



# Reimagining AI in Education: From Tool Integration to Human-AI Pedagogical Partnership

Serap Uğur<sup>1</sup>

<sup>1</sup>Asst. Prof. Dr. Faculty of Education, Anadolu University, 0000-0002-4211-1396

\*\*\*

**Abstract** - The rapid proliferation of artificial intelligence (AI) in education has shifted scholarly attention from questions of technological integration to deeper concerns regarding pedagogy, ethics, and learner agency. Despite this shift, existing approaches largely conceptualize AI as an instrumental tool, leading to persistent tensions between efficiency and meaningful learning, personalization and autonomy, and innovation and ethical accountability.

Responding to these challenges, this study advances a conceptual reorientation of AI in education by positioning AI agents not as external instructional tools but as pedagogical partners embedded within human-centered learning ecologies. Drawing on a structured integrative review of recent literature and policy frameworks, the study identifies key pedagogical, ethical, and socio-technical tensions shaping current AI implementations.

Building on this analysis, the study articulates a relational pedagogical model of Human-AI partnership, which reconceptualizes learning as a co-constructed process emerging through interactions between human and artificial agents. The model integrates three interrelated dimensions: foundational values (human agency and dignity), design principles (ethical-by-design, transparency, and inclusivity), and pedagogical outcomes (adaptive feedback, multimodal engagement, and socio-emotional responsiveness).

The study contributes to the literature by moving beyond framework-based approaches and offering a theoretical and epistemological repositioning of AI in education. It further highlights the emergence of hybrid and posthuman learning ecologies, where agency, knowledge, and pedagogy are distributed across human-machine assemblages. The findings provide a foundation for future empirical research and offer practical implications for educators, designers, and policymakers seeking to develop ethical, inclusive, and pedagogically meaningful AI-supported learning environments.

**Key Words:** Human AI Interaction, Artificial Intelligence, AI in Education, Human AI Partnership

## 1. INTRODUCTION

The integration of Artificial Intelligence (AI) into education has rapidly transitioned from experimental applications to a structurally transformative force shaping teaching and learning processes at multiple levels. Particularly with the emergence of large language models (LLMs) and agent-based systems, AI technologies have begun to mediate not only instructional delivery but also epistemic processes, learner engagement, and knowledge construction.

However, this rapid expansion has exposed a critical tension: while AI systems promise personalization, scalability, and efficiency, they simultaneously raise critical concerns regarding pedagogical coherence, learner autonomy, ethical accountability, and inclusivity. Current implementations often reflect a techno-centric logic, where AI is adopted as a functional enhancement rather than a pedagogically integrated component.

Recent scholarship has converged around the notion of the concept of hybrid intelligence, which frames learning environments as co-evolving systems where human cognition and artificial systems interact dynamically (Holstein et al., 2020). Within this paradigm, AI is no longer positioned as a replacement for human instruction but as an augmentative agent capable of supporting dialogic, inquiry-based, and adaptive learning processes (Luckin, 2017; Sisman-Uğur, 2025). This shift aligns with broader transformations in education toward learner-centered, flexible, and experience-driven models.

These gaps can be conceptualized across three interrelated dimensions:

- Pedagogical misalignment: AI applications remain weakly anchored in learning theory
- Ethical under-specification: limited operationalization of ethical principles in system design
- Agency displacement: increasing personalization at the expense of learner autonomy



These gaps indicate the need for a reconceptualization of AI's role in education, moving beyond instrumental use toward relational and collaborative paradigms.

In response, this study proposes a conceptual reorientation of AI in education, moving from tool-based integration toward relational and pedagogical partnership. This reorientation is operationalized through a Human–AI relational pedagogical model, positioning AI agents as co-teachers within ethically grounded and pedagogically meaningful learning ecologies (Ugur, 2026). This model contributes to the ongoing discourse by shifting the focus from AI adoption to AI collaboration, emphasizing shared agency, co-design, and human-centered learning. The study aims to reconceptualize the role of AI in education and articulate a relational pedagogical model grounded in human-centered and ethical principles.

