Journal of Educational Development and Social Sciences

ISSN: 3080-9967 (Print), ISSN: 3080-9975 (Online) | Volume 1, Number 3, Year 2026
DOI: https://doi.org/10.62051/jedss.v1n3.07
Journal homepage: https://jedss.org

University Teaching in the Era of Digital Intelligence: A Review and Outlook

Tian Ren[1, *], Yingjie Huang[2], Zhen Rao[3]

[1]Sichuan University of Science & Engineering, Yibin 644000, China
[2]Sichuan University of Science & Engineering, Zigong 643000, China
[3]Sichuan University of Science & Engineering, Zigong 643000, China

ABSTRACT

The contemporary world is in an era of deep integration of digital intelligence. A new wave of digital intelligence technologies, represented by generative artificial intelligence, is accelerating, exerting a profound impact on the logic and form of higher education: on the one hand, the deep empowerment of digital intelligence technologies has transformed the educational logic of universities; on the other hand, data has become a new educational resource, and intelligent algorithms as well as generative models are continuously permeating key dimensions such as knowledge acquisition, learning process management, and educational evaluation, thereby reshaping the fundamental approaches to university teaching. This paper aims to review domestic and international theories and practices concerning university teaching in the era of digital intelligence. On this basis, it outlines potential directions for future development, providing theoretical support and path references for the reform of university teaching.

KEYWORDS

Digital Intelligence Era; Artificial Intelligence; University teaching; Digital intelligence technology.

1. INTRODUCTION

"Digital intelligence" is a compound concept combining digitalization and intelligence. In international academic contexts, terms such as "Digital Era," "Artificial Intelligence Era," and "Smart Society" are commonly used to emphasize a social structure driven by data and characterized by intelligence[1][2][3]. In recent years, it has gradually been introduced into educational research to describe the educational transformation brought about by the deep integration of digital technology and artificial intelligence. Compared with the informatized education at the end of the 20th century, the characteristics of education in the era of digital intelligence lie in the following: First, education is no longer merely the transfer of knowledge assisted by information tools, but achieves real-time monitoring and feedback of the learning process through big data and intelligent algorithms; second, artificial intelligence technology can actively participate in curriculum design, knowledge generation, and personalized recommendations, thereby driving a fundamental shift in learning methods; third, digital intelligence education does not purely pursue efficiency enhancement, but places greater emphasis on the humanistic values and social responsibilities of education[4]. The "Era of Digital Intelligence" is not just a technological label; it signifies an overall reshaping of the educational ecosystem, knowledge structures, and talent cultivation paradigms. As Smith noted, higher education is shifting from a "logic of scarcity" to a "logic of abundance," and the digitization and openness of educational resources compel universities to reposition their functions and missions[5].

However, current university teaching in terms of content, form, and evaluation systems still primarily relies on traditional modes, making it difficult to meet the needs of personalized learning, cross-disciplinary capability cultivation, and compound talent development. It is precisely because of the tension between intrinsic value and technological alienation that the transformation of university teaching in the era of digital intelligence appears particularly complex and critical.

2. RESEARCH AND CURRENT STATUS OF UNIVERSITY TEACHING IN THE DIGITAL INTELLIGENCE ERA

(1) Artificial intelligence and university teaching

Currently, artificial intelligence (AI) is widely regarded as a key force driving the transformation of higher education. An analysis of cutting-edge literature by Crompton et al. reveals that the education sector has become a primary driving force for AI research and its application in university teaching[6]. Relevant research indicates that through paths such as data-driven and algorithmic recommendation mechanisms, the construction of "AI + teacher" collaborative teaching models, and automated evaluation, AI can be widely embedded into the entire process of university teaching, promoting the systematic reshaping of teaching models and functions, thereby achieving an overall leap in educational quality[7][8].

