

Integrating Medical Humanities Into Medical Education Amid the Digital-Intelligence Era: A Three-Dimensional Immersion Training Model for Clinical Postgraduates

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The deep integration of digital-intelligent technologies with clinical medicine has drastically improved diagnostic and therapeutic efficiency. Nevertheless, the concomitant phenomenon of technological alienation widens the divide between technical proficiency and humanistic literacy in medical talent training. Existing studies fail to fully respond to the contextual characteristics of the digital-intelligence era, and most attempts to integrate medical humanities remain superficial and fragmented. This study constructs a theoretical framework dubbed the “Three-Dimensional Immersion Model”, and designs a holistic implementation system covering curriculum construction, social practice, and multi-dimensional assessment on this basis. The results indicate that in-depth integration demands systematic top-down advancement: At the curriculum level, digital-intelligent simulation teaching tools including VR (virtual reality) and AR (Augmented Reality) can generate highly contextualized training scenarios, facilitating the transformation of theoretical humanistic knowledge into standardized clinical behaviors. At the practical level, immersive social projects such as community health services and in-depth engagement with patient support groups enable postgraduates to develop professional ethics rooted in real social contexts. At the assessment level, digital tools can be leveraged to build an intelligent multi-dimensional evaluation system covering individual clinical performance and organizational training environments, forming a data-driven closed-loop training mechanism of “teaching—practice—assessment—optimization”. This research provides a systematic theoretical framework and operable practical roadmap to address the dilemmas of medical humanities education in the digital-intelligence age. It carries prominent theoretical significance and practical reference value for advancing systematic reforms in medical education and cultivating high-caliber clinicians equipped with both sophisticated digital medical capabilities and consistent humanistic care.

Keywords: digital-intelligence era, medical humanities education, postgraduate medical training, simulation teaching, social practice, multi-dimensional assessment

Introduction

As digital-intelligent technologies permeate every link of clinical healthcare, the integration of medical humanities into professional training has become both an inevitable trend and an urgent priority. While digital

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intelligence delivers unprecedented precision and efficiency to diagnosis and treatment, it inadvertently breeds technological alienation between physicians and patients, exacerbating the longstanding tension between “technologically oriented clinicians” and “humanistic clinicians” in postgraduate medical education. This imbalance has evolved into a core bottleneck restricting the comprehensive quality of future medical practitioners. Its root cause lies in the pervasive misconception that humanistic education serves merely as an ornamental supplement to professional medical knowledge and technical training, rather than an indispensable core component of clinical reasoning, scientific thinking, and professional identity shaping for medical learners. As Sir William Osler once warned, medicine stripped of humanistic connotations will sink into the haze of technological fetishism, losing its soul as a healing art.

Prior literature has elaborated on the importance of medical humanities from diverse perspectives and accumulated valuable experience in curriculum design and instructional methods, yet notable limitations persist. On one hand, few studies deeply contextualize medical humanities education within the digital-intelligence era, lacking thorough analysis of both the challenges and empowering potential brought by digital technologies to humanistic training. On the other hand, research targeting clinical postgraduates—an advanced critical training stage—mostly stops at simple parallel or spliced arrangements of humanities and specialized medical courses, without systematic exploration of pathways to realize deep integration across knowledge internalization, behavioral transformation, and value shaping.

Postgraduate clinical education acts as a vital transition bridge between campus theoretical learning and frontline clinical service. The effectiveness of humanistic integration directly determines the warmth of future medical services and the overall professional quality of practitioners, and underpins the sustainable development of medicine in the digital-intelligence landscape. Against this backdrop, there is an urgent need to fill the research gap regarding deep medical-humanities integration and develop innovative context-based practical pathways. This paper argues that the breakthrough lies in reforming training approaches, specifically by constructing a “Three-Dimensional Immersion” integration model to drive holistic innovation in educational philosophy, instructional methodologies and assessment mechanisms.

Internalization of Medical Humanistic Spirit and Its Integration With Digital Simulation Teaching

The internalization of humanistic spirit hinges on highly contextualized, repeatable teaching environments, a demand perfectly addressed by the iterative advancement of digital-intelligent technologies. Medical humanities courses cultivate clinicians’ benevolent minds; cognitive education deepens holistic understanding of patients as whole persons; digital-intelligent simulation teaching reinforces learners’ comprehensive integration capabilities. Together, these three modules enable humanistic spirit to naturally translate into clinical competence. The ultimate training objective is to nurture physicians who master cutting-edge medical technologies while retaining profound compassion, rigorous ethical judgment, and proficient communication skills—capable of coping with the scientific complexity of clinical work, the multidimensional emotional demands of doctor-patient interactions, and emerging ethical and practical dilemmas triggered by digital-intelligent medical applications.

