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A dialogic theoretical foundation for integrating generative AI into pedagogical design

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Generative AI presents a profound challenge to the existing structures and purposes of education. It forces us to reconsider not only how we teach and learn but also, more fundamentally, what education is for. This conceptual paper argues that, in order to integrate AI into education in a way that can meet the major challenges facing humanity, ranging from ecological crisis to the future of democratic societies, we must reframe education. Drawing on the nature and potential of generative AI in conjunction with educational theory, we propose a double dialogic pedagogy that recognises education as both teaching thinking through dialogue and inducting students into participation in the long-term powerful dialogues of culture. We relate this double dialogic pedagogy with AI to education for collective intelligence. This pedagogy positions AI not as a replacement for human thinking, but as a partner in expanding the space of dialogue. By articulating this theoretical foundation, we offer a basis for the future design of educational practices and technologies that can support human flourishing in an age of accelerating technological change.

KEYWORDS
dialogic education, educational technology, educational theory, generative artificial intelligence

Practitioner notes

What is already known about this topic

- The rise of generative AI, particularly large language models, poses both opportunities and challenges for education.
- While existing research highlights AI's potential to support personalised learning through intelligent tutoring systems, concerns remain about its possible negative impact on students' critical and creative thinking.
- Previous studies have also noted the need for educational theory to keep pace with technological developments, yet little work has been done to articulate a pedagogical framework that addresses the broader societal and environmental challenges of the AI era.

What this paper adds

- This paper proposes a double dialogic pedagogy as a theoretical foundation for integrating AI into educational design.
- It situates current developments in AI within a historical and philosophical context, drawing on dialogic theory and the concept of the pharmakon to argue that AI is neither inherently beneficial nor harmful, but depends on pedagogical framing.
- The paper advances the field by explicitly linking AI-supported learning to education for collective intelligence, offering concrete illustrations of how AI can support both dialogic learning and induction into long-term cultural dialogues.

Implications for practice and/or policy

- This paper suggests that educational practice should shift from focusing on individual knowledge acquisition towards cultivating collective intelligence through dialogic pedagogy.
- Policymakers and educators are encouraged to design AI-supported learning environments that promote collaborative problem-solving and critical engagement with real-world challenges, such as those posed by the Anthropocene.
- Assessment policies should be re-evaluated to reward collaborative inquiry and ethical reasoning, rather than individual content reproduction.
- This reconceptualisation positions education as a key enabler of planetary-level self-regulation and human flourishing in the face of technological and environmental disruptions.

INTRODUCTION

The integration of generative artificial intelligence (GenAI) into education presents unprecedented challenges but also opportunities. One of the biggest opportunities is that this new technology prompts us to rethink the purpose of education. In rethinking education in the light of GenAI, it is important to take into account our historical situation and the major challenges that we face including the climate emergency. This paper explores how a dialogic theoretical foundation might guide the effective incorporation of GenAI into pedagogical design, particularly in service of fostering collective intelligence.

Our title is a nod to Winograd and Flores's seminal 1986 book ‘Understanding Computers and Cognition: A New Foundation for Design’, which challenged the way researchers were thinking about cognition, computers and AI at the time as if this was about abstract and

detached information processing instead of being, what they claimed it really was, a support for human communication in real-world contexts (Winograd & Flores, 1986). Like Winograd and Flores, we offer not a specific framework for design so much as a new foundation for design. We think that theory in the area of educational technology should be oriented to future design, but designs have to come from somewhere. Although we do offer some illustrations of possible pedagogical strategies in this paper, our main aim is not to offer specific guidance so much as to outline an orientation or way of looking at GenAI and education which we believe can provide a good basis for generating effective design frameworks.

Clarifying some core concepts

We use dialogic space to refer to a space that is not physical but phenomenological, a kind of space of possibilities that can be experienced when different perspectives are brought together and then held together in tension. Holding different perspectives together in tension is another way of referring to a dialogic relation. Within this space, the usual tendency to fix the meanings of signs as quickly as possible is troubled by the awareness that there is another perspective in play, and from that other perspective, the sign might mean something different. In dialogic space, participants experience the dynamic process of ideas interacting, sometimes resonating, sometimes clashing and sometimes generating new ideas (Bakhtin, 1981; Buber, 1970; Wegerif, 2011).

Collective intelligence refers to the enhanced capacity of people (or in some cases other living creatures) working together either directly, through real-time dialogue and collaboration where there is some form of shared attention, or indirectly, for example, by leaving traces in a shared environment for others to build upon.

While some approaches to collective intelligence focus on optimisation or convergence, we assume a dialogic understanding of collective intelligence which includes heterogeneity and generative tension as part of collective intelligence and indeed central to the continuous emergence of new ideas.