Facing technological development, many universities are actively exploring the application of AI in various aspects of teaching. Harvard University and the University of California have each established AI working groups to coordinate the use of AI in teaching. The University of Michigan has developed a series of AI tools, including UM GPT, which provides access to popular AI models (such as Azure OpenAI, GPT-Image-1, and open-source large language models hosted by the University of Michigan); UM Maizey, which allows faculty and students at the University of Michigan to provide custom datasets, enabling users to extract valuable insights and gain deeper knowledge; and the UM GPT Toolkit, designed for those who need full control over their AI environment and models. Peking University, Tsinghua University, Zhejiang University, Central China Normal University, and others have all established their own AI tool platforms. Among them, Peking University's "PKU Inquiry" platform uses locally deployed, full-version DeepSeek R1 and V3 as the underlying models connected to the campus portal system, featuring functional components such as a "Math Problem Solving Assistant" and a "Code Solution Assistant". On September 28, 2023, Tsinghua University officially launched the "Tsinghua University Artificial Intelligence Empowered Teaching Pilot Course Work Plan," using its self-developed multimodal large model GLM as the technical foundation to build an all-weather instant feedback platform. This platform can realize automatic knowledge point extraction based on provided materials and has created an AI teaching assistant system, through which students can input relevant requirements and interact with intelligent assistants in real-time to receive course tutoring.

In terms of automated evaluation, the University of Birmingham uses Graide, an AI-driven grading and feedback tool, which has significantly improved the efficiency of formative learning assessments[9]. Many universities are also committed to using automated evaluation to facilitate teacher growth; for example, Bolton College has developed the chatbot Ada and the assessment platform FirstPass to achieve real-time classroom interaction feedback and support students and teachers in addressing open-ended questions through formative evaluation[10]. Stanford University developed the "M-Powering Teachers" project, providing a dynamic platform based on machine learning for automatic course feedback, personalized support, and continuous improvement research, aimed at promoting teachers' professional growth and efficiency. Peking University has also built an AI-assisted physical education system, AIPE, which uses smartphone apps and wearable devices for motion monitoring, applies AI techniques and methods such as pose estimation and machine learning to physical movement evaluation, and has developed an intelligent physical movement evaluation system. Research confirms that automated feedback helps improve teachers' instructional effectiveness in both virtual and traditional teaching environments[11][12].

(2) Big data and learning analytics

Big data and learning analytics technologies represent another crucial topic in university teaching research. Research demonstrates that through the systematic collection and analysis of learning process data, learning analytics can achieve the prediction of students' academic performance. On this basis, it supports academic situation diagnosis, learning warnings, course improvement, and personalized learning recommendations, thereby providing data support for the optimization of university teaching[13]. At the same time, big data technology is also expected to break through the technical bottlenecks that exist in China's university teaching evaluation standards[14]. However, on the other hand, learning analytics systems face issues such as difficulty in cross-disciplinary portability, narrow informational output ranges, and single data sources[15].

In terms of practice, Purdue University’s "Course Signals" project predicts students' academic risks through learning data, significantly improving student passing rates[16]. Many universities, including Georgia State University and the University of Murcia, have applied similar early warning systems. A systematic review by Papamitsiou et al. indicates that learning analytics has been widely applied in areas such as learning prediction, real-time feedback, and course optimization[17]. With the rapid development of AI, integration with AI has become an important evolutionary path for learning analytics technology. The School of Intelligent Science and Engineering at Harbin Engineering University collects learning behavior data through big data and knowledge graph technologies, analyzes needs and learning trajectories, and comprehensively and accurately evaluates students' learning and development status. Concurrently, models trained on large-scale data are utilized for intelligent decision-making to formulate more scientific and effective teaching strategies and curriculum arrangements. Peking University comprehensively utilizes AI technologies such as big data mining, natural language processing, and multi-channel human-computer interaction to design a web-based student intelligent evaluation and tutoring system, which can achieve personalized intelligent tutoring for students through online big data mining[18]. Technological advancements have also made the implementation of large-scale learning analytics possible. The "National Smart Education Public Service Platform" developed by the Ministry of Education in 2022 has further promoted the integration and utilization of large-scale learning data. This platform not only provides teaching resources but also accumulates a vast amount of students' learning behavior data, creating conditions for learning analytics and teaching improvement.

