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Reimagining Teacher Professionalism in the Age of Artificial Intelligence : The CERD Conceptual Model

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Abstract: *The rapid proliferation of artificial intelligence (AI) and generative learning systems within the contemporary educational landscape has initiated a paradigm shift, altering the operational and structural roles of educators. This conceptual paper seeks to delineate the precise epistemological boundaries between pedagogical competence and pedagogical mastery (pedagogik mahorat), addressing a critical gap in contemporary literature where these two constructs are frequently conflated. Methodologically, the study is grounded in qualitative-conceptual research, cross-cultural comparative analysis, and theoretical modeling, synthesizing insights from Uzbek, Russian, and Anglo-American academic traditions between 1950 and 2026. Particular focus is directed toward integrating central Central Asian mentorship models, such as the "ustoz-shogird" (master-apprentice) custom, with modern digital pedagogy mandates. The analysis reveals that while pedagogical competence represents a static, standards-based, and inherently algorithmic corpus of knowledge, pedagogical mastery constitutes a dynamic, fluid, and reflexive capacity to navigate complex, non-linear educational situations that automated platforms cannot decode. In the AI era, the traditional "teacher-as-transmitter" model is rapidly losing its structural relevance, giving rise to an updated "teacher-as-facilitator-mentor" paradigm. To operationalize these shifting dynamics, this paper proposes a novel four-dimensional matrix: the CERD (Cognitive-Methodological, Emotional-Empathic, Reflexive-Adaptive, and Digital-Humanistic) model of teacher professionalism. The study demonstrates that as automated architectures assume the routine administrative and informational scaffolding of teaching, the educator's primary competitive advantage is shifting toward uniquely humanistic capabilities, specifically socio-emotional diagnostics, moral sense-making, and creative improvisation. Ultimately, the CERD model offers a robust theoretical framework and institutional blueprint for reimagining pre-service teacher education and continuous professional development programs in the second half of the 21st century.*

Authors Contribution
Conceptualization: all authors
Methodology: all authors
Investigation: all authors

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INTRODUCTION

In the third quarter of the 21st century, the educational system is undergoing profound paradigmatic shifts that challenge the very foundations of teacher professionalism. Whereas in previous eras the primary task of the teacher was knowledge transmission-the dissemination of factual information, disciplinary content, and established truths-today's educational landscape presents a radically different reality. The widespread integration of Generative Artificial Intelligence (GenAI), large language models (LLMs), and adaptive learning platforms has automated the mechanistic processes of knowledge acquisition, content delivery, and even basic assessment (Luckin, 2024; Zhao, 2022). This technological revolution raises a novel and pressing question within the educational domain: "What constitutes the professional distinctiveness of the teacher in an age where machines can outperform humans in information retrieval and processing?"

Contemporary educational standards and policy frameworks predominantly demand "competence" from teachers. Competence-based education (CBE), which emerged in the 1970s and gained global traction in the 1990s–2000s, has become the dominant paradigm for teacher evaluation and professional development (Hattie, 2009; Shulman, 1987). However, in scholarly literature, the concepts of competence and mastery are frequently treated as synonyms, leaving their epistemological and practical boundaries blurred. This conceptual ambiguity has significant implications for teacher education programs, which often prioritize the acquisition of measurable competencies over the cultivation of deeper, more nuanced forms of professional artistry.

The scientific novelty of this paper lies in its reconceptualization of competence as a "baseline standard"-a necessary but insufficient foundation for teacher professionalism-and mastery as "dynamic adaptation and humanistic creativity" within the context of digital transformation. Drawing upon pedagogical traditions from Uzbek, Russian, and Anglo-American scholarship, this study proposes a new multi-dimensional model of teacher mastery that accounts for the unique challenges and opportunities presented by AI integration in education.

Specifically, this paper addresses three research questions:

1. What are the epistemological and practical distinctions between pedagogical competence and pedagogical mastery?
2. How is the concept of teacher mastery being transformed in response to the proliferation of AI in education?
3. What conceptual framework can guide the development of teacher mastery in the digital age?