UNDERSTANDING THE CHALLENGE WE FACE IN A HISTORICAL CONTEXT

Reflecting on the challenge we now face with how to use new communications technology in education, veteran education technology researchers Pea and Cole (2019) draw our attention to the fact that the first recognisable formal schools arose about 5000 years ago as a response to the needs of a new communication technology. According to Pea and Cole, the emergence of writing in ancient Sumeria addressed the challenge posed by the fact that large numbers of people were living together in cities for the first time. Urban life required sophisticated record-keeping and enforceable contracts. Cuneiform which consisting of making marks on wet clay with a stick called a stylus, took off as a way to fulfil this need. However, this new communications technology did not work on its own. Schools emerged to train cuneiform operators, scribes. Wegerif and Major (2024) expand on this account to bring out just how similar to modern schooling the experience of education was in these first schools, with students sitting in rows working initially on simple coding and decoding exercises, then moving on to grammar and structured examples of model contracts and culminating with reading and reproducing some of the longer stories and framing myths of the culture. This narrative from the origins of schools in our distant past is relevant to aspects of our contemporary situation. It suggests that formal education systems are already technological from their inception and that as they have developed within history at least one

continuous function of schools and schooling has been supported the needs of evolving technologies including perhaps most centrally, communications technologies from literacy to, more recently, mass print literacy (Eisenstein, 1980; Ong, 1982; Poster, 2018; Wegerif & Major, 2024).

It is precisely because modern schooling is so enmeshed with communications technology that the new technology of generative artificial intelligence (GenAI) poses such an existential threat. If GenAI can successfully pass many examinations used to assess achievement in educational institutions today, then the raison d'etre of the whole system is cast into doubt (OpenAI, 2023). This challenge at the very least compels us to reflect more deeply and historically on the fundamental purposes of education and of examinations. Education has become so intertwined with print literacy that imagining it differently might be difficult. Yet education also exists without literacy in oral cultures, where education takes the form of being drawn into participation in shared practices (Lave & Wenger, 1991; Rogoff, 2014) and through initiation rituals inducting individuals into a dynamic relationship with their collective traditions and voices (Turner, 1977; Weichold et al., 2023). Considering education outside of what could be called the 'regime' of print literacy, therefore, can help us to think more about the essential functions that education serves in general and so perhaps guide us in rethinking how pedagogy might adapt to the challenge raised by GenAI.

The historical evolution of AI in education

AI itself is not a new phenomenon in education, having been a focus of research and development for decades, notably through intelligent tutoring systems (O'shea & Self, 1986; Watters, 2023). However, earlier AI systems now often termed GOFAI, or 'Good Old-Fashioned AI', did not fundamentally challenge print-based educational paradigms. On the contrary, these rule-based systems were extensions of the cognitive infrastructure facilitated by print literacy. Rule-based AI, including expert systems designed for well-structured knowledge domains, mirrored the codified, stable knowledge reinforced by formal education through textbooks. Such systems represent what Russian philosopher Bakhtin (1981) termed 'monologic' knowledge that is closed, finalised and detached from living dialogue. In so far as they were applied within education, it was to help individuals achieve mastery and exam success more rapidly and effectively within the education system (Ma et al., 2014; VanLehn, 2011).

GenAI is different. It is not merely an application of the logic of print literacy. It emerged from the internet era, relying upon massive datasets generated through the continuous, collective 'chatter' of online human communication. Unlike its predecessors, generative AI does not operate strictly through predefined rules. Instead, it learns patterns from vast unstructured data, offering context-sensitive, open-ended responses. From an epistemological perspective, this brings new challenges. The original data sets used for training contained bias and inaccuracies, and as generative AI operates (in simplified terms) by offering the statistically most likely response rather than consulting expertly validated knowledge generated through accepted scientific procedures, it may reproduce bias and inaccuracy. Efforts to address these issues have involved, among other things, asking a dialogic chatbot to consult carefully curated external databases when generating responses to specific questions.

Despite this, generative AI resembles less the fixed knowledge of a textbook and more the flexible, dynamic quality of a conversational partner which may be imperfect in factual responses, but which is able to draw from or illuminate multiple perspectives (Watson & Romic, 2025). In dialogue with human peers, we may also encounter bias, mis-remembering and other flaws, but a danger is that computers are understood as and treated as authoritative. To engage with these knowledgeable (in the sense of being broadly trained) but flawed

dialogic partners in a way that is helpful and promotes flourishing, dialogic approaches to education become even more fundamental. In conclusion, generative AI aligns much more closely than GOFAI with Bakhtin's concept of 'dialogic', where meaning requires interaction between different perspectives and so is always dynamically evolving and is never entirely finalised. However, the extent to which GenAI can be described as dialogic is a contested issue which we will pick up later in this paper.