(3) Educational modes and technology enhancement

With the rise of the Fourth Industrial Revolution and sustainable development issues, foreign scholars have proposed the concepts of "Education 4.0" and "Education 5.0". As a response to the development needs of Industry 4.0, Education 4.0 emphasizes the deep integration of humans and technology, and highlights the cultivation of cross-disciplinary capabilities and industrial adaptability, requiring university teaching to strengthen practice and innovation[19]. On this basis, relevant scholars have further proposed the concept of Education 5.0, advocating for relying on new technologies to build a more pervasive, participatory, and adaptive learning ecosystem, strengthening collaborative learning and personalized support, and incorporating ethical and humanistic care into the technological framework, while emphasizing human-machine symbiosis, sustainable development, and educational equity at the macro level of social transformation[20]. Relevant research suggests that Education 4.0 poses a challenge to the traditional class teaching system, while Education 5.0 further emphasizes the fusion of technological empowerment and humanistic leadership, promoting the formation of a new teaching paradigm that combines autonomy, collaboration, and technological support. However, in reality, university teaching reform remains relatively lagging, and the classroom, as the main battlefield of teaching, has not achieved a structural breakthrough. As a result, the academic community has proposed using research-based teaching and multi-dimensional classrooms as breakthroughs to create open classrooms empowered by digital intelligence by reconstructing the concepts of knowledge and learning.

Facing these changing trends, new forms of universities have emerged, and traditional universities are also actively transforming to respond. The Olin College of Engineering and Minerva University are representatives of the former: in terms of campus size, Olin College is only about 70 mu, while Minerva University does not have a university campus in the traditional sense, as its campus consists only of a headquarters building and several overseas bases; in terms of enrollment, their student numbers are extremely small; in terms of teaching mode, they both implement a "learning-centered" approach. Taking Minerva University as an example, although it adopts an all-online teaching model, due to highly efficient classroom interaction and the application of technologies like the flipped classroom, it does not suffer from the defects of most MOOC platforms. Specifically, students' speaking time is recorded, and the system automatically reminds students with insufficient word counts, while the real-time evaluation mechanism reinforces feedback. On the other hand, Minerva places students in a globalized environment through global rotation programs, and continuously provides feedback on learning effectiveness through a networked active learning platform, implementing dynamic adjustments and adaptations to achieve global immersive learning[21].

As for traditional universities, Queen Mary University of London applies the AR headset HoloLens in chemistry classrooms to build an immersive learning environment, while using Microsoft Teams and Mentimeter tools to enable students to participate in experiments remotely through holographic imaging and virtual reality technology, which not only significantly enhances the learning experience but also reduces inequalities caused by differences in learning backgrounds. Deakin University, on the one hand, has created a content-rich, personalized online learning community that includes competency certification, and on the other hand, has constructed a virtual learning platform to build an immersive learning arena through XR technology, achieving highly realistic reconstruction of learning and working scenarios[22].

In China, the Ministry of Education launched the "Virtual Simulation Experimental Teaching Project" in 2018, encouraging universities to widely apply virtual reality and AI technologies in engineering, medicine, and science experiments. Tsinghua University utilizes digital twin technology to conduct online-offline integrated hybrid teaching, expanding both depth (utilizing data to enhance real-time synchronized interaction) and breadth (promoting the integration of domestic and international resources) on the basis of constructing a comprehensive integrated teaching system. Its Circuit Principles Virtual Faculty Research Section, based on MOOC and SPOC platforms and supported by technologies such as the Internet of Things, big data, and cloud computing, conducts online-offline blended teaching for student groups, while carrying out collaborative teaching research for teacher groups[23]. Relying on the bandwidth improvement brought by 5G technology, Zhejiang University has established a web-based school operation space centered on knowledge graphs and integrating smart classrooms, the "Study at ZJU" teaching platform, and the ZJU Cloud Classroom into an intelligent teaching space; it has also constructed a multi-dimensional intelligent teaching evaluation indicator system centered on student growth, forming a teaching innovation system that supports the whole process, online-offline integration, and intelligent evaluation.

In addition, a group of new-type research universities, including Southern University of Science and Technology, ShanghaiTech University, Westlake University, and Fuyao University of Science and Technology, have also emerged in China. Their prominent characteristics are small scale, high starting points, an emphasis on scientific research and internationalization, and the cultivation of cross-disciplinary comprehensive capabilities through multi-disciplinary fusion. Among them, Fuyao University of Science and Technology plans to implement continuous undergraduate-master-doctoral cultivation, emphasizing cross-college and international cultivation, allowing students to obtain dual degrees from both Fuyao University of Science and Technology and prestigious overseas partner universities upon graduation. The university also achieves refined teaching and research guidance through small-class systems and heavily funded scientific research platforms, and co-builds deep integration of industry and education with enterprises such as the Fuyao Group.

