Exploration of Teaching and Application of Medical Imaging Laboratory under the Background of New Medical Sciences

Chenyang Shen, Jun Liu*, Feiyun Wu*, Yinsu Zhu

Nanjing Medical University, Nanjing, Jiangsu, China

Schenyang9@126.com, *liujun@jsph.org.cn, *wufeiyundd@163.com

Keywords: Medical imaging laboratory, Teaching, Talent Training

Abstract: Under the background of new medical sciences, the application of medical imaging laboratories in the development of imaging disciplines and teaching is observed, and the rationality and necessity of the laboratory settings are discussed. By setting up laboratories with different functional units, experimental sites are provided for the development of medical imaging disciplines and clinical teaching. By providing a multi-disciplinary cross-research experimental environment, disciplinary integration and the cultivation of talents are promoted. In long-term practice and application, a training model of "medical education, research and production" has been formed to improve the quality of talent training and provide support for clinical treatment.

1. Introduction

In April 2019, 13 Chinese departments including the Ministry of Education, the Ministry of Science and Technology, and the Central Political and Legal Affairs Commission jointly launched the "Six Excellence and One Outstanding" Plan 2.0. It comprehensively promotes the construction of new medical sciences, new agricultural sciences, new humanities and social sciences, and new engineering sciences. Improve the ability of colleges and universities to serve economic and social development[1]. The new medical concept was born. The new medical sciences, compared with traditional medical sciences, include not only new medical sciences, new fields and new specialties in medical sciences, but also new requirements for medical sciences, new concepts, new connotations, new models, new trends, new methods and new technologies in medical sciences. "New Medical Sciences" aims to effectively promote interdisciplinary integration of medicine, engineering, science and other disciplines, combined with technologies such as digitalization and artificial intelligence, integrate precision medicine, translational medicine and other medical fields, introduce the "medical-teaching-research-production" collaborative mechanism, and explore the application of multi-field and multi-level talent training models[2,3,4].

Medical imaging is a new discipline that uses various medical imaging technologies to diagnose human diseases and treat diseases under image monitoring. It is one of the fastest developing disciplines in the modern medical field with the widest range of applications. It includes image diagnosis (X-ray, CT, magnetic resonance imaging), medical ultrasound, nuclear medicine and interventional radiology. It is an interdisciplinary subject covering clinical medicine, biomedical engineering and artificial intelligence. This discipline requires students to have a background in anatomy, pathology, clinical medicine, biomedical engineering and artificial intelligence, and to be proficient in using medical imaging methods to diagnose, treat and evaluate treatment effects. The social requirements for medical talents today are no longer a single expertise in medicine as before, but require the intersection of medicine with engineering, agriculture, humanities and sciences[5]. Medical imaging is a practical discipline that not only requires students to have a solid theoretical knowledge, but also requires proficient practical skills. Especially under the background of building new medical sciences, the medical imaging discipline urgently needs to carry out relevant basic experiments due to various difficulties faced in the clinic. The setting of medical imaging laboratories is particularly important. Taking Nanjing Medical University as an example, the medical imaging laboratory is designed in different sections according to the talent training objectives of the new

  DOI: 10.25236/hecb.2023.010

medical sciences. It is hoped to provide inspiration and reference for promoting the development of medical imaging disciplines and improving clinical and experimental teaching modes under the background of new medical sciences[6].

2. Set up medical imaging experiment center

The medical imaging discipline of Nanjing Medical University relies on the Radiology Department of Jiangsu Provincial People's Hospital. Under its affiliation, the Medical Imaging Experiment Center is set up. Experimental teaching, as an important part of higher education, is an important way to cultivate students' innovative thinking and practical skills, and plays a key role in the cultivation of applied, interdisciplinary and innovative talents[7]. According to the talent training objectives of medical imaging, laboratories with different functional units have been set up, namely, medical imaging laboratory, medical imaging technology laboratory, molecular imaging laboratory and artificial intelligence laboratory.

2.1 Medical Imaging Laboratory

The medical imaging laboratory is mainly used for experimental teaching, independent learning and after-school practice. One laboratory is set up in each of the old and new campuses respectively for convenient teaching and practice. Each laboratory can accommodate 75 people and is equipped with hardware equipment such as computers, desks, chairs and servers, and monitoring facilities to facilitate management. The medical imaging experimental teaching and examination system software installed on the computer is used for teacher-student interaction in class, student after-school practice and online examinations. The software contains a case library with rich clinical cases for students to independently practice and write reports.

