US-China Education Review A, August 2024, Vol. 14, No. 8, 526-531
doi: 10.17265/2161-623X/2024.08.004

Research on the Status Quo and Practice Path of Medicine-Engineering Interdiscipline Between Universities and Hospitals

SONG Yiting
University of Shanghai for Science and Technology, Shanghai, China
ZHANG Yi
Shidong Hospital, Yangpu District, Shanghai, China
WANG Yuqing
University of Shanghai for Science and Technology, Shanghai, China
HUANG Liang
The First Affiliated Hospital of Wannan Medical College (Yijishan Hospital of Wannan Medical College), Wuhu, China

The medicine-engineering interdiscipline spans the broad categories of medicine and science and technology, both between disciplines and across the boundaries of schools and hospitals. The study selected University of Shanghai for Science and Technology and affiliated City East Hospital as samples to be analyzed, and found that the universities and hospitals in the present time have preliminary understanding of the medicine-engineering interdiscipline, but there is an information barrier between the two sides; initially, relevant platforms have been established, and the clinical applicability of medicine-engineering interdiscipline results is low; a certain system has been formed, but there is a lack of a long-term and effective guarantee mechanism. To break through these dilemmas, it is necessary to be practice-oriented, to form an organizational and cultural atmosphere of interdisciplinary exchanges, to establish a chain of medical-industrial intersection of industry-university-research transformation, and to improve the perfect mechanism and system.

Keywords: colleges and universities, hospitals, medicine-engineering interdiscipline, practice pathways

Introduction

Medicine-engineering interdiscipline, or "cross-fertilization of medicine and modern engineering technology", is the creation of innovative medical products that can meet clinical needs by combining medical knowledge and engineering technology for the benefit of people's lives and health, and centering on the specific needs of prevention, diagnosis, treatment, and rehabilitation (Liu et al., 2024). Universities and hospitals cooperate in

Acknowledgement: This research is supported by the Project of the 2024 Shanghai Education and Health Party Committee System Party Building Research Association (2024ZX059).
SONG Yiting, Lecturer, School of Materials and Chemistry, University of Shanghai for Science and Technology, Shanghai, China.
ZHANG Yi (Corresponding author), Associate Chief Nurse, Party Committee Office, Shidong Hospital, Yangpu District, Shanghai, China.
WANG Yuqing, University of Shanghai for Science and Technology, Shanghai, China.
HUANG Liang, Assistant Health Manager, Medical Department, Yijishan Hospital of Wannan Medical College, Wuhu, China.

depth to promote medicine-engineering interdiscipline, focus on the difficulties and pain points in clinical medicine, and explore innovative solutions. This not only helps to break through the "neck" technology in medicine and promote the progress and development of the medical field, but also promotes the synergistic development of science and technology, education and talents.

After reviewing existing research, it can be seen that the current research on medicine-engineering interdiscipline mainly focuses on connotation interpretation and value analysis, with less research from the perspective of university and hospital practice. The purpose of this study is to investigate the difficulties in the implementation of medicine-engineering interdiscipline between hospitals and universities, and to explore the new mode of in-depth implementation of "medicine-engineering interdiscipline" between universities and hospitals, so as to provide a model path for universities and hospitals to carry out medicine-engineering interdiscipline work.

Research Design

Research Sample and Methodology

University of Shanghai for Science and Technology is a key applied research university in Shanghai with a focus on engineering and coordinated development of multiple disciplines. The university attaches great importance to medicine-engineering interdiscipline. Shidong Hospital Yangpu District affiliated to University of Shanghai for Science and Technology is a Grade 2A comprehensive hospital integrating medical treatment, scientific research, teaching, prevention, and health care. In 2021 "Shidong Hospital Branch Center of Technology Transfer Center of University of Shanghai for Science and Technology" was established. The study takes these two as samples. The research subjects included medical technicians, teachers, administrators, and students who had participated in the medicine-engineering interdiscipline program in universities and hospitals. Eighty-six questionnaires were distributed and 84 questionnaires were valid, with a validity rate of 97.67%. Among the research subjects, 35.71% were teachers or researchers in universities, 33.33% were doctors or medical staff in hospitals, and 30.95% were students. The specific research samples are shown in Table 1 below. In addition, 8 of them were randomly selected for in-depth interviews, combining qualitative and quantitative research to more comprehensively analyze the dilemmas and causes of the medicine-engineering interdiscipline in colleges and universities at the present time.

