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Research and Practice on Connotation Construction and Implementation of Roadmap of "New Medicine" in Local Medical Colleges by Big Data Analysis

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Abstract: *Taking students from a local medical college in Shandong Province as the research object, we conducted a questionnaire survey on their satisfaction with the college education, innovation needs, innovative practices, and 'new medicine' understanding. The results show that the majority of students are satisfied with the overall education of their colleges but the student's theoretical knowledge and experimental skills are insufficient. Most students do not fully understand what "new medicine" means. According to the big data analysis, the key issues facing the training of new medical talents are analyzed from four aspects combined with the exploration and practice of the construction of "new medicine" in local medical colleges: updating the concept of medical education, optimizing the structure of medical professions, improving the talent training system, and improving the management and guarantee mechanism, and cultivating high-quality applied medical talents for technological revolution represented by artificial intelligence.*

Keywords: *new medicine, connotation construction, applied medical talents*

1. Introduction

Under the background of Healthy China 2030, Life Science Revolution 3.0, and Industry 4.0 Revolution Strategy, the concept of "new medicine" has shifted from simple diagnosis and treatment of diseases to the full cycle of life health with human development. The substantial changes have led to medical education reform.

Medical education is related to "Education Power" and "Healthy China". Especially after the outbreak of COVID-19, it is necessary to cultivate new opportunities in the crisis and accelerate the construction of new medical sciences. New medicine leads the innovation of medical education [1], explores a new model of outstanding medical talent education, and creates a new system of "new medicine" education with Chinese characteristics [2]. To deepen the coordination of medical education and promote the reform of teaching-oriented education to competency [3], the Excellent Doctor Education and Training Program 2.0 was implemented [4]. Due to the recently proposed concept of "new medicine", there has not been enough effort to implement the "new medicine" and adapt to the transformation of medical education from "medical education mode with biomedical science as the main support" to "medical education mode supported by medical literature, medical engineering, medical science, and medical X interdisciplinary disciplines". Cultivating high-quality applied medical talents as a new generation of technological revolution represented by artificial intelligence [5] is an urgent problem to be solved by medical schools.

At present, there is no clear implemented policy for how medical colleges cultivate "excellent doctors" who meet the requirements of the new medical era. Thus, we investigated the current medical college students' satisfaction with the college's education, innovation demands, and innovative practices, and the understanding of new medicine. We also combined the exploration and practice of the local medical colleges on the construction of "new medicine" and put forward targeted suggestions for the cultivation of new medical talents.

2. Methods and Samples

We selected all undergraduate students in a local medical college in Shandong province as the survey

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object. The method of hierarchical random sampling was used to send out 6000 questionnaires, and 5594 valid questionnaires were recovered with an effective questionnaire recovery rate of 93.23%. The sample covered 31 majors. The distribution structure in gender, grade, and college indicators was not much different from the overall distribution structure of undergraduate students in the local medical college. The details of the structure of the survey is shown in Table 1.

Table 1: Basic information of survey samples

Arguments		**Samples (N = 5594)**	**Percentage (%)**
Gender	Male	1917	34.27
	Female	3677	65.73
Grade	Fresh year	2175	38.88
	Sophomore year	1483	26.51
	Junior	943	16.86
	Senior	778	13.91
	Fifth year	215	3.84
College	School of Marxist	4	0.07
	School of Clinical Medicine	1170	20.92
	School of Basic Medicine	12	0.21
	School of Rehabilitation Medicine	264	4.72
	School of Public Health	530	9.47
	School of Management	707	12.64
	School of Nursing	482	8.62
	School of Stomatology	437	7.81
	School of Pharmacy	160	2.86
	School of Life Science and Technology	552	9.87
	School of Anesthesiology	842	15.05
	School of Medical Imaging	192	3.43
	School of Foreign Language	81	1.45
	School of Psychology	30	0.54
	School of Laboratory Medicine	131	2.34

3. Results and Analysis

3.1. Undergraduates' Satisfaction with College Education

Table 2: Satisfaction of undergraduates with the curriculum system and course content (%)

