

Research on the Pathways for Enhancing Innovation and Entrepreneurship Competencies of Medical Students under the Background of “New Medical Science”

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ABSTRACT

This study explores the innovation and entrepreneurship education model in medical education under the background of “New Medical Science,” aiming to cultivate interdisciplinary talents that can meet the future healthcare needs. With the advancement of the national innovation strategy, “New Medical Science” emphasizes not only the transmission of professional knowledge but also the development of interdisciplinary integration and innovation capabilities to address the rapid changes in medical technology. A survey was conducted to assess the innovation and entrepreneurship competencies of medical students at Pingdingshan University. The results show that students have a high level of awareness and participation in innovation and entrepreneurship education, yet there is a need to strengthen the integration of skill enhancement with professional knowledge. Based on the survey findings and theoretical foundations of innovation and entrepreneurship, the paper proposes pathways to enhance medical students’ innovation and entrepreneurship abilities, focusing on strengthening faculty development, improving the curriculum system, promoting the integration of specialty and entrepreneurship, and optimizing educational models. These efforts aim to cultivate medical professionals with stronger innovation and practical capabilities, contributing to the realization of the “Healthy China” strategy.

1. Introduction

In 2019, the Ministry of Education of China launched the “Six Excellence and One Top-Notch” initiative 2.0, which introduced the “Four New Construction” framework^[1]. In the same year, the Ministry of Education issued the “Opinions on Deepening Undergraduate Education and Teaching Reform to Fully Improve Talent Cultivation Quality,” which emphasized the construction of new engineering, new medical, new agricultural, and new liberal arts disciplines as leading factors for optimizing and ad-

justing university programs to enhance the quality of education^[2]. The concept of “New Medical Science” emerged alongside the development of medical fields and the national innovation strategy. It is an educational reform model aimed at cultivating high-quality, interdisciplinary medical professionals who can meet future healthcare needs. Under the “Big Health” philosophy, “New Medical Science” not only emphasizes the transmission of professional knowledge but also advocates for interdisciplinary integration and the cultivation of innovation capabilities in medical students to address the challenges posed by rapid

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medical technological advancements.

In 2016, the State Council of China issued the “National Innovation-Driven Development Strategy Outline,” which clearly set the development goals for China to become a leading innovative nation by 2030 and a global leader in scientific and technological innovation by 2050^[3]. The cultivation of innovation and entrepreneurship talent has become a core component of the country’s innovation-driven development strategy.

In higher medical education, innovation and entrepreneurship education provides medical students with more practical opportunities and space for development, making it a key direction in advancing the reform of medical education. The innovation and entrepreneurship abilities of medical students can enhance their capacity to cope with clinical and technological changes, improve the quality of medical services, and drive the development of the health industry, thus contributing to the realization of the “Healthy China” strategy. To promote the cultivation of innovation-driven medical talent and to enhance the ability of medical schools to serve the “Healthy China” initiative, this study investigates the cultivation of innovation and entrepreneurship talents in medical schools under the background of “New Medical Science.”

2. Medical Education Reform under the Background of “New Medical Science”

2.1 The Connotation and Characteristics of “New Medical Science”

“New Medical Science” is a key initiative in China’s medical education reform, emerging in the context of the integration of modern medicine and the technological revolution. Its essence lies in the innovation of medical education models and the deep integration of disciplines. The development of “New Medical Science” can be traced back to the national innovation-driven strategy. By combining various disciplines such as technology, information technology, and engineering, it drives the transformation of medical education from the traditional disease treatment model to the “Big Health” concept. In this process, medical education is no longer limited to the transmission of knowledge; rather, it emphasizes the cultivation of students’ innovative capabilities, interdisciplinary thinking, and comprehensive skills.

