

Letter to editor

Thinking about thinking about thinking

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Because my 5 year old grandson is growing up in the age of LLMs, which provide a cornucopia of knowledge, some of which is inaccurate, wrong, or outright lies, I've been looking into literature regarding research into teaching metacognition; a concept that recent research suggests is one way to immunize young people to the decline in thinking ability that appears to be a result of undisciplined cognitive offloading (Jones, 2025); the tendency to delegate mental work to external systems. It's not just the need for crap detection (Webster, 2012); it's the need for a structured approach to LLM use to avoid a decline in thinking abilities.

I'm not the first or only educator who is thinking about thinking as a pedagogical vaccine against erosive cognitive offloading. Knowing of my interest in this topic, a friend sent me a link to this post by Rafe Steinhauer (2025) on two specific classroom exercises for strengthening metacognition skills: "journey mapping" and "Janusian thinking."

In education, metacognition refers to intentional activities that increase students' awareness of—and participation in—how their learning occurs, and it's as close to an unalloyed propellant for learning as exercise is for health and well-being.

Steinhauer is speaking to secondary and higher education teachers, and I plan to follow this new pedagogy. I also will continue to focus as well on 5 year olds, the age at which I intuitively suspect it will be necessary to start if future generations are to resist handing their thinking skills over to machines.

Because so much uninformed and misinformed opinion is flying around right now, I feel it is particularly important to draw inferences from peer-reviewed research literature, and to refer to that literature to test intuitions. What does the literature say about cognitive offloading and its effects on learning? A few examples:

The homogenizing effect of large language models on human expression and thought

LLMs can amplify short-term accuracy and task performance, but perhaps at the cost of standardizing thinking, narrowing creative and

cognitive diversity, and encouraging increasing reliance on machine intelligence over human reasoning. Consequences could include hampering the ability to sustain collective knowledge creation and verification over the long run as well as degrading how humans think, create, and innovate (Sourati et al., 2025).

Does AI increase cognitive abilities, decrease them, or a little bit of each? And what are its implications for identification and development of the gifted?

Multiple analyses and working papers highlight that, while LLMs free up effort and improve performance on immediate tasks, they can also encourage delegating thinking to machines. This is correlated with lower engagement and less critical and analytical effort when humans rely on AI for reasoning or synthesis. Over time, this could impact *learning incentives and long-run skill development* across societies (Sternberg, 2026).

AI, human cognition and knowledge collapse

This one is scary: from the capture of fire to the World Wide Web, humans have benefitted from the aggregated knowledge of collective and individual discovery, with hard-won knowledge building on hard-won knowledge. While it is currently beneficial for machine learning to contribute to collective knowledge (c.f. Alphafold; European Molecular Biology Laboratory–European Bioinformatics Institute, n.d.), in the long run it may erode the million year-old cultural accumulation. This brief excerpt from this paper’s abstract is scary:

The model highlights a sharp dynamic tension: while agentic AI can improve contemporaneous decision quality, it can also erode learning incentives that sustain long-run collective knowledge. When human effort is sufficiently elastic and agentic recommendations exceed an accuracy threshold, the economy can tip into a knowledge-collapse steady state in which general knowledge vanishes ultimately, despite high-quality personalized advice (Acemoglu et al., 2026, Abstract).

AI tools in society: Impacts on cognitive offloading and the future of critical thinking

This source offers both a literature review and a research report. An oversimplified version of cognitive hygiene tactics derived from this report corroborates the “plan”, “look closely”, “try again” strategy in chatGPT’s metacognition exercises for 5 year olds:

Think → Ask → Verify → Revise → Reflect.

Before turning to an LLM for an answer or a report, pause to do your own thinking before offloading the task, then use SIFT (Common Sense Education, n.d.) and other crap detection strategies to subject LLM output to verification tests, change your own thinking and/or your LLM prompting to reflect what you have learned from pre-thinking and

verification testing, and finally, do your own thinking about what an LLM has provided before applying, disseminating, quoting. This series of mental actions can be grooved in (“neurons that fire together, wire together”) by applying it and re-applying (hint for educators and parents) (Gerlich, 2025).

Cognitive offloading or cognitive overload? How AI alters the mental architecture of coping

“Altering the mental architecture of coping” certainly commands attention. One thing the authors mean is that offloading mental tasks can be both augmenting and therapeutic, but habitually turning over to AI cognitive functions that were previously exclusively human can threaten a sense of autonomy, which is a core need. The authors of this paper suggest strategies that could inform educators (and therapists).

“To reduce these risks, multi-level strategies are needed. Designers will need to favor scaffold over substitution. Features would include reflective prompts in place of instruction, delays with individual reflection opportunities, and disclosure on how recommendations are generated” (Martinez-Martin, 2021, as cited in Chirayath et al., 2025).

Metacognition: A key to unlocking learning

I found this report from Australia particularly helpful in terms of practical advice:

Metacognition is often defined as ‘thinking about thinking’. Metacognition has two main components: knowledge and skill. Metacognitive skill is broadly comprised of activities or strategies that monitor and control cognition. When combined with motivational, social and behavioural factors, metacognition forms part of a broader framework of cognitive self-regulation. Metacognitive knowledge and skill start developing from a young age, but it is only through experience, explicit teacher instruction, scaffolding and modelling, as well as ample opportunities for practice, that students can develop into competent metacognitive adults (Smith-Ferguson, 2020: 3).

(“scaffolding” in education mirrors physical scaffolding—temporary structures (like templates, guidelines, infographics, modeling)— that act like training wheels until students master skills, methods, strategies)

I’ve been directing chatGPT to create a series of illustrated books about cognitive hygiene for 5 year olds, together with teaching guides for each one and a curriculum for the series, including links to all sources. The books are based on verified literature reviews of research into cognitive offloading, cognitive hygiene, and metacognition. They are available as print on demand (I take no profit), and it is possible to page through them on the website: Edition for 5-7 year olds (Rheingold, n.d.-a). Edition for adolescents (Rheingold, n.d.-b).

Author Note

Additional writing by the author is available at <https://patreon.com/howardrheingold>.

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