Projects	Very dissatisfied	Dissatisfied	General	Satisfied	Very satisfied
Curriculum system integrity	0.29%	0.39%	9.08%	48.59%	41.65%
Fullness of the course content	0.32%	0.32%	9.62%	47.44%	42.3%
Innovative course content	0.34%	0.43%	10.39%	47.53%	41.31%
Completeness of course content	0.32%	0.16%	9.13%	47.89%	42.49%
Completeness of course practice content	0.36%	0.25%	9.49%	48.14%	41.76%
Completeness of the course's network content	0.32%	0.27%	9.62%	47.75%	42.05%
Difficulty of implementing Content of the course research	0.36%	0.23%	9.69%	48.28%	41.44%
Rationality of the teaching schedule	0.38%	0.5%	9.8%	47.37%	41.96%
Social needs of the curriculum	0.34%	0.32%	9.47%	47.93%	41.94%
Practical teaching application	0.32%	0.27%	9.69%	47.59%	42.13%
Advanced nature of the curriculum concept	0.34%	0.3%	9.58%	47.59%	42.19%
Accuracy of course positioning	0.36%	0.32%	9.3%	47.91%	42.12%

First of all, the questionnaire survey result helps to understand the satisfaction of undergraduates with a college education. The results are shown in Fig. 1, including the students' satisfaction with teachers' academic level and teaching effect, teachers' working attitude and conduct, professional practice activities or lectures, professional elective courses, professional library resources, and classroom equipment. The satisfaction rate was in the range of 83.29−90.88%.

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The results of the survey on 12 aspects of course system integrity and course content enrichment, innovation, completeness, rationality, and social needs showed that nearly 90% of students were satisfied with the overall evaluation of the courses they had learned (Table 2). More than 83.41% of students considered the professional courses were highly practical. The above data showed that the majority of students have a high level of overall educational satisfaction with their colleges.

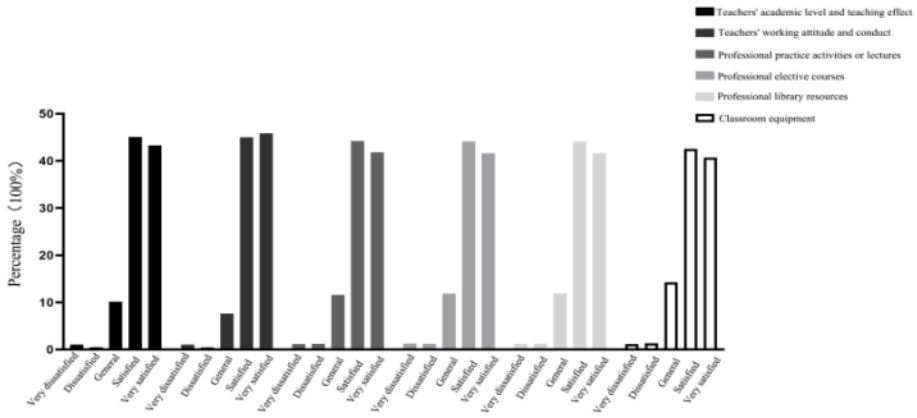

Figure 1: Satisfaction of undergraduates with college education

3.2. Innovation Demand and Practice

The survey results showed that 93.92% of students generally believe that the innovation ability was important for college students, as the innovation ability of college students was still relatively strong. According to the survey on innovative practice pathways, 47.73% of students hoped to participate in the innovation and entrepreneurship training program in the medical clinical category to improve their self-innovation practice ability, followed by health and wellness (11.39%) and disease prevention (8.01%). In terms of cultivating the scientific research and innovation ability of medical students, 45.03% of the students believed that it was mainly to cultivate interdisciplinary talents, and 23.53% of the students focused on providing innovation and entrepreneurship practical training and simulation training. When investigating innovation and entrepreneurship projects, 79.00% of students chose this major, and only 14.10% of students chose interprofessional. Among the problems encountered in improving the practical ability of innovation, 42.08% of the students believed that they did not have solid theoretical knowledge guidance, and 23.26% of the students believed that the completion of innovative projects took up more spare time, and it was difficult to find materials. 13.96% of the students lacked the spirit of hard work and perseverance in scientific research. Medical school students have recognized the importance of innovative practical ability, but students' theoretical knowledge and experimental skills are still insufficient, and they lack innovative spirit.

