore an area you've always been curious about? Could you launch a club, lead a robotics team, or introduce games development into your lessons? Sometimes, taking a risk can lead to unexpected rewards.

2. Step up and lead

For some, new roles bring new challenges and opportunities for growth. It's not for everyone, but becoming a head of department, mentoring new teachers, or leading a school-wide initiative might not only expand your skill set but also allow you to experience fulfilment from having a broader impact on your school community. Teacher Adam Rooney recently took on a leadership role to explore how AI can be utilised to reduce teacher admin, freeing teachers to focus on improving learning outcomes.

A leadership role can give you a chance to inspire others while also reigniting your own enthusiasm. It's an opportunity to think bigger, tackle meaningful projects, and support colleagues on their professional journeys.

3. Innovate in the classroom

Even within your current subject area, there's always room for fresh ideas. Experiment with new teaching methods like flipped learning, project-based learning, or unplugged learning. Teacher Mandy Nash encourages colleagues to shake things up, perhaps by hosting a computing day or launching a cross-curricular project.

4. Collaborate with colleagues on new projects

Partnering with colleagues across schools on interdisciplinary projects, research initiatives, or professional development not only broadens your horizons, but also strengthens professional relationships. Personally, as a secondary-school teacher, I found leading activities in primary schools incredibly rewarding and fulfilling.

Sharing ideas, learning new skills, and gaining fresh perspectives can be invigorating for both you and your students. Plus, you'll likely uncover creative approaches to challenges you hadn't considered before.

5. Balance time and workload

While embracing new challenges is rewarding, it's essential to strike a balance. Teaching is already demanding, so review your current workload and commitments before diving in. As teacher Mark Clarkson wisely advises, set realistic goals and avoid overcommitting — or you'll be in a rut, albeit a different one!

STEM subjects offer young women opportunities to be ambitious and independent

FROM SWITCHES TO SUCCESS

Meg Wang catches up with **Halima Bhayat** to discuss her inspiring journey in computer science

How did you become interested in computer science?

I come from Coventry in the UK, so I was an inner-city student. I'm also from an ethnic-minority background. My dad could speak some English, but my mum could not. When I went to school, we didn't really have computers. Then in Year 8 or Year 9 (ages 12 to 14), we had one computer for the whole class. I think the spark for computing came from there. The food technology teacher was asked to teach computing, and when she couldn't start the computer, I turned around and said, "Miss, the switch is not on." And she replied, "If you know so much, why don't you come and do this job? Then you can tell me what to do." It became a bit of a mission for me.

Eventually, my first teaching job was in a school where that same food technology teacher was also recruited as the advanced teacher of computing!

We're talking through this article because it's more comfortable due to your dyslexia. How has being dyslexic affected your interest in computer science?

As a child it was very frustrating, because I wasn't always able to do things. My reports would always say, "You're just rushing your work. That's why you can't do it." My school didn't diagnose me as being dyslexic because it wasn't known as a special-needs area back then, and funding wasn't available. It wasn't until university that someone suggested that maybe something wasn't right. They took me to be tested, and I was asked, "Can you distinguish between the number 42 and the number 94?" I did it, and they said, "You're not dyslexic. You just need to get a dictionary." But in my second year of university, when we had to write essays, the course leader said, "You write like my son, and he's dyslexic."

My parents bought me a computer because I told them I needed one for school, and that's when I fell even more in love with computers — I had something to help me with my spelling, because the computer had a spellchecker! After I was diagnosed, I was able to get funding for Dragon software, which meant that I could speak my thoughts and that the program would write them out (**helloworld.cc/dragon-speak**) — AI is just amazing. I use it for my teaching and learning and I also use it to support others as a whole-school initiative.

You teach at an all-girls school. Why in particular are you passionate about teaching computer science to girls?

I've always been ambitious, but growing up in a South Indian/African community, there were a lot of women who were not encouraged to be ambitious and were dependent on men. If these women studied STEM subjects, they would be standing on their

own two feet. They would never be without a job. They would have an income. You can have things your own way, do your own things, and if your career is not successful, you can move into another career, because STEM is always in demand.