By synthesizing classical pedagogical theories with contemporary insights from the philosophy of technology and digital education, this study aims to provide a robust theoretical foundation for reimagining teacher professionalism in the 21st century.

Theoretical Foundations and Literature Review

1. Evolution of Pedagogical Competence

The concept of pedagogical competence emerged in the 1970s–1980s as part of a broader movement toward accountability and standardization in education. Lee Shulman's

(1987) seminal work on "pedagogical content knowledge" (PCK) established a framework for understanding the specialized knowledge base required for effective teaching. Shulman argued that competent teachers must possess not only deep knowledge of their subject matter but also an understanding of how to make that subject matter accessible and meaningful to learners.
John Hattie's (2009) meta-analytic research further refined the competence paradigm by identifying specific teaching practices that correlate with student achievement. Hattie's work emphasized the importance of measurable outcomes and evidence-based practices, reinforcing the notion that teacher competence can be systematically assessed and developed.

The competence-based approach is characterized by several key features:

1. Measurability: Competencies can be observed, assessed, and quantified through standardized instruments.
2. Systematicity: Competence development follows a structured, sequential pathway from novice to expert.
3. Outcome-orientation: The focus is on demonstrable results-what teachers can do, rather than who they are.

While the competence paradigm has contributed significantly to the professionalization of teaching, it has also been criticized for its reductionist tendencies. Critics argue that by focusing exclusively on observable behaviors and measurable outcomes, competence-based frameworks neglect the deeper, more tacit dimensions of teacher expertise-what Donald Schön (1983) termed "reflection-in-action" and "knowing-in-practice."

2. Pedagogical Mastery: Classical and Contemporary Views

In contrast to the competence paradigm, the concept of "pedagogical mastery" has been analyzed in the works of classical educators as being associated with creative, non-conventional approaches and heightened psychological sensitivity. Anton Makarenko (1951), the pioneering Soviet educator, argued that true pedagogical mastery transcends technical proficiency and is fundamentally rooted in the educator's moral authority, emotional intelligence, and capacity for improvisation in the face of uncertainty.

Vladimir Kan-Kalik (1990) expanded on this notion, defining pedagogical mastery as "the highest level of professional development, characterized by the ability to solve complex, non-standard pedagogical problems through creative application of theoretical knowledge and practical experience." Kan-Kalik emphasized that mastery is not merely the accumulation of skills but the development of a distinctive pedagogical style-a unique way of being and acting in the educational environment.

Irina Zimnyaya (2018) further elaborated on the psychological dimensions of mastery, arguing that it involves a deep understanding of the learner's inner world and the ability to establish authentic, empathic connections that facilitate meaningful learning. Zimnyaya contended that mastery is inseparable from the teacher's personal qualities-their values, beliefs, and emotional maturity.

3. Uzbek Pedagogical Thought on Teacher Mastery

Uzbek pedagogical scholarship has made substantial contributions to the discourse on teacher mastery, particularly by contextualizing it within national identity, ethical traditions,

and cultural axiological frameworks. In the contemporary era, this discourse undergoes a critical evolution as traditional teacher-student dynamics intersect with the rapid digitalization of education.

A cornerstone of this theoretical foundation is the work of N. N. Azizkhodjayeva, whose seminal research on pedagogical technology and teacher mastery asserts that teaching transcends mere methodological proficiency. Azizkhodjayeva posits that pedagogical mastery is fundamentally rooted in the educator's spiritual, moral, and intellectual culture (Azizkhodjayeva, 2003; Azizkhodjayeva, 2006). Within this framework, the traditional Central Asian paradigm of "ustoz-shogird" (master-apprentice) relationships is elevated from a historical custom to a holistic pedagogical model. This model embodies a comprehensive approach to teacher development, systematically integrating advanced domain knowledge with spiritual integrity and ethical character (Azizkhodjayeva, 2010).