3.3. Understanding of "New Medicine"

According to the survey of students about "new medicine", only 10.83% of them knew it well, and the rest of them had only heard about it. 17.14% of them did not know anything about it. According to the survey results on the main reasons for students to participate in the new medical experiment, 71.11% of the students thought that it was conducive to the deep integration of medical science and engineering and could significantly broaden the training caliber. 66.55% of the students believed that it was conducive to cultivating composite talents. 63.51% of the students believed that it was an important link closely related to the development of the times. More than 50% of the students deemed that the new medical experimental class also helped to have an international training program, and at the same time has a huge market prospect in the field of big health. The above survey results show that the current undergraduates do not fully understand "new medicine", but they are full of expectations for the construction of the "new medicine" in the school.

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4. Implementation of "new medical science"

4.1. Updating Concept of Medical Education

The educational concept of the "new medicine" mainly cultivates students' innovative thinking, takes "interdisciplinary, integrated innovation" as the principle, and pays attention to the comprehensive application of multidisciplinary knowledge. At the same time, COVID-19 has created new demands for medical education and new goals for medical talent development.

In order to achieve the cultivation of outstanding medical talents, we need to change the concept of education, establish the "big health" concept of "whole process" and "full cycle" management of health, tightly around the "healthy China" strategy. We also need to focus on the whole cycle of the whole process to maintain the health needs of the masses and cultivate the knowledge and ability of medical students in the whole process of prevention, diagnosis and treatment, health care, rehabilitation, and other services [6]. At the same time, it is also necessary to establish the concept of "medicine + X" and establish the concept of medical education from "medical education mode with biomedical science as the main support" to "medical education mode supported by medical literature, medical engineering, medical science, and medical X interdisciplinary disciplines" to realize a new model of talent education with the job competence of medical talents through interdisciplinary talent training [7].

4.2. Optimizing Structure of Medical Specialties

4.2.1. Reform of existing specialties with the construction of specialized clusters

"Serving the whole life cycle and the whole process of health" policy requires breaking down disciplinary barriers and segmentation, giving play to the agglomeration effect of professional groups, integrating resources across disciplines and faculties, following the principles of medical and cultural integration, medical theory penetration, medical integration, and medical management integration, reorganizing teaching resources, and constructing medical professional groups such as preventive medicine and health management, clinical medicine and technology, rehabilitation medicine and education, pharmacy, and biological engineering. These need to combine medical science and culture, medical theory penetration, and medical and engineering integration. These measures are related to the agglomeration benefits and service functions of professional construction which is optimized by the professional structure and moved through the professional layout from the "pyramid" to the "five finger mountain". Driven by characteristics or advantageous majors, the cluster effect is used to achieve professional cross-integration and mutual penetration, and the core majors drive the overall development of majors in the professional cluster.

4.2.2. Scientific and technological revolution to set up the development of new medical specialty

It is necessary to explore the medical education model under the background of the global industrial revolution 4.0 and the life science revolution 3.0, take the initiative to dock advanced technologies such as precision medicine and artificial intelligence, set up and develop emerging medical majors, carry out the pilot reform of "medicine + X" composite medical talent training, and realize the transformation of medicine from a "medical model with biomedical science as the main support" to a medical model supported by "medical literature, medical engineering, medical science, and medical X interdisciplinary disciplines".

4.2.3. "Micro specialty" plan to improve our knowledge system

It is required to sort out the existing medical professional talent training program with the knowledge system lacking in "new medicine" talents and various high-quality educational resources such as MOOCs platform. The construction of artificial intelligence is targeted with big data and other "micro-professional" curriculum systems for students to complete the corresponding courses, and give "micro-professional" certification.