Just as the first recognisable schools emerged in response to the unprecedented demands of urbanisation which required new forms of social organisation, external memory and civic identity, so today, we face a similar but potentially even greater challenge: billions of people virtually living together via a single, interconnected communication medium, the Internet (Castells, 2010; Lévy, 1997; Schroeder, 2018; Wegerif, 2013). This digital convergence into one global inter-communicating culture not only challenges traditional education systems but it also strains social cohesion, democratic governance and the mental well-being of younger generations (Haidt, 2024; Vaidhyanathan, 2018).

The digital convergence of humans that makes possible the development of large language models upon which most recent GenAI is based is inseparable from the material challenges of the Anthropocene: an era in which human activity has become a planetary force (Latour, 2018). The rise of the Internet, which underpins contemporary developments in artificial intelligence, represents one manifestation of a broader, interconnected movement towards an increasingly unified human presence on Earth. Another aspect of this same movement is the increased global environmental risks. As humanity approaches a population of 10 billion and becomes more complexly integrated through a shared digital and cultural infrastructure, digital convergence occurs in parallel to cumulative impacts such as climate change, biodiversity loss and resource depletion. These interconnected challenges, sometimes referred to as a polycrisis (Jørgensen et al., 2024), cannot be meaningfully addressed at purely local or national levels but demand coordinated global responses and collective self-regulation on a planetary scale.

The argument of this paper is that a major shift in education is required if we are to convert the AI-enhanced Internet from being a force for harm to becoming a means for planetary-level self-regulation and collective flourishing. While the problems we face are undeniably complex, education holds a critical role in facilitating their resolution.

GenAI as pharmakon

Recent studies investigating the educational impact of generative AI have revealed an apparent paradox. On the one hand, emerging research provides evidence to support the growing concerns that reliance on AI may diminish learners' capacity for creative and critical thinking, as users increasingly offload cognitive efforts onto machines (Lee et al., 2025; Pikhart and Al-Obaydi, 2025; Toma & Yánez-Pérez, 2024). Conversely, another body of research illustrates how students can effectively enhance their creative and critical thinking by engaging with AI as a collaborative partner (Mollick & Mollick, 2023; Wang & Fan, 2025). This duality of two divergent outcomes arising from the same technological advancement recalls philosopher of technology, Bernard Stiegler's use of the concept of the pharmakon.

In Plato's Phaedrus, Socrates recounts a myth in which the Egyptian god Thoth offers writing to King Thamus as a remedy for human forgetfulness, claiming that it will strengthen memory and promote wisdom. However, Thamus responds critically, warning that writing will, in fact, produce forgetfulness in the souls of learners, who will come to rely on external marks rather than cultivating internal understanding. Writing, Thamus argues, provides only the appearance of wisdom, allowing people to repeat words without true comprehension or the capacity to defend their knowledge through dialogue. Bernard Stiegler draws

on this ancient text to frame writing as a pharmakon; a term in ancient Greek that means both poison and remedy. While Thoth presents writing as a kind of medicine or remedy ('pharmakon'), Thamus exposes its potential as a kind of poison (also 'pharmakon'). Stiegler generalises this insight, suggesting that all technological innovations, like writing, carry this same double-edged character. According to Stiegler, technologies act as external supports for memory, yet this outsourcing inevitably has a cost. One such cost is the disruption of cultural memory: For instance, when education from elders in the family is displaced by the influence of TikTok videos. A parallel concern raised in current research is that generative AI may have similar effects, leading to dependence or a decline in critical thinking.

> Technologies create new possibilities (remedy) but also generate new dangers (poison), such as addiction, automation of thought, or loss of agency. A genuinely new technology such as writing in ancient Greece and GenAI now, disrupts the way of looking at things that is supported by established educational practices while at the same time opening up a path to a possible new way of looking at things in the future that will require the development of new educational practices.
>
> (Stiegler, 2012)

We treat generative AI not simply as a tool to be used well or badly, but as a *pharmakon* in the sense developed by Stiegler (1998, 2010). A pharmakon is both poison and cure because it is a technical supplement that apparently supports human thought while also threatening to replace or erode it. Stiegler argues that all education involves external supports for memory and cognition, but when these supports are absorbed into automated systems governed by instrumental rationality, they risk displacing rather than cultivating human attention, care and reflection. In this light, the current disruptions associated with AI do not stem from the technology itself, but from a deeper structural tendency within education to surrender thought to technical systems. AI, in this framing, serves less as a new crisis than as a revealing symptom of an ongoing epistemological impoverishment.