Expanding upon this socio-cultural foundation, A. A. Kholikov evaluates pedagogical mastery through an ethnopedagogical lens, linking professional competencies directly with national values. Kholikov argues that educational excellence in the national context is inseparable from deeply ingrained societal imperatives, including communal responsibility, profound respect for mentorship, and the pursuit of knowledge as a moral duty (Kholikov, 2012). From this perspective, the modern educator must not merely demonstrate technical instruction skills but must actively operationalize these cultural and ethical values within the classroom environment, establishing a paradigm where professional identity is synchronized with cultural heritage (Kholikov, 2014).

As the pedagogical landscape shifts toward technological integration, the psychological and ethical dimensions of teacher mastery require urgent re-examination. O. Musurmonova addresses these dynamics by examining the development of spiritual and moral culture within pedagogical processes. Musurmonova's theories provide a robust framework for assessing the limits of technology and algorithmic scaffolding in contemporary learning environments (Musurmonova, 2014). She contends that while digital learning platforms, artificial intelligence, and automated systems possess the technical capacity to optimize information distribution and simulate interactive engagement, they remain inherently deficient in replicating the human-centric core of pedagogy (Musurmonova, 2020). Ultimately, the empathic perception of a learner's inner world, genuine ethical guidance, and holistic character formation remain an irreplaceable prerogative of the skilled human teacher.

Concurrently, contemporary digital pedagogy emphasizes that as technology handles routine information management, the teacher's role must shift towards fostering student agency and metacognitive growth (Hew et al., 2024; Williamson, 2021). This highlights the growing necessity of balancing digital competence with the irreplaceable spiritual, psychological, and culturally rooted guidance of the educator.

4. Russian Contributions to Pedagogical Mastery

Russian pedagogical thought has traditionally underscored the artistic, dialogic, and creative dimensions of the educational process, viewing teacher mastery not as a mechanical execution of directives, but as a deeply reflective, humanistic practice. This scientific tradition provides critical conceptual scaffolding for understanding how educators manage complex

interpersonal and intellectual environments, especially under the influence of modern technological paradigms.

A foundational element of this perspective is articulated by Victor Serikov, who advances a person-centered (anthropocentric) approach to schooling. Serikov posits that authentic pedagogical mastery is manifest in the educator's capacity to deliberately construct and dynamically navigate the "pedagogical situation". In his framework, a pedagogical situation is not merely an objective classroom event, but a specifically designed, socio-emotional micro-environment that disrupts routine learning behavior, prompting learners to engage in deep reflection, value-realization, and meaning-making. Consequently, mastery demands that the teacher possess heightened intuitive judgment and tactical fluidity, allowing them to rapidly decode student subject-experiences and orchestrate real-time, personalized interventions that technology alone cannot simulate.

Concurrently, Alexei Khutorskoy expanded the parameters of teacher professionalism through the integration of human-oriented education and heuristic learning models. Within his competency-based paradigm, Khutorskoy distinguishes between generalized external competencies and individualized internal student capabilities. Applied to teacher mastery, this requires a specialized cultural-pedagogical competence: the sophisticated ability to design, implement, and structurally transform educational spaces so that they directly respond to the unique ontological potential and developmental trajectories of each individual learner. Khutorskoy emphasizes that genuine educational mastery transcends the passive replication of standard methodologies; it demands continuous innovation, creative adaptation, and the proactive transformation of instructional designs when confronting emergent pedagogical challenges.

When contextualized within contemporary technology-enhanced and inclusive learning environments, these Russian contributions highlight a crucial axiom: as digital tools increasingly assume administrative and routine instructional scaffolding, the primary locus of teacher mastery must shift toward managing subtle psychological situations and fostering unique human competencies, ensuring that the subjective, empathic dimension of teaching remains central to the educational experience.

5. AI in Education: Challenging Traditional Paradigms

Recent international studies have highlighted the transformative impact of AI on education. Rose Luckin (2024) argued that AI tools are successfully handling competence-demanding tasks such as content creation, lesson planning, and assessment. This, in turn, necessitates a redirection of the vector of teacher mastery toward uniquely human capabilities such as empathy, creativity, and ethical reasoning.

