

Research on Constructing an Innovative Entrepreneurship Education System for Postgraduates under the Collaborative Education Mechanism: A Case Study of a Medical University

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Abstract

This study takes a medical university as a practical sample to explore the construction path and implementation effectiveness of an innovation and entrepreneurship education system for postgraduates under a collaborative education mechanism. By integrating the resources of universities, enterprises, and hospitals, a closed-loop training model of “theoretical teaching - practical training - achievement transformation” has been established, forming an innovation and entrepreneurship education ecosystem with medical characteristics. The research shows that the system significantly improves postgraduate innovation ability, promotes the transformation of scientific research achievements, and serves the local medical economy. It provides a replicable practical paradigm for the reform of innovation and entrepreneurship education in higher education.

Keywords

Collaborative Education; Postgraduate Education; Innovation and Entrepreneurship; Medical University.

1. Introduction

With the in-depth advancement of the “Healthy China” strategy, the demand for innovative talents in the medical field is growing rapidly^[1]. As the main base for cultivating innovative talents, universities need to break through traditional education models and build a collaborative education mechanism deeply integrating industry, academia, research, and medicine^[2]. This medical university has focused on cultivating the innovation and entrepreneurship capabilities of medical postgraduate^[3], ^[4], ^[5]. Relying on national-level research platforms and clinical resources, it has explored a “trinity” collaborative education model, effectively solving problems such as the disconnection between theory and practice and the inefficient transformation of innovative results in medical education. This paper systematically elaborates on the construction path and implementation effectiveness of the innovation and entrepreneurship education system under the collaborative education mechanism based on the university's practical experience.

2. Construction Path of the Innovation and Entrepreneurship Education System under the Collaborative Education Mechanism

2.1. Innovation in the “Three-Main-Body Linkage” Collaborative Education Model

2.1.1. Establishment of Cross-Disciplinary Dual-Tutor Teams

A cross-disciplinary mentor team of “university academic advisors + enterprise technical experts + clinical physicians” was formed in a ratio of 4:3:3. University tutors build theoretical frameworks (e.g., molecular mechanism research on precision oncology treatment), enterprise experts guide technical transformation (e.g., pharmaceutical engineers optimize drug synthesis processes), and clinical physicians provide case data and efficacy evaluation (e.g., design clinical trials with affiliated hospital physicians). The three parties conduct weekly multidisciplinary case seminars and hold monthly frontier technology workshops, forming a closed-loop training process of “problem proposal - collaborative problem-solving - clinical validation.”

2.1.2. Construction of the “Dual-Base” Practice System

(1) On-campus Innovation and Entrepreneurship Base: A 5,000-square-meter base covering six functional modules: education and training, simulation exercises, project incubation, etc. For example, the “Smart Intraocular Pressure Monitoring Device Development” project completed prototype development in the incubation area and performed market scenario simulation tests in the training zone.

(2) Off-campus Enterprise Training Base: In collaboration with dozens of pharmaceutical companies and research institutions, several thousand internship positions have been provided, implementing a “6-month clinical rotation + 12-month enterprise training” program. The Affiliated Eye Optometry Hospital, as a national demonstration base, receives more than a hundred students annually to participate in practical projects such as the “AI-based Retinal Disease Screening System.”

2.2. Construction of an Integrated Curriculum-Competition-Incubation System

2.2.1. Modular Curriculum Reform

Breaking disciplinary boundaries, a “basic theory + professional skills + innovation practice” curriculum system was built:

(1) General Compulsory Courses: Added “Fundamentals of Innovation and Entrepreneurship,” introducing medical innovation methodologies;

(2) Entrepreneurship Course Cluster: Courses like “Entrepreneurship Management in the Medical Industry” and “Frontiers in Medical-Engineering Cross Technologies” are offered, with CEO invited for lectures and real-case analyses (e.g., commercialization pathways of a medical product);

(3) Practical Courses: Based on project-based teaching, students participate in research projects (e.g., development of degradable coating materials for cardiac stents) to learn by doing.

