Simon Lea and Sarah Gleave share their experience of incorporating AI into their Initial Teacher Education Programmes.

AI in teaching: a CAREful introduction

As artificial intelligence (AI) continues to advance at an unprecedented pace, the education sector appears to be increasingly embracing its potential. The Department for Education (DfE) highlights that AI could enhance teaching and learning by reducing administrative burdens and providing tailored support to students (DfE, 2025). In some respects, the progress of AI within education fields feels like a runaway train and it can be difficult as educators to position ourselves professionally, ethically and morally. There is also a potential paradox: while AI can save teachers time, its effective use demands an increase in digital literacy and critical oversight that could add to teachers' workloads. Within this thought piece we discuss the possible benefits and limitations of using AI in mathematics education and give an example of a framework we use with our student teachers to encourage considered and effective use.

Benefits

Navigating the world of AI can be a challenge because of its ever-changing nature and the on-going development of myriad tools—not to mention the often-polarising dialogue surrounding AI. AI tools are wide and varied with generative AI models (such as ChatGPT, Microsoft Copilot, Google Gemini, Canva, Midjourney and Claude Anthropic) having the capacity to create text to text, text to image and text to video to some degree. For educators, these tools have the capacity to support teachers in designing and critiquing lesson plans, develop medium- and long-term unit plans, formulating questions, designing assessments, recommending resources and identifying adaptive teaching approaches and activities.

In many primary classrooms across England, structured and widely adopted mathematics schemes now play a central role in planning and teaching. It could be argued that while these schemes are anchored with key objectives, they are also static in nature and their application in the classroom relies on educators making them a living document that adapts and responds to student needs. On the other hand, a generative AI tool is conversational, can provide on-going interaction, can evolve to suit the dialogue provided, can provide instant support and works more like a thinking-partner or sounding board for the classroom teacher.

AI is also able to work in more innovative ways, for example, building mathematical stories and images that an educator could use as a hook or tease, or to give context for a mathematical concept. In primary mathematics, stories and images are powerful tools to help children make sense of abstract ideas. A well-chosen story, supported by a carefully matched image, can turn an abstract mathematical concept into something meaningful and engaging. By using stories, connections can be made to children's experiences and can help develop opportunities for oracy, curiosity, conceptual understanding and help students see mathematics as part of their everyday world, (EEF, 2020).

While AI cannot match the real, physical, interactive and multisensory engagement of a tactile book written through the eyes of diverse human authors, there is an argument that by prompting AI to craft a bespoke mathematics story, a teacher can instantly generate aligned, flexible narratives tailored to their learning objectives—saving time and producing something directly relevant.

A teacher may begin with a clear mathematical goal—such as helping children understand number facts to 10—and have a rough context in mind that could support it, like building a wall on a farm. From there, they might choose a pedagogically appropriate concrete resource, such as Cuisenaire rods, to model the idea. With these elements in place, the teacher can craft a

meaningful problem that brings the mathematics to life, supporting understanding through both context and manipulatives. In doing this, the teacher is not handing over responsibility to AI or removing their own role in planning—instead, they are drawing on their professional knowledge to shape meaningful learning. AI can support by generating tailored resources or refining a story idea, but the teacher sets the purpose, selects appropriate tools (e.g. Cuisenaire rods), and knows what will resonate with their class. It is not about replacing creativity or pedagogy—it is about enhancing it. This pairing of narrative and visual context could help children connect more deeply with the mathematics, making it feel purposeful and relevant. A text prompt and story generated using ChatGPT is shown in Figure 2, and the image shown in Figure 2 was matched using Google Gemini.

After some refinement of prompts and dialogue with the AI tools we settled on the story and image shown in Figures 1 and 2. For images, it is important to recognise that the aim is not to promote indiscriminate AI use, which raises important questions around energy consumption and environmental concerns, but rather to advocate for purposeful, low-volume, high-impact image choices.

Limitations

Scepticism towards AI in education is sometimes dismissed as negativity, but it often reflects a deep commitment to teaching, learning, and professional integrity. Concerns about over-reliance on effortlessly generated answers—potentially weakening critical thinking and problem-solving—highlights the need for caution. These concerns need to be balanced with providing professional development and building strategies that support teachers in understanding digital literacy (Kasneci et al., 2023).

Professional judgement, integrity, autonomy, ethics and creativity are all integral to the role of an educator but the instant gratification and seamless process of using AI could put these values at risk. Planning and teaching are never seamless, nor should they be. Questions rightly need to be asked about the risk of AI tools unintentionally curbing creative instincts. And what role might the immediacy of AI have upon sub-

Write a story for 5-6 year-old children featuring two friends, who are trying to solve a real-life problem involving number facts, addition and commutativity. The numbers should only go up to 10. The setting should be familiar and engaging such as two girls who are builders trying to choose suitable coloured blocks to build a wall for a farm. This story should align with the Year 1 UK Mathematics National Curriculum programme of study statements. The story should be around 150-200 words long and has language suitable for children of this age. The story should have an open ending

The Brilliant Builders and the Wobbly Wall

Mira and Ella were brilliant builders. One morning, Farmer Rose waved from the gate.

