ISRG Journal of Multidisciplinary Studies (ISRGJMS)

OPEN ACCESS

ISRG PUBLISHERS

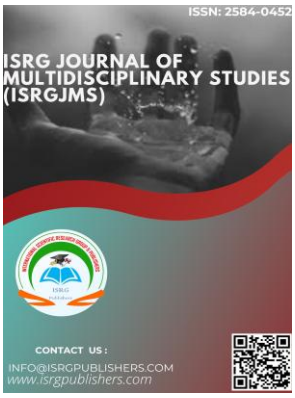
Abbreviated Key Title: isrg j. multidiscip. Stud.

ISSN: 2584-0452 (Online)

Journal homepage: https://isrgpublishers.com/isrgjms/

Volume – III, Issue - X (October) 2025

Frequency: Monthly



The "New Six Concepts" of University Teaching in the Age of Artificial Intelligence

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| **Received:** 19.10.2025 | **Accepted:** 23.10.2025 | **Published:** 26.10.2025

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Abstract

In the context of human–machine collaboration, the rapid advancement of artificial intelligence (AI) presents profound challenges to the traditional role of university faculty. While AI technologies can perform numerous instructional and administrative functions, they cannot supplant the irreplaceable human dimensions of teaching—namely, providing emotional support, fostering interpersonal relationships, serving as ethical and moral exemplars, cultivating cultural consciousness, and inspiring creativity in students. Rather than functioning as a substitute, AI should be understood as a strategic partner that augments and enhances the work of educators. To effectively navigate this new landscape, teachers must cultivate digital literacy across six dimensions: epistemological orientation, pedagogical orientation, evaluative orientation, ethical orientation, developmental orientation, and human-centered orientation. Strengthening these competencies enables faculty to advance student knowledge and skills, transform educational methods, and address emergent social and ethical concerns.

Keywords: *human–machine collaboration; artificial intelligence; digital literacy; sustainable teacher development; higher education*

DOI: 10.5281/zenodo.17447145

1. Background

Artificial intelligence (AI) is rapidly permeating nearly every aspect of daily life, and one of its most transformative domains is higher education. The potential of AI to reshape teaching and learning has garnered increasing scholarly and public attention, prompting a pressing question among educators, parents, and policymakers: *Will AI replace human teachers?* The unequivocal answer is that, unless teachers cultivate the essential qualities and competencies required for talent development in the intelligent era, AI may indeed supplant aspects of their work. While AI demonstrates significant advantages in automating routine tasks and facilitating personalized learning, the role of university faculty extends far beyond knowledge transmission or assessment. Teaching is inherently human, grounded in emotional support, interpersonal guidance, ethical and moral formation, cultural awareness, and the nurturing of creativity—dimensions that remain beyond the reach of machines. As such, AI may be regarded as a valuable "nutrient" for higher education, but not as a substitute for the "daily sustenance" that only teachers can provide.

The irreplaceable humanistic contribution of university teachers lies in their capacity to adapt pedagogical strategies to students' evolving needs, stimulate critical thinking and creativity, foster collaboration, and cultivate resilience. Teachers also play a pivotal role in shaping classroom culture, guiding students through ethical and moral dilemmas, and offering support in addressing personal and academic challenges. Their holistic influence on student development far surpasses the functional value generated by AI. Teaching is not merely a profession; it is a vocation that carries the profound responsibility of shaping the intellectual, ethical, and emotional lives of future generations. Beyond vocational preparation, teachers impart values and life skills that transcend disciplinary boundaries and sustain students in the long term.

Nevertheless, the accelerating integration of AI into education underscores its potential as a complementary partner rather than a rival. By supporting individualized learning, enriching instructional methods, and expanding access to knowledge, AI can serve as a catalyst that reinforces—rather than diminishes—the central role of educators. To harness this potential, teachers must actively embrace timely role transformations in the era of human–machine collaboration. Central to this transformation is the development of digital literacy, which enables educators to continuously enhance the effectiveness and quality of teaching while sustaining their irreplaceable role as mentors, guides, and cultural stewards.