### 1.1 Research Questions

Building on the conceptual and theoretical gaps identified in the integration of artificial intelligence in education, this study seeks to systematically explore the pedagogical, ethical, and socio-technical dimensions of Human–AI collaboration. In particular, it addresses the need to reconceptualize AI agents not merely as functional tools, but as active pedagogical partners within human-centered learning ecosystems.

Accordingly, the study is guided by the following research questions:

RQ1. What are the key pedagogical, ethical, and socio-technical challenges associated with current implementations of AI agents in educational contexts?

RQ2. How can AI agents be theoretically reconceptualized as pedagogical partners within human–AI collaborative learning environments?

RQ3. What foundational principles and design dimensions are necessary for developing ethical, inclusive, and human-centered AI-supported pedagogical configurations?

RQ4. How can the relational pedagogical model of Human–AI partnership contribute to bridging the gap between technological advancement and pedagogical coherence in AI-integrated education?

RQ5. What are the potential implications of positioning AI agents as co-teachers for learner agency, teacher roles, and future educational ecosystems?

## 2. LITERATURE REVIEW

### 2.1. Global Policy and Ethical Foundations

The ethical governance of AI in education has become a central concern in global policy discourse. Organizations such as UNESCO (2021) and OECD (2023) emphasize that AI integration must be guided by principles of transparency, accountability, inclusivity, and human rights protection. These frameworks position education not merely as a domain of AI application but as a critical site for shaping the societal implications of AI.

UNESCO's guidelines, in particular, highlight the importance of safeguarding human agency and dignity, arguing that AI systems must augment rather than override human decision-making processes. Similarly, OECD frameworks advocate for the development of AI-ready educational ecosystems, where institutional policies, teacher competencies, and technological infrastructures are aligned.

However, policy-level recommendations often remain abstract, necessitating translation into pedagogically actionable designs—a gap this study seeks to address.

### 2.2. Human–AI Collaboration and Hybrid Intelligence

The concept of hybrid intelligence has gained prominence as a response to the limitations of fully automated systems. Rather than viewing AI as an autonomous actor, this perspective emphasizes complementarity between human and machine capabilities.

Holstein et al. (2020) argue that effective AI systems in education should support teacher decision-making, adaptive scaffolding, and learner engagement, rather than replacing pedagogical judgment. Luckin (2017) further introduces the notion of shared agency, where AI systems and human actors collaboratively shape learning trajectories.

Recent studies extend this perspective by conceptualizing AI agents in multiple roles:

- Instructional agents (content delivery and feedback)
- Cognitive agents (supporting reasoning and metacognition)
- Pastoral agents (affective and socio-emotional support)

While these roles demonstrate the expanding scope of AI, they also raise critical questions regarding boundaries of agency, authority, and responsibility in AI-mediated learning environments.

### 2.3. Ethical Design and Responsible AI

Ethical considerations in AI have moved beyond abstract principles toward design-embedded ethics, where ethical values are integrated into system architecture. The ARCHED



framework (Floridi et al., 2021) provides a comprehensive structure emphasizing:

- Accountability
- Responsibility
- Consent
- Human oversight
- Equity
- Data privacy

However, emerging research suggests that ethical design must also address power asymmetries, algorithmic opacity, and epistemic control in AI-driven environments (Holmes et al., 2021).

A critical issue is the tension between data-driven personalization and privacy protection, as well as between algorithmic efficiency and fairness. These tensions highlight the need for anticipatory ethics, where potential risks are addressed proactively rather than reactively.

## 2.4. Pedagogical Integration Models and Limitations

Traditional models such as TPACK and SAMR provide valuable frameworks for integrating technology into education. However, these models were not originally designed to accommodate autonomous or semi-autonomous AI systems.

While TPACK emphasizes the intersection of technological, pedagogical, and content knowledge, it does not explicitly account for machine agency. Similarly, SAMR focuses on levels of technological transformation but lacks a framework for human-AI co-agency.

Recent research suggests the need for next-generation pedagogical models that:

- Integrate AI as an active agent in the learning process
- Address ethical and socio-emotional dimensions
- Support adaptive and personalized learning pathways

The Human+AI perspective builds upon these models by introducing a relational and ethically grounded pedagogical orientation

## 2.5. Learner-Centered Design, Inclusivity, and Equity

Inclusive AI design has emerged as a critical area of concern, particularly given the risk of AI systems reinforcing existing educational inequalities. Zawacki-Richter et al. (2019) highlight disparities in access, representation, and outcomes in AI-supported education.