From my experience of going to an inner-city school, there were negative influences around. My focus was always: I'm not going in that direction. I want to help young people to see that they too can follow a good path. Even beyond my role as a computer science teacher, I'm out there to support people. I'm an ambassador at digit<all> (**digitall.charity**) and an Amazon teacher, where I also help to train others in primary and secondary schools. Anything that comes along, I join in, because I want to share my story.

Computing is obviously not my only thing! I'm a qualified cake decorator. I'm a fitness instructor. I like to do things that are out of the ordinary. But I find that STEM creeps into everything. It means that my subject matter is always relatable.

Tell me a little bit more about your experiences teaching outside of the classroom (computer science, though, not cake decorating!)

Through digit<all>, I was introduced to Amazon Future Engineer and I volunteer in the teacher group. We give advice on the resources they create for young people to encourage students to pursue STEM subjects or use technology. I helped deliver a hackathon with digital<all> in Birmingham. We were working in the summer holidays with vulnerable students from different colleges, and trying to help them on their entrepreneurship journeys. We wanted to show these students that even if they don't pursue a computer science degree, they can still use the concepts and the technology to fulfil their ambitions.

We were using the 'Your Voice is Power' resources (**helloworld.cc/voice-power**) with software called EarSketch, which basically enables you to teach students to code music. There were music samples you could experiment with, from famous musicians like Pharrell Williams, Alicia Keys, and Khalid. The goal was to code a soundtrack which provides a mission or a statement about equity. I thought this was really good because I could use it in my lessons. Starting a lesson with lots of beats and vocals from these famous people, then incorporating EarSketch, where we could actually move things across to code in Python and make our own tracks … it's like the code comes to life! The Amazon Future Engineer programme is all about connecting with young people and getting them interested in engineering and computer science. My experience then helped me to do the same in my classroom with Year 9 students (ages 13 to 14).

As someone who was perceived as 'not academic' in your youth, how do you think educators can support similar young people in engaging with computer science?

Creative, practical, hands-on young people often don't fit in very well to the school environment, because the environment is more about academic roots. I know that our vision for computer science in the UK is to include technical qualifications. Our school was one of the first to introduce the UK's T levels, which we talked about in Hello World issue 22 (**helloworld.cc/22**, pages 82–83). I think it's great for young people — knowing that they can have a practical route into education and a career. They have aspirations to run their own business or set up a clothes market. Non-traditional qualifications allow young people to engage with the positive thoughts they have about what they want to do in life.

What would you say to other computer science teachers about trying new resources or curricula?

Just go for it! I say in my lessons, it's about trial and error, which is what computing is. We shouldn't be up there telling students what to do all the time — that's not what computing is, or what teaching should be.

So just start. With new resources, you may not know how to do everything, but let your students have the freedom and time to explore them themselves. Try and be unstructured at times, and build in flexibility, because that will help you to stay calm.

Students react to your emotions — they're like vultures! If you're more relaxed, they will also be relaxed, and you'll find that they will produce good work. Similarly, the hackathon was brilliant because it wasn't a school structure. We did not know what we would end up with as an end project. It was about trial and error. I believe it works for any student, really. (HW)

HALIMA BHAYAT

Halima has over 20 years of experience working in education, and is currently the head of computing and digital T levels at Ursuline High School in the UK. Halima is an Asian Women of Achievement 2021 Finalist and the Computing at School Merton lead for all schools, a digit<all> ambassador, and Amazon teacher. She is a computing advocate, empowering ethnic-minority girls to pursue a STEAM education and career.

(Hello World) Podcast

HEAR MORE FROM HALIMA ON OUR PODCAST, IN AUDIO AND VIDEO
helloworld.cc/pod-teacher-tips-digital-literacy

THE POWER OF CREATING WITH TECHNOLOGY: MAPPING OUR DIGITAL WORLD

Tracy Gardner and **Judith Ricketts** discuss how careful consideration of mapping can filter out past biases when using new technologies

In this column we have previously highlighted the importance of considering ethical issues when creating with technology. We'll now take a deeper look at the power that creating with technology can give to individuals and groups. Michael Conterio is on parental leave, so I'm joined by guest co-author Judith Ricketts, XR (extended reality) founder at AR Hive.