'Morning, girls,' she called. 'I have a problem my wall has fallen down and the cows will escape!'

At the farm, blocks were scattered everywhere—some long, some short, some in-between. They came in every colour you could imagine.

'We'll need to build rows of the same length,' said Mira. 'That way, the wall will be strong and straight.'

The girls got to work, lining up blocks and checking lengths. They didn't cut or break the blocks—they just chose carefully to fit pieces together.

'I have a long blue block,' said Mira.

'And I've got a small white one,' said Ella. 'Let's see if they work together.'

Ella placed the white block next to the blue one, but then remembered—she'd forgotten her spirit level! She dashed off to get it.

When she came back, she placed the blue block first by mistake.

'Oh no!' she said. Then paused. 'Hold on... it's still the same length. It still works!'

'Yes,' said Mira. 'Blue block add white block is the same length as white block add blue block.'

Just then, they heard another noise behind the haystack...and some loud mooing.

The cows were getting closer.

They needed to speed up.

Figure 1. Prompt and a story produced by ChatGPT (27 May 2025).

Figure 2. Image produced by Google Gemini (27 May 2025).

ject knowledge as teachers experience instant insight without waiting? By allowing AI to do the heavy lifting, there's a risk that knowledge is absorbed through a kind of technological osmosis—quick and surface-level—without cultivating the depth of understanding essential for effective mathematics education.

Good mathematics teaching often involves moments of confusion or doubt, usually leading to an impasse in instructional design or classroom management. Traditionally, such challenges are navigated through one's own research, the iterative process of rethinking approaches, reflective practice, engagement in self-driven professional development, and/ or robust conversations with colleagues. These deliberate steps foster deeper understanding and pedagogical growth. However, the emergent integration of AI into educational practice presents a notable risk: the potential to short-circuit this crucial process. When teachers instantaneously defer to AI for problem-solving, they bypass these critical phases of personal and collaborative reflection, inadvertently forfeiting opportunities for significant professional learning and the development of nuanced pedagogical expertise.

Like most things, the arguments above should not be seen as binary, and the answer is likely a balance somewhere in the middle with educators weighing up the value and purpose AI can have in different situations. For example, how might an AI tool assist an educator identify potential mathematical misconceptions? On the one hand, a teacher lacking sufficient subject knowledge and relying on generative AI to identify misconceptions may be unable to evaluate the accuracy or relevance of the output. However, engaging with AI in this way could be a catalyst for developing deeper mathematical understanding by drawing attention to key concepts and common errors that may have otherwise gone unnoticed.

Using AI CAREfully

At the time of writing, educational institutions may not have fully developed an agreed policy for teachers, student teachers, or learners. However, to maximise the potential of AI, an important first step may be to develop a shared framework. The Primary Education Team at Liverpool John Moores University (LJMU) uses the CARE framework for student teachers (see Figure 3). The framework acknowledges that different generative AI models can produce different results, whilst working within the remits of the curriculum and school policies. Choosing the right model ensures the tool is fit for purpose. For example, using a text model for creating images (or vice versa) may result in poor quality. Edu-