Yong Zhao (2022) contended that the proliferation of AI in education requires a fundamental rethinking of the teacher's role. Zhao argued that teachers must transition from being "knowledge transmitters" to "learning facilitators" and "mentors" who help students navigate the complex, information-rich environments of the digital age.

UNESCO's (2023) guidance on generative AI in education emphasized the importance of maintaining human oversight and ethical responsibility in the use of AI tools. The report argued that while AI can enhance efficiency and personalization, it cannot replace the moral and relational dimensions of teaching.

METHODOLOGY

Unlike empirical investigations that rely on quantitative or experimental metrics, this study is positioned within the tradition of conceptual pedagogical research and theoretical modeling. The methodological architecture is grounded in qualitative-conceptual analysis, which aims to clarify, systematically deconstruct, and structurally extend existing theoretical constructs through rigorous synthesis and dialectical examination (Grant & Osanloo, 2014). To generate a robust, forward-looking framework that synthesizes historical educational philosophies with the disruptive realities of artificial intelligence (AI), this paper operationalizes a multi-layered methodological approach consisting of four integrated research phases.

Systematic Conceptual Literature Synthesis

The foundational phase involved a rigorous, multi-tradition literature review spanning the Uzbek, Russian, and Anglo-American pedagogical heritages from 1950 to 2026. Rather than a passive descriptive review, this phase employed axio-thematic text analysis to track the evolution of "teacher mastery" (*pedagogik mahorat*). The review strategically isolated core parameters from three distinct scholarly epochs:

1. The Socio-Cultural and Axiological Foundation: Seminal works on Eastern and Central Asian mentorship models, specifically isolating the holistic attributes of the "ustoz-shogird" (master-apprentice) custom as formalized by Azizkhodjayeva (2003, 2006) and the ethnopedagogical paradigms established by Kholikov (2012, 2014).
2. The Anthropocentric and Dialogic Dynamic: Mid-to-late 20th-century and early 21st-century humanistic school theories, focusing heavily on person-centered situation building and heuristic instruction frameworks.
3. The Technological and Disruptive Paradigm (2020–2026): Hyper-recent international frameworks, empirical studies, and global policy documents addressing generative AI, algorithmic scaffolding, and shifting teacher-student agency in automated learning environments.

Cross-Cultural Comparative Analysis

To bridge geographically and philosophically distinct academic schools, a qualitative comparative matrix was deployed. This method was critical for identifying structural commonalities, theoretical divergences, and conceptual overlaps regarding teacher competence. The comparative mechanism evaluated:

1. The convergence between the Uzbek emphasis on the educator’s spiritual-moral culture (Azizkhodjayeva, 2006; Musurmonova, 2014) and the traditional Russian humanistic view of teaching as a deeply creative, reflective, and artistic practice.
2. The explicit synergy between the capacity to navigate highly complex, real-time "pedagogical situations" (Serikov, 2006) and the proactive, creative adaptation demanded by customized, individual learning trajectories (Khutorskoy, 2013).
3. The synthesis of national ethical imperatives with contemporary Anglo-American frameworks regarding the re-engineering of the teacher's role from knowledge transmitter to metacognitive mentor (Zhao, 2022; Luckin, 2024).

Phenomenological and Axiological Interpretation

To understand the lived experience and shifting ontology of the educator in an increasingly digitized landscape, the study utilized phenomenological interpretation. This method allowed for a deeper evaluation of how the introduction of intelligent systems impacts the traditional *subyekt-subyekt* (human-to-human) relationship in the classroom. This interpretive lens specifically interrogated:

1. The emotional, ethical, and relational boundaries of teaching, evaluating how automated content curation intersects with the teacher's irreplaceable empathic perception (Musurmonova, 2020).
2. The institutional and moral dilemmas faced by modern educators as they balance digital utility with the socio-emotional oversight demanded by global guidelines (UNESCO, 2023), ensuring that technology acts as a cognitive tool rather than an ethical surrogate.