2.2.2. Hierarchical Discipline Competition Cultivation Mechanism

Established a three-level system of “college-level selection - university-level training - national-level participation”:

(1) Pre-competition Preparation: Enterprise mentors provide one-on-one guidance, such as industrial design experts advising the “Smart Rehabilitation Equipment Development” team;

(2) Competition Participation: Over the past three years, postgraduates have won over a dozen national awards in competitions like the “Challenge Cup” and “Internet+ Competition”; the “Life 'Umbilical' Miracle - Needleless Smart Umbilical Cord Blood Collector” project won the national grand prize;

(3)Post-competition Transformation: Award-winning projects enter the incubation base with up to 200,000 RMB funding support.

2.2.3. Full-Cycle Incubation Support System

Using a “mentor + team + project” model to create a three-stage incubation chain of “atmosphere building - resource support - industrial connection”:

(1)Preliminary Activation: Innovation awareness is stimulated through dozens of entrepreneurship forums and lectures involving over a thousand participants;

(2)Mid-term Support: Provided facilities and technical support to over a hundred projects; for instance, the “New Rehabilitation Robot” project completed prototype development within one year;

(3)Later-stage Transformation: Connected with investors and hospitals; the “AI-assisted Medical Imaging Diagnosis System” received over one million RMB venture capital and was implemented in 10 hospitals.

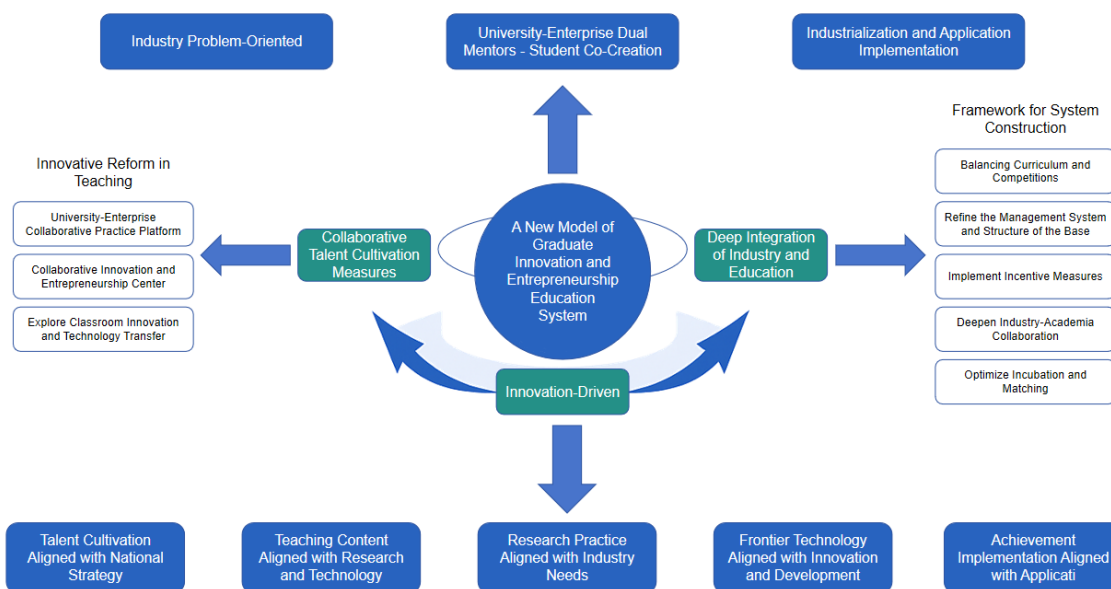


Figure: The Construction Path of the Innovation and Entrepreneurship Education System

2.3. Dual-Drive Mechanism of Technology Transfer and Institutional Innovation

2.3.1. Construction of a Market-Oriented Achievement Transformation Platform

Relying on the university's medical innovation technology transfer platform and utilizing big data to match enterprise needs, 43 research achievements have been successfully transformed. Representative cases include:

(1)AI-Based Fundus Disease Diagnosis System: In cooperation with a certain tech company, the company invested several million RMB, improving diagnostic accuracy from 82% to 95%, With applications in multiple hospitals, the annual revenue is expected to increase significantly.

(2)Scar Repair Silicone Gel: Industrialized in five medical device companies, it increased market share to 20% and promoted technological innovation in the wound healing field.

