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Reflections on Competency-Based Curriculum Reform in Master's Graduate Education of Basic Medical Sciences

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Abstract

The cultivation of job competency is a core objective of master's graduate education in basic medical sciences and plays a critical role in students' career development. Curriculum reform is a key strategy for enhancing the quality of graduate education. It not only lays the foundation for training high-caliber medical professionals but also facilitates adaptation to the evolving medical landscape, advances scientific research, and promotes the standardization of medical education. Therefore, by focusing on job competency development, we should establish a curriculum-based training pathway for master's education in basic medical sciences that meets the demands of the new era and aligns with the needs of medical development and public health. This paper presents the reform and implementation of a training model at our university, aiming to provide insights into the improvement of medical graduate education in China and to contribute to raising its overall quality.

Keywords Job competency; Curriculum System Reform; Basic Medicine; Master's graduate Education

1 Introduction

Medical master's graduate education is a critical component of the broader medical education system and is closely tied to the development of China's healthcare undertakings. The *Guiding Opinions of the General Office of the State Council on Accelerating the Innovative Development of Medical Education*(Guobanfa [2020] No. 34) (hereinafter referred to as the *Opinions*)[1] emphasize the need to "be guided by service needs, focus on the development of new medical disciplines, strive to innovate institutional mechanisms, and cultivate research-oriented, interdisciplinary, and application-oriented talents through classified training." The Opinions further state that "by 2030, a higher-level medical talent training system with Chinese characteristics should be established, with significantly enhanced capacity for scientific research and innovation, and a markedly strengthened ability to support healthcare development," thereby providing strong talent support for building a Healthy China and safeguarding public health.

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As basic medicine constitutes the cornerstone of clinical practice, medical research, and the innovation of diagnostic and treatment technologies, basic medical education occupies an irreplaceable role in cultivating high-level, innovative medical professionals[2]. Within this context, master's graduate education in basic medicine serves as a crucial bridge—it not only builds upon undergraduate education but also lays a vital foundation for future professional development. Most graduates pursue careers in universities, research institutes, and healthcare institutions. Therefore, basic medical master's education must not only deepen and expand theoretical knowledge but also focus on cultivating interdisciplinary thinking, scientific research competence, and clinical practical skills, enabling students to meet the professional demands of their future careers.

Job competency refers to the comprehensive demonstration of knowledge, abilities, skills, and personal traits necessary for an individual to perform a specific job[3]. Cultivating job competency is of utmost importance for the career development of master's graduate education in basic medical sciences, primarily manifested in: providing essential professional knowledge and skills to address scientific research and clinical challenges; enhancing scientific research innovation and data processing capabilities; improving clinical operation skills and service levels; and helping students maintain learning initiative to continuously upgrade their knowledge base and practical skills in response to increasingly complex job requirements.

The cultivation of job competency is inseparable from a curriculum system that aligns with the professional demands of master's graduate education in basic medical sciences. An effective curriculum should not only deliver rich theoretical instruction but also provide systematic training in scientific research and data analysis, as well as hands-on practice in laboratory and clinical operations. This enables graduates to strengthen their practical competencies and logical thinking abilities. Therefore, reforming the curriculum system based on job competency is pivotal to advancing the quality of master's education in basic medical sciences.

2 Problems in the Curriculum System of Master's Graduate Education in Basic Medical Sciences

After years of development, the curriculum system for master's graduate education in basic medical sciences in China has gradually improved. However, with rapid technological advancements and evolving societal demands, significant deficiencies remain in the cultivation of job competency.

In terms of course content, there is a widespread tendency in universities to prioritize knowledge acquisition over competency development. Curriculum updates often lag behind emerging needs, and the provision of core competency-related courses—such as those in basic medicine, clinical skills, research methods and design, ethics, and medical law—remains inadequate. In addition, interdisciplinary courses in areas such as artificial intelligence and public health are underrepresented, limiting students' exposure to emerging fields.

Regarding teaching methods, traditional teacher-centered instruction still dominates, while student-centered approaches—such as problem-based learning (PBL) and flipped classrooms—are underutilized. The adoption of intelligent teaching platforms by instructors remains low, and personalized learning pathways have yet to be fully implemented. Furthermore, the disconnection between classroom teaching and clinical practice impedes students' ability to translate basic medical knowledge into clinical reasoning, thereby undermining their development of job competency in real-world medical contexts.

3 Approaches to Competency-Based Curriculum System Reform for master's graduate education of basic medical sciences

3.1 Constructing a Curriculum System Centered on job competency

The curriculum system should be guided by clear training objectives and centered on job competency, ensuring alignment between program requirements and course design. Given that most graduates of master's programs in basic medical sciences pursue careers in universities, research institutes, or healthcare settings (e.g., as university instructors, medical professionals, or researchers), our curriculum emphasizes ideological and political education, scientific thinking, academic integrity, foreign language proficiency, international academic communication, and innovation-oriented practical training.

The curriculum structure consists of the following four modules: (1)Basic Courses: Disciplinary foundation courses that provide essential medical knowledge, and general education courses aimed at fostering comprehensive competencies. (2)Professional Courses: Core courses focused on job-related competencies, supplemented by elective courses covering cutting-edge technologies and interdisciplinary fields. (3)Practical Courses: Experimental and training courses designed to offer hands-on experience, as well as project-based courses that cultivate collaboration, problem-solving, and logical thinking. (4)Career Planning Courses: Modules offering career development guidance and support for professional pathway design.

