

Peer Review

Review of: "Metacognition and Pedagogy in the Era of Artificial Intelligence"

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Review of the Manuscript

1. Novelty and Contribution

The paper offers an **important and timely perspective** by linking **Artificial Intelligence (AI) advances** (neural networks, pattern recognition, reinforcement learning) with the need for a pedagogy centered **on metacognition**. Its novelty lies in:

Positioning **metacognition** as the “**final frontier**” of human competitiveness against AI, which is a compelling and underexplored theme.

Integrating **case studies** from AI milestones (Deep Blue, AlphaGo, AlphaZero, DeepSeek) with their pedagogical implications.

Proposing **practical classroom strategies** (self-questioning, reflective journals, think-aloud methods) within the context of AI-driven transformations, which grounds theoretical discussions in tangible practice.

This makes the work **original in framing education reform through metacognition** while situating it in the broader AI–human debate.

2. Strengths

Interdisciplinary scope: The paper successfully bridges AI developments with educational theory.

Practical relevance: Provides examples of classroom practices that are **low-cost and implementable**, which enhances its utility for educators.

Holistic framing: Balances technical explanations of AI systems with educational and philosophical reflection.

Clear urgency: The argument for rethinking pedagogy in light of rapid technological disruption is persuasive.

3. Weaknesses

Lack of empirical evidence:

While the paper presents strong theoretical arguments, it **does not include case studies, pilot studies, or empirical validation** of the proposed metacognitive practices.

Readers may find the claims broad and speculative without data to support learning outcomes.

Over-reliance on descriptive narrative:

Much of the content summarizes well-known AI milestones (Deep Blue, AlphaGo) without adding fresh analytical depth.

These sections could be shortened, as they risk overshadowing the core educational focus.

Limited engagement with educational theory beyond metacognition:

Contemporary frameworks such as **constructivism, self-regulated learning (SRL), experiential learning, or heutagogy** are not adequately discussed, even though they overlap with metacognitive practices.

Weak global perspective:

The discussion does not explore **diverse educational contexts (developing vs developed countries, higher education vs K-12)**, making the recommendations less universally applicable.

4. Missing References

The manuscript would be strengthened by citing additional seminal works in both **AI in education** and **metacognition**:

Metacognition & learning sciences:

Flavell, J. H. (1979). "Metacognition and cognitive monitoring." *American Psychologist*.

Schraw, G., & Dennison, R. S. (1994). "Assessing metacognitive awareness." *Contemporary Educational Psychology*.

Zimmerman, B. J. (2002). "Becoming a self-regulated learner." *Theory Into Practice*.

AI in education & learning analytics:

Luckin, R. (2018). *Machine Learning and Human Intelligence: The Future of Education for the 21st Century*.

Baker, R. S., & Inventado, P. S. (2014). "Educational data mining and learning analytics." Springer Handbook of Learning Analytics.

Without these, the literature base feels **overly narrow** and largely tied to the authors' prior works.

5. Grammatical and Stylistic Issues

The manuscript is generally well-written, but there are some **grammatical, stylistic, and structural issues**:

Long, complex sentences make comprehension difficult:

Example:

"The very volatility of the present renders everyday life marked by rapid changes, hindering the development of a clear vision of future requirements for professional practice as well as for citizenship itself."

→ Could be simplified into shorter, more direct sentences.

Inconsistent terminology:

Sometimes "AI," other times "artificial intelligence systems," and occasionally "machines." Consistency would improve clarity.

Overuse of rhetorical phrases:

Phrases like *"this reality imposes the necessity"* or *"humans' remaining hope"* are somewhat dramatic and could be toned down for academic style.

Minor errors:

"favourise" (British) vs. "favor" (US) inconsistencies.

"geographically locate themselves" → should be simplified to "understand their social and global context."

"a reflexive activity about one's own reflection" → redundant phrasing.

6. Recommendation

The paper presents **an engaging and novel framework** connecting AI advancements with metacognitive pedagogy.

However, it requires **tightening of argumentation, addition of foundational references, and editing for conciseness and clarity.**

Empirical validation, even through small case studies, would significantly strengthen the impact.

Decision: *Major Revision*

Declarations

Potential competing interests: No potential competing interests to declare.