2.3.2. Institutional Incentive Reform

(1)Mentor Evaluation Mechanism: Revised the “Postgraduate Supervisor Selection Measures” to include “guiding students to win national-level competition awards” and “leading industry-academia-research cooperation projects” as evaluation criteria, partially replacing publication requirements;

(2) Student Evaluation System: Implemented an innovation and entrepreneurship credit recognition system, where participation in research, patent applications, and entrepreneurial practices can be credited. Over 600 students completed academic evaluations through non-thesis formats.

3. Implementation Effectiveness and Social Impact

3.1. Significant Improvement in Talent Quality

3.1.1. Comprehensive Enhancement of Innovation Ability

Over the past three years, several thousand innovative medical talents have been trained. Among over a thousand graduates sent to partner institutions, 30% became technical backbones or clinical department heads. On average, each postgraduate participated in 1.2 research projects. SCI paper publications increased by 25% year-on-year, with dozens of invention patents and software copyrights.

3.1.2. Outstanding Competition Results

The university ranks first among medical universities in the number of national innovation project approvals (over 260) and provincial “Xinmiao Program” projects (over 300). In the China Postgraduate Mathematical Modeling Competition, the number of participants increased from 6 in 2022 to 45 in 2024, with a 200% growth in awards and honors such as “Outstanding Individual in Modeling.”

3.2. Fruitful Outcomes in Industry-Academia-Research Integration

3.2.1. Remarkable Benefits from Technology Transformation

In 2024, the total value of technology transfer contracts reached 150 million RMB, ranking 38th among national universities and first among independent medical universities. Multiple patents, including the “Smart Multimodal Medical Imaging Diagnosis System,” were industrialized, generating several hundred million RMB in economic value.

3.2.2. Deepened University-Enterprise Collaborative Ecosystem

Joint laboratories were built with multiple biotech companies, introducing more than 20 million RMB in R&D funds annually. For example, the “High-Performance Biomedical Materials Development” project obtained four national invention patents, increasing product market share by 15%.

3.3. Enhanced Social Service and Industry Influence

3.3.1. Hosting National Competitions and Brand Promotion

In 2024, the university hosted the National Clinical Skills (Imaging Reading) Competition for Postgraduates of Medical Universities, attracting 32 participating institutions. It won the “Best Organization Award,” and its experience was recognized as an “Outstanding Case of Graduate Education Innovation.”

3.3.2. Demonstrative Effect of Institutional Innovation

The revised “Graduate Degree Application Achievement Recognition Measures,” which incorporate competition awards and patent results into graduation requirements, were adopted by 12 peer universities. Project results were selected by the education authorities as a “Typical Case of Innovation and Entrepreneurship Education Reform” and promoted province-wide.

4. Challenges and Future Prospects

4.1. Current Challenges

(1)Insufficient Depth in Cross-Field Collaboration: Some enterprise mentors lack continuous involvement in teaching; clinical physicians are limited by heavy workloads.

(2)Limited Internationalization: Few joint training programs with overseas institutions; lack of opportunities for students to participate in international competitions and multinational enterprise training.

4.2. Future Directions

(1)Deepen University-Enterprise-Clinical Collaboration: Establish a “mentor credit system” linking enterprise mentor teaching hours and project effectiveness with corporate talent policies; promote a “dual employment system” for clinical physicians to serve as university supervisors.

(2)Expand International Training Channels: Build joint innovation labs with top international medical schools, introduce course resources from MIT and Cambridge, and send students for internships at global medical enterprises (e.g., Medtronic, Johnson & Johnson).

(3)Strengthen Digital Platform Support: Develop a “Smart Medical Innovation and Entrepreneurship Platform” using resources like Wanfang Data, integrating online courses, achievement showcases, and investment matching to improve efficiency and precision.

5. Conclusion

By constructing a collaborative education mechanism among universities, enterprises, and hospitals, this medical university has formed an innovation and entrepreneurship education system with “in-depth theoretical teaching, practical training platforms, and achievement transformation channels.” This project-driven, problem-oriented, and industry-targeted model effectively addresses issues such as insufficient postgraduate innovation capabilities and transformation barriers, offering a benchmark case for innovation and entrepreneurship education in medical universities. Looking forward, efforts should be made to further deepen cross-disciplinary collaboration, expand international perspectives, and enhance digital empowerment to promote higher-quality development and contribute more compound innovative talents to the “Healthy China” strategy.

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