(4) Educational values and ethical reflections

As digital intelligence technology gradually becomes embedded in the university teaching process, reflections surrounding educational values and technological ethics have also become crucial research topics. The academic community generally points out that the application of digital intelligence technology in university teaching carries the risk of over-technologization. Relevant studies suggest that over-reliance on digital technology may compress students' subjective space, weakening their critical thinking and independent judgment capabilities; if university teaching overemphasizes data output and learning performance indicators, educational activities may be reduced to a production process of calculable and quantifiable results, thereby deviating from the intrinsic mission of promoting subject generation and character development[24]. Therefore, scholars advocate maintaining a cautious attitude during the process of technology application, guarding against the tendencies of "technological determinism" and "pure technologization," and avoiding simply equating educational issues with technical problems while neglecting their social and value-oriented nature[25].

At the level of concrete practice, the ethical risks brought about by generative artificial intelligence and learning analytics technologies are gradually manifesting. On the one hand, although the widespread application of generative artificial intelligence in academic writing and problem solving has enhanced learning convenience, it may also trigger problems such as the weakening of academic integrity, knowledge dependence, and cognitive outsourcing. Relevant surveys indicate that generative artificial intelligence has become an important tool for university students' daily learning, but some students have expressed concerns regarding the unfair advantages it may bring. On the other hand, learning analytics and data mining technologies involve the collection and processing of large-scale learning behavior data; if explicit boundaries and transparent mechanisms are lacking, they may trigger issues such as privacy leakage, data abuse, and algorithmic bias. The risk of "labeling" driven by algorithms may also lead to stereotypes and algorithmic bias against individuals, thereby amplifying unfairness within the teaching process.

Furthermore, the process of digital intelligence transformation may exacerbate the differentiation of educational resources at the institutional level. Research points out that significant differences exist among different universities regarding funding, platform construction, and technical capabilities; high-quality universities can more easily leverage technological advantages to improve teaching quality, whereas universities with relatively insufficient resources may be further marginalized during the technological transition. Concurrently, new "digital divides" may form within the teacher community due to differences in digital literacy, impacting their professional autonomy and classroom leadership[26].

In response to the aforementioned problems, an increasing number of universities have begun to establish regulations for the use of generative artificial intelligence and data governance frameworks, emphasizing privacy protection, data security, and compliant applications in an effort to strike a balance between technological innovation and ethical regulation. For instance, the University of Michigan stated that it will prioritize the privacy and safety of all members of the University of Michigan community, and institutions such as Zhejiang University, Shanghai Jiao Tong University, East China Normal University, and Beijing Normal University have all issued guidelines for the use of generative artificial intelligence. However, existing institutional arrangements remain in the exploratory stage, and institutional gaps still persist in areas such as the definition of data sovereignty, algorithm transparency, and accountability mechanisms[27].

3. THE LANDSCAPE OF UNIVERSITY TEACHING IN THE DIGITAL INTELLIGENCE ERA

University teaching in the Digital Intelligence Era has entered a stage of profound transformation driven jointly by educational philosophies, technological empowerment, and institutional innovation. It is evolving into an open and generative system jointly constituted by humans, intelligent technologies, and data. Within this emerging system, digital intelligence technologies permeate the entire teaching process, giving rise to a new landscape characterized by deep technological integration, diversified pedagogical transformation, reconstructed educational roles, and continuous reflection on educational values and ethics.

From a technological perspective, artificial intelligence, learning analytics, big data, and virtual simulation technologies have become deeply embedded throughout university teaching. Intelligent tutoring systems provide personalized guidance and automated feedback; learning analytics platforms continuously monitor and analyze students' learning processes; and virtual learning environments transcend temporal and spatial constraints by recreating authentic learning scenarios. Technology has therefore become one of the most dynamic driving forces behind teaching reform, continuously promoting greater intelligence, personalization, and immersion in university teaching.

In terms of pedagogical models, the traditional instructional paradigm is gradually giving way to more flexible and diversified forms of learning. Blended learning has dissolved the physical boundaries of conventional classrooms, while flipped classrooms and project-based learning relocate knowledge transmission outside class and devote classroom time to collaborative inquiry and higher-order problem solving. Digital platforms facilitate interdisciplinary curriculum integration and the reconstruction of knowledge systems, whereas emerging educational formats—including massive open online courses (MOOCs), micro-credentials, and micro-majors—provide increasingly diversified learning opportunities. Together, these developments foster an open educational ecosystem that transcends spatial and temporal limitations, responds to individual learning needs, and emphasizes competency development.