The characteristics of “New Medical Science” are primarily reflected in three aspects^[4]:

Interdisciplinarity: With the global advancements in artificial intelligence, big data, the Internet of Things, Industry 4.0, and the life sciences revolution (Life Sciences 3.0), the modern medical model faces significant trans-

formations. Medicine is transitioning from a biomedical model to one that integrates multiple disciplines. Fields such as medical engineering, medical humanities, and medical physics are converging. Innovations such as surgical robots, big data precision medicine, 3D-printed organs, bioinformatics and molecular medicine, and translational medicine all stem from the intersection of multiple disciplines with traditional medicine.

Cross-boundary: In the context of informationization and intelligence, to meet the needs of industry integration and future development, it is essential to break traditional industry boundaries and foster cross-disciplinary collaboration and innovation. This characteristic drives reforms in medical education, aligning with technological innovations and integrating new technologies such as automation, artificial intelligence, and big data analytics into the talent development system, with the goal of training medical leaders who can thrive across industries.

Innovation: This is both a fundamental requirement of social development and the “Healthy China” initiative and a true reflection of the value of “New Medical Science.” Faced with the rapid development of new technologies and industries in healthcare, medical education must proactively adapt and plan ahead. Through innovation in technology, industry, and particularly talent training models, China aims to gain a leading position in the global healthcare sector, driving major breakthroughs in core medical technologies and cultivating high-level innovative talents capable of solving frontier issues in life sciences.

2.2 Innovation and Entrepreneurship Requirements in Medical Education

Modern medical education is no longer content with cultivating healthcare professionals who only possess basic clinical skills. It now requires students to develop innovative thinking and entrepreneurial abilities to meet the increasingly complex healthcare needs and the challenges posed by rapid technological advancements. Innovation capability is not only key to solving medical problems but also a driving force for technological progress in the healthcare industry. Entrepreneurial capability enables medical students to better identify market demands and promote the transformation and upgrading of medical products or services in their future careers.

Under the background of “New Medical Science,” the requirements for innovation and entrepreneurship capabilities in medical education have become even more prominent. First, students must master an interdisciplinary knowledge system and be able to innovate by combining knowledge from fields such as medicine, technology, and management. Second, “New Medical Science” demands

that students have the ability to identify problems and propose innovative solutions in real clinical and research environments, which calls for enhanced practical involvement in innovation projects. Moreover, the cultivation of entrepreneurial abilities should not be limited to market analysis and business model development but should also equip students with the ability to translate technology into practical applications to better serve the healthcare industry and public health needs.

2.3 Challenges and Opportunities Brought by “New Medical Science”

The introduction of “New Medical Science” has not only driven the transformation of medical education but also brought both challenges and opportunities. The challenge of interdisciplinary knowledge integration is particularly prominent. In the traditional medical education system, disciplinary boundaries were clearly defined. However, “New Medical Science” requires breaking these boundaries and integrating engineering, information technology, management, and other fields with medicine. This raises higher demands on medical students, who must master core knowledge from multiple disciplines within a limited timeframe and adapt to a learning model based on interdisciplinary integration. Additionally, the shortage of faculty and the integration of teaching resources pose practical challenges in advancing “New Medical Science.”

However, “New Medical Science” also offers unprecedented opportunities for medical students in terms of innovation and entrepreneurship. With the application of cutting-edge technologies such as artificial intelligence, gene editing, and robotic surgery in medicine, students are exposed to more innovative fields and broader career paths. Through the “specialty + innovation and entrepreneurship” training model, medical students can not only propose innovative solutions in research and clinical work but also drive the application and transformation of technology through entrepreneurial practice. The teaching reforms in “New Medical Science” equip students with stronger practical abilities and innovative thinking, enabling them to play an active role in the transformation of the healthcare industry and contribute to the realization of the “Healthy China” strategy.

3. Theoretical Foundations of Innovation and Entrepreneurship Competencies for Medical Students

3.1 Constructivist Theory

Constructivist theory emphasizes that learners actively construct their own knowledge systems through interac-

tion with their environment. In innovation and entrepreneurship education, this theory advocates for guiding students to independently explore and practice innovation by solving real-world problems and tasks, thereby gradually building the knowledge and skills related to innovation and entrepreneurship^[5]. This learning model focuses on medical students’ practice in real-world contexts, enabling them to integrate theoretical knowledge with practical applications.