The topics and resources discussed in this article could be used as the basis of a lesson or enrichment activity. Share it with geography, history, and PSHE (personal, social, health, and economic education) teachers too.

How maps shape our understanding of the world

Judith's creative work explores the power dynamics inherent in the built environment and specifically the dynamics of map-making, examining how Western approaches to looking at land are reflected in this perspective. Her work identifies potential for reflecting on:

- **Decision-making**: how do cultural, political, and economic factors influence who typically has the power to decide how and what maps represent?
- **Representation:** whose stories and history are depicted on a typical map, and whose are left out?
- **Visual narratives:** what stories do typical maps tell through their visual elements, and which narratives remain overlooked?

Given this considered way of looking at maps, their use and creation can be seen as important tools that shape our understanding of the world.

TRACY GARDNER & JUDITH RICKETTS

Tracy is a computer scientist, tech industry professional, technology educator, and co-founder of Flip Computing. Judith is a founder of AR Hive, a senior lecturer in games, a CHASE PhD candidate, and a Women in Games ambassador (**linkedin.com/in/judericketts**).

Counter-mapping

Counter-mapping refers to map creation by communities to articulate place-based narratives that challenge dominant narratives. Judith has developed a workshop to create a collaborative digital map resource that can be used in group sessions.

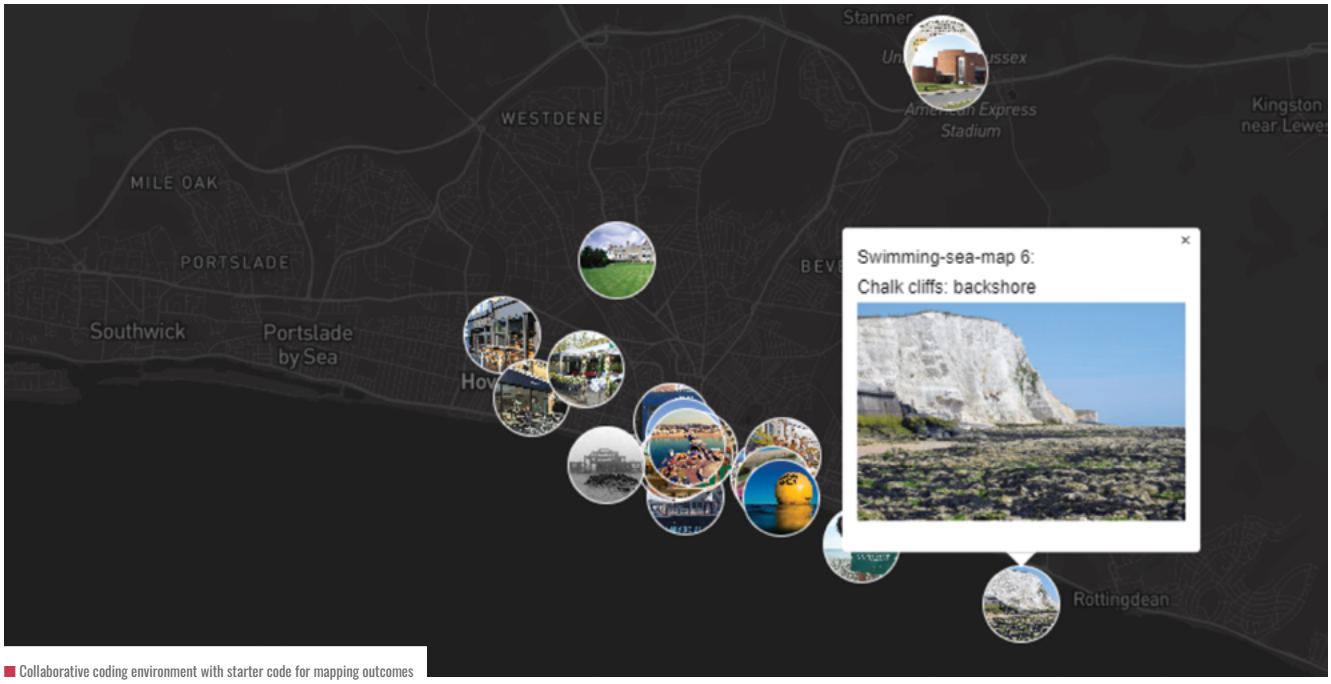
She begins by encouraging participants to think critically about mapping and explore alternative possibilities for mapping. She then prompts participants to consider what types of map would be beneficial for their specific group, starting with basics such as paper or digital formats, and how they envision the mapping process.