The roles of educational participants are also undergoing fundamental transformation. Teachers are shifting from knowledge transmitters to learning designers and facilitators, with their core responsibilities centering on designing human–AI collaborative learning experiences, orchestrating higher-order thinking activities, and providing the humanistic guidance that intelligent systems cannot replace. Meanwhile, students are transitioning from passive recipients of knowledge to autonomous learners who develop self-directed learning capabilities and competencies for human–AI collaboration through personalized learning pathways supported by intelligent technologies. These transformations have given rise to a new tripartite educational relationship among teachers, students, and intelligent agents, in which all participants continuously redefine their respective roles within a dynamic and collaborative learning community.

Finally, increasing attention has been devoted to the ethical and value-related implications of technological advancement in higher education. The tension between education's fundamental mission of fostering holistic human development and the instrumental rationality embodied in standardized, technology-driven approaches has become increasingly apparent. Ethical concerns surrounding big data analytics and generative artificial intelligence—including technological alienation, privacy infringement resulting from extensive data collection, threats to academic integrity caused by the misuse of generative AI, and issues of educational equity in digitally intelligent environments—have become central topics of scholarly discussion. These challenges have stimulated further theoretical reflection on educational values and AI ethics, prompting universities to pursue a balanced integration of technological rationality and value rationality throughout the ongoing process of digital-intelligence transformation.

4. FUTURE OUTLOOK FOR UNIVERSITY TEACHING IN THE DIGITAL INTELLIGENCE ERA

(1) From technological empowerment to intelligent symbiosis

Although contemporary university teaching has become deeply embedded within ecosystems of artificial intelligence and big data, technology is still primarily employed as an auxiliary tool for instruction. The future of university teaching should move beyond this instrumental perspective toward an educational paradigm of intelligent symbiosis. Within this vision, technology is no longer regarded as an external support for teaching but as an intrinsic component of the educational system, serving as a mediating presence between teachers, students, and knowledge. Consequently, teaching is transformed from an activity dominated by a single actor into a multidimensional interactive system jointly constituted by humans, intelligent technologies, and data.

An educational ecosystem characterized by intelligent symbiosis can be understood through the integration of three complementary dimensions. First, it entails the integration of human intelligence and artificial intelligence. Rather than existing in a hierarchical relationship of substitution or dependence, the two forms of intelligence complement and reinforce one another through continuous interaction, forming a dual-centered cognitive system that enhances both instructional effectiveness and creative knowledge generation. Second, it seeks to integrate collective educational objectives with individualized development. By establishing a dynamic balance between standardized educational goals and personalized learning pathways, university teaching can simultaneously respond to the demands for talent cultivation in the era of new quality productive forces while fostering the comprehensive and differentiated development of every learner. Third, it advocates the integration of technological rationality and value rationality. Value rationality should guide the application of technological rationality, ensuring that educational values remain central throughout the deployment of intelligent technologies. Through continuous dialogue between technological logic and the educational mission, university teaching can achieve a dynamic equilibrium that combines efficiency with humanistic care, enabling technology to consistently serve the fundamental purpose of education rather than overshadow it.

In essence, university teaching in the Digital Intelligence Era should not be understood merely as a digital enhancement of traditional instruction. Rather, it represents a comprehensive transformation of educational philosophy, learning paradigms, and governance structures. Its ultimate vision is an educational model characterized by human–AI co-intelligence, the integration of physical and virtual learning environments, intelligent governance, the convergence of education and scientific innovation, and the coordinated cultivation of moral character and professional competence. Such a model embodies the transition from technological empowerment to intelligent symbiosis, where technological advancement and humanistic values evolve in mutual reinforcement.

(2) Intelligent collaborative classrooms: reshaping and reconstructing teaching relationships

A defining characteristic of future university classrooms will be human–AI co-teaching and collaborative knowledge generation. As artificial intelligence continues to advance, intelligent pedagogical agents will evolve from passive instructional assistants into proactive partners that actively support teaching and learning. Consequently, the tripartite relationship among teachers, students, and intelligent agents will no longer be organized within a hierarchical structure but will instead develop into an open learning community sustained through continuous interaction and collaboration.

