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Teaching Students How to Think, Not What to Think: Reimagining Critical Thinking in the Age of Generative AI

An Interdisciplinary Pedagogical Approach to Intellectual Independence, Knowledge Construction and Responsible AI Integration

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Abstract: ***The rapid proliferation of Generative Artificial Intelligence (GenAI) is fundamentally reshaping educational practices, transforming how learners access information, approach academic tasks and construct knowledge. Although AI-powered platforms offer considerable opportunities for personalised instruction, immediate feedback and expanded access to educational resources, their unregulated or pedagogically unstructured use raises concerns regarding cognitive engagement, independent reasoning and intellectual autonomy. The central challenge confronting contemporary education is therefore not merely how to incorporate artificial intelligence into classrooms, but how to ensure that technological convenience does not displace the cognitive processes that education is intended to cultivate. This paper critically examines the implications of Generative AI for student learning, with particular emphasis on critical thinking, scientific reasoning, critical literacy, reflective judgement and independent knowledge construction. Adopting an interdisciplinary pedagogical perspective, it argues that the ability to question information, evaluate evidence, interpret perspectives and construct reasoned arguments must become central to educational practice. Drawing upon established theories of reflective thinking, critical thinking and contemporary AI-in-education research, the paper proposes the THINK Framework, comprising five interconnected stages: Think Independently, Hypothesise and Question, Investigate and Interpret, Navigate and Evaluate AI, and Knowledge Creation and Reflection. The framework seeks to reposition AI as a cognitive resource that facilitates intellectual exploration rather than a substitute for human judgement. The paper further discusses its classroom applicability, assessment implications, implementation challenges and potential for future empirical investigation. It concludes that meaningful educational transformation in the age of AI requires a shift from answer-oriented instruction towards inquiry-driven, evidence-based and intellectually independent learning.***

Keywords: ***Generative Artificial Intelligence, Critical Thinking, Intellectual Independence, Scientific Reasoning, Critical Literacy, AI Literacy, Interdisciplinary Pedagogy, Knowledge Construction.***

I. INTRODUCTION

The purpose of education has never been confined to the accumulation of information. At its core, education seeks to develop the intellectual capacities through which individuals understand their surroundings, examine established assumptions, interpret experiences and arrive at informed conclusions. However, the increasing integration of Generative Artificial Intelligence into everyday learning is compelling educational institutions to reconsider the relationship between information acquisition, knowledge construction and independent thinking. The emergence of AI-powered platforms capable of generating essays, explaining complex concepts, interpreting texts and solving academic problems has significantly altered the accessibility of knowledge. Tasks that previously required sustained reading, investigation and analytical effort can now be completed through a relatively simple interaction with an AI system. While these capabilities create new possibilities for educational support, they also introduce a fundamental pedagogical concern: Does the ability to obtain an answer necessarily indicate the ability to understand, evaluate or independently arrive at that answer? This distinction is central to the present study. A student may produce an academically sophisticated essay without developing the ability to construct a coherent argument independently. Similarly, a learner may obtain an apparently accurate scientific explanation without understanding the underlying principles, examining the evidence or recognising the limitations of the response. Consequently, the quality of an academic output can no longer be treated as an unquestionable indicator of the learning process that produced it.

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The challenge is not to resist technological advancement or exclude AI from educational environments. Rather, it is to redefine its pedagogical role. Education must move beyond the conventional emphasis on information delivery towards the cultivation of intellectual competencies such as questioning, interpretation, analytical reasoning, evidence evaluation, communication and reflective judgement.

These competencies are inherently interdisciplinary. Scientific inquiry requires learners to formulate hypotheses, examine observations and establish conclusions through evidence. Language-based learning requires them to interpret meanings, evaluate arguments, recognise perspectives and articulate reasoned positions. Both involve the active examination of information rather than its passive acceptance.

The present paper therefore examines how these interconnected intellectual processes can be strengthened through purposeful AI integration. It proposes an interdisciplinary pedagogical framework designed to preserve human intellectual agency while enabling learners to benefit from emerging technological capabilities.

II. LITERATURE REVIEW

The relationship between critical thinking and meaningful learning has been extensively examined in educational scholarship. Dewey (1933), in *How We Think*, conceptualised reflective thought as an active and deliberate examination of beliefs in relation to the evidence supporting them. His work established inquiry and reflection as essential foundations of intellectual development.

Building upon this tradition, Facione (1990) identified interpretation, analysis, evaluation, inference, explanation and self-regulation as fundamental dimensions of critical thinking. These competencies demonstrate that genuine learning involves more than the acquisition or reproduction of information; it requires the ability to examine the reasoning through which knowledge is constructed and justified.