Iterative Conceptual Modeling

The final methodological phase integrated the insights distilled from the comparative and phenomenological stages to construct a new, multi-dimensional conceptual model of *Teacher Mastery in the AI Era*. The structural design of the model was subjected to an iterative refinement process consisting of:

1. *Theoretical Scaffolding:* Mapping out the explicit functional boundaries of AI (e.g., content generation, routine administrative scaffolding, and diagnostic assessment) as identified by Luckin (2024).
2. *Core Invariant Anchoring:* Defining the non-negotiable human core of pedagogical mastery (empathy, moral guidance, and metacognitive facilitation) rooted in the *ustoz-shogird* tradition.
3. *Peer Deconstruction:* Presenting preliminary schematic formulations to a panel of expert researchers in digital pedagogy and special education, utilizing their critical feedback to systematically eliminate conceptual redundancies and optimize the model’s systemic validity.

Through this comprehensive methodological matrix, the paper successfully transcends regional isolation, presenting a unified pedagogical model where advanced digital literacy is structurally subordinated to, and synchronized with, the timeless spiritual and ethical culture of the educator.

RESULT AND DISCUSSION

Discussion and Conceptual Analysis

The conceptual line drawn between pedagogical competence and pedagogical mastery represents a critical epistemological boundary in modern educational philosophy. Within this framework, pedagogical competence can be categorized as a static, rule-governed, and somewhat algorithmic construct. It denotes the baseline level to which an educator conforms to established institutional standards, encompassing standard methodological knowledge, psychological training, and disciplinary foundations. Essentially, competence functions as a standard "map"-a highly structured representation of a known educational territory that successfully guides an instructor under predictable, normative classroom conditions.

In sharp contrast, pedagogical mastery (*pedagogik mahorat*) manifests as a dynamic, reflexive, and fluid capability. It represents the distinct ability to navigate unfamiliar educational spaces not covered by any standardized map, such as a student's sudden emotional crisis, an unexpected inquiry, or the psychological stress induced by a sudden technical failure. While competence operates on fixed guidelines, mastery functions as a cognitive "compass" and sharp pedagogical intuition, enabling the educator to dynamically adapt to ambiguous, real-time contexts. Utilizing a classic physical metaphor, if competence represents ice-frozen, structured, and rigid standards-mastery embodies water, demonstrating an adaptive fluidity that is fundamentally shaped by the evolving needs of the classroom environment. This distinction shifts the focus of teacher training from the passive acquisition of measurable metrics toward the cultivation of deep professional adaptability.

The ongoing digitalization of the global educational space and the rapid proliferation of generative artificial intelligence systems have accelerated a paradigm shift, altering the traditional core of teacher mastery. Historically, the teacher's primary authority was tied to domain competence as a primary "knowledge transmitter." In the contemporary AI era, this information-delivery function becomes secondary, given that advanced learning platforms can instantly retrieve and present factual content. Consequently, the locus of authentic pedagogical mastery is shifting away from routine content delivery toward advanced humanistic and meta-cognitive orchestration. Modern teacher mastery is now operationalized through three critical dimensions: empathic diagnostics, sense-making, and reflexive facilitation. Empathic diagnostics demands an advanced socio-emotional capacity to detect a learner's cognitive overload or underlying emotional distress through facial cues, vocal inflections, and subtle body language far sooner and more accurately than predictive algorithms can achieve.

Furthermore, sense-making elevates the teacher's role to an ethical guide, helping students extract moral, philosophical, and structural meaning from the unorganized volume of information produced by automated systems. In an environment defined by information saturation, mastery no longer entails providing ready-made answers; rather, it involves training students to ask intellectually rigorous questions and critically discern truth from algorithmic noise. This is intrinsically tied to reflexive facilitation, where the instructor fosters an inclusive classroom culture anchored in inquiry and deep critical thinking, guiding learners toward self-regulated learning and metacognitive independence.