Within this emerging classroom paradigm, AI systems will automatically recommend learning resources based on learners' profiles and generate personalized learning pathways in real time, thereby enabling adaptive instruction tailored to individual learners. Teachers will assume the roles of learning designers and facilitators, responsible for orchestrating instructional strategies, guiding in-depth academic discussions, and providing emotional support, inspirational guidance, and ethical judgment-areas that remain beyond the capabilities of artificial intelligence. Meanwhile, students will evolve from passive recipients of knowledge into active participants and co-creators of learning. Supported by intelligent learning platforms, they will engage directly in knowledge generation and continuous learning feedback while devoting greater attention to critical thinking, creative knowledge production, and complex problem solving.

Such an instructional model will establish a three-dimensional pedagogical framework characterized by human–AI collaboration, data-driven decision-making, and affective support. Within this framework, students genuinely become the central agents of their own learning, realizing a learner-centered educational philosophy in its fullest sense. Accordingly, the teaching process will no longer consist of a linear transmission of knowledge but will evolve into an open, adaptive, and continuously evolving system in which teaching, learning, and intelligent technologies co-develop through ongoing interaction.

This transformation represents not merely an innovation in classroom organization but a fundamental reconfiguration of educational relationships. Human intelligence and artificial intelligence will jointly participate in knowledge creation, instructional decision-making, and learning support, fostering a more collaborative, responsive, and generative educational ecosystem. Rather than replacing teachers, intelligent technologies will augment human expertise and creativity, enabling university classrooms to evolve into spaces where knowledge is collaboratively constructed, intelligence is collectively cultivated, and learners achieve holistic development through sustained human–AI collaboration.

(3) Ubiquitous learning spaces: dissolving and reconstructing the boundaries of learning

Future university teaching will no longer be confined to physical classrooms or fixed schedules but will instead embrace the principle of learning anytime and anywhere through ubiquitous learning environments. With the continued advancement of virtual simulation, extended reality (XR), digital twins, and related technologies, learning spaces will evolve from isolated physical settings into integrated knowledge networks that seamlessly connect physical and virtual environments. This transformation will be characterized by three key developments.

First, digital twin campuses will become an integral component of higher education. Through a wide range of interactive devices-including wearable technologies, smartphones, and personal computers-students will be able to access immersive virtual learning environments where they can conduct replicated laboratory experiments, participate in simulated projects, and collaborate remotely with peers and instructors. Learning will thus transcend the spatial limitations of traditional campuses and become truly borderless. Second, immersive learning environments will facilitate a deep integration of knowledge acquisition and experiential learning. Supported by intelligent learning spaces that combine physical and virtual realities, learning activities will shift from passive observation and information reception toward active experience, exploration, and knowledge creation. Through multisensory engagement, learners will construct richer cognitive experiences, deepen conceptual understanding, and strengthen the connection between knowledge and authentic practice. Third, intelligent learning companions will function as learners' cognitive extensions. Continuously available to respond to individual learning needs, these intelligent systems will record learning trajectories, behavioral preferences, and competency development over time. Based on these data, they will provide personalized learning planning, adaptive instructional support, and lifelong learning services, thereby enabling learners to receive continuous guidance throughout their educational journeys.

As learning spaces are fundamentally reconfigured, the traditional boundaries of learning will gradually dissolve. Universities will evolve from being primarily physical institutions into nodes within interconnected knowledge networks, supporting dynamic learning communities that transcend temporal, spatial, and disciplinary boundaries. Consequently, university teaching will shift from closed and static instructional environments toward open, fluid, and continuously evolving ecosystems, where learning occurs across multiple contexts and is sustained through ongoing interaction among learners, knowledge, and intelligent technologies.

(4) Industry-education integration: reconstruction of the knowledge innovation ecosystem

University teaching in the future will serve as a critical component of knowledge production and practice. Driven by digital-intelligent technologies, the knowledge generation mechanism will dissolve the boundaries between teaching and practice, allowing industry and education to advance symbiotically within the same knowledge ecosystem. Diversified talent cultivation will be implemented in boundary-breaking scenarios, ultimately realizing in-depth integration of industry and education.

