

# Research on the Practical Obstacles and Pathways of Cultivating Humanistic Literacy for College Students Majoring in Medical Engineering Integration under the Background of “New Medicine + New Engineering”

Shuangshuang Zhao\*

Yunnan University of Traditional Chinese Medicine, Kunming 650500, Yunnan, China

*\*Author to whom correspondence should be addressed.*

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**Abstract:** In the context of the “Healthy China 2030” strategy and the construction of “New Medicine” and “New Engineering”, higher requirements are put forward for the cultivation of composite talents with both technical ability and humanistic literacy. This article is based on an analysis of the “four major obstacles” in cultivating humanistic literacy—the lack of value rationality, the fragmentation of knowledge systems, the breakage of practical chains, and the fuzzy evaluation criteria. It proposes a three-dimensional collaborative operation mechanism of “knowledge ability value”: constructing a cognitive framework through interdisciplinary integration, strengthening ethical thinking and clinical empathy through ability cultivation. Further research proposes the introduction of ideological and political education to build a value bridge of “benevolence and skill”; Build a three-level curriculum system of “foundation core application” to connect the knowledge barriers of medical engineering; Building an interdisciplinary collaboration platform, relying on social practice and project-based learning to deepen scene immersion; Establish a “quantitative + qualitative” diversified evaluation mechanism, incorporate humanistic literacy into institutionalized assessments, and help cultivate high-quality composite talents who possess both moral and technical abilities.

**Keywords:** Medical engineering integration; Real obstruction; Humanistic literacy; Cultivation path

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## 1. Introduction

Under the policy guidance of the deepening of the Healthy China 2030 strategy and the comprehensive implementation of the Ministry of Education’s “New Medicine” and “New Engineering” construction, the deep integration of engineering technologies such as medicine, artificial intelligence, biotechnology, and big data has become the core trend of contemporary medical development and the transformation and upgrading of the healthcare industry. The cultivation of interdisciplinary and composite talents in medicine and engineering has become increasingly important. At present, the medical model has completed the transformation from the traditional biomedical model to a comprehensive model of biology, psychology, and society. Medical and health services are gradually developing from single disease diagnosis and treatment to full life cycle health protection, which puts higher demands on relevant professionals. Talent literacy

is no longer limited to a single technical ability, and comprehensive qualities such as bioethics, doctor-patient empathy, humanistic care, and professional ethics have become the core evaluation criteria. At the same time, with the rapid development of medical engineering integration, the tendency towards technology has gradually become prominent. In the current talent cultivation system of medical engineering integration in universities, there is a common shortcoming of emphasizing the teaching of science and engineering skills over the cultivation of humanistic literacy, and emphasizing the teaching of professional knowledge over ethical and moral education. This has led students to fall into the cognitive misunderstanding of “emphasizing technology over life”, and many practical difficulties such as algorithm ethics, medical privacy protection, and poor communication between doctors and patients have emerged. It is difficult to meet the demand of modern medical industry for “technically skilled and humanistic” composite high-quality talents. In multiple contexts, strengthening the cultivation of humanistic literacy among students majoring in medical engineering integration is not only an inevitable measure to make up for the shortcomings of existing talent cultivation and implement the fundamental task of moral education in universities, but also a practical need to return to the essence of medicine, prevent technological ethical risks, and build harmonious doctor-patient relationships.

## **2. Four obstacles of humanistic quality cultivation of medical engineering integration major students**

### **2.1. Weak value rationality and lack of humanistic spirit**

Technology education and humanities education are like two wings of a bird, and two wheels of a car, both indispensable<sup>[1]</sup>. The tension between craftsmanship spirit and humanistic spirit, medical holism, dialectical thinking and engineering data, logical thinking is becoming increasingly prominent, and problems such as technology priority and the lack of humanistic spirit are becoming increasingly prominent. In the current era where technological innovation is prioritized, students often overlook the ultimate service object of technology—the embodied understanding of patients, and are rarely guided to reflect on how the “sick body” is, rarely questioning the legitimacy of meaning, the experience of caring for the subject, and ethical constraints. The core of medicine lies in the intersubjectivity and humanistic care in the doctor-patient relationship, but the infiltration and expansion of engineering into the medical field may lead to a value mismatch between the engineering logic of “creation” and the medical humanistic care of “saving lives”, which may lead to the risk of weakening humanistic care<sup>[2]</sup>.