Table 1

List of Survey Sample Information

Gender		Status		Age		Political profile		Educational status		Title	
Male	47	University teachers /researchers	30	20-30	37	Communist Party member	46	Bachelor	10	Junior titles	2
Female	37	Hospital doctor/ medical staff	28	31-40	20	Democratic Party	4	Master	43	Intermediate titles	26
		Student	26	41-50	16	Communist Youth League Member	20	Doctor	31	Deputy senior titles	16
				51-60	11	Mass	14			Full senior titles	14
										No titles	26
Total	84		84		84		84		84		84

Research Results and Discussion

Research Results

Initial awareness of the medical-industrial interface and the existence of an information barrier between the two sides. In terms of the understanding of medicine-engineering interdiscipline, 63.1% of the respondents said they had participated in the study of medicine-engineering interdiscipline, 32.14% had a superficial understanding, 4.76% had heard of it but did not understand it, and 0% had not heard of it at all. It can be seen that universities and hospitals currently have a high degree of recognition of medicine-engineering interdiscipline. Regarding the role of medicine-engineering interdiscipline in promoting medical technology innovation and medical service improvement, 77.38% thought it was very important and 22.62% thought it was relatively important. As for the basic understanding of medicine-engineering interdiscipline, 48.81% thought that it was the organic integration of engineering and medical disciplines to form a new system, 26.19% thought that the theoretical methods of engineering and medical disciplines would be integrated together to conduct research, and 25% thought that it was the theoretical methods of engineering disciplines that would be applied to medical disciplines, and some teachers in the interviews mentioned that "The purpose is the integration of technology and the integration of industry, academia, and research".

The weak sense of integration between doctors and researchers causes doctors and researchers to be "in the form of integration but not in the meaning of integration" (Tan & Sun, 2012). In the research on the difficulties of medicine-engineering interdiscipline projects, 60.71% think that there is a lack of effective communication mechanism. In the interview, some doctors mentioned that "When the project was applied for, it was the university's side of the management, and we were really involved in it less, but there were problems with the exchange of information, and there was not a regular communication mechanism". Some teachers also mentioned that "After the doctor put forward the demand, he basically seldom participates in this topic, and it is unrealistic to expect the teacher to do it". 48.81% think that the content of synergy is not clear, doctors and teachers have different professional backgrounds and differences in their ways of thinking, both sides do not know enough about each other's needs, and there is still an information barrier to cooperation. "The combination of medicine and engineering must have an entry point, without which everything is empty talk". 35.71% of the respondents think that there is insufficient staff cooperation, and some teachers mentioned that "Doctors are usually quite busy, and teachers of science and engineering do laboratories and take students to classes, so everyone is quite busy, and it's not easy to communicate together is not easy".

Initial establishment of relevant platforms and low clinical applicability of medical-industrial intersection results. According to the findings of the study, regarding the establishment of full-time organizations in colleges and hospitals for the cross-management of medical and industrial affairs, 39.29% said they fully agreed, 40.48% said they agreed, 19.05% thought they were average, and 1.19% disagreed. It can be seen that schools and hospitals have basically established relevant full-time management organizations initially. As for the construction of interdisciplinary information exchange and sharing platform, 58.33% thought that the current mechanism was very perfect, 28.57% thought that it still needed to be improved, 5.95% thought that it was in the process of preparation, 3.57% thought that it had not been established yet, and 3.57% said they were not sure. However, there is still a need for further improvement in the construction of the sharing platform.

The study found that in the interviews there were faculty members who said that "The project funding cycle is only two years, and the project will be closed in two years, so we will take our students to do the

project and develop it, and send out papers and projects, but the road to product application is still long". Medicine-engineering interdiscipline projects from the trial, development, application to clinical time span, long R & D cycle, "the process in the clinic is more troublesome, many projects need to be done for a long time". To deep plowing in a certain research direction requires long-term sustained investment, in the absence of market recognition, the project is often to apply for patents, and published relevant papers will be completed to end the project. It can be seen that at present, the medicine-engineering interdiscipline between universities and hospitals is mostly in the form of project cooperation, and the clinical application of the results achieved is relatively small, failing to truly realize the clinical transformation.