Specifically, teaching content will be dynamically updated. AI systems can flexibly adjust teaching content in line with industrial practices to ensure teaching aligns with the forefront of practical development. The teaching process will evolve into "generative learning": students and teachers will jointly immerse themselves in real production scenarios via technologies including virtual simulation and extended reality (XR), where they raise questions, devise solutions and deliver outcomes with AI support. The evaluation system will also transition from static assessment to continuous comprehensive evaluation, with a focus on the output of creative achievements. An indicator system will be built based on practical demands, and intelligent teaching agents will generate comprehensive performance profiles of learners, thereby delivering a true evaluation of learners in real-world contexts.

This teaching model, which delivers instruction at the very site where knowledge is generated, infuses teaching with vitality by integrating learning with knowledge practice. Furthermore, it fosters innovation through the heterogeneous combination of the two, positioning teaching as a new cornerstone of knowledge innovation.

(5) Intelligent governance: a key direction for institutional innovation

Future university teaching governance entails not only the construction of technical systems, but also the reconstruction of institutional logic. With the widespread application of learning analytics and generative AI, teaching management is shifting from experience-based decision-making to data-driven decision-making, and future teaching governance will take the co-governance of "intelligence + ethics" as its fundamental framework.

At the technical level of governance, an intelligent decision-making mechanism based on big data should be established. Through learning analytics platforms, intelligent agents can dynamically monitor the operation status of teaching, conduct real-time analysis and issue proactive warnings. On this basis, administrators can evaluate course quality and learning outcomes to realize the scientific allocation and adaptive adjustment of teaching resources. Data will thus become an important basis for teaching improvement and policy formulation.

At the ethical level of governance, a multi-level system of technical ethics and data security should be put in place. Universities shall set up dedicated digital-intelligence ethics departments to supervise the scope of AI application, the boundaries of data collection and the fairness of algorithmic outcomes, so as to prevent algorithmic discrimination and academic misconduct. Meanwhile, the awareness of data sovereignty among teachers and students shall be strengthened, and a traceable and accountable governance framework for teaching data shall be established. More importantly, the goal of intelligent governance is not to replace human judgment with algorithms, but to achieve resonance between algorithmic rationality and educational rationality - technology improves efficiency, institutions ensure fairness, and educational values uphold humanistic care.

(6) Return of Educational Values: The Symbiosis of Technical Rationality and Value Rationality

The continuous expansion of technology requires education to re-establish a human-centered spiritual stance. The value focus of future university teaching should shift from a "technology-led" orientation back to "value infusion", realizing a reawakening of the inherent essence of education.

In an ideal teaching ecosystem, technological development must serve human growth and social progress, and the ultimate value of technology will be embodied in unleashing the creativity of both teachers and students. University teaching should strengthen students' subjective consciousness and moral judgment through humanistic guidance, so that learning goes beyond the expansion of "cognitive knowledge" and extends to the practice of "goodness" and the experience of "beauty". Furthermore, university teaching will place greater emphasis on cultivating competencies irreplaceable by AI, such as critical thinking, empathy, and cross-boundary innovation capabilities.

Therefore, digital-intelligent transformation is not the end of educational humanism, but its extension. The future of university teaching does not lie in how precise algorithms can be, but in whether technology can be leveraged to better understand, respect and help individuals fulfill their potential. The balance between technical rationality and value rationality is precisely the spiritual fulcrum for the sustained and sound development of university teaching.

5. CONCLUSION

University teaching in the digital-intelligent era is undergoing a profound transformation. On the one hand, emerging technologies represented by big data and artificial intelligence have unlocked unprecedented possibilities for differentiated support, human-machine intelligent collaboration and data-driven optimization in university teaching. On the other hand, university teaching still faces a multitude of challenges at the technical, conceptual and institutional levels.

The future reform pathway of university teaching should uphold the dual emphasis on technological empowerment and value guidance, advance institutional innovation and categorized development in parallel, and integrate international dialogue with local practice. Driven by joint efforts across theoretical, technical and institutional dimensions, university teaching will truly realize its digital-intelligent transformation. It will not only satisfy the strategic needs of new quality productive forces and Chinese modernization, but also respond to the epochal mission of building a country strong in education and a community with a shared future for mankind.

In other words, the ultimate goal of university teaching in the digital-intelligent era is not the piling up of technical tools. Rather, it is to achieve the full digital-intelligent upgrading of university teaching and give full expression to humanistic values, through human-machine collaboration and digital-intelligent empowerment.

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