Applying Stiegler's pharmakon framework to GenAI suggests a crucial insight: if educational systems remain bound to the traditional print-based assumptions and assessment methods, GenAI is likely to appear as a cognitive poison. For example, students who feel under pressure to produce essays demonstrating their personal capacity to produce a critical synthesis of large amounts of knowledge may naturally rely heavily on GenAI, because it can do this task better than they can, but in the process, they may diminish their personal creative and critical engagement and sense of agency. Conversely, should educational priorities shift towards rewarding collaborative engagement with GenAI to solve collective problems, fostering hybrid human and AI forms of thinking, creativity and innovation, it becomes possible for critical and creative thinking, now in a new hybrid form, to flourish once again. Without intentional pedagogical innovation and changes in assessment, inserting generative AI into existing educational assessment systems may inadvertently harm human cognitive development. Viewed in this pharmacological light, AI is understood as making more visible and urgent a deficit that predates it; the focus on technical instrumental rationality in the education system such that tasks and assessments can be automated. The remedy we argue lies in re-animating dialogic, care-centred pedagogy.

CAN YOU HAVE A DIALOGUE WITH TECHNOLOGY?

The pharmakon concept above is drawn by Stiegler from Plato's Phaedrus, in which Socrates, an oral thinker, famously criticises writing as cognitively and educationally

damaging (Plato, 1997). His main argument is that, if you question writing it does not answer, or rather it keeps giving the same answer. A person reading a scroll from the library might appear wise but when questioned reveals their inability to respond. Socrates' pedagogy, now often referred to as the Socratic method, assumes that intellectual growth emerges from interactive dialogues involving multiple viewpoints, that help participants achieve wisdom through reflection. Socrates, as an advocate of the oral tradition, saw education not only as the transmission of fixed information but also, more fundamentally, as the development of a capacity for reflective, responsive dialogue.

In preferring the warm breath of oral exchange to what he called the dead words of written signs, Socrates was probably being unfair about the potential for written texts to support real dialogue and dialogic education. He was taking the same sceptical and conservative position towards the new technology of writing that many now take towards GenAI. Cambridge professor of design, Alan Blackwell, for example, claims in a recent book that it is not possible to hold a meaningful conversation with the Internet or with a large language model such as ChatGPT (Blackwell, 2024). In making this case, he repeats some of the arguments Socrates used against writing to the effect that the new technology is static and has no will or purpose of its own (Blackwell, 2024). However, Socrates was ultimately proved wrong. The philosopher of dialogue, Bakhtin, for example, explored authentic dialogue related to the learning of wisdom in written texts (Bakhtin, 1984). For Bakhtin, meaningful dialogue is not defined solely by the physical medium of interaction; it does not require face-to-face speech, but it is defined rather by responsiveness, openness and the continual negotiation of meaning through the interaction of multiple voices and perspectives. For Bakhtin and many others, the use of written texts has not prevented dialogue and dialogic education but instead, in some respects at least, expanded the generating and sharing of wisdom sometimes found in face-to-face dialogues to include a wider range of voices both from around the world and across time (Oakeshott, 1989).

It is common to consider genuine dialogue to be a uniquely human interaction, necessitating the presence of two distinct separate human consciousness. This is part of the traditional definition of dialogue in psychology (Rommetveit, 1974). It is probably the assumption that lies behind the claim, made explicitly or implicitly by many educationalists, that education with technology is not genuine dialogic education (Biesta, 2019; Bingham & Sidorkin, 2004). However, the doubts raised by Alan Blackwell and many others that technology can support real dialogue seem to run counter to many people's experience. An early indication that technology can indeed mediate meaningful educational dialogues was provided by Joseph Weizenbaum's pioneering work with ELIZA in the 1960s (Weizenbaum, 1966). ELIZA, despite its technological simplicity, was remarkably successful at engaging users in reflective dialogue from which many came away claiming that they had learnt something.

The classic humanist perspective on dialogue may misunderstand one of the mechanisms through which dialogue fosters educational growth. Research into children's problem-solving dialogues demonstrates that dialogue supports cognitive advancement by promoting what has been termed a ‘rise-above’ move; enabling participants to step back and examine problems from an external, reflective vantage point. Crucially, this form of reflective dialogue does not necessarily rely on deep empathic connection with another individual's unique point of view. Rather than simply providing a different viewpoint, the role of the ‘other’ in dialogue is to create a productive tension that acts as a catalyst for reflection. This tension encourages participants to step back into a witness position, enabling them to share, compare and even playfully contest perspectives in ways that can give rise to new ones (Wegerif, 2011, 2025).