These sessions encourage discussions of key topics, including:

- **Maps as tools of power:** exploring how cartography has been used to reinforce and challenge power structures throughout history
- **Reclaiming representation:** investigating community-led mapping initiatives that amplify diverse voices and inclusive narratives
- **Decolonising maps:** discussing how collaborative map-making processes can promote social justice and equitable representation

Participants are asked to document all contributions, without judgement, during the process of creative thinking before they consolidate ideas.

Groups then choose their identified locations (points of interest) and gather images, descriptive data, and so on. Then individual teams add their researched information to the collective digital map starter code.



Collaborative coding environment with starter code for mapping outcomes

Once the maps are completed, teams share their decision-making process by walking everyone through the key elements included in their map and demoing what local artefacts are and which audiences they are for. This is followed by a discussion about whether there are any connective strands between the points of interest, or between the stories.

Technological innovation

The power dynamics inherent in creating maps extends into all aspects of technological innovation. Encourage your students to name individuals and groups who hold significant influence in society due to their ownership of technology.

Have follow-up discussions about who writes the technology and how that technology influences their attitudes and beliefs, other people, and the world around them.

It is essential to include diverse voices in teams of decision-makers, developers, and designers to encourage discussions about the pros and cons of technological developments. This approach ensures a more inclusive and balanced perspective in the development process.

Mapping with new technologies

As the digital landscape embraces emerging technologies which incorporate or rely on computer vision, such as artificial intelligence, machine learning, extended reality, and facial recognition, we must ensure that these advancements benefit everyone, not just a historically narrow subset of society.

Judith's experience with automatic water taps (which use computer vision) highlights this issue: the technology often fails to recognise her dark skin tone. This points to flaws in the development process, from the diversity of training data to the make-up of the team and the rigour of real-world testing.

To create a more equitable digital future, it is essential that development teams reflect the full spectrum of society's diverse voices. At a minimum, they should include a broad and inclusive range of perspectives. By doing so, we can avoid replicating the biases of the past built into our future technologies. To read more about Judith's workshop model for empowering communities in counter-mapping hidden stories, go to *Co-Creating Interactive Geo-Visual Stories: Counter Mapping Methodologies* at **helloworld.cc/Ricketts**. (HW)

BEBRAS PUZZLE

BEBRAS PUZZLE SOLUTION: PASSCODE (PAGE 67)

The passcode for the electronic lock is:

7	2	6	2	9	2	6	2	7

Hints 1, 2, and 3 tell us that number 9 appears once, number 6 and 7 appears twice, and number 2 appears four times.

Hint 4 tells us that number 9 must be in the middle. Hint 6 (with hint 4) tells us that 7 must be at the beginning and the end. Hint 5 tells us that the number 2 must be at places 2, 4, 6, and 8. Now you know where to place the 6s. (HW)

THE LEARNER'S APPRENTICE: AI AND THE AMPLIFICATION OF HUMAN CREATIVITY

The 'little-person model' of educational computing grows up

INFO BY Ken Kahn | PUBLISHER Constructing Modern Knowledge Press | PRICE $26.95 | ISBN 9781955604208 | URL helloworld.cc/learners-apprentice

Henry Lieberman

Ken Kahn and I worked together in educational computing at the original MIT Artificial Intelligence Laboratory, in the 1970s, under the direction of pioneer educator Seymour Papert. In order to help kids develop a mental model of how to interact with a computer, Papert asked them to imagine that the computer was a 'little man' (today, we would say 'little person') that they could ask to do things, just as you could ask a real person to do things. And you had to speak to that 'little person' in a language it could understand — that was the programming language.