Theoretical Framework and Hierarchical Curriculum System

Medical humanities education for clinical postgraduates in the digital-intelligence era requires targeted, logically coherent instructional design to achieve deep alignment with specialized training and respond to

emerging technology-derived ethical issues. The curriculum system is built upon three mutually supportive, progressively deepening dimensions:

1. Clarifying the essence of medicine and establishing a dialectical medical worldview:

Through seminars covering medical philosophy, medical history, and digital medical ethics, learners are guided to move beyond fragmented knowledge memorization. They analyze the historical evolution and inherent limitations of medical development, dissect the value boundaries and ethical risks of AI (artificial intelligence), big data, and other digital medical tools, and develop reflective critical thinking. This module anchors medicine's fundamental attribute as a human science, and clarifies the necessity of upholding humanistic values amid digital clinical scenarios.

2. Strengthening narrative and communication training to cultivate empathy and relational wisdom:

Interdisciplinary modules of narrative medicine and doctor-patient communication are incorporated, with special focus on emerging scenarios including online consultation standards and humanistic writing of electronic medical records. Training equips postgraduates with competencies to listen to and interpret patients' illness narratives, offsetting the risk of dehumanization brought by over-reliance on technology, and comprehensively boosting patient-centered care capabilities.

3. Consolidating ethical and professional cultivation to internalize value-driven professional identity:

Centered on general medical ethics and supplemented with digital medical ethics content, this dimension runs through the entire clinical rotation and research training process. It guides learners to define clear ethical boundaries for technological application, internalize core professional values such as benevolence, justice, and integrity, and form morally conscious professional identities competent to tackle complex ethical challenges unique to the digital-intelligence era.

Cognitive and Emotional Foundations of Humanistic Internalization

First, educators must establish a holistic “whole-person” cognitive orientation. While digital-intelligent tools can accurately capture objective disease indicators, they cannot replace holistic comprehension of patients' life backgrounds and interpersonal circumstances. Clinicians must situate each patient within their unique life context to achieve complete understanding, avoiding the separation of illness from personal experience caused by overreliance on technical data, and consistently adhere to the patient-centered core principle.

Second, systematic training of emotional awareness and empathy is essential. Digital tools can assist in identifying patients' emotional cues, yet they cannot substitute physicians' innate emotional perception and empathic responses. Clinicians must first recognize and accept their own and patients' emotional states—acknowledging the existence of emotional experiences—as the foundation of effective doctor-patient communication and the core source of human warmth in digital-era medical interactions.

Third, in-depth experiential perception of the meaning of life should be reinforced. Medical knowledge originates not only from textbooks, laboratories, and digital databases, but more profoundly from frontline clinical encounters. Confrontations with life-or-death decisions, suffering, and hope enable clinicians to resonate with the value of life, fostering enduring reverence for humanity even as they master advanced medical technologies.

Innovative Application of Digital-Intelligent Simulation Teaching

Context-rich, repeatable training environments constitute the core prerequisite for humanistic knowledge internalization, and digital-intelligent technologies unlock brand-new avenues to construct such environments.

By developing digital simulation scenarios centered on communication deadlocks, ethical conflicts, and medical resource allocation, and combining VR, AR and other immersive technologies, learners can practice humanistic judgment, clinical decision-making, and reflective thinking under high-pressure, near-real clinical conditions. When paired with traditional standardized patient (SP) simulations and role-play exercises, digital simulation tools deliver integrated training in empathy, ethical sensitivity and communication competence, accelerating the transformation of humanistic theoretical knowledge into embodied, habitual clinical practice.

Deep digital-intelligent integration drives four-dimensional innovation in simulation teaching:

1. Precise, diversified scenario construction:

Simulation models, standardized patients, VR/AR virtual scenes, and digital twin technology enable high-fidelity replication of real clinical environments without exposing patients to risks. Priority is given to developing exclusive scenarios featuring digital medical applications—such as ethical decision-making in AI-assisted diagnosis and conflict resolution in online medical consultations—forming a closed teaching loop of “theoretical learning → digital simulation → reflective optimization”.

2. Low-risk, error-tolerant teaching workflows:

Digital simulation platforms create immersive trial-and-error training spaces. Postgraduates can repeatedly refine clinical decisions and operational procedures without endangering real patients, while alleviating anxiety about practicing humanistic communication and digital technology application, offering a controllable testing ground for knowledge transformation.