We acknowledge that describing AI as a ‘dialogic partner’ is metaphorical, particularly when it is not conscious or responsive in the human sense. However, this metaphor becomes pedagogically meaningful when situated within dialogic processes characterised

by asymmetry, unpredictability and alterity. Drawing on Bakhtin's concept of 'responsive understanding', we stress, reading Bakhtin (1981) in a way influenced by also reading Levinas (1979) on the possibility of generative dialogue with the 'Infinite Other', that true dialogue involves engagement with an irreducibly *other*, that is to say an otherness that resists being fully known or controlled. While GenAI lacks sentience, its responses often bear the signature of the unknown: surprising, destabilising and prompting reflection. In this way, GenAI can function within dialogic pedagogy not merely as a conversational simulation but as a generative alterity: a non-human 'other' capable of catalysing genuine dialogic processes of learning and meaning-making. We therefore propose a distinction between dialogic metaphors (eg, 'AI as tutor') and dialogic processes which we understand as being emergent, relational and grounded in the epistemological value of difference.

Wegerif and Major (2024) argue that one reason why some educationalists seem to want to deny that technology can support meaningful dialogic education might be their default model of meaning as tied to human consciousness. A better supported alternative model of meaning is that it is found wherever tensions are resolved between self-organising systems and their environments. Food has meaning for animals, including single-celled bacteria, because it resolves a tension and enables them to continue existing (Damasio, 2018; Maturana & Varela, 2012). An elegant equation has meaning in the long-term dialogue of mathematics because it resolves various tensions and reduces uncertainty. The human experience of meaning is then always hybrid combining animal consciousness with communications technologies. As Coekleburgh and Gunkel point out (2025, p. 66) meaning is always co-authored between people and a language of some sort. Merleau-Ponty put this more poetically to argue that signs possess us as much as we possess them and that the language speaks through people as much as people can be said to speak through the language (Merleau-Ponty, 1968). In resolving tensions in patterns of text to come up with more elegant ways to express ideas GenAI is, on this view, working with meaning, even though it has no consciousness and no purpose of its own. GenAI's combination of being able to prompt the opening of a dialogic space and then to resource this contingently with information as and when this is needed, potentially makes it the ideal moderator for educational dialogues, the sort of dialogues which lead to insights and the experience of enlightenment.

One key to successful educational dialogues is not the interaction of separate consciousness but entering together into a reflective dialogic space (Buber, 1970; Gadamer, 2013; Wegerif, 2025). Joseph Weizenbaum's early research with ELIZA further illustrates that technology can fulfil this dialogic prompting role, effectively initiating and expanding the reflective dialogic space necessary for critical and creative thinking (1966). What the critics of technology often seem to fail to realise is that human thinking has always been hybrid, using natural technologies such as gestures and words in the air or when using created technologies such as marks made by sticks in clay, or GenAI. Kant famously wrote, in his Critique of Pure Reason that: 'Thoughts without content are empty, intuitions without concepts are blind' (1998, A51). In a similar way, we can say that GenAI alone is empty of purpose lacking any grounding in embodied affective contexts whereas humans without communications technology might have feelings (sentience) but remain blind to the complexity of the world. There is no human thinking without communications technology of some kind; different and better technologies such as GenAI can expand the time, space and complexity of human thinking.

Using AI to support education for collective intelligence (CI)

So far AI in education has mostly been applied to support individual learning on the pedagogical model of the 'teaching machine' (Wegerif & Major, 2024). Given the historical

context and current challenges we face a sensible alternative might be to design AI to support education for collective intelligence.

Dialogues in small groups to solve problems are clearly already a form of collective intelligence (Woolley et al., 2010). However, CI is a larger concept than collaborative learning. In addition to direct dialogues, it also includes indirect patterns of interaction asynchronously on a larger scale (Hogan et al., 2025). Examples include crowdsourcing, citizen science projects, wikis like Wikipedia and other platforms where collaboration is mediated by technology and coordinated through shared artefacts, tasks or environmental cues. Solving complex and global problems is a compelling reason for the development and practice of CI, but this does not simply imply getting better at working together efficiently and effectively to achieve a collective goal (although sometimes this may be useful), but also being able to enter into a dialogue about what these goals should be, and a dialogue that entertains different ways of framing and understanding problems and issues. A dialogic approach to CI also implies that multiple voices are heard and respected, and that differences of approach and understanding may be maintained, rather than being fully resolved.

Dialogic education is good at preparing for direct CI (Mercer et al., 2019). Education aimed at indirect CI prioritises skills in distributed coordination, information management, critical evaluation of contributions and understanding of how individual inputs collectively create emergent solutions or knowledge. Education for Collective Intelligence involves designing educational practices and environments that intentionally cultivate the capacity for groups of people to think, learn and solve problems together, harnessing diverse perspectives and skills through dialogue, collaboration and technology. A study into the existing uses of AI to support collective intelligence (CI) identifies three main areas where AI can support CI education:

> *Grouping*: AI might help form and compose effective groups, using diversity or similarity based on various attributes to optimise collaborative potential, although the evidence for the effectiveness of this is currently mixed.
> *Process*: AI coaches dialogue and collaboration, improving the quality of interactions within groups by promoting productive communication patterns, facilitating 'rise-above' moves and supporting reflective thinking.
> *Staging*: AI guides groups systematically through the stages of collaborative tasks, optimising workflows, task allocation and progress monitoring, especially in complex and multi-stage collaborative projects. (Casebourne et al., 2024)

These three areas can apply across different group sizes, from small teams to large-scale collaborations and through two main interaction modes: AI embedded seamlessly into environments or AI acting explicitly as interactive agents or chatbots.