The emergence of Generative AI has introduced a new dimension to this discussion. Kasneci et al. (2023) acknowledge the educational opportunities offered by large language models, including personalised explanations, learning assistance and enhanced accessibility. However, they also identify concerns relating to inaccurate outputs, bias, academic integrity and the necessity of human oversight.

Similarly, UNESCO's *Guidance for Generative AI in Education and Research* (Miao & Holmes, 2023) advocates a human-centred approach that prioritises human agency, ethical responsibility and pedagogically appropriate technology integration. It emphasises that AI should empower teachers and learners rather than displace the human dimensions of education.

More recent research reinforces the importance of instructional design. A 2026 OECD report, *Digital Education Outlook 2026*, distinguishes between successful task completion with AI and genuine learning, emphasising that technological assistance must be guided by clear pedagogical objectives. A 2026 systematic literature review of 63 empirical studies also identifies both the potential of structured GenAI use to support critical thinking and the risks associated with cognitive offloading and uncritical acceptance of generated responses.

Taken together, these perspectives indicate that the educational impact of AI cannot be understood through a simple distinction between technological benefit and technological risk. Its influence is mediated by the nature of the learning task, the learner's prior understanding, the degree of teacher guidance and the extent to which independent cognitive engagement is preserved.

The research problem: Despite the growing discussion surrounding AI integration, an important pedagogical challenge remains: how can educational practices systematically develop students' ability to question, interpret, verify and construct knowledge when AI systems can perform many information-processing and content-generation tasks on their behalf?

This paper addresses the challenge through an interdisciplinary approach that connects scientific inquiry, language-based interpretation, evidence evaluation and critical AI literacy within a unified model of learning.

III. GENERATIVE AI AND THE EMERGING CRISIS OF COGNITIVE ENGAGEMENT

The increasing availability of AI-generated responses has changed not only how students complete academic tasks but also the cognitive processes involved in completing them. The central concern is the possibility that technological convenience may gradually replace the intellectual effort required for meaningful understanding.

One important dimension of this concern is cognitive offloading: the delegation of mental tasks to external tools or resources. In educational settings, students may increasingly rely on AI to generate explanations, formulate arguments, summarise reading material and solve problems. Although such assistance can be beneficial, excessive reliance may reduce opportunities to practise independent reasoning, sustained attention and reflective judgement.

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A related concern is the emergence of answer-oriented learning. When students prioritise obtaining a finished response over understanding how that response was developed, the learning process becomes increasingly transactional. The emphasis shifts from investigation to retrieval, from reasoning to reproduction and from knowledge construction to content consumption.

The reliability of AI-generated information introduces another layer of complexity. Generative systems can produce fluent and persuasive responses that contain factual inaccuracies, unsupported assertions, misleading interpretations or implicit biases. Their linguistic coherence should not be mistaken for factual authority or sound reasoning.

For example, an AI-generated explanation of a scientific phenomenon may contain an incorrect causal relationship, while an AI-generated interpretation of a literary text may overlook contextual complexity or impose an unsupported reading. In both situations, the learner must possess the ability to interrogate the response rather than accept it merely because it appears convincing.

These concerns also extend to academic integrity and originality. If assignments are evaluated primarily through polished written outputs, it becomes increasingly difficult to distinguish a learner's independent understanding from content generated or substantially shaped by AI.

The underlying issue, therefore, is not the mere presence of AI in educational environments but the possible displacement of intellectual responsibility. A meaningful learning environment must ensure that students remain responsible for asking questions, examining evidence, evaluating alternatives and justifying conclusions.

IV. RECONSTRUCTING THE FOUNDATIONS OF CRITICAL THINKING THROUGH INTERDISCIPLINARY LEARNING

Critical thinking should be understood as a comprehensive intellectual disposition rather than an isolated academic skill. It involves the ability to approach information with curiosity, examine its foundations, recognise inconsistencies, evaluate competing explanations and construct defensible conclusions.

Several interconnected competencies are particularly important in AI-assisted learning environments.

1) Questioning and intellectual curiosity enable learners to move beyond accepting information at face value. Students must be encouraged to ask why a phenomenon occurs, how a claim has been established and whether alternative explanations are possible.

2) Evidence-based reasoning requires the examination of facts, observations, sources and supporting arguments before arriving at conclusions. It is essential for distinguishing substantiated knowledge from speculation or misinformation.