3. Synergy of standardized training and personalized tutoring:

Digital systems guarantee uniform teaching content and consistent assessment criteria through standardized design. Meanwhile, big data analytics accurately evaluate trainees’ performance in simulation scenarios, identifying individual deficiencies in humanistic literacy or technical operation, and supporting customized training plans and targeted feedback to realize personalized development within standardized frameworks.

4. Comprehensive, integrated competency cultivation:

Digital-intelligent simulation teaching breaks the limitations of traditional skill-focused training, covering scenarios ranging from basic clinical operations and specialized procedures to humanistic ethical judgment and digital medical tool application. It fosters simultaneous advancement of clinical expertise, humanistic literacy, and digital operation capabilities, precisely matching the competency requirements of clinicians in the digital-intelligence era.

The effective implementation of simulation teaching innovation relies on structured feedback and in-depth humanistic reflection mechanisms. After each simulation exercise, instructors organize systematic debrief sessions that integrate objective digital data (e.g., communication duration, decision-making logic) with trainees’ subjective performance (e.g., empathic expression, ethical reasoning). Debriefing focuses on the effectiveness of humanistic knowledge application, quality of doctor-patient relationship management, and rational use of digital technologies, integrating clinical operations, decision logic, and ethical reflection to drive internal transformation of postgraduates’ knowledge, skills, and professional attitudes. Furthermore, cross-institutional shared digital simulation platforms can be established through joint case library development and inter-university collaborative training, broadening postgraduates’ horizons for humanistic practice and strengthening their capacity to handle complex clinical and technology-related dilemmas.

Digital-intelligent simulation teaching serves as the core carrier to strengthen learners’ comprehensive integration capabilities, enabling iterative practice and feedback covering technical operations, humanistic care,

and ethical decision-making. It acts as a pivotal support for upgrading medical education in the digital-intelligence era, with the fundamental goal of cultivating clinicians proficient in digital medical tools, full of compassion, ethically rigorous and skilled in communication—equipped to navigate medical, interpersonal, and technological complexities, and deliver solid talent support for advancing the Healthy China Initiative.

Social Practice as a Carrier for Integrated Medical-Humanities Training

Well-designed, expanded medical-humanities social practice projects—including community health outreach, narrative life-story research targeting specific patient groups and public health policy investigations—are of vital importance. Within immersive social practice contexts, postgraduates shift their perception of illness from isolated pathological specimens to unique individual patients, and redefine medicine from mere therapeutic techniques to a caring ethical practice. Social practice should become an indispensable developmental stage in clinical postgraduate training, allowing learners to identify social determinants of health, experience diverse roles within the healthcare system, and practice patient-centered ethics in authentic doctor-patient and socio-cultural environments. Beyond extending clinical skill training, it constitutes a core link in shaping professional identity, cultivating social responsibility and building systematic thinking, elevating humanistic spirit from individual empathy to collective social commitment.

Cultivating Professional Ethics Rooted in Social Reality

Social practice delivers deep realization of medical-humanities integration. During fieldwork, postgraduates step out of the single identity of trainee specialists and take on multiple roles as medical volunteers, active listeners, collaborative partners, and community residents, immersing themselves in the social contexts where illness arises. They observe firsthand how disease is shaped by personal life trajectories, family dynamics, economic status, and cultural beliefs, transforming the biopsychosocial medical model from textbook theory into lived experience, and consolidating the core conviction that “physicians treat people, not merely diseases”.

Core Fields and Targeted Project Design of Social Practice

Social practice provides postgraduates with opportunities to expand clinical skills, nourish emotional perception, and reshape professional identity. Learners validate and enrich abstract medical humanities theories within complex real-world social settings, elevating superficial sympathy to profound empathy and translating abstract responsibility into tangible action—this constitutes the core educational goal of medical-humanities social practice: nurturing health guardians who truly understand life and uphold humanistic care. To achieve this goal, social practice relies on service-oriented, reflective, and educational project frameworks categorized as follows:

1. Grassroots medical service and specialized institution internships:

Postgraduates complete short-term placements in community health service centers, township hospitals, occupational disease prevention stations, mental health rehabilitation institutions, and disability service organizations. They participate in family doctor contracting, chronic disease management, electronic health record establishment, community health education, and group rehabilitation activities, gaining insight into the distribution of medical resources and social drivers of health inequity. Interactions with underserved patient groups including those with mental illnesses and physical disabilities break stereotyped perceptions, foster equal, respectful care, and consolidate postgraduates’ commitment to health equity and social accountability.