2.2 Medical Imaging Technology Laboratory

The medical imaging technology laboratory is mainly used for students to practice practical operations. The laboratory is equipped with simulated advanced DR machines, simulated advanced CT machines, high-performance servers, and simulation CT operation teaching systems and MR operation teaching systems installed on public experimental platforms. Students use the simulation teaching system to learn and experience how to correctly set parameters, place patients, operate equipment, etc. They can better understand the course content, while ensuring that teachers simulate clinical operations in a radiation-free environment.

2.3 Molecular Imaging Laboratory

The molecular imaging laboratory provides an experimental platform for undergraduate and graduate students' innovative entrepreneurship projects and scientific research. The laboratory is equipped with a gamma counter, liquid scintillator counter, cell culture incubator, -80°C refrigerator, confocal microscope system and other equipment to support small animal molecular imaging research and related molecular biology experiments. It provides experimental sites for students from medical imaging, life sciences, chemistry and other disciplines to carry out molecular imaging and interdisciplinary research.

2.4 Artificial Intelligence Laboratory

The artificial intelligence laboratory is mainly used for interdisciplinary experimental teaching and research. As an interdisciplinary major in medicine and engineering, the medical imaging discipline inevitably involves connections with disciplines such as biomedical engineering, computer science and artificial intelligence. At the new stage where various intelligent devices are competing to be used in clinics around the world, the cultivation of new types of medical talents with both science and engineering backgrounds has been put on the agenda[8]. To cultivate interdisciplinary innovative talents, it is particularly important to provide an interdisciplinary experimental research platform for undergraduate education and graduate education.

The artificial intelligence laboratory is equipped with high-performance servers, electronic computers, high-definition display equipment, monitoring equipment, etc. The electronic equipment is complete and has high-performance operating characteristics, which fully meet the daily teaching and after-school research needs.