3) Interpretation and critical literacy enable learners to understand how meaning is constructed and communicated. Students must examine the assumptions, perspectives, language and contextual influences that shape information.

4) Analytical judgement and problem-solving involve identifying relationships, recognising logical inconsistencies, comparing alternatives and evaluating the implications of different decisions.

5) Reflection and metacognition require learners to examine their own thinking processes, recognise limitations in their understanding and revise conclusions when presented with stronger evidence.

These competencies are mutually reinforcing. Consider a learning activity centred on environmental sustainability. Students may examine scientific data relating to pollution, investigate its potential causes, analyse how environmental issues are represented in public discourse and develop an evidence-supported argument concerning possible solutions. They must simultaneously interpret information, evaluate evidence, communicate their reasoning and consider alternative perspectives.

Similarly, when exploring the ethical implications of genetic engineering or artificial intelligence, learners can investigate the underlying scientific principles, examine social and ethical arguments and construct reasoned positions based on available evidence.

Such learning experiences demonstrate that scientific reasoning and language-based critical thinking are not competing educational objectives. They are complementary processes through which individuals investigate, interpret and communicate knowledge.

Consequently, interdisciplinary pedagogy offers a valuable means of developing transferable intellectual competencies that extend beyond the boundaries of individual subjects.

V. FROM PASSIVE CONSUMPTION TO ACTIVE KNOWLEDGE CONSTRUCTION: REIMAGINING CLASSROOM PRACTICES

The development of critical thinking requires a corresponding transformation in classroom pedagogy. Conventional instruction frequently places considerable emphasis on explaining content, delivering information and assessing the reproduction of established knowledge. Although foundational instruction remains important, it must be complemented by activities that require students to engage actively with ideas and evidence.

An inquiry-driven classroom begins with a problem, question or phenomenon rather than a predetermined answer. Students are encouraged to formulate hypotheses, examine relevant information, investigate possible explanations and communicate their conclusions.

For instance, an activity concerning climate change may involve examining scientific reports, interpreting statistical representations, evaluating competing public claims and developing an argumentative presentation. Students can subsequently compare their conclusions with AI-generated explanations, identify inaccuracies or omissions and justify their final position through credible evidence.

Another activity may involve presenting students with an AI-generated interpretation of a text alongside the original material. Learners can identify differences in interpretation, examine the assumptions underlying each response and develop an independent analytical explanation.

Debates, collaborative investigations, reflective journals, problem-based assignments and project-based learning can further strengthen these competencies. Such activities encourage students to engage with diverse perspectives, articulate their reasoning and reconsider conclusions when confronted with contradictory evidence.

Generative AI can also be incorporated as a critical interlocutor. Rather than requesting a completed answer, students may ask an AI system to challenge their assumptions, suggest alternative explanations or identify weaknesses in an argument. The resulting responses become material for further examination rather than substitutes for independent judgement.

UNESCO (2023) specifically discusses the potential of GenAI to facilitate inquiry and project-based learning, including its use in Socratic dialogue, while emphasising the importance of prior knowledge, verification and appropriate instructional design.

The pedagogical emphasis must therefore shift from simply teaching students how to obtain information to enabling them to investigate its foundations, interpret its significance and construct meaningful knowledge.

VI. THE PROPOSED THINK FRAMEWORK: A PEDAGOGICAL RESPONSE TO AI-ASSISTED LEARNING

In response to the identified challenges, this paper proposes the THINK Framework, an interdisciplinary pedagogical model designed to strengthen independent reasoning, critical engagement and responsible AI use.

The framework is founded on the principle that technological assistance should complement, rather than replace, the learner's intellectual contribution. It establishes a structured progression from independent engagement to questioning, investigation, AI evaluation and original knowledge creation.'

A. T – Think Independently

The learning process begins with the student's own intellectual engagement. Before consulting AI, learners are encouraged to interpret a question, attempt a solution, express an initial opinion or formulate a preliminary explanation.

This stage preserves the importance of prior knowledge and individual cognitive effort. It also enables learners to recognise what they understand and identify areas requiring further exploration.

B. H – Hypothesise and Question

Students subsequently formulate questions, identify assumptions and develop possible explanations. Rather than immediately seeking confirmation, they explore alternative possibilities and examine the reasons supporting their initial understanding.

This stage promotes curiosity, intellectual flexibility and the willingness to challenge established beliefs.

C. I – Investigate and Interpret

The third stage involves the systematic examination of evidence and information. Students may investigate scientific phenomena, interpret data, analyse written material, compare sources or explore competing perspectives.

