Article

Research on the Core Competence Training System for Health Service and Management Majors in Universities under the New Medical Science Context

Jianhong Xing[1,*]

[1] Hainan Vocational University of Science and Technology, Haikou, China
* Correspondence: Jianhong Xing, Hainan Vocational University of Science and Technology, Haikou, China

Abstract: The construction of the new medical science paradigm emphasizes the comprehensive cross-integration of traditional medicine with engineering, management, humanities, and social sciences. This interdisciplinary approach serves as an essential mechanism to adapt to the Healthy China strategy and to cultivate highly versatile professionals for the rapidly expanding big health industry. As an emerging and highly interdisciplinary field, the health service and management major currently encounters several critical challenges in higher education. These include an unclear positioning of core competencies, insufficient integration between medical and management disciplines, a highly fragmented curriculum system, lagging digital skills training, and relatively weak industry-academia collaboration. Based on the fundamental educational orientation of the new medical science context, this paper systematically defines five essential core competencies required for modern professionals: basic medical services, intelligent processing of health data, health management and operation, health promotion practice, and comprehensive professional qualities. To address existing educational gaps, this study constructs a comprehensive, closed-loop training system encompassing "goals, courses, practice, teachers, and evaluation." Furthermore, it establishes a systematic technical route alongside a multi-dimensional guarantee mechanism, proposing targeted optimization paths for educational reform. Ultimately, this research provides a robust theoretical foundation and valuable practical references for universities seeking to restructure their training models for health service and management talents. By implementing these strategies, academic institutions can significantly enhance students' overall job competence and better adapt to the dynamic development of the global digital health industry.

Keywords: medical education; health management; core competence; talent training; industry collaboration

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1. Introduction

The development of new medical science emphasizes the integration of medicine with disciplines such as engineering, management, and humanities and social sciences. This approach aims to cultivate interdisciplinary medical professionals who can adapt to emerging business models, including digital health, medical care, elderly care, and wellness services [1]. Such efforts align with broader national health strategies that prioritize talent development to meet evolving healthcare demands. Educational guidelines for health service and management programs highlight the necessity of transcending traditional single-discipline frameworks to produce professionals equipped with expertise in medicine, health risk management, institutional operations, and digital technology applications. The rapid evolution of the healthcare industry has significantly increased the demand for interdisciplinary health management professionals in areas such as internet-based healthcare, precision management of chronic diseases, and health insurance services. Despite this, many universities continue to rely on conventional training models that lack sufficient interdisciplinary integration and fail to incorporate robust digital teaching methodologies. This disconnect between academic training and industry requirements often leaves graduates ill-prepared for the practical demands of the healthcare sector. Addressing these challenges requires a comprehensive reconfiguration of the core competency development system within health service and management education, guided by the principles of new medical science. Such reforms are essential for ensuring the high-quality development of this academic field and for meeting the dynamic needs of the healthcare industry.

2. Existing Problems in the Training of Health Service and Management Professionals from the Perspective of the New Medical Science

2.1. Ambiguous Core Ability Positioning and Insufficient Cross-Disciplinary Integration

The training objectives in many universities often lack specificity, offering only broad statements such as "acquiring knowledge in medical and management fields" without clearly defining or structuring the essential competencies required [2]. This results in a curriculum design that primarily combines medical and management courses in a simplistic manner, with minimal interaction or integration between disciplines such as basic medicine, clinical medicine, health management, and health big data. The absence of interdisciplinary courses that focus on areas like medical management further exacerbates this issue. Moreover, the training programs fail to address the critical digital skills emphasized by the evolving field of medical science, such as artificial intelligence, health big data analytics, and the use of wearable medical technologies. Instead, students are primarily trained in traditional health assessment techniques, leaving them ill-prepared for roles in emerging digital healthcare environments, such as internet hospitals and intelligent health centers, where advanced technological competencies are increasingly essential. This gap highlights the urgent need for a more integrated and forward-looking approach to professional training.

2.2. Fragmented Curriculum System and Lack of Ability-Oriented Design

The current curriculum structure is divided into four primary sections: general education, medical foundation, management, and practice. However, these modules lack a coherent and logical connection, resulting in a fragmented system that does not align with a progressive pathway for achieving core competencies [3]. The courses are not designed in a manner that builds upon foundational knowledge to develop advanced skills systematically. Practical courses are predominantly limited to classroom simulations and brief observational visits, which fail to provide comprehensive, project-based training. Essential areas such as chronic disease management across its full cycle, operational strategies for health institutions, and advanced health data analysis are notably underrepresented. Furthermore, the integration of vocational certificates, such as Healthcare Manager, Public Nutritionist, and Health Data Analysis Certificate, with professional courses is minimal. The standards associated with these certificates are insufficient to effectively drive the development of core professional abilities in a reverse manner.