Recent studies emphasize the importance of designing AI systems that are:

- Culturally responsive
- Accessible to neurodiverse learners
- Sensitive to linguistic and socio-economic diversity

Heffernan and Heffernan (2022) argue that intelligent tutoring systems must move beyond standardized models toward context-aware and adaptive systems.

At the same time, research warns that excessive reliance on AI can lead to reduced learner autonomy and critical thinking, particularly in generative AI environments (Wolf et al., 2024). This underscores the need for agency-preserving design principles, which are central to the proposed framework.

## 3. METHODOLOGY

### 3.1. Research Design

This study adopts a conceptual qualitative research design grounded in a structured integrative literature review and theory-building approach. Rather than conducting a bibliometric or statistical analysis, the study aims to critically interpret and synthesize recent scholarly and policy-oriented literature to develop a pedagogically grounded and ethically informed model for Human-AI collaboration in education.

The research design is guided by a multi-layered analytical logic aligned with the research questions, enabling a transition from problem identification to conceptual reconstruction and model development.

Accordingly, the study is structured across three analytical layers:

- Diagnostic layer (RQ1): Identification of key challenges in AI integration
- Interpretive layer (RQ2-RQ3): Conceptual re-framing of AI as a pedagogical partner
- Constructive layer (RQ4-RQ5): Articulation of the conceptual reorientation and relational pedagogical model

This layered design enables the study to move beyond descriptive synthesis toward conceptual integration and theoretical contribution, which is essential for high-quality conceptual research.

### 3.2. Literature Selection and Scope



The study draws on a purposefully selected body of recent literature focusing on the intersection of artificial intelligence, pedagogy, ethics, and inclusive education.

Rather than aiming for exhaustive coverage, the selection prioritizes conceptual relevance, theoretical contribution, and recency. The corpus includes:

- Peer-reviewed journal articles
- Recent conceptual and empirical studies on AI agents and learning systems
- International policy and guidance documents (e.g., UNESCO, OECD)

The selection is limited to studies published between 2022 and 2025, ensuring alignment with the rapidly evolving nature of AI technologies in education.

The inclusion criteria focused on studies that explicitly address at least one of the following dimensions:

- Pedagogical implications of AI integration
- Ethical and governance-related considerations
- Learner experience, agency, or inclusivity

Studies with a purely technical or algorithmic focus, lacking educational or pedagogical relevance, were excluded.

### 3.3. Analytical Approach

The analysis was conducted through an iterative and interpretive process, structured in three phases directly aligned with the research questions.

#### ***Phase 1: Diagnostic Analysis (RQ1)***

Purpose: To identify key challenges in current AI integration

Selected studies were examined to identify recurring patterns of concern. Through iterative reading and coding, three overarching categories of challenges were identified:

- Pedagogical misalignment
- Ethical and governance-related risks
- Tensions between personalization and learner autonomy

This phase established the problem space that necessitates a new conceptual approach.

#### ***Phase 2: Conceptual Reframing (RQ2–RQ3)***

Purpose: To reconceptualize AI agents as pedagogical partners

In this phase, the literature was analyzed using a reflexive thematic approach, focusing on how AI is positioned within learning environments.

Key conceptual dimensions emerged, including:

- Human–AI co-agency
- Adaptive and affective interaction
- Ethical-by-design principles
- Inclusive and learner-centered AI systems

Rather than treating these themes descriptively, they were reinterpreted and reorganized to support a shift from tool-based to partnership-based AI integration.

#### ***Phase 3: Conceptual Model Articulation (RQ4–RQ5)***

Purpose: To construct the Human+AI Pedagogical Partnership Concept

Insights from the previous phases were synthesized into a multi-layered conceptual model.

The model was developed through:

- Abstraction of core constructs
- Integration of pedagogical and ethical dimensions
- Structuring into hierarchical levels

The resulting model consists of three interrelated layers:

- Foundational values (human agency, dignity, shared control)
- Design principles (transparency, inclusivity, ethical-by-design)
- Learning outcomes (adaptive feedback, multimodal engagement, socio-emotional responsiveness)

This phase provides a direct response to the constructive research questions, offering a theoretically grounded and practically relevant model.