3.2 Strengthening Curriculum Content Updates and Teaching Method Reform

To enhance the job-oriented nature of the curriculum, our school promotes interdisciplinary integration, streamlines redundant content, and fosters connections between basic medicine and fields such as clinical medicine, bioengineering, and computer science. Interdisciplinary courses—such as *Medical Big Data Mining and Intelligent Diagnostic Technology*—have been developed to broaden students' knowledge base, cultivate integrative thinking and interdisciplinary innovation, and stimulate learning motivation.

To advance internationalization, high-quality foreign curricula have been introduced to strengthen students' global perspective and international competitiveness. The proportion of artificial intelligence modules in core courses has been significantly increased, reflecting the deepening integration of AI and medicine. This includes expanded content on data processing and intelligent analysis, such as hands-on training with AI tools like DeepSeek for scientific research applications.

In terms of teaching methods, case-based learning, flipped classrooms, simulation training, and problem-based learning (PBL) have been introduced to foster student initiative, self-directed learning, and innovative thinking. Blended learning approaches combine online pre-class preparation via MOOC/SPOC platforms with offline seminars, aiming to improve instructional effectiveness. Smart teaching platforms—such as China University MOOC, the National Smart Education Platform for Higher Education, and Yutang—are employed to deliver personalized learning resources, monitor progress in real time, and support a pedagogical shift from instructors acting as "knowledge transmitters" to "facilitators of critical thinking."

Furthermore, virtual simulation technology offers risk-free clinical training environments, helping to compensate for the limited availability of hands-on opportunities in traditional medical education

3.3 Enhancing Clinical Practice Competency of master's graduate education of basic medical sciences

Clinical practice ability is a key component and essential evaluation criterion of job competency in master's graduate education in basic medical sciences. Therefore, strengthening the cultivation of clinical practice skills within the curriculum is an urgent priority.

First, efforts have been made to integrate basic and clinical courses, supported by the establishment of interdisciplinary teaching teams that collaboratively foster student development. Second, clinical teaching

components have been expanded, and closer collaboration between universities and affiliated hospitals has been promoted to provide students with high-quality practical training platforms. These initiatives help students enhance their clinical skills and problem-solving abilities in real-world medical settings.

Third, specialized courses have been introduced to bridge scientific research with clinical practice. These courses emphasize innovative topic selection driven by actual clinical problems and systematically cover all aspects of clinical research, including design, implementation, data collection, and analysis. The goal is to cultivate students' research innovation capacity and their ability to apply research findings to clinical contexts.

3.4 Innovating Assessment Methods

When evaluating master's graduates, the School of Basic Medicine at our university has strengthened the assessment of fundamental knowledge, innovative thinking, problem-solving abilities, and practical skills. Curriculum assessment emphasizes both the learning process and final outcomes, with increased attention to students' in-class performance, self-directed learning outside the classroom, and overall competency development.

A diversified and multi-level evaluation system has been implemented. The evaluation criteria now incorporate components such as medical humanities, ethics, and professional conduct, highlighting the integration of medical ethics education throughout the curriculum. Master's courses are subject to supervisory teaching inspections, with a particular focus on ideological and political elements, as well as the advancement and innovativeness of course content.

Student performance is evaluated through a combination of formative (process-based) and summative (outcome-based) assessments, aimed at capturing students' comprehensive abilities. Process assessment leverages intelligent teaching platforms to track learning trajectories and assess students' mastery of knowledge and skills in real time. In the outcome assessment, third-party expert blind reviews and dedicated medical ethics scoring criteria are introduced to reinforce the integration of research integrity, academic standards, and ethical professionalism.

4 Cultivation Outcomes

The reform was implemented for 57 master's students admitted in 2023. Questionnaire surveys indicated significant improvements in key competency indicators compared to the pre-reform 2021 cohort (with 2022 as a transition year and thus excluded from analysis). Students' overall quality showed marked enhancement (see Table 1). The updated curriculum emphasized medical humanities, ethics, professional conduct, and research integrity; incorporated physical education as a compulsory component with over 10 specialization options; and ensured 100% participation in international courses. These measures collectively contributed to improvements in students' English proficiency and an increased rate of SCI-indexed publications.

Table 1: Comparison of Core Indicators Before and After Curriculum Reform (2021 vs. 2023)

Indicator	**Pre-reform (2021)**	**Post-reform (2023)**	**Increase**
Student Satisfaction	86.5% (45/52)	100% (57/57)	13.5%
Physical Fitness Improvement Rate	48.1% (25/52)	87.7% (50/57)	39.6%
International Course Participation Rate	48.1% (25/52)	100% (57/57)	51.9%
Annual SCI Publications	3.6 papers	5 papers	38.9%

5 Conclusion

Curriculum reform based on job competency is essential for cultivating high-quality, application-oriented master's graduates in basic medical sciences and for improving the overall quality of education. Optimizing curriculum design, updating teaching content, and strengthening clinical practice can enhance students' innovation capacity, practical skills, and global perspective, thereby contributing to discipline development and national health initiatives.

Although the current reform efforts have demonstrated short-term effectiveness, their long-term impact remains to be assessed through broader pilot programs. As a systematic undertaking, curriculum reform requires coordinated efforts from universities, faculty advisors, students, and society. It should incorporate emerging technologies such as artificial intelligence, deepen international cooperation, and continuously refine implementation strategies. Ultimately, the goal is to build a sustainable educational ecosystem for nurturing high-level medical professionals in alignment with China's Health Strategy.

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