2.3. Single Practice Education Carrier and Insufficient Depth of Medical-Industry Integration

Professional practice bases in the field of health management are predominantly concentrated within hospital health check-up centers, which limits the exposure of students to a broader range of industrial scenarios. Areas such as internet healthcare platforms, elderly care institutions, and health insurance services remain underrepresented in practical training programs. This narrow focus restricts the development of a comprehensive understanding of the diverse applications of health management [4]. Furthermore, university-enterprise collaborations are often confined to the basic provision of internships, with limited involvement of industry enterprises in critical aspects such as curriculum development, practical training design, and the evaluation of teaching outcomes. Additionally, many universities face significant challenges in acquiring advanced digital practical equipment, including health management information systems and big data analysis platforms. This lack of modern technological resources hinders the ability to provide students with robust digital training, which is essential for addressing the evolving demands of the healthcare industry.

2.4. Unbalanced Teacher Team Structure and Weak Cross-Disciplinary Teaching Ability

The composition of the teaching team predominantly consists of professionals with specialized backgrounds in either medicine or management, resulting in a lack of educators who possess integrated expertise across practical medical skills, health management, and digital health technologies. This imbalance hinders the ability to deliver comprehensive cross-disciplinary education, which is essential for advancing new medical science. Furthermore, many university educators have limited practical industry experience, leading to a disconnect between academic instruction and the evolving demands of the healthcare sector. The management system for industry-partnered educators is also underdeveloped, with insufficient mechanisms to ensure standardized teaching practices and long-term sustainability. These challenges collectively impede the development of robust cross-disciplinary teaching frameworks necessary for addressing the complexities of modern healthcare education [5].

2.5. Single Evaluation System and Failure to Implement Outcomes-Based Education

The current assessment framework predominantly relies on final written examinations and course papers, emphasizing the memorization of theoretical knowledge. This approach neglects the incorporation of process-based evaluations that assess practical skills, project execution, and data analysis proficiency [1, 6]. Furthermore, the evaluation process is primarily conducted by university faculty, with minimal involvement from industry professionals or enterprises. This limited collaboration restricts the ability to refine and adapt training programs based on real-world job performance feedback. Such a system fails to align with the principles of modern medical education, which advocate for an outcomes-based approach and emphasize the importance of continuous improvement in educational methodologies and practices.

3. Construction of the Core Ability Framework for the Health Service and Management Major in the Context of the New Medical Science

The core framework for competencies in the Health Service and Management major is constructed based on the foundational principles of the new medical science. This interdisciplinary approach emphasizes the integration of medical engineering, medical management, and medical literature, enhanced by digital empowerment and the fusion of medical education. Through comprehensive industry position research and the application of the Delphi expert consultation method, the professional competencies are systematically categorized into five primary abilities and fifteen secondary abilities. This hierarchical structure ensures a progressive development of skills, addressing a wide spectrum of requirements [7, 8]. These range from foundational service capabilities to advanced management expertise, and from traditional practical operations to the incorporation of digital intelligence, thereby meeting the evolving demands of the healthcare industry.

3.1. Core Competencies of Medical Basic Services (bottom-Level Basic Competencies)

This capability represents a fundamental distinction of the medical profession compared to fields such as business administration and public administration. It serves as the foundation for supporting health assessments, managing chronic diseases, and providing clinical auxiliary services. This competency is divided into three secondary abilities. First, the foundational understanding of medical sciences involves acquiring knowledge in anatomy, physiology, pathology, and nutrition, enabling the identification of common risk factors associated with diseases [9]. Second, the ability to conduct clinical health screenings encompasses familiarity with the diagnostic and treatment principles of prevalent conditions in areas such as internal medicine, surgery, geriatrics, and women's and children's health. This includes performing basic monitoring of physical signs and collecting health-related questionnaire data. Third, the provision of preventive services rooted in traditional Chinese medicine includes skills such as identifying physical health profiles, promoting dietary wellness, and applying traditional rehabilitation techniques. These competencies align with roles in integrated medical-nursing services and traditional Chinese medicine-based health management.