2. In-depth volunteer participation in patient support organizations:

Postgraduates conduct long-term volunteer work within disease-specific support groups (for diabetes, cancer, rare diseases, and other chronic conditions). Activities include assisting patient salon meetings, compiling self-management experience archives, and listening to the real hardships of patients and their families. Adopting an insider's perspective of patient communities deepens understanding of shared patient struggles, the value of peer support networks and systemic service gaps, significantly enhancing doctor-patient empathy and prompting future clinical treatment plans to fully incorporate patient lived experience and social support demands.

3. Participatory field research on health-related social issues:

Under faculty supervision, postgraduates conduct small-scale field surveys and oral history interviews focusing on specific social health challenges—such as elderly loneliness and health risks in urban communities, migrant workers' occupational protection, and correlations between regional dietary culture and chronic diseases. This training builds their capacity for social diagnosis, teaching learners to listen to community voices, identify socio-cultural root causes of health disparities, and contextualize cold epidemiological data within vivid personal narratives and structural social factors, cultivating critical thinking and cross-disciplinary medical application capabilities.

Supporting Mechanisms and In-depth Reflection Systems for Social Practice

To avoid superficial, formulaic social practice activities, comprehensive supporting and reflective frameworks must be established:

1. Professional supervision and pre-practice training:

Each practice project is assigned dual-discipline mentors with backgrounds in both clinical medicine and medical humanities/social sciences. Pre-departure training covers operational skills, safety protocols, sociological and anthropological analytical frameworks, as well as basic observation and interview methodologies.

2. Structured continuous reflection procedures:

The core educational value of social practice lies in ideological transformation triggered by on-site experience. Postgraduates are required to maintain ongoing reflection through two channels: keeping field journals to record key events, dialogue excerpts, and personal inner confusion; participating in regular small-group seminars to share practice experiences with peers and mentors, generating multi-perspective dialogue to deepen cognitive understanding.

3. Narrative-based comprehensive outcomes summary:

Instead of rigid standardized research reports, postgraduates submit narrative medicine essays or reflective case analyses integrating field experience, ethical deliberation, and professional clinical analysis as final practice deliverables.

4. Linkage with the overall postgraduate assessment system:

Performance in social practice and the depth of reflective output are weighted components of postgraduates' comprehensive humanistic literacy evaluation. Outstanding practice achievements serve as key criteria for merit evaluation and scholarship selection. Meanwhile, stable collaborative partnerships and bidirectional feedback loops are built between universities and practice institutions.

Construction of a Multi-Dimensional Intelligent Assessment System

The effectiveness of integrated medical-humanities education must be measured and consolidated through scientific, systematic assessment frameworks. In the digital-intelligence era, assessment boundaries extend to all

core clinical practice scenarios, leveraging digital technologies to realize deep integration and dynamic monitoring between educational training and clinical service environments. This paper proposes an intelligent multi-dimensional assessment mechanism that connects university training bases and medical institutions, aggregates multi-source data, and features guiding, formative, and developmental evaluation attributes. By combining formative and summative assessment, quantitative and qualitative analytical tools, and deploying digital platforms and intelligent data analysis, assessment shifts from mere testing of humanistic theoretical knowledge to comprehensive evaluation of core practical competencies including communication skills, ethical decision-making, empathic care, teamwork, and social responsibility. Assessment methodologies integrate intelligent behavioral observation scales, natural language processing analysis of reflective texts, virtual simulation scenario examinations, real-time patient and peer feedback systems, and growth tracking via electronic portfolios. Data fusion and intelligent analysis dynamically capture the developmental trajectory of postgraduates' humanistic literacy. Assessment results are promptly fed back into training workflows through digital platforms and serve as core reference standards for talent evaluation, forming a data-driven closed-loop training system of "teaching—practice—assessment—optimization" to sustainably upgrade educational quality.

Shifting Assessment Focus From Knowledge Mastery to Behavioral and Systemic Dimensions

Assessment priorities require a dual transformation: First, shift toward behavioral outcome evaluation, measuring whether postgraduates can translate abstract humanistic qualities such as empathy, communication competence, and ethical reflection into tangible clinical behaviors and decisions, which can be objectively recorded and identified via digital monitoring tools. Second, shift toward systemic environmental assessment, evaluating whether training and clinical institutional environments supported by information systems encourage and standardize humanistic clinical practice. Accordingly, the complete assessment framework covers two layers: individual postgraduate performance and organizational (department/hospital) training environments, forming a mutually reinforcing closed loop through cross-platform data interconnection.