The emphasis is on distinguishing evidence from assumption, recognising relationships and developing conclusions through reasoned investigation.

D. N – Navigate and Evaluate AI

AI is introduced as an additional resource for exploration and comparison. Students examine AI-generated explanations, identify factual inaccuracies, recognise potential bias and assess whether arguments are adequately supported.

Rather than treating AI-generated responses as authoritative, learners are required to verify information through credible sources and evaluate its relevance to the problem under consideration.

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E. K – Knowledge Creation and Reflection

The final stage involves synthesising the information examined throughout the learning process and developing an independent conclusion. Students communicate their findings through analytical writing, presentations, discussions or other appropriate forms of expression.

They also reflect on how their understanding evolved, which assumptions required revision and how AI contributed to their learning.

Table 1. Operationalisation of the THINK Framework

Stage	Core learning process	Illustrative classroom practice
Think Independently	Individual reasoning and prior knowledge activation	Attempting a problem or developing an initial interpretation without AI
Hypothesise and Question	Curiosity, assumption identification and inquiry	Formulating possible explanations and challenging initial beliefs
Investigate and Interpret	Evidence examination and critical analysis	Conducting investigations, interpreting data and examining texts
Navigate and Evaluate AI	Verification and critical AI literacy	Comparing AI responses with credible sources and identifying inaccuracies
Knowledge Creation and Reflection	Synthesis, communication and metacognition	Presenting original conclusions and reflecting on the learning process

The framework is designed to be adaptable across educational disciplines and levels. Its distinguishing feature is the sequencing of independent cognitive engagement before and after AI interaction. Students are not discouraged from using technology; instead, they are expected to retain responsibility for the reasoning and judgement underlying their final work.

The THINK Framework is a proposed conceptual model and requires empirical investigation to establish its effectiveness across different classroom contexts.

VII. IMPLEMENTATION, ASSESSMENT AND RECOMMENDATIONS

The practical implementation of the proposed framework requires a coordinated transformation in teaching strategies, assessment practices and institutional approaches to AI integration.

1) Strengthening teacher preparedness: Educators require professional development that extends beyond technical familiarity with AI tools. Training should focus on designing inquiry-oriented activities, evaluating AI-generated content and facilitating discussions that encourage independent reasoning.

2) Reorienting assessment towards intellectual processes: Assessment should consider not only the final academic output but also the reasoning through which it was produced. Students can be evaluated through oral explanations, reflective journals, evidence-based presentations, comparative analyses and structured classroom discussions. Such approaches help make the learner's intellectual contribution more visible.

3) Establishing responsible AI practices: Institutions should develop clear guidelines regarding acceptable AI assistance, disclosure of AI use, verification of information and academic integrity. Students must understand that using AI does not remove their responsibility for the accuracy and originality of submitted work.

4) Encouraging interdisciplinary learning: Educational institutions should create opportunities for collaborative projects that integrate investigation, interpretation, communication and problem-solving. Complex real-world issues can provide meaningful contexts for developing these interconnected competencies.

5) 7. Maintaining equitable and inclusive access: AI integration should account for differences in technological infrastructure, digital literacy, language backgrounds and individual learning requirements. Human guidance and accessible educational resources must remain central to the learning environment.

For evaluating the proposed framework, future classroom-based research may employ pre- and post-intervention assessments, student reflections, assignment analysis and teacher observations. Potential indicators include independent reasoning, evidence evaluation, identification of inaccurate AI-generated information, argument quality and reflective judgement.

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A comparative study involving different classroom practices could further examine whether structured AI-assisted learning produces different outcomes from conventional instruction or unstructured AI use. Such investigation would provide an empirical foundation for refining the framework.

VIII. CONCLUSION AND FUTURE DIRECTIONS

The emergence of Generative AI represents a significant turning point in the evolution of education. It has expanded access to information, transformed academic workflows and created new possibilities for personalised learning. However, these developments also necessitate a fundamental reconsideration of what constitutes meaningful educational achievement.

The ability to generate an answer, complete an assignment or produce a sophisticated academic response cannot, in itself, establish that learning has taken place. Meaningful education must continue to cultivate the intellectual capacities through which learners question information, examine evidence, interpret perspectives, recognise limitations and construct independent conclusions.

This paper has argued that critical thinking must become a central organising principle of AI-assisted pedagogy. Scientific reasoning, critical literacy, analytical judgement and reflective learning should be approached as interconnected competencies that support the development of intellectually independent individuals.