3.2. Core Competencies of Intelligent Processing of Health Data (New Medical Science Characteristic Digital Competencies)

This newly introduced dimension of ability is designed to align with the evolving requirements of digital health and the internet medical industry. It encompasses several critical competencies. First, there is the ability to collect and standardize health data, which involves ensuring the accurate and systematic gathering of information from physical examinations, wearable devices, and electronic health records. Second, proficiency in big data analysis and risk modeling is essential, utilizing tools such as statistical software and programming languages to develop predictive models for chronic disease risks. Finally, the application of intelligent health tools is a key competency, requiring expertise in operating advanced monitoring equipment and cloud-based health management platforms. This includes conducting online health follow-ups and implementing personalized digital plans aimed at enhancing health outcomes through targeted measures.

3.3. Core Competencies of Health Management (Professional Management Core Competencies)

Reflecting the interdisciplinary nature of professional management, this area focuses on roles related to the operation of health institutions and the planning of health industry initiatives. Key competencies include the ability to manage the operations of health institutions, which involves overseeing personnel, controlling costs, and ensuring the quality of services provided by facilities such as health examination centers, community health service centers, and elderly care institutions. Additionally, expertise in health industry planning and marketing is emphasized, encompassing the design of initiatives for health education, health insurance, and the promotion of health care products [10, 11]. Furthermore, a thorough understanding of health policies and relevant legal frameworks is essential, including knowledge of basic medical and health management principles, data privacy protection measures, and strategies to mitigate professional risks.

3.4. Core Competencies of Health Intervention Practice (Position Practical Core Competencies)

Aligning with the essential professional skills required for health management practitioners, this section emphasizes the integration of theoretical knowledge with practical application. First, the ability to conduct health risk assessments is highlighted, which involves identifying and categorizing risk factors for individuals or groups to ensure accurate classification. Second, the capacity to design tailored health improvement plans is underscored, focusing on creating comprehensive strategies that address exercise, nutrition, and psychological well-being for managing chronic conditions, addressing suboptimal health states, and supporting specific populations. Lastly, the ability to enhance collective health outcomes is emphasized, including organizing community health education initiatives, managing follow-up programs for chronic diseases within groups, and implementing public health projects aimed at improving overall well-being.

3.5. Core Competencies of Comprehensive Professional Quality (long-Term Development Support)

Throughout the four-year educational journey, students are equipped with essential skills to support their long-term career development in the medical field. Firstly, they develop the ability to communicate effectively with patients and demonstrate humanistic qualities, including providing compassionate care, fostering understanding, and engaging in health-related education. Secondly, students cultivate innovative scientific research capabilities, enabling them to conduct comprehensive studies in health management, analyze complex datasets, and produce high-quality academic papers. Lastly, they are trained in professional ethics and lifelong learning, emphasizing the importance of safeguarding medical privacy, adhering to ethical standards in health services, and staying updated with advancements in digital health technologies and evolving industry policies. This holistic approach ensures their readiness for sustained professional growth [3].

4. Construction of the "Five-in-One" Core Competency Training System under the Guidance of New Medical Science

With the achievement of the training goals serving as the central focus, a comprehensive "Training Goals - Cross-Course Group - Hierarchical Practice Platform - Dual-Teacher Teaching Team - Diversified Output Evaluation" five-in-one closed-loop training system has been developed. This system ensures a seamless integration of ability objectives, instructional content, practical training, educator support, and quality assessment. By aligning these components, the framework facilitates a holistic approach to competency development, enabling learners to acquire and refine the necessary skills across multiple dimensions. The structure emphasizes adaptability and continuous improvement, ensuring that the training process remains dynamic and responsive to evolving educational and professional demands.

The hierarchical ability training goals are restructured to align with the interdisciplinary focus of new medical science. These goals are designed to support the fundamental task of fostering moral character and cultivating talents, while also addressing the strategic objectives of the Healthy China initiative and the evolving requirements of medical science. During the first year, students concentrate on solidifying their medical foundation and acquiring digital general knowledge, which establishes essential service capabilities. In the second and third years, the curriculum advances to integrate medicine, management, and data, enhancing skills in data analysis and health-related applications [12]. By the fourth year, through on-the-job internships and project-based practices, students develop management operation skills and comprehensive professional literacy, culminating in a well-rounded competence for their future roles. This phased approach highlights key features of new medical science, including the intersection of medical management, the empowerment of digital technologies, and the integration of industry and academia. The framework ensures that learners are equipped with the necessary tools to navigate complex professional environments and contribute effectively to the healthcare sector.

