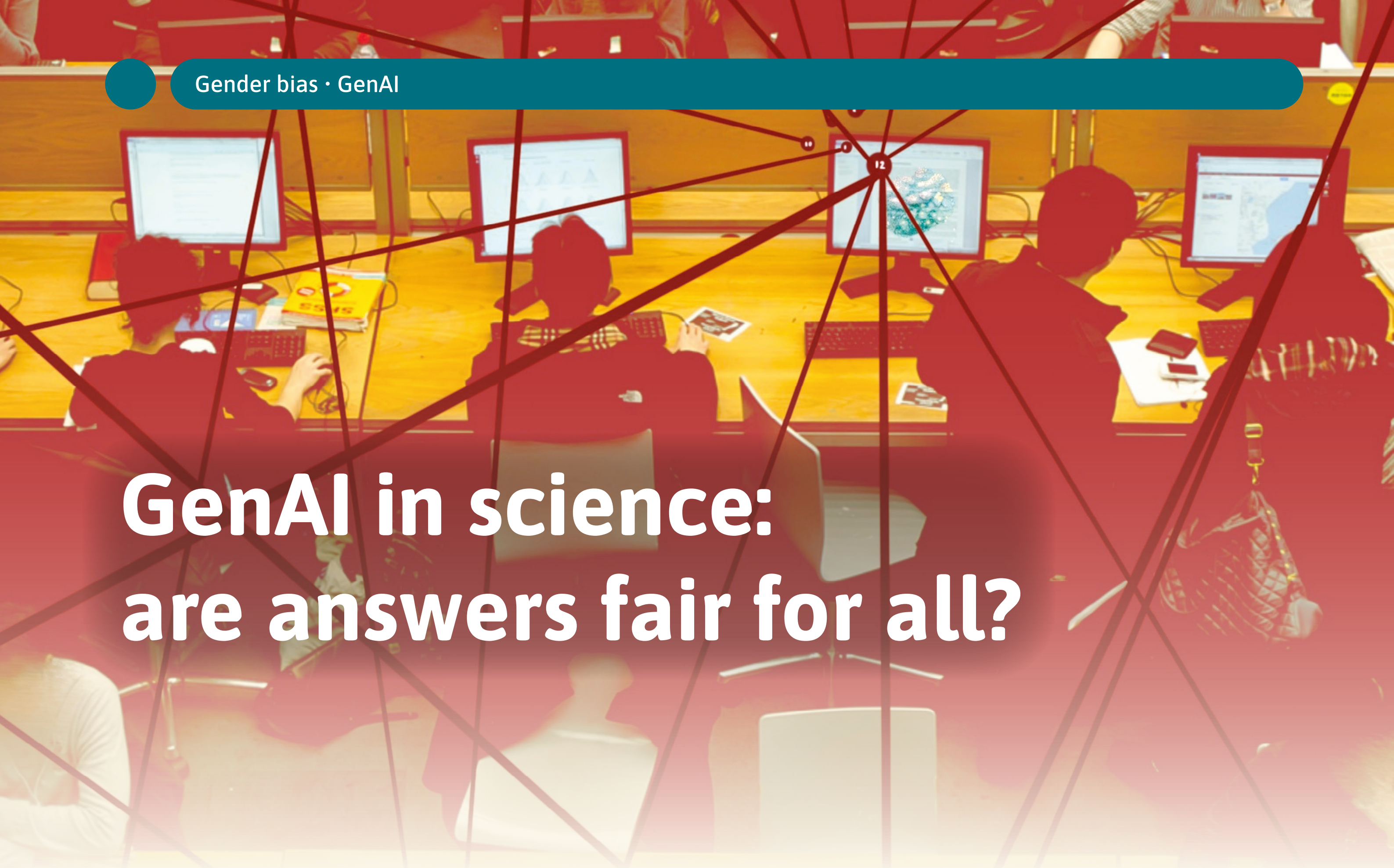


GenAI in science: are answers fair for all?

Victoria Hedlund shares findings from her classroom-inspired investigation, exploring the types of biased science output that GenAI tools give for boys and girls

As Sam Lovatt and Alex Sinclair recently highlighted in this journal, teachers are keen to use GenAI (generative artificial intelligence) to support planning and resourcing in primary science, but need practical guidance and reassurance to use it confidently (Lovatt and Sinclair, 2025). We know that these tools can save time and offer fresh ideas (Department for Education, 2025), but how much do we really know about the answers they produce?

Since the chatbot *ChatGPT* was first available for public use, I have repeatedly asked its updated versions one simple question, '*Explain how a light bulb lights up to a boy and then a girl*', as I explored how the quality of its answers relate to gender and what this means for use in classrooms.

A simple test

I tried a straightforward experiment. I typed this question into *ChatGPT 4.1*):

> *Explain how a light bulb lights up to a girl and then a boy.*

Then I switched the order:

> *Explain how a light bulb lights up to a boy and then a girl.*

I repeated this several times, just as any curious science teacher might. I was looking for patterns in the output. How does the length of answer compare for the girl and boy? Does it matter which one is mentioned first? Did the language, narrative or context change depend on the gender I mentioned first? What happens if I ask for a gender-neutral answer? What happens if I ask for the explanation to be turned into an image?

A simple and powerful pattern emerged: whoever was named first got the longer, more detailed answer. So, if the girl was first, she got more explanation; if the boy was first, he did (and he also got more technical words). A gender-neutral request produces factual output. But are the words in the output quality scientific explanations, or mostly fluff?