### 3.4. Conceptual Rigor and Validity

To enhance the rigor of the study, several strategies were employed:

- Purposeful sampling of recent and conceptually relevant literature
- Iterative reading and coding to ensure depth of interpretation
- Alignment between research questions and analytical phases
- Integration of policy and academic perspectives for theoretical triangulation



Although the study does not employ quantitative or bibliometric techniques, its strength lies in systematic conceptual synthesis and theory development, providing a robust foundation for future empirical validation. The final phase involves the articulation of a conceptual reorientation, operationalized through a relational pedagogical model that integrates pedagogical, ethical, and socio-technical dimensions.

#### **4. ANALYTICAL FINDINGS AND THEORETICAL INTERPRETATION**

##### **4.1. Pedagogical, Ethical, and Socio-Technical Tensions in AI Integration**

The analysis of recent literature indicates that the integration of artificial intelligence in education is not characterized by a linear progression toward improvement, but rather by a set of persistent and interrelated tensions. These tensions emerge at the intersection of pedagogy, ethics, and socio-technical structures, revealing critical limitations in current AI implementations.

One of the most prominent findings concerns the misalignment between AI applications and pedagogical frameworks. A considerable body of research demonstrates that AI systems are frequently deployed to enhance efficiency—such as automating content generation, assessment, or feedback—without sufficient grounding in established learning theories (Zawacki-Richter et al., 2019). While such implementations may improve instructional delivery, they often fail to support higher-order cognitive processes, including critical thinking, metacognition, and reflective learning (Istrate, 2024). This suggests that AI integration remains predominantly technology-driven rather than pedagogy-driven, reinforcing concerns that instructional design principles are being overshadowed by technological affordances.

Closely related to this issue is the growing concern regarding ethical and governance fragility. Despite the proliferation of ethical frameworks and policy recommendations, including those proposed by UNESCO (2021) and OECD (2023), their practical implementation in educational AI systems remains limited and fragmented. Studies highlight persistent risks related to data privacy, algorithmic bias, and lack of transparency (Floridi et al., 2021; Holmes et al., 2021). These findings point to a critical gap between ethical principles and operational practices, suggesting the need for a shift toward ethics-by-design approaches, where ethical considerations are embedded within system architecture rather than applied retrospectively.

A further tension emerges in what can be conceptualized as the personalization–autonomy paradox. AI-driven systems are widely recognized for their capacity to deliver personalized learning experiences through adaptive feedback and data-driven recommendations (Baker & Inventado, 2014). However, recent studies caution that increased personalization may come at the cost of reduced learner autonomy, as students become increasingly reliant on AI-generated content and guidance (Wolf et al., 2024). This paradox challenges fundamental assumptions of constructivist and self-regulated learning theories, which emphasize learner agency, exploration, and independent knowledge construction.

Taken together, these findings reveal that current AI integration practices are marked by structural tensions that cannot be resolved through incremental technological improvements alone. Instead, they call for a fundamental conceptual reorientation that redefines the role of AI within pedagogical systems.

##### **4.2. Reframing AI as a Pedagogical Partner**

In response to the identified tensions, the literature increasingly points toward a reconceptualization of AI as an active participant in the learning process rather than a passive instructional tool. This shift is reflected in the growing emphasis on human–AI collaboration and hybrid intelligence.

Recent studies conceptualize AI agents as supporting not only instructional delivery but also cognitive scaffolding, dialogic interaction, and learner engagement (Holstein et al., 2020; Luckin, 2017; Ugur, 2026). Within this perspective, AI is positioned as a co-constructive agent that participates in the co-creation of knowledge, thereby extending the boundaries of traditional pedagogical roles. Cheng et al. (2024), for instance, identify multiple roles for AI agents in education, including instructional, cognitive, and pastoral functions, highlighting their expanding scope and complexity.

This shift can be interpreted as a transition from instrumental AI to relational AI, where the value of AI lies not merely in its functional capabilities but in its capacity to engage in meaningful pedagogical interactions. From a theoretical standpoint, this aligns with socio-constructivist and dialogic learning frameworks, which emphasize interaction, collaboration, and shared meaning-making as central to learning processes.