3.2 Action Learning Theory

Action learning is a process in which learning occurs through solving real problems, emphasizing learning through action and improving through reflection^[6]. In medical education, action learning theory encourages medical students to accumulate experience by participating in innovative activities during clinical practice and research projects, thereby enhancing their innovation and entrepreneurship capabilities through teamwork. This theory is particularly suited for developing students’ adaptability and decision-making skills when faced with complex medical problems.

3.3 Innovation Diffusion Theory

Innovation diffusion theory studies how innovations spread within social groups, revealing the dissemination patterns of new technologies and methods among medical students and in the healthcare industry. Understanding this diffusion process helps medical students identify market demands and promotes the application of new technologies in innovation and entrepreneurship^[7].

3.4 Situated Learning Theory

Situated learning theory emphasizes learning in authentic contexts, that is, enhancing knowledge mastery through practice and contextual experiences. Through contextualized learning experiences such as medical simulations, entrepreneurship training, and clinical practice, medical students’ innovation and entrepreneurship abilities can be developed and improved^[8].

4. The Current Status of Innovation and Entrepreneurship Among Medical Students at Pingdingshan University

4.1 Research Design

A survey was conducted using a questionnaire to assess the innovation and entrepreneurship abilities of medical students at Pingdingshan University. Based on existing literature^[9], a questionnaire development team was formed

to design the “Survey on the Current Status of Innovation and Entrepreneurship Among Medical Students.” The questionnaire was divided into five sections: basic information about medical students, awareness of innovation and entrepreneurship, development of innovation and entrepreneurship abilities, construction of innovation and entrepreneurship platforms, and students’ expectations for innovation and entrepreneurship.

4.2 Distribution and Collection of the Questionnaire

The questionnaire was created using the Wenjuanxing app and distributed with the assistance of the university’s Youth League Committee. The survey was open from March 1, 2024, to April 20, 2024, and a total of 1,012 valid responses were collected. The basic information of the respondents is as follows: in terms of gender, 765 were female (75.59%) and 247 were male (24.41%). In terms of academic year, 653 students were in their first or second year (64.53%), and 359 students were in their third year or higher (35.47%).

4.3 Questionnaire Results and Analysis

4.3.1 Effectiveness of Cultivating Innovation and Entrepreneurship Awareness

According to the survey results, 52.23% of medical students were relatively familiar with innovation and entrepreneurship, and 27.21% expressed interest in national policies supporting innovation and entrepreneurship for college students. 70.10% of medical students reported having ideas related to innovation and entrepreneurship, 53.76% preferred to voluntarily enroll in innovation and entrepreneurship courses, and 58.89% were willing to attend innovation and entrepreneurship lectures or related activities. This indicates that medical students are highly engaged in innovation and entrepreneurship education, with strong awareness and participation in relevant activities. It is recommended that future research on innovation and entrepreneurship education for medical students further focus on developing their competencies.

4.3.2 Demand for the Development of Innovation and Entrepreneurship Abilities

The data revealed that medical students’ participation in innovation and entrepreneurship activities was mainly concentrated in college innovation and entrepreneurship projects (42.35%), “Internet+” competitions (31.78%), and the “Challenge Cup” competition (27.22%). 36.58% of the students had participated in various levels of “Internet+” competitions. Students reported that the greatest benefits of participating in innovation and entrepreneur-

ship projects included improving interpersonal communication skills, enhancing independent learning ability, and increasing extracurricular knowledge. This suggests that innovation and entrepreneurship projects are effective ways to enhance students’ overall qualities.