2. Objectives

2.1 Understanding Shifts in Talent Demand in the Era of Human–Machine Collaboration

Examine how the integration of artificial intelligence reshapes the competencies required of future graduates, and identify the implications for enhancing teachers' comprehensive literacy in a more targeted and systematic manner.

2.2 Opportunities and Role Transformation of Teachers in Human–Machine Collaboration

Analyze the opportunities created by AI-driven educational environments and explore the evolving functions of university teachers as facilitators, mentors, and co-creators of knowledge.

2.3 Future Directions for Teacher Development in the Age of Human–Machine Collaboration

Investigate potential developmental pathways for educators, emphasizing the adaptation of pedagogical models, professional identity, and institutional support mechanisms to meet the demands of the intelligent era.

2.4 Cultivating Teachers' Digital Literacy for Sustainable Professional Growth

Highlight the central role of digital literacy in empowering teachers to achieve sustainable development, enhance teaching quality, and contribute to the advancement of high-quality education in an AI-supported context.

3. The Changing Demand for Talent in the Era of Artificial Intelligence

3.1 Innovative and Versatile Talent as the New Priority

From a macro perspective, data, knowledge, and innovation have emerged as the core drivers of economic growth. Consequently, industries increasingly demand large numbers of innovative professionals capable of contributing to sustainable development. At the micro level, innovation has become the fundamental engine through which enterprises maintain competitiveness in rapidly evolving markets. Employers now emphasize not only technical expertise and innovation capacity but also competencies such as teamwork, interpersonal communication, emotional regulation, stress management, and problem-solving. In the context of AI-driven transformation, individuals with narrow or single-skill profiles—and organizations that depend solely on specialized talent—are unlikely to maintain long-term competitiveness.

3.2 The Rising Demand for Human–Machine Collaborative Talent

Traditional, repetitive forms of labor are progressively being replaced by intelligent automation. At the same time, the labor market is witnessing the emergence of numerous decision-oriented, adaptive, and technologically mediated professions. Most of these new positions require employees to collaborate with digital systems in their daily work. Human–machine collaboration has therefore become the dominant mode of production and service delivery. This shift necessitates professionals who are proficient in applying AI theories and methods across diverse contexts, capable of operating AI-driven software systems, and skilled in adapting to hybrid work environments where human creativity and machine intelligence converge.

3.3 Self-Directed and Lifelong Learning as Core Competencies

As AI technologies continue to evolve, the scope of knowledge expands and its rate of renewal accelerates. Material, temporal, and spatial constraints on learning are increasingly diminished, while employment pathways grow more diverse. In this dynamic environment, sustained competitiveness requires individuals to embrace self-directed and lifelong learning. Professionals must continuously update their knowledge structures, acquire new skills, and adapt to shifting demands in the talent market. Lifelong learning is no longer a supplementary attribute but an essential characteristic of talent in the AI era (Xue, 2024).

4. Opportunities: Teacher Development in the Era of Artificial Intelligence

The transformation of teachers' professional roles in the age of artificial intelligence (AI) has opened new avenues for growth and innovation. AI technologies provide educators with more abundant, accessible, and diverse learning resources, enabling continuous

DOI: 10.5281/zenodo.17447145

knowledge enrichment and skill development. Through online learning platforms, intelligent recommendation systems, and data-driven professional development tools, teachers can pursue personalized and precise growth pathways tailored to their evolving needs. Within human–machine collaborative teaching, teachers are called to reflect on and refine their pedagogical practices, redesign learning experiences, and develop innovative course content that sustains student engagement and fosters curiosity. This shift signals a transition from teachers as mere transmitters of knowledge to active guides, facilitators, and collaborators in the learning process. Institutions should further encourage interdisciplinary exploration, supporting teachers in drawing upon cross-domain knowledge to address pedagogical challenges and to innovate in teaching practice (Fan, 2025).

A second dimension of this transformation lies in the redefinition of teachers as curators and mediators of educational resources. With the widespread integration of intelligent technologies into classroom practice, teaching and learning have been reshaped to create richer and more dynamic experiences for students. In this context, teachers face the challenge of effectively embedding emerging technologies into authentic instructional settings. This requires moving beyond traditional models of resource use to embrace intelligent tools that support curriculum design, align with learning objectives, and promote more adaptive forms of instruction. Teachers must increasingly serve as resource excavators and selectors, capable of identifying, filtering, and recommending high-quality materials. In doing so, they facilitate personalized, collaborative, and student-centered learning environments.