Relevant systems have been formed, but lack long-term effective guarantee mechanisms. The existing schools and hospitals have initially established systems and management methods related to medicine-engineering interdiscipline, but in the process of implementation, 39.29% of the interviewees believe that the difficulties of medicine-engineering interdiscipline are due to the inadequacy of the system. Some interviewees also pointed out that "There is a lack of relevant mechanism construction and mechanism guarantee, such as funding, property right guarantee, talent training, subject declaration, etc.". In terms of mechanism construction, there are mainly difficulties in the following aspects; the most difficult is the financial input and resource allocation (accounting for 82.14%); some teachers mentioned in the interviews that "There is insufficient or even no financial support for the project, which is easy for us to be insufficiently motivated, and it requires a lot of input to do the research, and it would be better if the funding is more adequate. More adequate funding would be better". This is followed by technological innovation and R&D capability, policy support, and orientation, which account for 66.67% respectively, and talent training and introduction (41.67%).

The current personnel management and financial reimbursement system and benefit distribution system are not perfect, "Universities and hospitals are two lines, teachers can only be reimbursed in the school, not to go to the hospital, doctors are reimbursed in the hospital, not to come to the school, but the project is owned by everyone, initiated by the university, it is more difficult to use it as a doctor who wants to use it". Currently, universities and hospitals lack the management of the basic conditions of research, integration of resources, sharing of research results and research experience, resulting in a great challenge to the intersection of medicine and industry.

Discussion: Countermeasures for Medicine-Engineering Interdiscipline Cooperation Between Universities and Hospitals

Forming an organizational culture of interdisciplinary communication. Colleges and hospitals should, through various forms, form a common follow organizational culture atmosphere and cultural concepts, laying a good foundation for cross-depth cooperation between medical and industrial. First, strengthen the cultural construction; offer relevant interdisciplinary courses to cultivate relevant talents; organize high-quality academic salons to promote exchanges between hospitals and universities; carry out regular project seminars to strengthen interdisciplinary exchanges and forms of cooperation; carry out activities such as mutual learning and visits, party building, and joint construction to cohesion of centripetal force between the two sides. Secondly, we will fully integrate the resources and infrastructures of schools and hospitals with high degree of relevance and complementarity, strengthen the construction of the supporting resource base, and form a mechanism of openness, sharing, and cross-fertilization.

Establishment of medicine-engineering interdiscipline transformation chain. Universities and hospitals should form a complete medicine-engineering interdiscipline transformation chain to promote the virtuous cycle of medicine-engineering interdiscipline, which can be referred to the following Figure 1. First, universities and hospitals should fully investigate the academic background, research fields, and specific needs of doctors and university researchers, and do a good job in matching doctors and teachers. During the interviews, some teachers mentioned that "Doctors have the most power to say whether the clinic needs them or not, and the project idea of medicine-engineering interdiscipline should be put forward by doctors". Doctors have medical background, and in the process of clinic, they will encounter a lot of difficulties and even "choke points", and there will be a lot of blockages and pain points in the process of preventing and treating diseases and maintaining health, so doctors are responsible for identifying and proposing problems, and researchers in universities will be oriented by the actual needs, and utilize their scientific and technological backgrounds to elevate clinical needs into scientific problems, and work with doctors. The university researchers are oriented to the actual needs, using their academic background in science and technology to raise the clinical needs into scientific issues, discussing with doctors and identifying the "entry point" and "breakthrough" to solve the problems. Secondly, focus on process management. Based on the above research, it is found that after the doctors put forward their demands, the research process of medicine-engineering interdiscipline projects is dominated by the participation of university research teachers and postgraduates, with less participation of doctors. Therefore, the mid-term check should be strengthened to ensure the smooth progress of the project. Thirdly, focusing on clinical application and oriented by "transformation rate", the evaluation mechanism should be adjusted so that the assessment will no longer be based on papers and patents, but more on the transformation of the project and the training of human beings, i.e., whether the project can be applied in the clinic to benefit the patients, and whether it is able to cultivate relevant medical-industrial cross-composite talents.