The reason we encouraged the kids to anthropomorphise the computer was that thinking through the process of programming helped them understand their own thought processes better. Thinking about how to explain your problem to a computer through a programming language led to thinking about how your own problem-solving was structured, and how it could be improved. It made the students better learners.

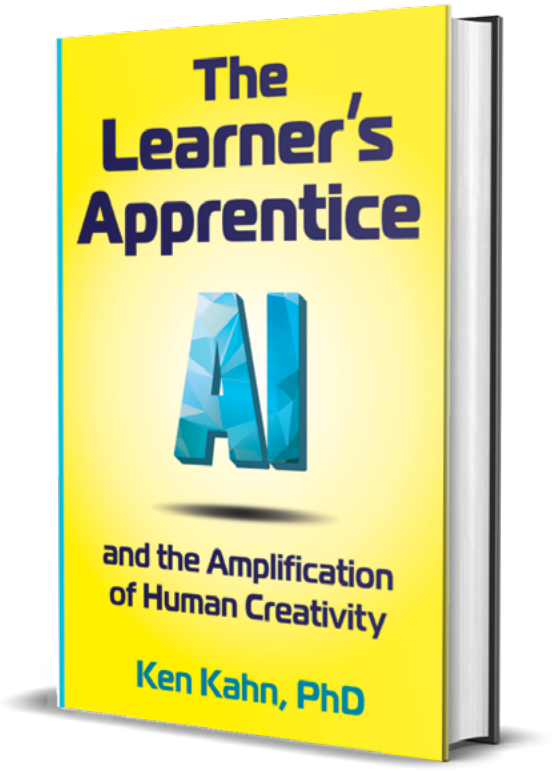
Little person, grown up

Now here we are, 50 years later, and that 'little person' has grown up. In the time since, they've learnt to speak our language, so we don't need to communicate solely via a programming language. And they have 'gone to school' and learnt a lot. Because they're trained on the vast array of knowledge on the web, they come with all sorts of capabilities that can be put at the disposal of students to aid their learning. We now call these 'little people' chatbots, like ChatGPT, Gemini, and Claude.

Some teachers are wary of AI, because they fear that chatbots will help students cheat on tests; that students will rely on not-always-correct chatbot answers; or that students will get lazy because they can delegate so much. But rather than focus on potential disruption to today's instructional methods, it's much more productive to focus on the opportunities for developing new instructional methods that take advantage of chatbots' new capabilities. That's what Ken Kahn's new book, *The Learner's Apprentice: AI and the Amplification of Human Creativity*, does.

Project-based learning

Kahn shows us how we can fulfil Papert's original goal of helping people improve their own thinking and learning by interacting with



chatbots. Even though we know that a computer isn't a person, it's still useful to pretend it is during the interaction, so that we can engage our own social intelligence in communication with it. That's often enough to engage the introspective thought processes that allow students to reflect on their learning through experience.

Kahn is, as am I, very much an advocate of constructionism — the idea that students learn best by doing, and by thinking about what they do. Student activities shouldn't be about memorisation and testing. We should put students in situations where they work on projects that are of interest to them, and where they have the licence to explore and invent creative solutions.

Chatbots can be great tools for project-based learning, and Kahn shows us how to use them in that way. He walks us through the various 'virtual personalities' we can assign to a chatbot and how each can have a different role in a particular kind of educational activity. And that's the key — to assign an appropriate role to the chatbot such that it enhances the educational value of the activity, rather than replacing the student or trapping them in a forced-march curriculum.

Using chatbots for learning

Much project-based learning is centred on the creation of some kind of artefact: a textual narrative; an image, sound, musical piece, or movie; or an interactive computer program such as a phone app or website. The chatbot can be cast as a co-creator, or project partner. The student can start by asking for a particular artefact, or the student can provide their own. But that's just the start. Most of the learning happens in the ensuing conversation, in which the student or the chatbot propose changes or alternatives, and they work through them together.