4.3. Personnel Training System

A new curriculum system is required to improve the professional quality and practical ability of medical students, adhering to the concept of "three advances" of moving forward in a contact practice. Then it is possible to move forward with medical problems and scientific research and training and implement the horizontal integration of medical-related discipline courses and the vertical integration of basic and clinical courses. Vertically, "from macroscopic to microscopic, from morphological to

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functional, from normal to abnormal", the curriculum integration of "organ-system-centered" is implemented. Horizontally, in line with the principle of "strengthening the integration of basic and clinical, clinical and preventive, humanities and sciences and other disciplines", it is necessary to build a public foundation, professional foundation, professional core, and professional development course group. An "integration" high-quality curriculum system of "basic sharing, core separation, expansion, and mutual selection, and progressive ability" is created, then.

It is needed to construct an "online and offline hybrid" curriculum system that meets the requirements of "new medicine" and consists of professional courses, humanities, social sciences, artificial intelligence, natural sciences, and physical and mental fitness courses. A "medical X" fusion experimental practice platform is needed. Through interdisciplinary and college, a comprehensive experimental platform for basic medical and public health is built. It also helps to have "four unified" operations of the center director responsibility system and teaching tasks, teachers, equipment, and systems, the cluster effect of the platform and build a clinical ability training center that combines virtual and real.

It is necessary to deepen medical-educational collaboration, school-enterprise cooperation, and school-site linkage. Thus, we have built collaborative innovation centers or modern industrial colleges and an experimental practice platform for the integrated development of "medical X" [8]. The teachers optimize the teaching method system, promote the classroom revolution, carry out PBL, CBL, and other teaching method reforms, emphasize problem guidance and interest inspiration, and enhance students' independent learning ability.

We explore the teaching of experimental practice and integration of competition and cultivate students' practical ability, professionalism, and innovative thinking. The "micro-professional" system has been built. Based on online courses and supplemented by offline courses, we form a course sequence with core knowledge and skills, and systematically provide medical students with the content of "X" in the "Medical X Interdisciplinary". Finally, it is necessary to improve the academic evaluation system. The assessment content is reformed to try divergent thinking and challenging test questions, and adopt objective structured clinical examination (OSCE) and other assessment forms. Then the examination reform is promoted to combines process and final evaluation, and build a diversified academic evaluation system oriented by ability evaluation.

4.4. Management and Security Mechanisms

It is important to have segmented management, sharing of teaching resources, the implementation of the majority system, the exchange and integration of similar disciplines, and the integrated management for teaching students from entry to graduation. The mechanism of "medical education, industry and research collaboration" needs to be introduced to establish multi-level and multi-field cooperation in running schools. For this, it is needed to explore multidisciplinary and cross-integrated medical talent training models, establish interdisciplinary talent training systems and project platforms, and develop innovative clinical and medical research practice bases. Adhering to the concept of "stabilizing the foundation, ensuring teaching, the key points need to be understood to promote development. Thus, we need to ensure that teaching funds are invested to strengthen the construction of information-based teaching resources such as online courses and virtual simulation experimental teaching projects, the construction of intensive experimental platforms, and the quality construction of practical teaching bases. It is necessary to establish the concept of "total quality management", and improve the teaching quality monitoring and evaluation organization system and the PDCA closed-loop teaching quality monitoring system in the talent training process. We need to adhere to the combination of introduction and education, specialization and combination for improving the structure of the teaching team and the incentive mechanism. Then, it is possible to highlight the teaching status, implement the "double return" strategy of basic and clinical teachers, strengthen the construction of teaching teams, and establish a diversified teacher training system of a high-quality teacher team [9].

5. Conclusion

There were great differences in educational ideas between new and traditional medicines, and most students did not know much about "new medicine". The construction of new medicine needs high-level and high-quality medical professionals, as well as excellent doctors with high comprehensive quality and development potential. Based on the particularity of medical education, it is required that medical education maintain a high level of talent selection and training to ensure talent level and education quality to make medicine better serve the people's health cause and the needs of future social development.

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Although the construction of "new medicine" is an innovative measure of China's medical education reform, there are still limitations in the existing understanding and practice. We need to emancipate our minds and expand the connotation and action path of construction. We put forward the specific implementation path for how to implement the "new medicine" construction in medical colleges to provide a practical and theoretical basis for cultivating "excellent doctors" who meet the requirements of the new medical era.

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