Another significant development concerns the emergence of affective and multimodal AI systems. Advances in affective computing enable AI systems to detect and respond to learners' emotional states, thereby supporting more responsive and engaging learning environments. While such developments hold promise for enhancing motivation and engagement, they also introduce new ethical and pedagogical



challenges, particularly in relation to emotional surveillance and the authenticity of human–AI interactions (Holmes et al., 2021; Uğur & Kurubacak, 2019).

In parallel, the literature underscores the growing importance of inclusive and learner-centered AI design. AI systems are increasingly expected to accommodate diverse learner needs, including neurodiversity, linguistic variation, and socio-economic differences (Heffernan & Heffernan, 2022). This reflects a broader shift toward equity-oriented educational technologies, where inclusivity is treated as a foundational design principle rather than a supplementary feature.

These developments collectively suggest that AI is undergoing a transformation from a tool of efficiency to a partner in pedagogy, new pedagogical conceptualizations that can capture this evolving role.

### 4.3. Reconceptualizing AI through Human–AI Pedagogical Partnership

Building on the identified tensions and conceptual shifts, this study advances a conceptual reorientation of AI in education, articulated through a relational pedagogical model of Human–AI pedagogical partnership.

The analysis indicates that existing approaches often address pedagogical, ethical, or technological dimensions in isolation, resulting in fragmented and incomplete solutions. In contrast, the proposed model adopts a multi-layered structure that integrates these dimensions into a coherent conceptual model.

At the foundational level, the model emphasizes human-centered values, including agency, dignity, and shared control. These values serve as the normative basis for all subsequent design and implementation decisions, ensuring that AI systems augment rather than diminish human roles in education.

The second layer consists of design principles, including ethical-by-design approaches, transparency, inclusivity, and teacher co-creation. These principles translate foundational values into actionable design strategies, guiding the development of AI systems that are both pedagogically meaningful and ethically responsible.

The third layer focuses on learning outcomes, such as adaptive feedback, multimodal engagement, learner autonomy, and socio-emotional responsiveness. These outcomes represent the practical manifestations of the framework, reflecting its impact on teaching and learning processes.

The integration of these three layers reflects a shift from AI integration to AI orchestration, where AI systems are not simply added to existing practices but are intentionally designed as part of a broader pedagogical ecosystem.

### 4.4. Implications for Educational Roles and Learning Ecosystems

The findings of this study have significant implications for the future of education, particularly in relation to the roles of teachers and the structure of learning environments.

First, the reconceptualization of AI as a pedagogical partner necessitates a transformation in teacher roles. Rather than functioning solely as knowledge transmitters, teachers are increasingly positioned as co-designers, facilitators, and ethical mediators of AI-supported learning environments (Holstein et al., 2020). This shift requires new competencies, including the ability to critically engage with AI systems, design meaningful human–AI interactions, and ensure ethical and inclusive practices.

Second, the integration of AI agents contributes to the emergence of hybrid learning ecologies, where human and artificial agents interact within dynamic and interconnected systems. These environments extend beyond traditional classroom boundaries, incorporating digital platforms, adaptive systems, and multimodal interfaces.

From a broader perspective, these developments signal a transition toward what can be described as posthuman learning environments, where learning is distributed across human and non-human actors. While this transformation offers new opportunities for personalization, scalability, and innovation, it also raises fundamental questions about agency, responsibility, and the nature of knowledge itself.

## 5. Discussion

### 5.1. Reframing AI: From Integration to Pedagogical Reorientation

The findings of this study suggest that the current discourse on artificial intelligence in education remains largely confined to questions of integration, efficiency, and optimization. However, the identified tensions—particularly those related to pedagogy, ethics, and learner agency—indicate that these approaches are insufficient for capturing the transformative implications of AI.

Rather than treating AI as an external component to be integrated into existing systems, this study advances a conceptual reorientation, positioning AI as an intrinsic element of pedagogical processes. This shift challenges dominant technology-centric paradigms and calls for a redefinition of educational design as the orchestration of relationships between human and artificial actors.