To structurally synthesize these shifting dynamics, this study introduces the CERD (Cognitive-Emotional-Reflective-Digital) conceptual model, which redefines contemporary teacher mastery as a unified, four-dimensional matrix. The systemic interactions and core dimensions of the proposed model are structurally illustrated in Figure 1.

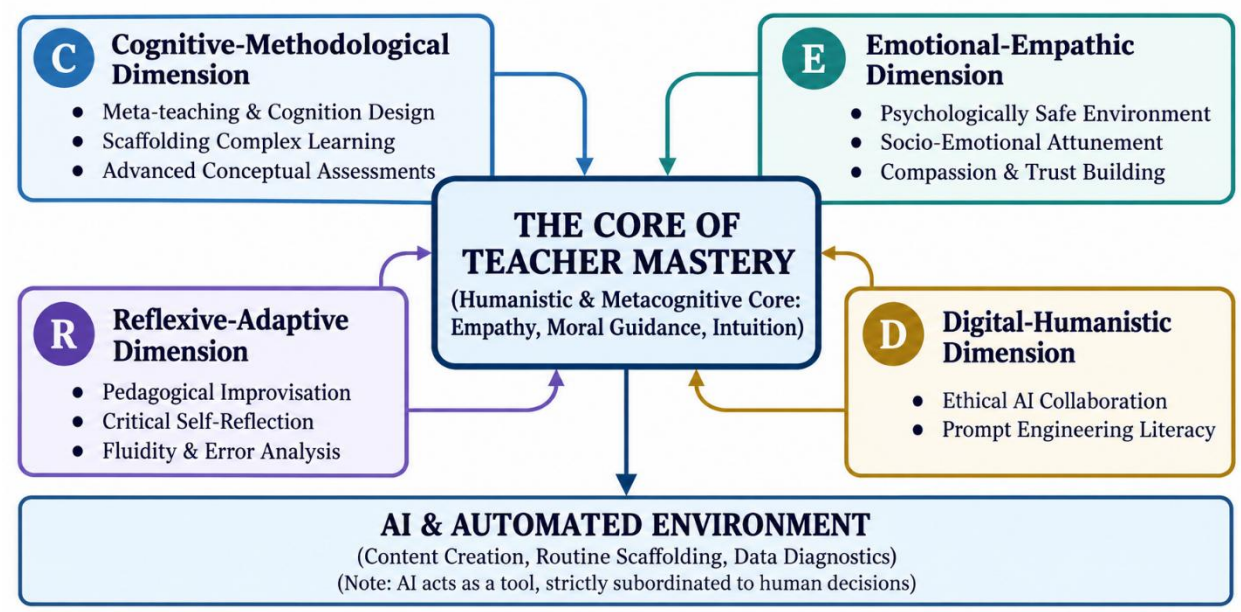


Figure 1. The CERD Conceptual Model of Teacher Mastery in the Age of Artificial Intelligence.

The first component, the Cognitive-Methodological dimension, focuses on designing the learner's cognitive architecture rather than merely distributing domain information. Educators demonstrating mastery in this space scaffold complex, non-linear learning experiences that challenge students to think critically while engineering assessments that evaluate deep conceptual understanding rather than rote memorization. This is structurally reinforced by the Emotional-Empathic dimension, which represents the core human element completely absent from automated intelligence: genuine human compassion and deep emotional attunement. Mastery here is defined by the deliberate creation of a psychologically safe classroom ecosystem where vulnerable learners feel holistically supported, allowing the teacher to model emotional regulation and resilience when facing emergent educational challenges.

Crucial to the sustainability of this model is the Reflexive-Adaptive dimension, which encompasses an educator's ability to critically analyze their own instructional missteps, abandon rigid dogmatic approaches, and engage in constructive pedagogical improvisation. This fluidity allows teachers to continuously learn from both instructional successes and failures, ensuring high flexibility when confronting unexpected developments. Finally, the Digital-Humanistic dimension bridges technological utility with ethical oversight, preventing what can be termed technological servitude. Teachers possessing digital-humanistic mastery collaborate effectively with intelligent software through sophisticated prompt engineering and computational literacy, while simultaneously evaluating the ethical, privacy, and systemic implications of AI integration. Ultimately, this dimension guarantees that the final moral, pedagogical, and instructional decisions rest entirely with the human teacher rather than an automated algorithm.