The proposed THINK Framework offers a structured pedagogical response by positioning independent thought, inquiry, investigation, AI evaluation and knowledge creation as essential stages of the learning process. Its central contribution lies in establishing a purposeful sequence through which AI can support intellectual exploration without displacing the learner's responsibility for understanding and judgement.

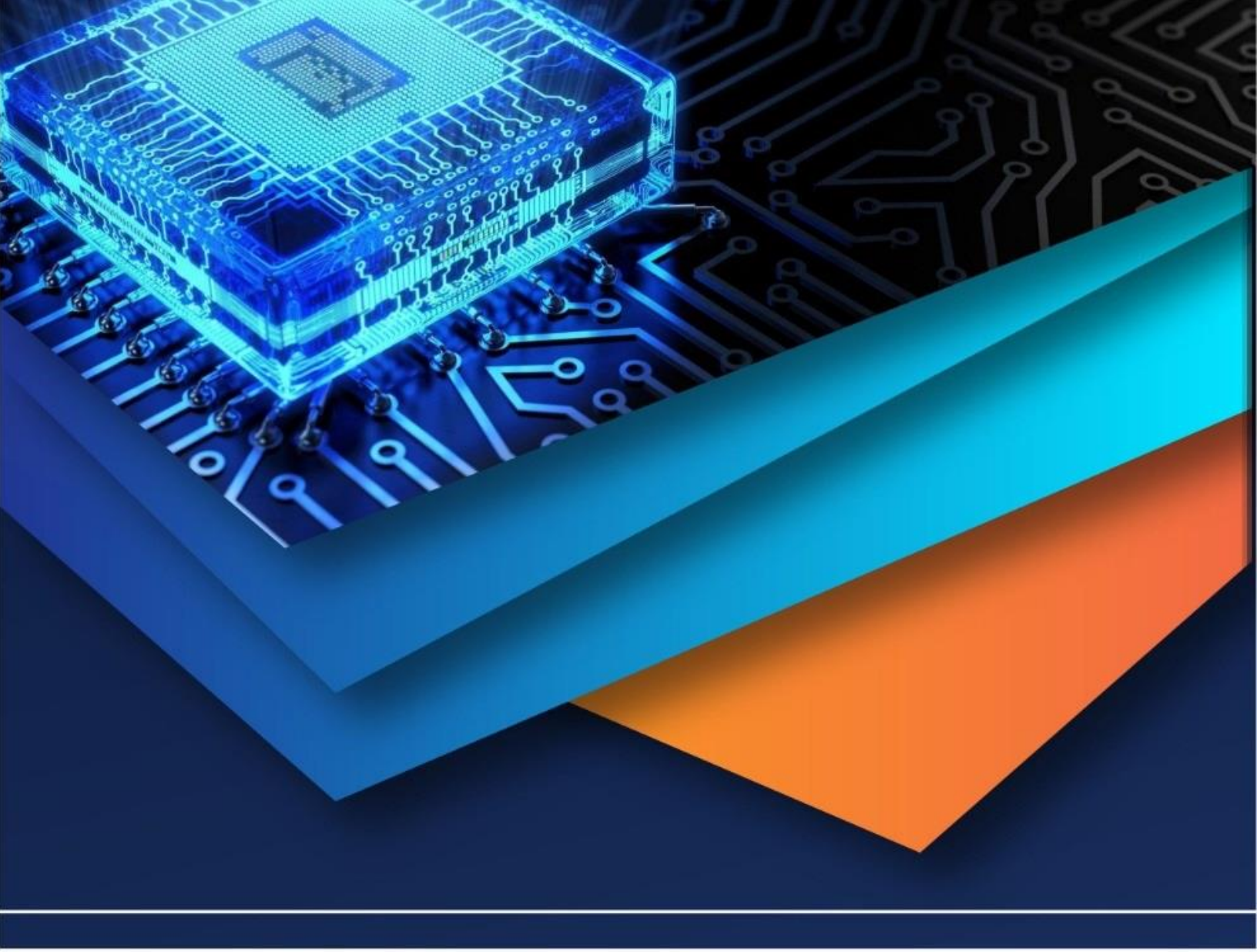
Future research should examine the framework's practical applicability across educational levels, disciplinary contexts and diverse learner populations. Particular attention should be given to developing appropriate assessment instruments for measuring independent reasoning, critical AI literacy and knowledge construction.

Ultimately, the challenge confronting education is not whether machines can generate increasingly sophisticated answers, but whether human beings will continue to develop the capacity to question those answers. The future of education must therefore be guided by a fundamental pedagogical commitment: technology may expand the possibilities of knowledge, but education must preserve and strengthen the human capacity to think.

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