Finally, teachers are progressively assuming the role of collaborators and guides in students' knowledge acquisition. Intelligent platforms allow educators to help students transcend the limitations of time and space, enabling autonomous learning and fostering greater agency in educational pursuits. Simultaneously, teachers can deepen classroom interaction by reimagining traditional methods such as questioning, discussion, and group collaboration through the use of AI-enhanced tools. By recording and analyzing students' learning behaviors and achievements, teachers can provide personalized feedback and guidance, strengthening their role as co-learners and mentors. This new model of teaching not only enhances students' self-directed learning capacities but also nurtures critical habits of independent inquiry and reflective thinking (Feng, 2024).

5. Reflecting on the Challenges of Teacher Development in the Era of Artificial Intelligence

The integration of artificial intelligence (AI) into education has created unprecedented opportunities, but it has also posed significant challenges for teacher development. These challenges require continuous reflection and adaptation in order to sustain professional growth and educational effectiveness.

5.1 Strengthening Teaching and Academic Competence

In the intelligent era, the evolving demand for talent has raised higher requirements for university teachers' teaching and academic capacities. Teaching and research are inherently interconnected, and ongoing scholarly inquiry into pedagogical issues fosters improvement in both teaching practice and academic development. While AI technologies can provide data-driven insights into the effectiveness of certain educational strategies, they cannot predict with certainty which methods will succeed in future contexts. This necessitates teachers' ability to engage in critical reflection, exercise sound judgment in selecting educational technologies and methods, and assess the outcomes of their application. The stronger a teacher's academic and pedagogical competence, the better they can adapt to the demands of human–machine collaborative education (Zhou, 2025).

5.2 Enhancing Interdisciplinary Integration

The ability to integrate knowledge across disciplines has become increasingly important in an AI-driven society. Reflection is not separate from action but occurs simultaneously within educational practice. Academic integration involves broadening the horizons of a given discipline, identifying intersections with neighboring fields, and promoting either disciplinary convergence or differentiation. Such integration supports the reconstruction of teachers' knowledge systems and fosters innovative approaches to teaching and research. In the AI era, access to diverse disciplinary resources has become more convenient, but the challenge lies in synthesizing these resources into coherent frameworks. University teachers must therefore strengthen their interdisciplinary integration skills, leveraging human–machine collaboration to expand both the depth and breadth of their disciplinary expertise (Zhang, 2024).

5.3 Deepening Knowledge Reserves and Theoretical Literacy

The traditional metaphor of teachers possessing "a bucket of water" to provide "a bowl of water" to students is no longer sufficient in the age of AI, where vast stores of global knowledge are instantly accessible. In this context, teachers require not just a finite reservoir but a "flowing river" of knowledge to remain responsive to the dynamic educational landscape. This entails the continuous accumulation of new knowledge through extensive reading of cutting-edge scholarship, engagement with emerging theories, and integration of novel perspectives into teaching practice. By cultivating strong theoretical literacy, teachers can move beyond the mechanical transmission of knowledge to foster conscious, reflective, and adaptive teaching (Qian, 2024).

5.4 Reconstructing Role Identity and Professional Self-Understanding

Teacher identity, both professional and personal, faces profound redefinition in the age of AI. Traditionally, teacher identity has been anchored in subject knowledge and instructional expertise. However, contemporary roles increasingly emphasize guiding learning, fostering students' emotional and personal development, and co-creating knowledge within dynamic learning environments. Teachers are now organizers of learning spaces, providers of emotional support, and mentors for student growth. This requires attention to learners' diverse needs, the use of AI technologies to provide personalized support, and strategies to cultivate motivation, collaboration, critical thinking, and problem-solving. At the same time, teachers' self-identity—how they perceive and value their own role—remains critical. Sustaining passion for the teaching profession, embracing openness and innovation, and continuously updating pedagogical methods are essential for adapting to rapid technological change. By aligning self-identity with evolving professional roles, teachers can ensure their continued relevance and effectiveness in AI-enhanced education (Lin, 2024).