### **2.2. Knowledge gaps and barriers to dialogue**

The two major fields of medicine and engineering have formed clear barriers in terms of knowledge systems, discourse logic, and thinking paradigms. Medicine focuses on clinical context, patient experience, and ethical considerations, while engineering emphasizes model construction, technological implementation, and efficiency optimization. The two lack common cognition and language, leading to a gap in the connection of knowledge systems. In addition, courses related to medicine are mostly elective courses, and there is a lack of core interdisciplinary courses that are organically connected. Students find it difficult to form interdisciplinary disciplinary logic, which makes it difficult for humanistic literacy to take root in the medical field and integrate into the value core of engineering design. Insufficient solidification of disciplinary barriers and cross-border integration make it difficult to truly internalize into students’ comprehensive literacy and value consciousness.

### **2.3. The practical education chain is broken and disconnected, and the scene infiltration is insufficient**

There are multiple difficulties in the teaching of interdisciplinary courses in medicine and engineering, including curriculum and projects, on campus and off campus, engineering and medicine, and the disconnection of training and employment chains. The application of knowledge in practical scenarios is misaligned with the needs of the scenario,

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resulting in a low match between students' knowledge structure and actual ability requirements, and weak conversion ability. Engineering students often disconnect the connection between equipment and medical scenarios, fail to grasp the core principles of clinical application scenarios and diagnosis and treatment basis corresponding to the equipment, and lack a deep understanding of the underlying logical coherence of professional instruments. There are few off campus practice bases, mostly in hospital information departments, with shallow practical depth. Internships often focus on information system operation and maintenance, and there are not many project results that can be summarized or refined. The vague educational goals lead to unclear directions for cultivating core competencies of composite talents, and these skill gaps are ultimately exposed in job interviews, internships, and projects, resulting in unit evaluations: students have weak communication skills, unclear professional expression, and lack of smooth interdisciplinary collaboration.

#### **2.4. The evaluation system is biased and the standards are vague**

The evaluation of talents in universities focuses more on academic indicators and neglects the cultivation of literacy, and emphasizes technical abilities and neglects value guidance, resulting in a lack of clear cultivation goals and quantifiable and operable evaluation standards for humanistic literacy. On the one hand, the evaluation system is overly biased towards scientific research achievements, technical indicators, and engineering implementation under engineering thinking, and lacks institutionalized attention to soft literacy such as medical ethics, professional responsibility, communication and empathy, and humanistic care, resulting in the marginalization and formalization of humanistic cultivation in the training program; On the other hand, the implicit and comprehensive characteristics of humanistic literacy are also difficult to measure with measurable and assessable standards. Teachers have no clear basis to carry out teaching, students have no clear direction to improve themselves, and deep institutional barriers make it difficult to implement the cultivation of humanistic literacy.

### **3. Three-dimensional operation mechanism for cultivating humanistic literacy among students majoring in medical engineering integration**

#### **3.1. The knowledge dimension is the foundation for cultivating humanistic literacy among students majoring in medical engineering integration**

By building a multidisciplinary cognitive system, technical knowledge and humanistic literacy are logically interconnected and mutually empowered in application. In specific implementation, the historical logic, ethical boundaries, and social values of technological development are understood through interdisciplinary curriculum construction, integrated textbook development, and interdisciplinary research. Integrating the evolution of disciplines into the introduction of professional courses, allowing students to see how technology is shaped by society and how it reshapes healthcare relationships in reverse; Integrating 3D modeling into medical aesthetic education, synchronizing technical training with aesthetic training. This cross fusion of knowledge guides students to analyze problems rationally while reflecting on technological applications from a humanistic perspective, understanding "why" and "for whom", and achieving organic unity between professional abilities and humanistic literacy in cognitive structure.