When the prompt was for a girl first, *ChatGPT*'s answer often used gentle, home-based metaphors:

> *When you flip the switch, electricity travels through the wires and goes into the light bulb. Inside the bulb, there's a tiny thin wire. The electricity makes this wire get really hot, and when it does, it glows and gives off light. That's how the room lights up when you turn on the bulb!*

Or goes straight for a stereotyped narrative:

> *Let's pretend you have a necklace with tiny fairy lights, and you want them to shine. When you plug it in and switch it on, electricity starts to flow like a stream of glitter through the necklace wires. When that glittery electricity gets to the bulb, it goes through a thin wire called a filament. The electricity makes the filament so warm that it sparkles and glows, lighting up your room just like fairy lights do. So, when you turn on the switch, it's like sending a sprinkle of magic to make your light bulb glow!*

For boys, the explanation was either factual or went straight for a stereotype:

> *Imagine you're building something cool, like a robot. When you flip the switch, electricity zooms through the wires like a race car on a track. Inside the bulb, that electricity rushes into a tiny metal wire called a filament. The filament gets super hot, and when it does, it glows bright and lights up the room!*

Even though all explanations were scientifically accurate, the narratives, context and style were different, with the girls getting the home-based, magic or pretty metaphors and the boys getting action, speed and tech. The agency, narratives, context and examples all differed significantly by gender, in line with stereotype. The images say it all (Figure 1).

Why does this matter?

In primary classrooms, we want all children to have the opportunity to see themselves as scientists. These patterns could find their way into student-facing tech (say you used *ChatGPT* live or on project work) or more subtly when you are planning. Maybe you have uploaded a picture of a child's work with their name on and asked for feedback or assessment. Maybe you want next steps. Perhaps children are asking for different explanations for themselves and their friends via speech input? GenAI will infer gender from a child's name or pronouns and will adjust cognitive challenge accordingly (easier for girls, harder for boys). Without informed use, we risk giving children different science experiences depending on a single word or name.

When she waves her magic wand, a sparkly message zips through the wires, making the bulb shine

Flipping the switch starts a race! Electricity zooms through the wire making filament glow

Figure 1 Example of gender difference images produced through AI

Louise Archer's work on Science Capital and the ASPIRES studies (see *Useful links*) have shown us that some children do not identify themselves as scientists, and that this crucial decision starts forming in primary school (Archer, 2018). Without careful and critical use, GenAI can magnify the amplitude of this negative self-concept.

Practical activity

Try this with your class or your colleagues!

1. Type the same science question into *ChatGPT* twice: Once 'for a girl,' once 'for a boy.', once for 'neutral gender'. Or try it with different names.
2. Compare the answers: Is one longer, more detailed, or does it use a different story?
3. Spot the patterns: Are girls' answers more about home or stories? Are boys' answers more technical or active? What happens for the gender-neutral example?
4. Discuss as a class: '*Are these answers fair? How could we make them better for everyone?*'
5. Let children suggest their own, more inclusive analogies. It's a simple way to ignite rich conversations about fairness and representation in science.
6. Try adding '*ensure there is no bias*' to your input and appraise: sometimes it reduces the bias, sometimes

it will provide a neutral answer, sometimes it ignores the request.

7. Upload a piece of work with a name on. Ask for next steps. Repeat for a different gender. Compare.

Why does this happen?

GenAI (like the models underlying *ChatGPT*) learns from huge amounts of our internet data (training data) such as books, websites, stories and more (UNESCO and IRCAI, 2024). That means it is infused with stereotyped associations and schema. The order of names or words in your question can nudge GenAI to use different language, metaphors, or even decide how much detail to give.

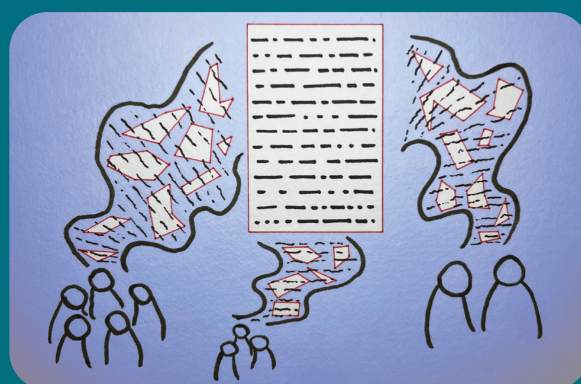
How can teachers use GenAI more fairly?

Try the following:

- Check before you use: try swapping the order of names or using a gender-neutral prompt.
- Edit the answers: make changes so every child gets a fair, engaging explanation.
- Talk about it: use the differences you spot as a visual for class discussion; for example '*How would you explain this to someone who has never seen a light bulb before?*'
- Encourage curiosity: let children play 'GenAI detective' and see what they discover.

Key takeaway

GenAI looks set to stay, and it can be a brilliant tool that can positively affect teachers and students alike. Just as you would critically appraise a worksheet from a scheme of work, GenAI output needs the same oversight and critical eye. Used in this way, we can get closer to giving every child the opportunity to see themselves as a scientist, rather than further deepening gender disparity and ideals.



USEFUL LINKS

ASPIRES research: www.ucl.ac.uk/ioe/departments-and-centres/education-practice-and-society/research/aspires-research

GenEd Labs.ai: genedlabs.ai

UNESCO Gender-sensitive language guidelines: https://unesdoc.unesco.org/ark:/48223/pf0000377299

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