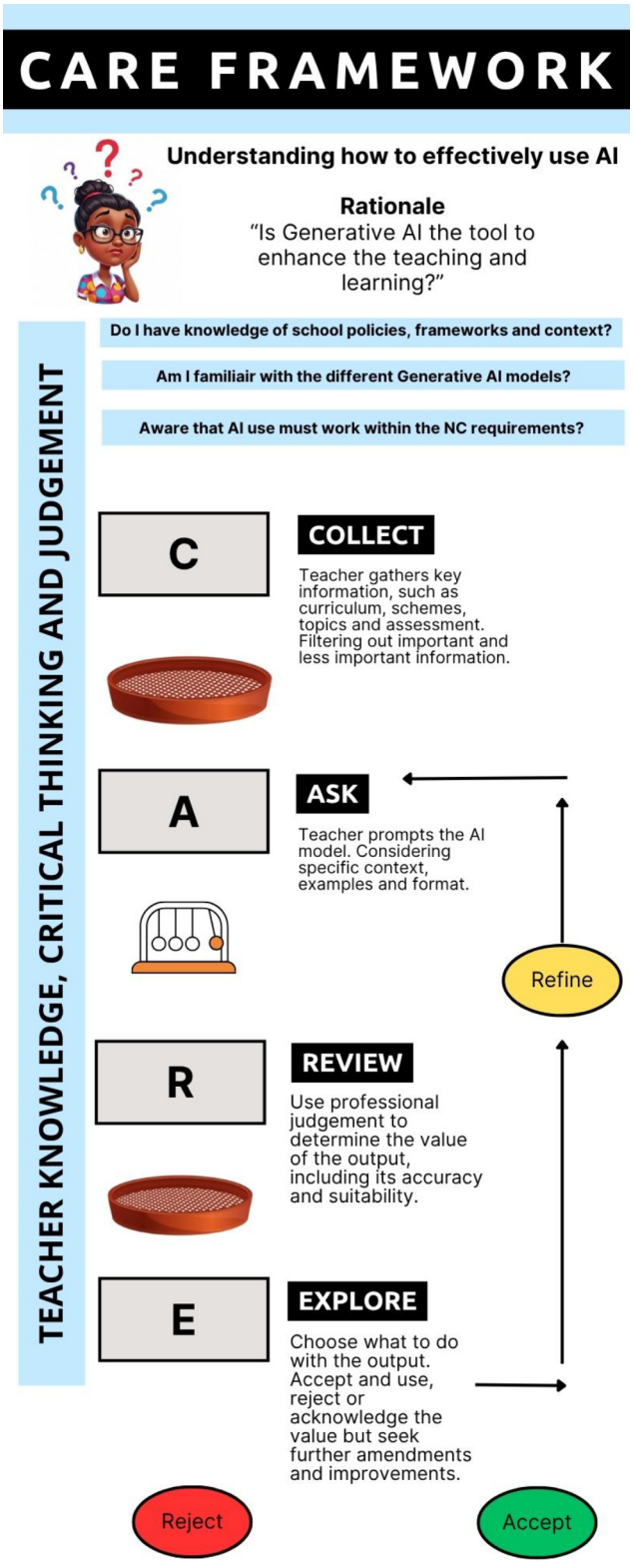

Figure 3. The LJMU CARE Framework

cators should also consider whether the AI tools are school-friendly and trained using verifiable educational content.

A key aspect to the CARE framework is that ongoing critical appraisal of AI should be integrated at every step instead of being a retrospective exercise. Before engaging with AI, teachers must be clear about why they might choose to use it, what they already know, their objectives, what to avoid, and what success looks like. Before formulating a prompt, the usefulness of AI for creating stories, images and identifying misconceptions will depend on the teacher's current understanding of the concept, as well as their understanding of the intended learning journey and potential pitfalls.

The CARE framework is described below.

Collect. In a safe and ethical manner, collect information about the class, prior learning, current topics, programmes of study statements, objectives and outcomes. This stage also includes what we might call a filtering of necessary and unnecessary detail that would help improve the next step, the prompt.

Ask. Prompt engineering: maximise the AI response by considering the most effective and efficient way to communicate what you are looking for. This could include examples such as the role you wish the AI tool to take, some important context around the content you are working with, word count, response structure, language and age-appropriateness.

Review. Carefully scrutinise the AI tool's output. Recognise possible strengths and weaknesses, including content you feel may or may not be beneficial. It may be helpful to repeat the filtering stage to help you dissect the output and decide on the next steps.

Explore. Explore three possible options once the content has been reviewed.
1) Reject the output and start again.
2) Refine the prompts and improve the output.
3) Accept the output and use it as a resource for your teaching.

One example where our framework was of particular value for supporting student teachers' critical evaluation of AI-generated content involved a recommendation about common misconceptions when learning place value. The AI tool suggested that learners might believe 14 is greater than 25 because of the presence of the digit 4, without considering that 25 includes the digit 5. A more accurate diagnosis would consider how number words are heard and processed—for example, confusion stemming from 'fourteen' beginning with 'four.' It would bet better if the AI highlighted to the student teachers that learners may process and interpret spoken numbers and written numbers differently. This example highlights the essential role of teacher expertise in scrutinising AI outputs for clarity, accuracy and pedagogical appropriateness.

In conclusion, pedagogical goals must drive the process. Considerations about learning should precede the choice of AI tools, ensuring technology serves the educational purpose rather than the other way around. Also, using a CAREful framework can maximise the potential of AI while still valuing the subject and pedagogical knowledge of our teachers. We believe that AI could have real benefits for educators and learners but that it must be used as a tool and kept under the expertise and agency of the professionals.

Good luck and take CARE!

References

Department for Education (2025). *Generative artificial intelligence (AI) in education.* `www.gov.uk/government/publications/generative-artificial-intelligence-in-education/generative-artificial-intelligence-ai-in-education`

Education Endowment Foundation (2020). *Improving mathematics in the early years and Key Stage 1 (Guidance report).*

Kasneci et al. (2023). *ChatGPT for Good? On Opportunities and Challenges of Large Language Models for Education. Computers in Human Behavior.* `www.sciencedirect.com/science/article/abs/pii/S1041608023000195`

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