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6. Findings: Constructing Six Dimensions to Support Teachers' Sustainable Development in the Era of Human–Machine Collaboration

In the era of intelligent development, the role of teachers has undergone profound transformation. Under the traditional education model, particularly in resource-limited contexts such as rural areas, teachers' responsibilities were largely confined to following prescribed textbooks, examination standards, and model answers. Instruction was dominated by a "score-oriented" paradigm, with limited opportunities for pedagogical reflection, innovation, or professional growth t (Zhang et al., 2024). By contrast, higher education in the age of human–machine collaboration has entered a diverse, networked, and interactive teaching environment, where human teachers and intelligent systems work in concert. Intelligent technologies can complement human capacities, compensate for instructional limitations, and facilitate new opportunities for enhancing teaching quality, efficiency, and diversity (Huang, 2024).

Global organizations have also emphasized the urgency of this transformation. In September 2024, UNESCO released the *AI Competency Framework for Teachers* for K–12 educators, underscoring the necessity for teachers to not only understand AI but also integrate it into pedagogical practice and develop corresponding professional competencies (Miao, 2024). While this represents a significant advance for basic education, higher education still lacks a targeted framework to guide the development of university teachers' AI-related capabilities. Drawing upon multiple UNESCO policy documents on AI and education, as well as strategic perspectives from leading universities worldwide, this study proposes a framework for cultivating teachers' digital literacy through six dimensions: knowledge, teaching, evaluation, ethics, development, and people-oriented values. This model, here conceptualized as the *"New Six Concepts" of College Teachers in the Era of Intelligent Development*, seeks to provide a systematic pathway for teacher growth and the improvement of educational quality.

6.1 Knowledge Concept: Enhancing Quality and Efficiency

A robust knowledge concept entails teachers' ability to distinguish between AI-based tools and traditional educational resources, ensuring that technologies are deployed effectively to maximize instructional outcomes. Beyond merely applying AI in the classroom, teachers must acquire a foundational understanding of its principles and applications, enabling them to make informed choices about which tools are most appropriate for specific pedagogical contexts and learner needs. In this way, teachers can harness AI not only to create compelling and adaptive teaching materials but also to guide students in critically understanding the role of technology in knowledge production and dissemination.

6.2 Teaching Concept: Advancing Human–Machine Collaboration

The teaching concept emphasizes the strategic integration of AI into instructional design and delivery. By selecting AI applications aligned with lesson themes and objectives, teachers can enrich curricular content, diversify teaching methods, and foster more interactive and engaging learning environments. This integration supports innovation in course design, allowing professional expertise to be effectively combined with technological affordances. Human–machine collaborative teaching models also facilitate deeper student engagement, enabling learners to interact dynamically with both knowledge content and intelligent tools. In this sense, teachers are not replaced but rather repositioned as coordinators of pedagogy, technology, and learner experience—ensuring that AI enhances, rather than diminishes, the centrality of human guidance in education.

6.3 Evaluation Concept: Adopting a Comprehensive Assessment Perspective

An evaluation concept requires teachers to integrate AI into assessment practices in ways that meaningfully support student learning and growth. This involves designing assessment methods that are appropriate for AI-enhanced environments, monitoring learning processes in real time, and ensuring that the use of intelligent tools remains aligned with broader pedagogical goals. By leveraging AI for formative and summative evaluation, teachers can obtain richer insights into student performance, identify learning gaps more effectively, and adapt instructional strategies accordingly. At the same time, teachers can strategically employ AI to support students' self-assessment, encouraging greater learner autonomy, initiative, and responsibility. Such practices not only enhance students' professional knowledge and skills but also help them develop the capacity for continuous self-directed learning in a rapidly changing world.