4.3.3 Integration of Professional and Innovation Entrepreneurship Education

The survey results showed that 72.32% of medical students applied or partially applied their professional knowledge during innovation and entrepreneurship projects, 56.37% believed that innovation and entrepreneurship activities were helpful for their professional learning, and 72.87% indicated that professional courses provided support for carrying out innovation and entrepreneurship projects. This indicates a close connection between professional education and innovation entrepreneurship education in medical colleges. However, further integration of professional and innovation entrepreneurship education still requires strengthening.

4.3.4 Medical Students’ Choices and Preparation for Innovation and Entrepreneurship

The survey results revealed that 52.41% of medical students would choose innovation and entrepreneurship if they had no family burdens and sufficient financial resources. 19.70% of students stated they would consider entrepreneurship if employment prospects were not ideal. In the innovation and entrepreneurship process, 63.77% of students identified a lack of social connections as the main obstacle, while 54.64% cited insufficient funding. Regarding the qualities necessary for successful entrepreneurs, 67.22% of students believed that challenge spirit and professional knowledge were key. This shows that most medical students are rational when choosing innovation and entrepreneurship, preferring to take action once they are adequately prepared professionally. Lack of social connections, funding, and experience are the primary barriers to their entrepreneurial endeavors.

5. Pathways to Enhance Innovation and Entrepreneurship Education in Higher Education

With the advancement of medical education reform, there is an urgent need to address the awareness and capability development of medical students regarding innovation and entrepreneurship education. Based on the feedback from survey data, the deficiencies and expectations of medical students in innovation and entrepreneurship education have been clarified, presenting new challenges and opportunities for medical institutions to cultivate talent that meets the requirements of the New Medical Science framework.

Therefore, medical universities should actively construct an innovation and entrepreneurship education system that aligns with the Healthy China strategy.

5.1 Changing Educational Concepts and Building an Innovative, Interdisciplinary Faculty

In response to the demands of the New Medical Science talent training system, the shortage of high-quality innovation and entrepreneurship faculty, combined with the growing demand for such educators, has become a prominent issue. As such, developing a high-caliber, interdisciplinary faculty focused on innovation and entrepreneurship education has become a priority in the construction of New Medical Science^[10]. First, excellent teachers should be selected based on their strong professional ethics, innovation and entrepreneurship mindset, interdisciplinary background, advanced teaching philosophy, and dedication to their students. A teaching team focused on innovation and entrepreneurship should be established. In practice, it is important to strengthen communication and training on innovation and entrepreneurship experiences among faculty members to promote their self-improvement. Additionally, faculty should be encouraged to lead students in research projects focused on innovation, while also promoting the translation of research outcomes into practical applications. Furthermore, well-known scholars from industry could be invited to give lectures, inspiring students' awareness and passion for practical innovation, while improving their professional literacy and skills. Faculty should also be encouraged to utilize information technology to develop online courses for the New Medical Science, promoting the "Internet + New Medical Science" teaching model.

5.2 Improving the Curriculum System and Developing Demonstration Courses

Curriculum design is crucial to innovation and entrepreneurship education. Medical universities should establish a systematic curriculum for innovation and entrepreneurship education, integrating it with both general education and specialized courses. The curriculum should balance theory and practice, especially in medical disciplines, and cover a range of topics such as innovative thinking, entrepreneurship management, and market research.

In line with the needs of the New Medical Science framework, curriculum reform must also be implemented. First, traditional courses should include content related to comprehensive health services, integrating prevention, treatment, and rehabilitation education to create a knowl-

edge system for lifelong health services. Second, courses related to precision medicine, such as "Pharmacogenomics" and "Bioinformatics Analysis Techniques," should be introduced. Furthermore, the integration of precision medicine content into traditional courses should be explored, fostering students' precision medicine thinking and improving their ability for personalized diagnosis and evaluation. Additionally, innovative thinking training should be strengthened, reducing the emphasis on traditional confirmatory experiments and increasing innovative experiments related to disease treatment. Virtual simulations utilizing bioinformatics and big data technologies should also be incorporated into the curriculum^[11].