While previous models such as TPACK and SAMR provide valuable foundations (Mishra & Koehler, 2006; Puentedura, 2009), they remain limited in addressing the relational and semi-autonomous nature of AI systems. In contrast, the present study argues that AI necessitates not an extension of existing models, but a reconfiguration of pedagogical thinking itself.

## 5.2. Rethinking Learner Agency in Human-AI Ecologies

A central implication of this reorientation concerns the transformation of learner agency. The findings highlight a critical tension between personalization and autonomy, where AI systems simultaneously support and constrain learner engagement.

This paradox reflects a broader shift in how agency is conceptualized. Traditional learning theories position agency as an individual capacity; however, in AI-mediated environments, agency emerges as a distributed and relational phenomenon, shaped through interactions between learners, educators, and intelligent systems.

This perspective aligns with emerging critiques of generative AI, which emphasize risks of cognitive offloading and dependency (Wolf et al., 2024), while also extending these discussions by proposing the notion of relational agency. Within this framework, the goal is not to minimize AI influence, but to design systems that support agentic participation, preserving learners' capacity for critical thinking, reflection, and decision-making.

## 5.3. Ethics as a Pedagogical Condition, Not a Constraint

The findings also underscore the inadequacy of treating ethics as a secondary or regulatory concern. Although frameworks such as ARCHED (Floridi et al., 2021) and policy guidelines from UNESCO (2021) provide important foundations, their impact remains limited when not embedded within pedagogical design.

This study advances the view that ethics should be understood as a constitutive condition of pedagogy, rather than an external constraint. In this sense, ethical considerations are not separate from instructional design but are integral to how learning environments are structured, experienced, and governed.

This reconceptualization shifts the focus from compliance to anticipatory and participatory ethics, where ethical principles are operationalized through design decisions and stakeholder involvement. It also highlights the need to address deeper issues of power, transparency, and epistemic

control, which are often overlooked in technical discussions of AI.

## 5.4. Reconfiguring Teacher Roles as Pedagogical Architects

The reconceptualization of AI as a pedagogical partner also necessitates a redefinition of teacher roles. The findings indicate that teachers are no longer positioned solely as knowledge transmitters but as designers and orchestrators of Human-AI learning ecologies.

This transformation extends beyond the integration of digital tools and requires new forms of professional competence. Teachers must engage with AI not only at the level of use, but at the level of pedagogical design, ethical judgment, and interaction management.

In this context, the teacher emerges as a pedagogical architect, responsible for shaping environments in which human and artificial agents collaborate meaningfully. This role reflects a shift toward more complex and reflexive forms of teaching, aligned with broader transformations in education.

## 5.5. Toward Hybrid and Posthuman Learning Ecologies

At a systemic level, the findings point toward the emergence of hybrid learning ecologies, where learning is distributed across human and non-human actors. These ecologies are characterized by dynamic, adaptive, and multimodal interactions that extend beyond traditional classroom boundaries.

From a theoretical perspective, this transformation can be understood within posthumanist frameworks, which challenge human-centered assumptions about knowledge, agency, and learning. In such contexts, learning is not located solely within the individual but is co-constructed through human-machine assemblages.

However, this shift also introduces significant challenges, particularly in relation to agency, responsibility, and the role of human judgment. The conceptual reorientation proposed in this study addresses these challenges by emphasizing balance rather than replacement, ensuring that AI enhances rather than diminishes human presence in education.

## 6.6. Repositioning AI in Educational Theory



Finally, this study contributes to a broader theoretical repositioning of AI within educational research. Rather than situating AI within existing pedagogical frameworks, the findings suggest that AI requires a reframing of the theoretical foundations of education itself.

This includes:

- moving from individual to relational conceptions of learning
- from tool-based to partnership-based models of technology
- from reactive to anticipatory approaches to ethics

In this sense, the study does not simply extend existing theories but contributes to the development of a new conceptual vocabulary for understanding education in the age of AI.

## 6. CONCLUSION AND IMPLICATIONS

### 6.1. Conclusion

This study set out to critically examine the integration of artificial intelligence in education and to move beyond prevailing instrumental perspectives by advancing a conceptual reorientation of AI's role within pedagogical systems. Rather than treating AI as a functional enhancement to existing practices, the study reconceptualizes AI agents as pedagogical partners embedded within human-centered learning ecologies.