4.1. Build a Modular Cross-Curriculum Group, Precisely Matching Core Competencies

The fragmented course structure is replaced with a modular curriculum system comprising five distinct modules, each tailored to core competencies. The medical foundation module emphasizes the development of essential diagnostic skills and knowledge related to health preservation. The digital health module focuses on the analysis of large-scale data and the application of intelligent health technologies, reflecting advancements in modern medical science. The health management module addresses institutional operations, industry practices, and the understanding of technical guidelines, ensuring a comprehensive grasp of organizational and administrative aspects. The health application module is designed to align with professional certifications, enhancing practical and technical skills. Lastly, the literacy development module fosters interpersonal communication and innovation in scientific research. Instructional methods prioritize case-based and project-based learning, facilitating the seamless integration of academic content with broader educational objectives, including the cultivation of critical thinking and ethical awareness.

4.2. Build a "three-Stage Four-Category" Medical-Industry Integration Practical Teaching Platform, Strengthening Practical Skills

A layered and progressive practice system is essential for cultivating practical skills in medical-industry integration [13]. During the initial years of study, students engage in foundational activities such as basic data collection and health assessment simulation training, utilizing the school's digital training center to build core competencies. As students advance to the second year, their learning transitions to clinical internships and health education initiatives conducted in hospitals and community health centers, providing them with exposure to real-world healthcare environments. The summer vacation period serves as an opportunity for immersive experiences that bridge theoretical knowledge with practical application. In the later stages of their education, students participate in on-the-job internships within internet medical and healthcare enterprises, where they undertake real job project tasks, further enhancing their professional readiness. Concurrently, innovation projects and research investigations are integrated into the curriculum to foster creativity and problem-solving abilities. By aligning training standards collaboratively developed by schools and enterprises with industry requirements, the practical content ensures relevance and applicability, preparing students to meet the dynamic demands of the healthcare sector.

4.3. Build a "in-School + Industry" Dual-Teacher Composite Support System

A cross-disciplinary empowerment mechanism for in-school teachers and a two-way introduction mechanism for enterprise professionals should be implemented to enhance the quality of education and training. In-school teachers can be regularly engaged in industry-sponsored training programs, which will enable them to acquire advanced digital health skills and practical operational expertise [14]. Simultaneously, professionals such as hospital health management experts, data analysts, and senior executives in healthcare operations can be invited to serve as part-time educators. This approach facilitates the formation of interdisciplinary teaching teams that integrate expertise from medicine, management, and digital technology. Such teams address the challenge of single-discipline educators being unable to effectively support the demands of cross-curriculum teaching, thereby fostering a more comprehensive educational framework.

4.4. Establish an OBE-oriented Multi-Comprehensive Evaluation System, Closing the Loop for Training Improvement

To establish a robust evaluation framework aligned with Outcome-Based Education (OBE), a three-dimensional model is proposed, encompassing process assessment, industry assessment, and outcome assessment. The internal process assessment evaluates students' engagement in project assignments, practical training sessions, and classroom performance, contributing 50% to the overall evaluation. Industry practice assessment, conducted by enterprise mentors, focuses on job operation proficiency, service capabilities, and team collaboration, accounting for 35%. The outcome assessment emphasizes measurable achievements such as professional certifications, competition accolades, and scientific research outputs, contributing the remaining 15%. This comprehensive evaluation system enables dynamic optimization of courses, training methodologies, and teacher allocation based on the results obtained. By continuously refining these elements, the system ensures a sustainable improvement loop that enhances the overall quality of training and education.

5. Implementation Guarantee Strategies for the Core Competency Training System in the Context of New Medical Science

5.1. Policy and Institutional Guarantees, Improvement of Professional Overall Planning

Universities utilize dedicated funding allocated for the development of new medical science disciplines to revise training plans for health services and management. These revisions aim to integrate the five core competencies into both the training objectives and graduation requirements. To ensure effective implementation, specialized management systems are introduced to support the construction of interdisciplinary courses, facilitate the reciprocal introduction of educators, and promote collaboration between academic institutions and enterprises. These systems clearly define the roles and responsibilities of departments, hospitals, and health enterprises in fostering cooperative education. Additionally, alignment is established with industry-specific education and training guidelines to ensure consistency and relevance. Regular professional evaluations are conducted to assess progress, and the standards for competencies, as well as course content, are dynamically updated to reflect advancements in the field. This approach ensures that the training system remains responsive to evolving industry needs and maintains high academic and professional standards [1].