3. Teaching and application

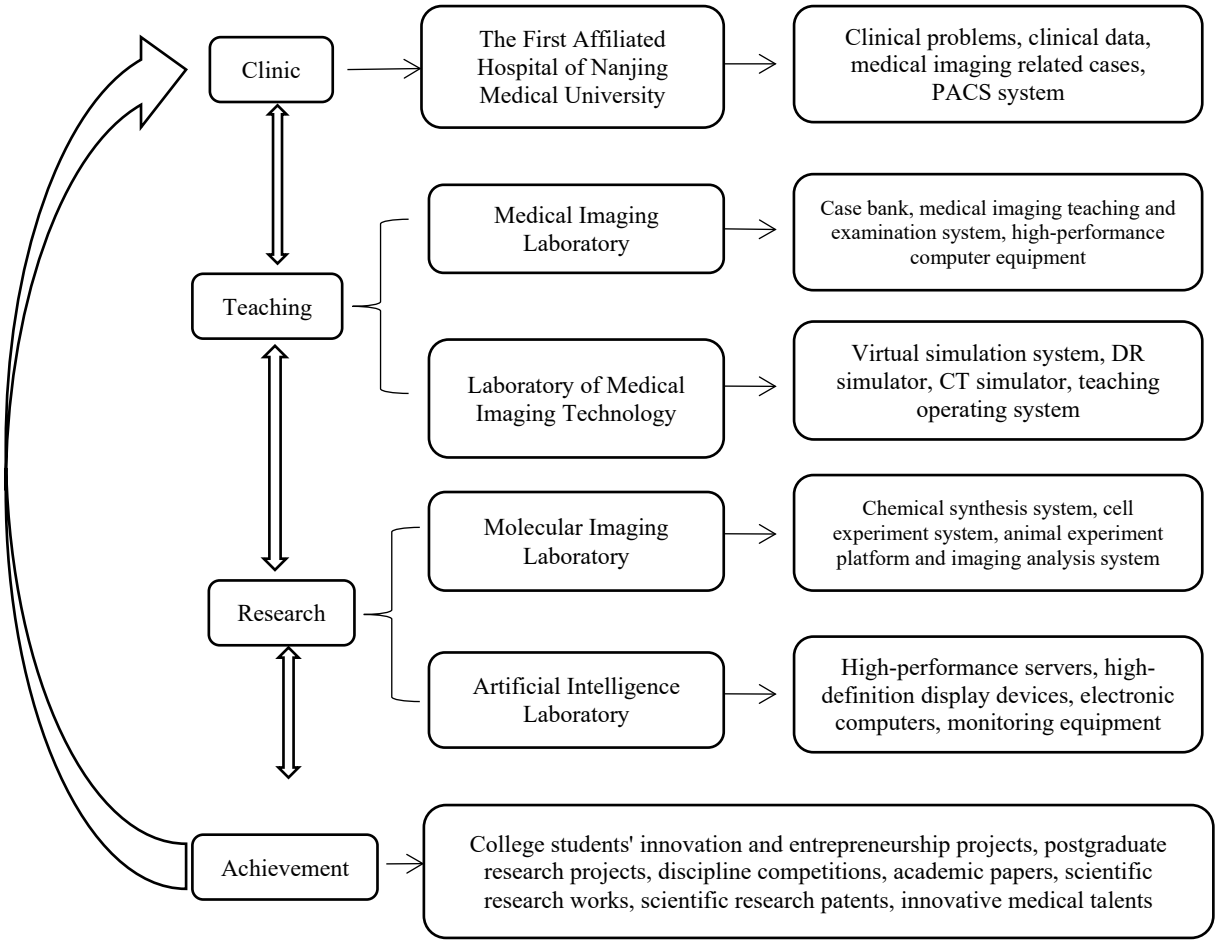

Figure 1. Schematic diagram of medical imaging laboratory composition and clinical teaching

As shown in Figure 1, in the teaching process, first, students preliminarily master the types and severity of diseases through theoretical knowledge explanation, case discussion, etc. in the medical imaging laboratory, and use the medical imaging teaching and examination system to exercise case analysis and report writing skills. Secondly, in the medical imaging technology laboratory, using virtual simulation equipment, CT, DR simulators, etc., students practice practical skills through simulating the standard use of hospital equipment in reality. In the teaching process, the focus is on cultivating students' logical thinking ability and experimental practical ability. After certain improvement in theoretical knowledge and practical skills, the foundation is laid for the next step of clinical treatment and scientific research.

After students have mastered a certain amount of theoretical and practical knowledge, for some deeper and more complex issues, students can conduct in-depth research in molecular imaging and artificial intelligence laboratories, give full play to the advantages of medicine and engineering, and enable students to maintain rigorous scientific research attitudes through experimental design, experimental observation, experimental records, and experimental corrections. Developing good scientific research habits continuously broaden the depth and breadth of interdisciplinary integration, laying the foundation for the cultivation of interdisciplinary talents and in-depth and complex clinical research.

After students have certain scientific research capabilities, they can produce corresponding research results, including participating in undergraduate innovation and entrepreneurship projects, graduate scientific research projects, discipline competitions, publishing academic papers, monographs, patents, etc. The output results can be used for subsequent clinical research to continuously promote discipline development and continuously output high-quality interdisciplinary innovative medical talents for clinical disease treatment.

4. Discussion

The new medical sciences are an important foundation for building a healthy China. Medical education should actively adapt to new requirements, promote reform through innovation, promote development through reform, and focus on cultivating a large number of outstanding medical talents[9]. The medical imaging discipline has a wide coverage and is highly comprehensive. In addition to having clinical professional knowledge, it often also requires knowledge reserves in biology, biomedical engineering, computer science and other fields, and inevitably involves interdisciplinary integration. In recent years, China's higher education and health sectors have issued a series of important documents, emphasizing strengthening medical talent training and education reform, vigorously developing new medical sciences, integrating the advanced knowledge system of medicine and related disciplines with the practical experience of clinical medicine, and correcting and adjusting it according to the environment, society, psychology and engineering, and make it a new medical system that is more in line with human health and disease diagnosis and treatment[10]. Under the background of the new medical sciences construction, in order to cultivate interdisciplinary and practical innovative talents, the medical imaging discipline not only needs to combine clinical and experimental teaching, but also requires providing students with an interdisciplinary platform for resource integration. These require medical imaging laboratories to play an important role.