#### **3.2. Cultivating medical engineering talents with technical excellence and humanistic responsibility**

As a carrier for cultivating humanistic literacy among students majoring in medical engineering integration, the cultivation of composite talent abilities aims to go beyond the single standard of emphasizing technology in traditional engineering education, and should also have a progressive ability dimension of ethics, context, reasoning, communication, and competence. In teaching design, a teaching loop of cognitive input, situational activation, reflective internalization, and integrated output can be constructed. Through situational schemata, role insertion, critical thinking, value integration, and other methods, critical thinking training can be carried out in practice, comprehensive practice and cultural immersion can be strengthened, and humanistic nourishment can be integrated into the entire classroom process. Students are not

only proficient in the technical methods of how to do it, but also familiar with “what can be used” and “what can be done”, cultivating compound talents who possess both technical ability and humanistic sentiment, innovative strength and humanistic responsibility.

The value dimension, as the core of cultivating humanistic literacy for students majoring in medical engineering integration, aims to achieve the coordination and complementarity of data, logical thinking, holistic and dialectical thinking, and the integration and symbiosis of craftsmanship spirit and medical compassion. In teaching practice, students should be guided to use engineering thinking to accurately quantify physiological signals, such as quickly completing disease diagnosis and screening through deep learning models; It can also grasp life phenomena with holistic dialectical thinking, while pursuing efficiency in algorithms, it can also be aware of the differences in physiological characteristics and social backgrounds, and solve the dimensional problem of how to “understand the world”; The integration of the spirit of craftsmanship and the compassion of doctors is not a double stacking of professional identities, but rather the value embedding and character cultivation of “medical technology” carrying “human heart” and “compassion” injected into “craftsmanship”. Through value adjustment, doctors transform pure medical technology cognition into a medical philosophy that combines warmth and responsibility. At the same time, they use compassion as a benchmark to calibrate the direction of medical technology application, so that exquisite medical skills always serve the core goal of life and health, solve the problem of how to get along with the world, and encourage students to actively think about “what should be done” in engineering design and technological innovation, internalizing social responsibility into conscious action <sup>[3]</sup>.

## **4. Research on the cultivation path of humanistic literacy for students majoring in medical engineering integration**

### **4.1. Introduce intermediary variables for ideological and political education, and build a bridge between value embedding and character development**

The value dimension, as the core of cultivating humanistic literacy for students majoring in medical engineering integration, aims to achieve the coordination and complementarity of engineering thinking and holistic thinking, and the integration and symbiosis of craftsmanship spirit and medical compassion. Firstly, ideological and political education uses systematic thinking as a link to build a cognitive bridge for medical engineering. There is a methodological resonance between the holistic and dialectical view of traditional Chinese medicine and the data logic and algorithm loop of information engineering. By extracting common thinking paradigms, it helps medical personnel understand the structured support of engineering technology, promotes engineers to grasp the overall needs of clinical diagnosis and treatment, and resolves disciplinary barriers from the cognitive source. Secondly, ethical mutual learning will upgrade the medical ethics of Jingcheng to a cross-border professional standard. On the one hand, it guides engineers to balance precision and humanistic warmth in algorithm optimization, breaking away from the efficiency-oriented approach; On the other hand, it promotes the awareness of technical rigor among medical personnel, establishes a foundation of cross professional trust, and forms a two-way ethical constraint of “technical rationality + humanistic care”. Finally, cultural symbiosis builds an interdisciplinary community culture of “benevolence, refinement, and skill”. Through the triple path of integrating ideological and political education into the curriculum, personalized case teaching, and practical immersion, we integrate the humanistic heritage of traditional Chinese medicine with the spirit of engineering science, cultivate a value consensus of “keeping the original intention with a benevolent heart and fulfilling the mission with refined technology”, achieve a cultural transition from professional opposition to innovative collaboration, and promote the development of interdisciplinary talents in medicine and engineering towards “both virtue and skill”.