Storytelling is a great learning medium, whether the story is fact or fiction, and whether the student reads or writes the stories, or both. The chatbot can be asked to tell the story in different ways, or to review or critique an existing story. The chatbot can be assigned a role to play one character in a story, so that the student can focus on the other characters. It can represent historical figures expressing their viewpoints of events, or scientists who argue for their theories and discoveries. The story can also be made into an interactive adventure or simulation. It is a truism in education that you don't learn something well until you try to teach it to somebody else. So asking a student to teach a chatbot, or to co-create a game or interactive application that could be used to teach another student, is a great anchor for helping them engage with the material.

The ability of chatbots to write in programming languages fulfils a dream I and many others have had, of removing from the process of programming the obstacle of writing a program in a formal language. But the programming language reappears here, as a common communication tool to talk about the program, between the programmer and the chatbot. Most importantly, as Papert originally intended, it helps the student to gain valuable experience in project planning, expressing goals, evaluation, and especially, the art of debugging.

Exploration

For educators, this is a book of news you can use. It gives detailed, step-by-step descriptions of projects. It dispenses good advice for how to use the chatbots, which don't come with much guidance themselves. The transcripts of chatbot interactions are available, but lengthy interactions do not interrupt the flow of narrative in the book. The projects are shovel-ready for a classroom teacher, or equally suitable for students to use themselves if they're learning on their own.

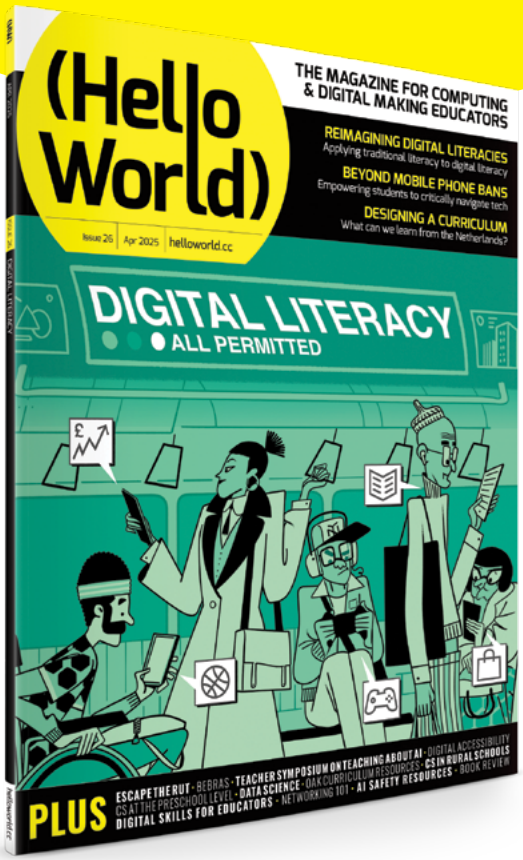
> THE KEY IS TO ASSIGN AN APPROPRIATE ROLE TO THE CHATBOT SO THAT IT ENHANCES THE EDUCATIONAL VALUE

In this confusing moment, when we're in the early stages of the AI revolution, it can be stressful for ordinary people to be caught in between the self-serving hype of the tech companies, and the fear-mongering doom warnings of the social critics. If you really want to get a handle on the potential of AI in education, disconnect from all that, gather a few students and mentors, and let Kahn be your guide in exploring it all for yourselves. You'll have a blast. (HW)

(HW)

SUBSCRIBE TODAY

FREE IN PRINT for UK-based educators



Why subscribe?

- Teaching resources and ideas used by over 90 percent of our readers
- Exclusive news, research findings, and in-depth features
- Delivered to your door three times a year

TO SUBSCRIBE VISIT:

helloworld.cc/subscribe

Not a UK-based educator?

- Buy a print copy from **helloworld.cc/buy** — we ship to over 50 countries
- Subscribe to receive the free PDF on the day it is released
- Read features and news at **helloworld.cc**

FREE PDF for anyone, anywhere

helloworld.cc

Raspberry Pi
Foundation