Embedding Humanistic Performance Assessment Into Institutional Hospital Management

Integrating humanistic care indicators into routine hospital performance appraisal constitutes a core lever to leverage digital tools for shaping systemic humanistic atmospheres and standardizing clinical behavior. Information systems clearly convey the institutional value proposition that humanistic literacy carries equal weight to clinical technical skills, supported by quantifiable, traceable multi-dimensional indicator systems. For instance, validated digital evaluation scales and real-time feedback terminals systematically collect patient and family feedback on communication quality, respect, and emotional support, synchronizing data into departmental and individual performance dashboards. Meanwhile, automatic monitoring and statistical analysis are deployed for process indicators including clinical ethics discussion records, patient preference incorporation in major clinical decisions, and advance care planning (ACP) implementation rates. Internal digital survey platforms assess departmental collaborative atmospheres, institutional attention to staff wellbeing, and humanistic coping strategies for medical disputes. Participation in public health education, free clinics, and medical services for vulnerable populations is also quantified through digital certification and point systems to incentivize social responsibility beyond individual clinical care.

In implementation, hospital management teams coordinate the design of appraisal indicators to guarantee operability, fairness, and positive guiding effects. Information systems enable automatic data collection and visual analysis to avoid excessive administrative burdens and perfunctory evaluation. Ultimately, assessment

results are reasonably linked to departmental honors and resource allocation, forming data-supported institutional incentive mechanisms.

Humanistic Literacy Assessment During Clinical Rotations

Clinical rotation evaluation expands beyond medical record writing and technical operation assessment to systematically examine postgraduates' humanistic performance in interactions with patients, family members, and medical teams, with digital tools enabling precise full-process documentation. Assessment focuses on communication performance in ward rounds, bad news delivery, and informed consent consultations; audio-video analytical technology assists objective evaluation of listening proficiency, explanation clarity, empathic expression, and trust-building capacity. Evaluators also examine learners' ability to identify ethical dilemmas (resource allocation, end-of-life care, patient privacy protection), apply ethical principles for logical reasoning, and participate in standardized clinical decision-making under supervision—relevant cases are incorporated into online ethical simulation and assessment systems.

Rotation assessment prioritizes formative evaluation with multi-source continuous feedback. Daily observational scoring by clinical supervisors is combined with multi-angle feedback from nurses, social workers, and peers via mobile evaluation terminals. Where clinical safety and information compliance permit, standardized patient feedback and affective computing technology serve as supplementary objective evaluation tools.

End-of-rotation comprehensive assessments include humanistic practice evaluation modules, such as ethical conflict case analysis reports or reflective essays on challenging doctor-patient communication scenarios, which may be defended via online platforms. A standardized "Clinical Rotation Humanistic Literacy Assessment Form" is embedded within electronic rotation management systems, featuring clear behavioral indicators, intelligent scoring prompts, and standardized evaluation frameworks to reduce subjective bias and randomness in manual scoring.

Data Integration and Practical Challenges of the Multi-Dimensional Assessment System

A well-functioning multi-dimensional assessment system supports seamless cross-platform data circulation and integration. Hospital-level humanistic performance assessment data are transmitted via data interfaces to evaluate the humanistic training quality of corresponding clinical practice bases. In turn, postgraduates' rotation performance data feed back into the assessment of departmental humanistic environments. University academic administrations and hospital education departments establish regular data sharing and joint analysis mechanisms, leveraging educational big data platforms to identify training deficiencies and iteratively optimize curriculum and practice systems.

The ultimate objective of assessment is to guide clinical postgraduates to internalize humanistic spirit as an indispensable core component of professional identity, and foster a pervasive culture of humanistic care within technology-driven medical institutions. Only a practice-centered, multi-stakeholder participatory, data-supported and continuously optimized assessment system can enable integrated medical-humanities education to take root and deliver tangible outcomes amid digital-intelligent medical transformation.

Conclusion

Integrated medical-humanities education in the digital-intelligence era not only determines the quality and human warmth of future clinical services, but also represents a core initiative to shape physicians' professional identity. By exploring the systematic training pathway of "curriculum immersion—practical cultivation—

assessment guidance”, we can promote thorough internalization of medical humanistic spirit into the professional awareness and behavioral norms of clinicians working within digital-intelligent medical contexts, realizing coordinated development of technological empowerment and humanistic values. This model delivers structural innovation to traditional medical education while marking a profound return to medicine’s essential nature as a human science.

Looking forward, sustained advancement in educational philosophy innovation, instructional methodology reform, and institutional supporting system improvement will ensure medical-humanities integration flourishes amid rapid technological iteration. Ultimately, this training framework cultivates outstanding medical talents capable of navigating complex digital medical technologies, upholding reverence for life, and leading the high-quality development of public health in the new era.

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