These three approaches mostly support direct collective intelligence referring to immediate, synchronous collaboration among individuals actively engaging with each other. This involves participants working together simultaneously, typically in small or moderate-sized groups, through explicit dialogues, joint problem-solving activities and collaborative decision-making processes. Educational strategies here focus on developing communication skills, empathy, reflective dialogue, and collective reasoning.

Much work in the area has focused on the facilitation and processes of small group discussion, but CI processes also encompass larger scale collaboration (eg, Citizen Science projects) and deliberation. A variety of tools have been developed to scaffold processes of larger scale deliberation and decision-making. Audrey Tang's work in Taiwan provides a practical example of education for collective intelligence applied to democratic governance. Through initiatives like vTaiwan and the use of Pol.is, a digital, AI-assisted platform for large-scale public deliberation (which has been used for several projects in multiple countries),

Tang and their team facilitated structured, distributed dialogue among thousands of citizens on complex social and policy issues. This is a form of collective intelligence in which differences are not smoothed over by the technology but actively developed in order to promote dialogue between a range of distinct voices.

Pol.is enables participants to submit, vote on and refine statements, with the aim of revealing areas of consensus and divergence without descending into polarisation. Rather than seeking majority rule through adversarial debate, the process highlighted shared understandings and helped guide participants towards collectively authored solutions. Participants were not only consulted but educated through this process, learning about the complexities of the issues, encountering diverse viewpoints and participating in constructive meaning-making (Tang, 2021).

While framed as civic engagement, this represents a public pedagogy of collective intelligence, where the population learns together how to deliberate, reflect and reach creative solutions to shared problems. It models an educational approach relevant beyond politics, suggesting how schools and other learning environments could cultivate similar capacities for collaborative sense-making and decision-making in students. Beyond the existing approaches to using AI in education for collective intelligence, a fourth principle is its potential to support deliberation and deliberative learning. In this role, AI can help bring multiple perspectives together, creating opportunities for participants to move beyond opposition and generate solutions that integrate the underlying motivations and values expressed in the dialogue.

Double dialogic pedagogy

If we are to overcome the challenge to education posed by GenAI, we suggest rethinking education firstly through the lens of the more oral approach of education as induction into dialogue as first advocated and practiced by Socrates and second through the more recent approach of education for participation in collective intelligence. Looking at education through these two lenses gives us a coherent double dialogic pedagogy. A pedagogy that is on the one hand true to the liberatory ideas of Paulo Freire's dialogic education (1970) and on the other hand also consistent with the idea of a liberal education as induction into the conversation for mankind as advocated by Oakeshott (1989). Unlike his contemporaries Ivan Illich and the influential education technologist Seymour Papert, Freire never spoke in favour of 'deschooling' society. He was aware that, in order to change the world, students need not only the ability to think critically but also access to participation in those long-term dialogues which carry powerful knowledge. Freire is associated with education for the oppressed while Oakeshott is more associated with elite education but both articulated similar dialogic theories of learning (perhaps influenced by their mutual engagement with the thought of Hegel). While Oakeshott spoke of education as an inheritance of cultural achievements he understood this education to take the form of induction into participation in what he called 'the conversation of Mankind', an induction that had to take place through what he referred to as 'conversational encounters'. Oakeshott, who studied modern Hegelian philosophy at Cambridge, did not think of this induction into 'the conversation of Mankind' only in terms of the transmission of knowledge but also, indissolubly and more fundamentally, as an induction into collective thinking referred to by Hegel of course simply as 'mind' or 'geist' (Hegel, 1977).

Extensive research on the Thinking Together approach to small group dialogues supported by ground rules that promote asking questions and giving reasons has demonstrated that it is possible to teach students to think together better (Littleton & Mercer, 2013). These dialogues are designed not only to help students process content knowledge but also to

develop their dialogic capacity: the ability to switch perspectives, pose questions, reflect critically and contribute creatively to the co-construction of new knowledge.

However, education is not only about learning how to think in small groups and as individuals; it also involves induction into the larger thinking of the culture. The second level or loop of dialogic pedagogy involves inducting students into existing long-term cultural dialogues, such as those found in science, philosophy or literature, by learning to engage with the accumulated knowledge and perspectives that have developed over generations. This involves understanding 'the dialogue so far' and situating new learning within an ongoing, evolving tradition of thought.