The findings reveal that current implementations of AI in education are shaped by persistent tensions, particularly in relation to pedagogical alignment, ethical accountability, and learner agency. These tensions indicate that the challenges of AI integration cannot be resolved through incremental technological improvements alone. Instead, they require a fundamental rethinking of how AI is positioned within educational processes.

In response, this study articulates a relational pedagogical model of Human-AI partnership, which integrates pedagogical, ethical, and socio-technical dimensions into a coherent conceptual structure. This model shifts the focus from AI adoption to AI orchestration, emphasizing shared agency, co-design, and the preservation of human dignity in increasingly AI-mediated learning environments.

Importantly, the study does not merely propose a new model but contributes to a broader epistemological shift, reframing AI from an external instructional tool to an internal component of the learning ecology. This reconceptualization provides a foundation for understanding education as a hybrid and relational system, where learning emerges

through dynamic interactions between human and artificial agents.

### 6.2. Theoretical Implications

This study contributes to the literature in several significant ways.

First, it advances a conceptual reorientation of AI in education, addressing a critical gap in existing research, which has largely focused on technological affordances rather than pedagogical meaning. By repositioning AI as a pedagogical partner, the study extends current discussions on hybrid intelligence and aligns them with socio-constructivist and relational learning theories.

Second, the study integrates fragmented strands of research—spanning pedagogy, ethics, and technology—into a multi-dimensional conceptual synthesis. This integration moves beyond isolated frameworks and offers a more holistic understanding of AI-supported learning environments.

Third, the study introduces the notion of relational agency in Human-AI interaction, emphasizing that agency is not diminished by AI but reconfigured through human-machine collaboration. This perspective challenges dominant narratives that frame AI as either a threat or a tool, instead positioning it as a co-constitutive element in the learning process.

Finally, the study contributes to emerging discussions on posthuman and hybrid learning ecologies, offering a theoretically grounded perspective on how AI reshapes educational structures, roles, and epistemologies.

### 6.3. Practical Implications

The findings of this study have important implications for educators, instructional designers, and policymakers.

For educators, the study highlights the need to move beyond passive adoption of AI tools toward active engagement as co-designers of Human-AI learning environments. This requires the development of new competencies, including AI literacy, ethical reasoning, and the ability to orchestrate meaningful human-AI interactions.

For instructional design, the proposed model underscores the importance of ethics-by-design and inclusivity-by-design principles, ensuring that AI systems support diverse learners while safeguarding autonomy and dignity. Designers must consider not only what AI can do, but what it should do within pedagogical contexts.

For policymakers, the study emphasizes the need to translate high-level ethical principles into operational guidelines and context-sensitive practices. This includes



addressing issues of data governance, algorithmic transparency, and equitable access to AI-supported learning opportunities.

#### 6.4. Implications for Future Research

While this study provides a conceptual foundation, several avenues for future research emerge.

First, there is a need for empirical validation of the proposed relational pedagogical model across diverse educational contexts. Future studies could examine how Human-AI partnerships function in different disciplines, age groups, and learning environments.

Second, further research is required to explore the dynamics of learner agency in AI-mediated environments, particularly in relation to cognitive offloading, dependency, and self-regulated learning.

Third, interdisciplinary research combining education, computer science, and ethics is essential to develop context-aware and culturally responsive AI systems, ensuring that technological advancements align with educational values.

Finally, future work should investigate the long-term implications of AI integration for educational equity, identity formation, and the evolving role of human cognition in learning.

#### 6.5. Final Reflection

As artificial intelligence continues to reshape the educational landscape, the central question is no longer whether AI should be integrated into education, but how it should be meaningfully and ethically positioned within it.

This study argues that the future of education lies not in the replacement of human roles, but in the development of intentional, relational, and human-centered partnerships between humans and intelligent systems. In this sense, AI does not redefine education on its own; rather, it challenges us to redefine education itself.

#### References

Baker, R. S., & Inventado, P. S. (2014). Educational data mining and learning analytics. In J. A. Larusson & B. White (Eds.), *Learning analytics: From research to practice* (pp. 61–75). Springer.