5.2. Digital Training Resource Guarantee, Filling the Hardware Shortcomings of New Medical Science

Efforts are being directed toward the establishment of a comprehensive digital health training center equipped with advanced technologies to address the limitations in hardware and offline training scenarios within the field of new medical science. This includes the acquisition of intelligent wearable monitoring devices, health management information systems, and big data analysis workstations, which collectively enhance the infrastructure for medical education and practice. Additionally, online virtual simulation teaching platforms are being introduced to facilitate the development of virtual simulation projects that focus on the full-cycle management of chronic diseases and the operational aspects of internet hospitals [15]. Collaboration with internet medical enterprises further strengthens these initiatives by enabling the creation of a digital teaching resource library, which incorporates real, de-identified health data from industry sources to enrich course training and provide practical learning opportunities.

5.3. Guarantee of the Long-Term Mechanism for School-Enterprise Collaboration, Deepening the Integration of Education and Industry

To ensure a robust and sustainable framework for collaboration between educational institutions and industries, a "school-hospital-enterprise" joint professional council should be established. This council would involve active participation from medical institutions and health enterprises in various critical processes, including the revision of talent training plans, the development of specialized courses, the assessment of practical skills, and the evaluation of graduates. Customized training programs can be implemented to address specific industry needs, such as creating specialized classes focused on Internet-based medical services, integrated medical and elderly care, and other emerging fields [16]. These programs could also provide enterprises with opportunities to offer scholarships, internship placements, and direct employment pathways for students. Furthermore, the establishment of an industry-focused college would enable the joint development of interdisciplinary digital health courses and practical training projects. This approach ensures that educational content evolves in tandem with industry advancements, fostering a seamless integration of theoretical knowledge and practical application.

5.4. Guarantee of Full Coverage of Course Ideological and Political Education, Implementing the Fundamental Task of Fostering Virtue and Cultivating Talents

The integration of medical humanities, public health missions, health ethics, and digital data security into all core courses is essential for fostering a comprehensive educational framework [17]. This approach emphasizes the exploration of practical ideological and political cases, including chronic disease prevention and control, grassroots health services, and the benefits of digital health. During health-related training and hospital internships, there is a strong focus on cultivating professional values such as compassion and a commitment to serving the public. Additionally, professional ethical literacy is incorporated into comprehensive ability assessments to ensure a balanced development of both technical expertise and ideological awareness. This dual cultivation strategy aims to align professional competencies with a deeper understanding of ethical and societal responsibilities, thereby enhancing the overall quality of talent development.

6. Conclusion and Outlook

The construction of new medical science provides an important opportunity to transform the health service and management major from a traditional single-discipline teaching model into a comprehensive educational system that integrates medicine, management, engineering, and the humanities. In response to prominent problems in current professional development, including unclear competency orientation, fragmented curriculum design, insufficient digital teaching support, and incomplete evaluation mechanisms, this study proposes a five-core capability framework and further establishes a five-in-one closed-loop training system composed of targets, courses, practice, faculty, and evaluation. This framework clarifies the logical relationship between training objectives and teaching implementation, strengthens the internal coherence of curriculum and practice, and improves the alignment between talent cultivation and the evolving needs of the big health industry. At the same time, the supporting technical route and multi-dimensional guarantee mechanism enhance the operability, continuity, and adaptability of the model, thereby addressing the long-standing disconnect between conventional educational approaches and the digital, interdisciplinary, and application-oriented development trend of modern health services and management.

Looking ahead, universities may further optimize the weighting and sequencing of competency cultivation according to their institutional orientation, disciplinary strengths, regional service needs, and available educational resources. With the support of information technology, it is also feasible to establish a dynamic database for tracking student competency growth, learning trajectories, practical performance, and developmental outcomes, thereby promoting more personalized, precise, and evidence-based education. On this basis, the training system developed in this study can serve as a practical reference for similar institutions seeking to improve training plans for interdisciplinary new medical science majors. It may also support continuous curriculum reform, faculty development, digital platform construction, and the refinement of quality assurance mechanisms. Ultimately, this model is expected to contribute to the cultivation of high-level, application-oriented, and innovative health management professionals with interdisciplinary literacy, digital competence, and strong practical ability, while also providing sustained support for the modernization of health service systems and the high-quality development of the broader health industry.

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