### **4.2. Build a three-level curriculum system of basic integration core cross application integration to achieve organic connection of knowledge systems**

At the level of basic integration, courses such as “Introduction to Medical Information Engineering” and “Medical Ethics

and Data Security” are offered, integrating engineering logic and medical scenarios. For example, in the introduction course, students are taught how to transform clinical diagnosis and treatment needs into the development logic of medical information systems, establishing a basic understanding of “medical problems - technical solutions”. Special training on medical digital literacy is also provided, covering medical data collection and organization, digital retrieval of medical literature, explaining the core concepts of medical AI, and the boundaries of AI applications in medical scenarios. This allows students to establish a basic understanding of AI technology applications in advance and lay the foundation for deep learning in the future. At the core cross level, we will add core compulsory courses for medical engineering integration, focus on the core competencies of medical engineering, and offer courses such as “Medical Data Modeling”, “Medical AI Application Ethics”, and “Medical Information System Design and Clinical Adaptation”. These courses will deeply adapt the mastery of medical exclusive modeling, industry AI, and system development technologies to medical clinical contexts, patient needs, and ethical boundaries, filling the gap in knowledge integration. On the application integration level, it pays attention to the integration and innovation of scenarios, and dynamically introduces AI to assist drug design, knowledge mapping to drive the communication and innovation of traditional Chinese medicine culture in the form of academic lectures, thematic discussions, literature intensive reading, etc. to maintain the progressiveness and foresight of the curriculum content <sup>[4]</sup>.

#### **4.3. Build a comprehensive education pattern for all staff, covering multi-dimensional education scenarios**

It is important to establish an interdisciplinary collaboration platform between the School of Medicine, School of Engineering, and School of Humanities, promote the “dual employment and dual cross” faculty sharing, and build a composite team of “management cadres + professional teachers + academic mentors + counselors”. Through collaborative linkage in top-level design, medical ethics, personalized guidance, and practical cultivation, a closed loop of institutional guarantee classroom penetration practical experience personalized guidance is formed. Based on the second classroom, we will carry out cross disciplinary social practice and volunteer service activities in the field of medicine and engineering, such as grassroots medical informationization popularization activities, school enterprise “Three Down to the Countryside” social practice activities, and “Xinqihuang”. Traditional Chinese Medicine Wisdom brand practice activities. We will integrate professional abilities, ideological and political literacy, and professional character into real scenarios of social practice, achieving dual enhancement of skills and value shaping. We will carry out project-based learning (PBL) methods, relying on subject competitions such as “Challenge Cup” and “Innovation and Entrepreneurship Program Training” to develop integrated medical and technological projects, such as “Diannan Herbal Knowledge Graph and Traditional Chinese Medicine Culture Communication” and “Yinling Intelligent Care”, guiding students to integrate humanistic care and social responsibility awareness into understanding practical problems. We also plan to create “Cross border Workshops” and “Medical Engineering Dialogue” peer communities, regularly organize medical, engineering, and humanities majors to participate in design thinking training, social problem research, and other activities, exercise students’ interpersonal communication and communication skills, cultivate students’ cross-cultural communication skills and diverse perspectives <sup>[3]</sup>. Some universities have explored the establishment of “Technology and Humanities Integration Innovation Centers” to explore the dual empowerment of technology and humanities, providing institutionalized resource guarantees and practical platforms for interdisciplinary education.

#### **4.4. Focus on the pain points of evaluation system bias and standard ambiguity, and establish a comprehensive and diversified mechanism for cultivating and evaluating humanistic literacy**

It will be helpful to optimize the elements of the training program, clarify the goals, content, and implementation path of cultivating humanistic literacy, and include soft literacy such as medical ethics, humanistic care, communication and collaboration, and professional responsibility in the same training status as professional knowledge and technical abilities, to eliminate the misconception of emphasizing technology over literacy in training; Innovate the

evaluation criteria elements, establish a “quantitative + qualitative” evaluation system, develop operable and observable evaluation indicators based on the implicit characteristics of humanistic literacy, and include classroom performance, practical participation, ethical thinking, clinical empathy, interdisciplinary collaboration, etc. in the evaluation content; Improve the main elements of evaluation, establish a diversified evaluation mechanism that combines self-evaluation by teachers, enterprise mentors, clinical physicians, students, and peer evaluation, and achieve diversified evaluation subjects; Strengthen the application elements of evaluation results, incorporate the evaluation results of humanistic literacy into the comprehensive quality assessment of students and the effectiveness assessment of teacher education, and force the implementation of humanistic literacy cultivation, forming a comprehensive education loop of “goal implementation evaluation feedback”. And finally, from the institutional level, to solve the problems of formalization and marginalization of humanistic literacy cultivation, and provide institutional guarantees for the implementation of humanistic literacy.

## Disclosure statement

The author declares no conflict of interest.

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