Cheng, H., Zhang, W., & Liu, Y. (2024). Conceptualizing pedagogical AI agents: A review of 92 studies in higher education. *Educational Technology Research and*

*Development*, 72(1), 33–51.  
<https://doi.org/10.1007/s11423-025-10447-4>

Floridi, L., Cowls, J., Beltrametti, M., Chatila, R., Chazerand, P., Dignum, V., ... & Vayena, E. (2021). How to design AI for social good: Seven essential factors. *Science and Engineering Ethics*, 27, 1–19. <https://doi.org/10.1007/s11948-020-00213-5>

Heffernan, N., & Heffernan, C. (2022). Cultural responsiveness in intelligent tutoring systems: A review. *Journal of Educational Computing Research*, 60(3), 456–478. <https://doi.org/10.1177/07356331211043210>

Holmes, W., Bialik, M., & Fadel, C. (2021). *Ethics and the use of AI in education*. Center for Curriculum Redesign.

Holstein, K., Wortman Vaughan, J., Daumé, H., Dudik, M., & Wallach, H. (2020). Improving fairness in machine learning systems: What do industry practitioners need? *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*, 1–16. <https://doi.org/10.1145/3313831.3376446>

Istrate, O. (2024). AI agents in education: An early systematic review. *Revista de Pedagogie Digitala*, 4(1), 22–38. [https://pedagogie-digitala.ro/articol/RPD\\_2024\\_Istrate\\_AI\\_agents\\_in\\_education\\_early\\_systematic\\_review.pdf](https://pedagogie-digitala.ro/articol/RPD_2024_Istrate_AI_agents_in_education_early_systematic_review.pdf)

Luckin, R. (2017). Towards artificial intelligence-based assessment systems. *Nature Human Behaviour*, 1, 0028. <https://doi.org/10.1038/s41562-016-0028>

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for integrating technology in teacher knowledge. *Teachers College Record*, 108(6), 1017–1054. <https://doi.org/10.1111/j.1467-9620.2006.00684.x>

Ng, A., & Newman, C. (2024). AI agents as co-teachers: Opportunities and ethical tensions. *Journal of Artificial Intelligence in Education*, 34(2), 115–132. <https://doi.org/10.1007/s40593-024-00312-9>

OECD. (2023). *AI and the future of skills: AI and education policy perspectives*. OECD Publishing. <https://www.oecd.org/education/skills/>

Office of Superintendent of Public Instruction. (2024). *Comprehensive guidance on the use of AI in education*. Washington State Department of Education. <https://ospi.k12.wa.us/sites/default/files/2024-06/comprehensive-ai-guidance.pdf>



Puenteadura, R. R. (2009). SAMR: A model for technology integration. Retrieved from <http://hippasus.com/resources/tte/>

Sisman-Ugur, S. (2025). Artificial Intelligence-Supported Meta-Learning Assistant. In *Integrating Artificial Intelligence in Education: Enhancing Teaching Practices for Future Learning* (pp. 153-176). IGI Global Scientific Publishing.

Ugur, S. (2026). A bibliometric analysis of agentic AI and the agentic pedagogical agency framework. *International Journal of Educational Technology and Learning*, 20(1), 1-18.

Uğur, S., & Kurubacak, G. (2019). Artificial intelligence to super artificial intelligence, cyber culture to transhumanist culture: Change of the age and human. In *Handbook of Research on Learning in the Age of Transhumanism* (pp. 1-16). IGI Global.

UNESCO. (2021). *AI and education: Guidance for policy-makers*. United Nations Educational, Scientific and Cultural Organization. <https://unesdoc.unesco.org/ark:/48223/pf0000376709>

Wolf, M., Ivanov, A., & Caron, D. (2024). Generative AI and learner autonomy: A scoping review. *arXiv preprint*. <https://arxiv.org/abs/2411.00631>

Zawacki-Richter, O., Marín, V. I., Bond, M., & Gouverneur, F. (2019). Systematic review of research on artificial intelligence applications in higher education: Recommendations for future research. *International Journal of Educational Technology in Higher Education*, 16(1), 1-27. <https://doi.org/10.1186/s41239-019-0171-0>