Medical imaging laboratories are crucial for talent training and discipline development, but there are still some problems and shortcomings. It is mainly reflected in the following aspects:

4.1. Inadequate experimental facilities

Because the teaching and scientific research of medical imaging disciplines involve a wide range of disciplines, although different functional experimental laboratories have been set up, these laboratories require a large investment of human, material and financial resources, and the construction period is usually long. Although they can currently meet the basic teaching and after-school research needs, some in-depth and complex research is still relatively difficult, and the equipment update speed is slow, long-term use is easy to become old and degraded.

4.2. Less experimental management personnel

Although each laboratory is equipped with professional research mentors, there are fewer and less professional experimental management personnel. Each laboratory should be equipped with at least one full-time scientific researcher in a related professional field to be responsible for the instrument, equipment and consumable management of this laboratory. However, due to job restrictions or saving manpower, the requirements for one-on-one full-time management cannot be met. In addition, the professional background and research disciplines of some experimental administrators are not relevant, resulting in lack of professionalism in laboratory management.

4.3. Unbalanced experimental laboratory resource allocation

In order to meet the needs of teaching and scientific research, laboratories with different functional areas have been set up for teaching and research. Teaching laboratories have larger space to meet teaching needs, but limited opening hours. Research laboratories have limited space and cannot accommodate too many people, so students have the impression that they cannot enter the research. In addition, the opening hours of each laboratory are limited and cannot meet the needs of a large number of students at the same time. Students' time to enter the laboratory for research cannot be reasonably allocated, resulting in low resource utilization.

5. Conclusion

Under the background of vigorously developing new medical sciences, medical imaging laboratories have emerged as the main positions of imaging disciplines and experimental teaching, and have gradually played their roles and advantages, which helps cultivate students to discover clinical problems from clinical cases and continue in-depth research, provide an interdisciplinary environment to promote interdisciplinary talent training, and lay a good foundation for solving practical problems in future clinical practice and scientific research. By continuously practicing and applying, the "medical-teaching-research-production" talent training model is formed, the quality of talent training is continuously improved, and support is provided for interdisciplinary research and discipline development.

Acknowledgement

Supported by Education Research Project of Nanjing Medical University (2021LX057),2021 Project of Jiangsu Provincial Education Science "14th Five Year Plan"(B/2021/01/73)

References

[1] Ministry of Education.Notice of the Ministry of Education on Issuing the Action Plan for Education Informatization2.0. http://www.moe.gov.cn/srcsite/A16/s3342/201804/t20180425_334188.html.2019-04-07

[2] Peng SH.(2020). Accelerate the construction of "new medical science" and focus on cultivating outstanding medical innovative talents.China Higher Education, 9, 35-37.

[3] Ji ZY,Zhou YM,Yang B.(2020)Teaching Design and Practice of Biomedical Engineering Specialized Course under the background of New Engineering and New Medicine.Medical Education Research and Practice.3,374-376.

[4] Jiang YX,Wang Y.(2020)Exploration of Medical Student Training Model Based on the Concept of "New Medical Science".Journal of Inner Mongolia Medical University,1, 114-116.

[5] Zeng YX,Gao T,Ke DZ.(2023)Exploration of Cultivating General Practitioner Talents under the Background of New Medical Sciences.Modern Medicine Health.1,152-154+157.

[6] Xu G,Li ZH,Tian K,Zhong WL, Qu W, Zhang WG.(2023)Exploration of teaching and application oforthopaedic laboratory under the background of “new medical sicence.Laboratory Science,1,232-235.

[7] Zhu L. (2022)Exploration on model of university experiment teaching under the background of”double first-class“ construction. Laboratory Science,5,140-143.

[8] Ma XL, Ma JX,DU YR, Yang BC.(2019).The combination of medicine and industry leads the development of "precision" and "intelligence" in orthopedics. Transportation medicine,6,545-547.

[9] Han Y,Deng HF,Wang GX, Zhou J, Chen ZJ.(2022) Exploration and Reflection on the Function Experimental Teaching Reform under the Background of NEW Medical Science.Strait Pharmaceutical, 12,79-82.

[10] Hu Y, Wu JH, Chen F.(2020)Exploration and Practice of Medicine-engineer Integration in Orthopedic Clinical Teaching from the Perspective of New Medicine.Journal of HEFEI university of technology (Social Science), 3,119-122.