5.3 Integrating Innovation with Professional Education to Promote Cross-Disciplinary Integration

In medical education, the integration of professional education and innovation entrepreneurship education is particularly important. The New Medical Science framework requires that medical talents not only possess solid medical knowledge but also have the innovation and practical skills necessary to meet the increasingly complex medical environment and societal demands. To achieve this goal, universities should design interdisciplinary innovation and entrepreneurship courses and encourage students to participate in research projects and practical activities, thereby enhancing their innovation capabilities. Additionally, medical universities should collaborate with enterprises and research institutions to develop practical courses and internship projects, helping students transform theoretical knowledge into practical abilities. For example, high-level laboratory systems and interdisciplinary resources such as innovation laboratories, innovation projects, and incubation centers can be integrated to promote collaborative development between students, faculty, disciplines, and medical education teams^[12]. This approach allows students to accumulate experience through practical projects and cultivates their entrepreneurial awareness and teamwork skills.

5.4 Stimulating Innovation among Faculty and Students, Building a Diverse Educational Model

When developing an innovation and entrepreneurship education model, universities should fully consider the involvement and enthusiasm of both faculty and students. By reforming the faculty evaluation system, universities can encourage faculty to actively participate in innovation and entrepreneurship education, thus enhancing their sense of involvement and responsibility. Furthermore, the successful experiences of world-renowned institutions,

such as MIT and Stanford, can be referenced, and corresponding incentive mechanisms should be implemented to encourage faculty to incorporate their research outcomes and entrepreneurial experiences into classroom teaching.

For students, universities should establish a student-centered educational model, guided by the Outcome-Based Education (OBE) philosophy. By designing practical and feasible talent development programs^[13], universities can stimulate students' interest in learning and their curiosity, encouraging active participation in innovation and entrepreneurship education and fostering a positive interactive and collaborative atmosphere.

5.5 Enhancing Educational Platforms and Innovating Talent Development Mechanisms

In the context of technological change and the "Four New" educational background, medical universities must comprehensively enhance the effectiveness of their innovation and entrepreneurship education platforms, bridging the gaps between the educational chain, innovation chain, and industrial chain. This includes strengthening cooperation with enterprises and industry associations, establishing and improving university-enterprise cooperation mechanisms, and providing students with diversified practical opportunities and resource support through joint course development, scholarships, internship bases, and other forms of collaboration.

Moreover, medical universities should build a new form of innovation and entrepreneurship education that involves all participants throughout the entire process and in an all-encompassing manner. This will foster collaborative development across disciplines, innovate talent development mechanisms, and ensure the fulfillment of the goal to cultivate innovative, interdisciplinary talents. Focusing on student development and industry innovation needs, universities should promote multi-party cooperation between academia, industry, and research, and integrate innovation factors to improve the collaborative talent development mechanism for the medical field. This will contribute to cultivating innovative, interdisciplinary medical talents in the healthcare industry, and achieving an organic connection between the education chain, talent chain, and industry chain in the broader healthcare sector^[14]. Regular innovation and entrepreneurship activities, competitions, and seminars should be organized to encourage students to apply their knowledge in practice, enhancing their comprehensive qualities and practical abilities.

6. Conclusion

In the context of the "New Medical Science" frame-

work, the innovation and entrepreneurship education model in medical education holds significant theoretical and practical value. As medical technology advances and industry needs evolve, medical students must possess innovative thinking and entrepreneurial abilities to tackle complex healthcare challenges. According to the results of the survey, medical students exhibit high levels of engagement with innovation and entrepreneurship education, but there is still a need to strengthen their ability development and application of professional knowledge. Therefore, medical universities should actively construct an innovation and entrepreneurship education system that aligns with the requirements of the New Medical Science framework, change traditional educational concepts, enhance faculty capabilities, and provide diversified practical platforms to cultivate high-quality, interdisciplinary medical talents. This will contribute to the implementation of the national health strategy.

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