6.4 Ethical Concept: Fostering Integrity and Responsibility

The ethical concept emphasizes the centrality of human responsibility in AI-mediated education. Teachers must recognize that biases and risks associated with AI systems ultimately stem from human design and application, and thus require critical evaluation and accountability. Educators should guide students to understand the ethical implications of technology use, instilling principles of integrity, fairness, and responsibility in digital interactions. Particular attention must be paid to safeguarding sensitive information—such as examinations, grades, and personal data—by adopting best practices to mitigate risks related to privacy, security, and algorithmic bias. Furthermore, teachers can enhance students' AI literacy by modeling responsible use and by explicitly teaching strategies for engaging with AI safely and thoughtfully. In doing so, they nurture a generation of learners who are not only technologically competent but also ethically grounded in their decision-making.

6.5 Development Concept: Fostering Open and Mutual Learning

The development concept highlights the importance of continuous professional growth and collaborative knowledge exchange among teachers in the age of AI. Educators should actively pursue diverse learning opportunities to expand their expertise in integrating AI into pedagogy. This includes adopting effective strategies to explore, evaluate, and select advanced AI tools at the forefront of educational innovation. Teachers are encouraged to engage in ongoing professional development activities—such as workshops, training programs, and online courses—that deepen their understanding of AI's educational applications. Equally important is the cultivation of professional communities where teachers share experiences, insights, and best practices in the use of AI, both within and across institutions. Such peer-to-peer collaboration fosters innovation, collective learning, and the co-construction of effective pedagogical strategies. By continuously learning, sharing, and supporting colleagues, teachers contribute not only to their

DOI: 10.5281/zenodo.17447145

own professional advancement but also to the collective growth of the broader educational community, thereby accelerating the integration of AI into high-quality teaching and learning.

6.6 Human-Centered Concept: Prioritizing Values and Well-Being

The human-centered concept emphasizes that, despite the increasing integration of AI into education, teaching and learning must remain grounded in human values. Teachers should critically evaluate AI tools not only for their capacity to personalize instruction and enhance engagement but also for their potential effects on students' physical, emotional, and social well-being. By fostering a balanced and ethical approach to technology use, educators help students establish a harmonious relationship with AI. Moreover, teachers should guide students to understand the broader societal implications of AI, including its influence on employment patterns, interpersonal relationships, and social dynamics. Integrating this perspective ensures that learners are not only proficient in using AI tools but also capable of exercising critical judgment and ethical reasoning in technological contexts. Ultimately, the human-centered concept reaffirms that education must remain oriented toward cultivating responsible, resilient, and value-driven individuals, ensuring that the integration of AI serves to enhance, rather than diminish, the human dimension of learning.

7. Conclusion

Teachers' digital literacy is emerging as a decisive factor in shaping the future of education in the era of artificial intelligence. The cultivation of high-level digital competencies not only influences the effectiveness of teaching and learning but also contributes to students' holistic development and to broader societal progress.

First, high digital literacy equips teachers to better prepare students for their future professional and social lives. As AI becomes embedded across industries and public institutions, educators must ensure that students acquire the skills to navigate, evaluate, and apply intelligent tools responsibly and effectively. By doing so, teachers enable learners to achieve sustainable success in a technology-driven world.

Second, digital literacy empowers teachers to transform educational methods. Through the integration of AI-driven personalization, intelligent management systems, and high-quality digital resources, teachers can move beyond traditional, uniform modes of instruction. This shift allows for greater differentiation, improved teaching efficiency, and the creation of richer and more engaging learning experiences that are responsive to diverse student needs.

Third, teachers with advanced digital literacy play a critical role in addressing the ethical challenges associated with AI adoption. Issues such as data privacy, algorithmic bias, and the opacity of automated decision-making demand thoughtful guidance within the educational sphere. By modeling and teaching principles of integrity, responsibility, and critical evaluation, teachers can help students understand the limitations of AI while also fostering awareness of its broader implications for society.

In sum, the sustainable development of teachers' digital literacy is not simply a professional requirement; it is a foundational condition for advancing educational reform, cultivating future-ready talent, and guiding society toward the responsible integration of artificial intelligence.

Funding:

This work was supported by the Key Project of the Chinese Adult Education Association in 2023, "Research on the Optimization and Application of the Monitoring Index System for Learning City Construction—From the Perspective of Chinese Modernization" (Project No. 2023-069ZA).

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DOI: 10.5281/zenodo.17447145