The practical implications of the proposed CERD model demand a structural overhaul of contemporary teacher education programs and professional development paradigms. Rather than restricting curricula to the acquisition of isolated, easily quantifiable competencies, teacher education must systematically prioritize the balanced development of all four interconnected CERD dimensions. Achieving this objective requires integrating rigorous

reflective practices and mindfulness techniques directly into pre-service teacher preparation programs to cultivate internal cognitive resilience. Furthermore, teacher candidates must be provided with structured, field-based opportunities to develop emotional intelligence and advanced empathic skills through highly supervised practicum experiences, particularly within diverse or adaptive learning settings.

Educational institutions must also encourage critical, hands-on engagement with generative AI tools, training future educators not as passive users of technology, but as active, ethically responsible designers of hybrid learning environments. By embedding these multi-dimensional principles into the continuum of lifelong professional development, the educational sector can successfully prepare a new generation of teachers whose advanced digital literacy is seamlessly balanced by a deep, culturally rooted spiritual and intellectual culture.

CONCLUSION

This conceptual analysis demonstrates that in the contemporary educational landscape of the artificial intelligence era, the boundary defining pedagogical competence and pedagogical mastery is undergoing a radical, structural transformation. While competence serves as the technical and algorithmic foundation-functional dimensions that automated intelligence systems can increasingly optimize and assume-pedagogical mastery (*pedagogik mahorat*) remains a sublime art. This mastery is fundamentally grounded in profound human empathy, creative reflexivity, cultural integrity, and moral responsibility, establishing an ontological domain that cannot be replicated by robotic architecture or generative algorithms. Ultimately, as machines assume the cognitive burden of routine content curation and data processing, the authentic value of the human educator is not diminished but rather elevated, shifting the primary focus of the profession toward socio-emotional guidance and holistic student agency. Consequently, modern teacher education systems must intentionally pivot away from a restrictive focus on standard, static competencies toward cultivating dynamic, adaptive mastery. The proposed CERD (Cognitive-Emotional-Reflective-Digital) matrix offers a comprehensive, interdisciplinary framework designed to guide this transition, providing institutional scaffolding to reimagine teacher professionalism within technology-enhanced and inclusive educational environments.

Despite the robust theoretical scaffolding presented in this study, certain conceptual and structural limitations must be acknowledged to guide future scholarly inquiry. Because this investigation is inherently theoretical and modeling-based, the operational validity of the proposed CERD framework requires systematic empirical validation across diverse, real-world educational ecosystems. To address these limitations and expand upon this foundational research, future academic efforts should be systematically directed toward four key areas. First, researchers must empirically test the functional dynamics of the CERD model within various institutional settings, including early childhood education, inclusive classrooms, and specialized hospital pedagogy environments, to evaluate its adaptive capacity under differing structural constraints. Second, there is an urgent need to design and validate specialized psychometric instruments, evaluation scales, and diagnostic metrics capable of accurately measuring an educator's digital-humanistic mastery and emotional attunement during live instructional improvisation.

Third, conducting longitudinal research tracking pre-service teachers from their initial university preparation programs into long-term professional practice will provide critical data on how reflective-adaptive and emotional competencies evolve over an educator's career continuum. Finally, cross-cultural and ethnopedagogical investigations should be undertaken to explore how national ethical traditions, such as the Central Asian *ustoz-shogird* mentorship custom or equivalent humanistic philosophies, interact with global digital mandates. By systematically addressing these empirical gaps, subsequent research can successfully refine, extend, and operationalize the conceptual framework established in this study, ultimately contributing to the realization of a more balanced, effective, and profoundly humane approach to global teacher education in the age of artificial intelligence.

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