This double movement, engaging in immediate dialogic exchanges and linking these to participation in longer term powerful traditions of knowledge, aims to develop learners who are not merely recipients of static knowledge but active participants in living, dynamic conversations that renew and expand understanding for future generations. It recognises that meaning is not fixed but arises in the interplay of voices, perspectives and contexts, both past and present. In this way, double dialogic pedagogy unites cultural transmission with the cultivation of critical, creative and collaborative thinking (Wegerif & Major, 2024: Wegerif, 2025).

Discussion: GenAI as a tutor for dialogue as learning how to think

Some commentators have suggested that the use of GenAI chatbots like ChatGPT has a tendency to reinforce users' assumptions leading them into an echo chamber of their own views. It is true that the default version of ChatGPT and other AI bots tends to be supportive, encouraging users to feel good about themselves. However, this tendency reflects specific training parameters rather than an inherent limitation of GenAI. Other designs are possible. Below we introduce examples of ways in which AI might act in this way. Future research should explore how dialogic collective intelligence can be supported and assessed through empirical studies in educational settings. This includes small-scale design-based research studies and intervention studies in classrooms that combine AI tools, such as chatbots or adaptive feedback systems, with dialogic pedagogies. Additionally, observational studies of how learners engage dialogically with generative AI agents might be useful to help illuminate the dynamics of emergent hybrid meaning-making. To evaluate these interventions, researchers should employ mixed-methods approaches capable of capturing not only behavioural and performance metrics but also the quality of epistemic emergence or the extent to which genuinely novel, integrated understanding arises from the interplay of diverse perspectives.

Pedagogical intervention 1 QReframer

QReframer is an innovative generative AI tool developed by Professor Simon Buckingham Shum at the University of Technology Sydney (UTS). Designed to enhance critical thinking and question formulation, QReframer assists users, mainly students, educators and researchers, in reflecting on and refining their inquiries by uncovering implicit assumptions. It can be seen as a form of scaffold for critical dialogic thinking, enabling students, through repeated practice, to develop the habit of and capabilities for unpacking and questioning the assumptions in the questions they ask.

QReframer functions as a chatbot prompt that, instead of directly answering questions, identifies up to three underlying assumptions within a user's query. This process encourages users to reconsider and deepen their original questions, fostering a more reflective and

analytical approach to inquiry. The tool is accessible across various AI platforms, including ChatGPT, Microsoft Copilot, Anthropic Claude and Google Gemini (https://educationexpress.uts.edu.au/blog/2024/07/01/whats-up-bot-exposing-assumptions-gen-ai/).

At UTS, QReframer has been integrated into educational practices to promote critical thinking and collaborative learning. For instance, in the 'Technologies Reimagined in a Complex World' course, students engage with QReframer to dissect and explore the assumptions behind their questions, leading to more nuanced discussions and insights.

QReframer is essentially an automated Socrates. For every prompt, it identifies and numbers up to three assumptions that are being made. Users are then invited to select an assumption they find intriguing, prompting the chatbot to suggest subquestions that delve deeper into the topic. This cycle continues, encouraging users to refine their thinking and develop more sophisticated inquiries. While not a full dialogue partner, this AI chatbot is able to draw on its training data to identify potential assumptions in the question and to scaffold the student through a reflective process which is an essential aspect of and preparation for a fuller dialogic enquiry.

Pedagogical intervention 2: A group thinking ModeratorBot

Experiments are currently underway in the Cambridge Digital Education Futures Initiative (DEFICambridge.org) using a GenAI bot to support small group dialogues with three students online. The bot monitors group interaction patterns (through text or speech inputs) and gently intervenes when certain voices dominate or others are silent. AI can suggest prompts like, 'What do others think about this?' or 'Let's hear from someone who hasn't spoken yet'. Research so far suggests that this has potential and is effective in getting more participation.

It is also possible to get the bot to generate provocative, open-ended questions related to the topic under discussion. The AI could deliberately generate questions from multiple perspectives—such as ethical, technical, social or environmental—to scaffold perspective-switching and deepen collective inquiry. This is an approach which has been reported as effective by users. The work is ongoing and results have not yet been published.

Pedagogical intervention 3: AI as Devil's advocate and idea extender

One pedagogical approach being widely used with GenAI is to invite GenAI to critique emerging group conclusions, introducing evidence or counterarguments to prevent premature consensus and stimulate critical evaluation. After the group settles on a solution, then ask GenAI to argue against it from a plausible opposing viewpoint to test the group's reasoning. Teachers can encourage students to submit initial ideas, which GenAI can then extend, reframe or develop in creative ways—helping the group build more sophisticated responses collaboratively (Pratschke, 2024). To give a possible example: Students could propose solutions to a climate change scenario and GenAI then elaborates on each by adding possible consequences, interdisciplinary links or stakeholder reactions for the students to consider in their next iteration.