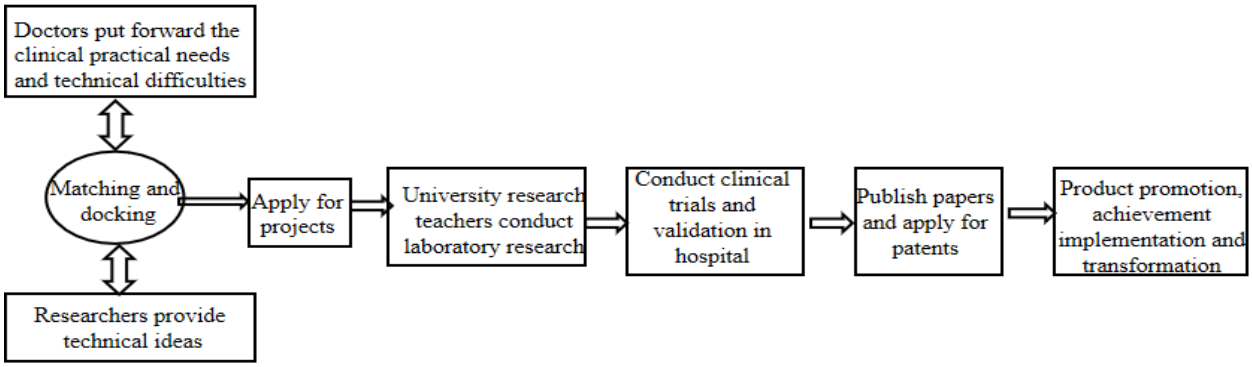

Figure 1. Idea diagram of medical-industrial cross-platform construction between universities and hospitals.

Sound and improved mechanisms and institutions. Build a platform for the transformation of medicine-engineering interdiscipline projects, set up a special organization responsible for medicine-engineering interdiscipline, and establish a supporting mechanism and system to promote the virtuous circle of medicine-engineering interdiscipline. First of all, take the project as a link to encourage teachers and doctors to jointly declare relevant subject funds. Break through the barriers between schools and hospitals, and between teachers and medical workers. Secondly, improve the allocation of resources and establish special funds for medicine-engineering interdiscipline, so as to provide sufficient institutional guarantee and financial support for

resource sharing, equipment sharing, and achievement sharing between schools and hospitals. Finally, optimize the existing title assessment and performance appraisal-related mechanisms in universities and hospitals to provide protection for interdisciplinary scientific research teams, provide mutual recognition and incentives for teachers and doctors to participate in interdisciplinary paper publications and subject declarations, and provide incentives for allowances and conditions of job promotion.

Conclusion

Universities and hospitals should collaborate with each other, and it is necessary for the leadership, researchers, and managers of universities and hospitals to form a consensus on medicine-engineering interdiscipline, give full play to the enthusiasm of the relevant personnel, constantly explore the new problems arising in the process of development of medicine-engineering interdiscipline, clear up the barriers of the mechanism and system, promote the integration and optimization of human, financial, and material resources, and form the mechanism of integration of the transformation of the industry-university-research integration to create a new growth point of the disciplines and to advance the cross-disciplinary synergistic development.

References

Jiang, T. Y. (2018). Research on the training mechanism of medical engineering interdisciplinary graduate students in research universities (Doctoral dissertation, Zhejiang University, 2018).

Liu, Q., Huang, G. L., Ding, Z. H., Qiu, H. X., & Yang, S. H. (2024). Preface to the special topic of “Medical Engineering Integration and Transformation”. *Chinese Journal of Lasers, 51*(9), 9-10+2.

Song, Y. N., & Liu, J. (2018). Construction of medical engineering interdisciplinary platform based on supply side reform. *Medical Education Research and Practice, 26*(2), 211-213.

Tan, H., & Sun, L. Z. (2012). Exploration and countermeasure analysis of cross disciplinary cooperation in medical engineering (science) in universities. *Science and Technology Management Research, 32*(14), 161-163+168.

Wang, S. H. (2021). Research on the cross disciplinary graduate education model in medicine and engineering (Doctoral dissertation, East China University of Science and Technology, 2021).

Wang, Y. D., & Tian, J. (2014). Focusing on drawing a blueprint for the development of “Medical Engineering Integration” in China. *Chinese Journal of Emergency Medicine, 23*(1), 6-7.

Yang, H. Y. (2008). The development of interdisciplinary studies at the graduate level in the United States and its implications for China. *China Higher Education Research, 24*(8), 40-44.