In dialogic educational theory, learning is not simply the transfer of information from teacher to student but an induction into participation in long-term cultural dialogue: participation which begins necessarily by gaining some knowledge of what has been thought up to now or 'the dialogue so far'. Yet helping students participate meaningfully in these ongoing intellectual traditions requires more than exposing them to authoritative knowledge; it requires pedagogical structures that position them as active contributors. The IDRF

model—initiation, discussion, response, feedback—provides one such structure. Unlike the familiar IRE or initiation (by a teacher), response (by a student) and evaluation (by the teacher) pattern, which often closes down dialogue by positioning the teacher as the final evaluator of correct answers, IDRF opens space for collaborative reasoning. The teacher's initiating question serves not as a test, but as an invitation to enter a shared inquiry shaped by the accumulated thinking of generations (Wegerif, 2007).

For example, when teaching concepts such as gravity and force, a teacher might begin by posing a question that situates students within the historical development of scientific understanding: 'Why do you think objects fall to the ground? And how might Aristotle, Newton, and Einstein have answered this question differently?' This framing draws students into the 'dialogue so far', connecting their everyday experiences with falling objects to centuries of scientific debate. In the discussion phase, students work together to bring their own ideas into contact with these historical perspectives, comparing and challenging assumptions. Their collective response is then treated not as an endpoint, but as a contribution to an ongoing dialogue, to which the teacher or peers offer further feedback, perhaps prompting them to consider the role of invisible forces, field theory or the limits of Newtonian mechanics. In this way, students learn to see knowledge not as static or finished, but as a living conversation they are invited to join.

Technologies such as generative AI can enhance this process by serving as a dialogic partner, helping to surface perspectives from the broader cultural dialogue. For instance, students could ask AI to simulate the responses of historical figures like Newton, or to generate contrasting explanations based on different scientific models. This enables students to encounter the complexity of disciplinary thinking and reflect on their own emerging understanding. AI can also moderate discussion by prompting questions, encouraging participation and challenging premature consensus, ensuring that students engage not just with each other but with the larger body of knowledge they are learning to inhabit. Through such practices, students are not only learning about gravity and force but are being apprenticed into the cultural and scientific dialogue itself, becoming participants in the ongoing evolution of shared understanding (Pratschke, 2024; Wegerif, 2004).

Pedagogical intervention 4: Use GenAI to guide the group through structured collaborative processes

GenAI sets up a challenge to apply knowledge that has been learnt to a particular complex problem, perhaps a problem related to climate change or one of the UN sustainable development goals. It then prompts the group of users through steps like: 'First define the problem,' 'Now search out what we know so far', 'Now brainstorm possible causes,' 'Now consider alternative solutions,' 'now build a model', 'now test the model', 'explain what you found' and so on.

Prototypes to help with this larger project of induction into dialogue exist. For example, the BCause project at the Open University in the UK is designed to guide large-scale group discussion on topics and uses AI to summarise the ongoing discussion (Anastasiou & De Liddo, 2023).

CONCLUSION

The intertwined challenges of the Anthropocene and the advent of AI call for a revisiting of the purpose of education. At its core, dialogic pedagogy redefines education as the expansion of dialogic spaces and times. These connect individual learners to larger,

ongoing global conversations. Through this approach, learners are not merely recipients of knowledge but active participants in evolving dialogues that shape the future of their communities, societies and the planet. Generative AI can play an important role in this process by mediating and enhancing dialogic interactions. It can facilitate access to diverse perspectives, simulate complex systems and support learners in engaging critically both individually and collaboratively with both local and global issues.

To address the challenges of AI, education must equip learners to interrogate AI systems, identify biases and advocate for more just and inclusive uses of technology. To address the challenges of the Anthropocene, education must equip learners to work together collectively to solve complex problems.

The challenges presented by generative AI to educational systems represent what Stiegler would recognise as a pharmakon moment: GenAI is both a potential poison and a potential remedy. The parallels between ancient Sumerian scribal schools and contemporary AI integration suggest not only that education has always been technologically mediated, but that society now stands at a similarly transformative threshold where pedagogical approaches must evolve to address new communication paradigms and a new historical context. It is not a coincidence that this educational challenge is happening in the Anthropocene when we also face the challenge of collective self-regulation of the planet. By expanding dialogic spaces and times, creating inclusive learning environments and redefining success to prioritise collaboration and responsibility, dialogic education focused on producing collective intelligence could help prepare learners to meet the urgent challenges of our time. As humanity faces the profound crises of the Anthropocene, education must rise to the occasion, not only equipping learners with the tools to survive but also empowering them to thrive as active participants in shaping a sustainable and dialogic future.

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ETHICS STATEMENT

Ethical approval was not required for this study as it did not involve human participants, identifiable personal data, or experimental interventions.

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