

## **An Exploration on the Teaching Reform of Bilingual Educational Basic Medical Courses for Biological and Medical Engineering Majors**

Shuo Yang<sup>1,a</sup>, Hongwei Zheng<sup>2</sup>

<sup>1</sup>Jilin Business and Technology College, Changchun, 130507, China

<sup>2</sup>Changchun Equipment and Technology Research Institute, Changchun, 130012, China

<sup>a</sup>yangyu1983@sina.com

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**Abstract.** The development of basic medical courses in the biological and medical engineering major has always been a problem for universities of science and technology. This is related with the orientation of such universities. Then, a complete knowledge system composed of basic medical knowledge and professional courses under limited conditions is the effective means to improve the level of biological and medical engineering major in universities of science and technology. This essay has initially explored the teaching reform of basic medical courses for the biological and medical engineering majors.

### **Introduction**

Biomedical engineering is an interdisciplinary subject formed by the reciprocal crossing, penetration and combination of engineering technology with medical science. Applying the principles and technologies of engineering, it solves the problems in bioscience, playing an important role in the development of modern medical science. But a complete teaching system has not formed yet due to the widely covered knowledge and the relatively short period of undergraduate education. Having always been an important part in the teaching system of biomedical engineering major, the teaching of basic medical courses is precisely a weak link of universities of Science and Technology. The teaching basis and experimental conditions of medical courses are far behind from those of medical colleges. In addition, the sufficient teachers have to teach huge contents in limited class hours and the practice base is well below the medical colleges in terms of gradation and convenience. Therefore, how to make the students efficiently and flexibly understand and master the knowledge of basic medical courses within a short period and make the basic medical courses and the other courses of biomedical engineering major form an integrated system has become a problem for the educators of biomedical engineering major in the universities of science and technology. In this connection, we have explored the teaching mode of basic medical courses for the biological and medical engineering majors of universities of science and technology, as concluded in the followings.

### **Integration of Basic Medical Courses**

According to the cultivation target of biomedical engineering major, the entire curriculum planning, teaching resources and environment, closely combining the characteristic photoelectricity of universities of science and technology, we have chosen the basic medical courses closely related with the professional cultivation, including systemic anatomy, human physiology, basic pathology, introduction to clinical medicine and biochemistry. All these courses are widely and closely connected. In the integration of courses, on the basis of anatomy, human physiology and basic pathology are integrated as physiopathology, mainly lecturing the knowledge about physiologic pathology related with the professional courses and supplemented with biological and chemical knowledge. The introduction to clinical medicine and the clinical medical engineering technology are combined as introduction to the clinical medical engineering, mainly teaching the medical instruments, the evolution of clinical mode and the application of medical apparatus and equipment in diagnosing of diseases. In this way, the six courses are integrated into three, that is, systemic analogy, physiopathology, introduction to clinical medical engineering supplemented by the experiments of analogy and physiopathology. The teaching from macro to micro can enhance the students' memorization. The teaching from morphology can help the students better the understanding of physiological function. The teaching from the norm to abnormality can enhance

comparison of the two. The teaching from medicine to the principles and technology of engineering is conducive to the combination of medicine and engineering and cultivation of the students' consciousness of innovation so as to improve the teaching efficiency.

### **Characteristics of the Writing and Integration of Textbooks**

As the educational courses develop, interdisciplinary sciences are expanded as well. Traditional textbooks can no longer meet the teaching needs of different levels. The medical colleges are usually five -year, which allows more basic medical knowledge to be learned than those of universities of science and technology. The textbooks nationally compiled for medical colleges. Because the length of schooling of universities is four-year and a few medical courses are set, basically two to three. Huge amounts of contents have to be taught in limited course hours. Therefore, it is not appropriate to use the basic medical textbooks learned by medical students. The key of the integration and reform of basic medical courses is the writing of specialized text books. But currently, China has not organized the writing of the basic medical textbooks for the students of the biomedical engineering major in universities of science and technology. And different colleges are using different textbooks. Against this background, according to the cultivation targets of universities of science and technology, the characteristic photoelectricity and the development direction of biomedical engineering, we have chosen the basic medical textbooks, compiled and published the applicable textbooks.

The projected teaching material (Version 7)<sup>[1]</sup> of the eleventh five-year plan edited mainly by Bai Lingshu and published by People's Medical Publishing House is chosen for systemic analogy. As a macromorphologic science, systemic analogy is connected with the professional lessons of biomedical engineering, expounding emphatically its status and role in biomedical engineering system and its morphological characteristics in iconography.

We have written and published the physiology textbooks<sup>[2-3]</sup> suitable for biomedical engineering major. Contents of photoelectricity are added, including the passive electrical characteristics, the relationship between the macro-current single-channel current and the optical characteristics of eyes. Organic and progressive junction with the relevant contents of subjects has prevented the disconnection among subjects and avoided repetition while ensuring that the textbook is systemic and complete. It has creatively explained the profound theories in simple languages with highlights and innovations. It is really thoughtful, pioneering, scientific and practical. When teaching physiology, the pathology is integrated as the comparison of the two is helpful for the association and memorization.

We have also written and published the textbook of introduction to clinical medical engineering in which clinical medicine and engineering technology is combined organically with the following contents: the physical property of organisms, the physiological effects of physical agents as well as the working principle, main technologies, installation, commissioning, maintenance of medical equipment and their role and status in the development of clinical medicine. Closely connected with the measurement and detecting technology of physiology, pathology and medicine, the structure and system of the course are more reasonable and practical. Its contents go from the easy to the difficult and sophisticated and are interpenetrated, broadening the horizon of students.

Reform the Teaching method and Upgrade the Teaching Means. In theoretical teaching, theories, discussion and the multi-media teaching means are utilized. Combining the characteristics of the major, the basic medicine and clinical applications, medicine and the principles and technology of engineering are linked as much as possible to make the students become more interested in learning what they feel is useful. Questions are set by teachers to lead students in learning and discussion. The previous teaching mode with teachers and coursebooks centered are changed. The theories level and experience of teachers are complemented with the strengths, functional advantages of students to improve the teaching efficiency. For example, when the cardiac morphology, structure and physiological functions are taught, the students will be asked how they will change when cardiac diseases happen. And how will such changes be reflected in clinical

electrocardiogram detection, iconography and ultrasonic images? In this way, the students can closely connect the anatomy, physiology, pathology and detecting knowledge. Through such expanded connection, the students are led to inter-cross the knowledge of medicine, electronics, picture processing and computers and enlightened to combine that of medicine and engineering. They will understand that the basic knowledge of medicine is the important foundation for the work in biomedical engineering technology which will promote the development of medicine in turn. Hence, the students are clear about the importance of leaning the basic knowledge of medicine with broadened horizon and knowledge. The interactive discussion between teachers and students helps their emotional communication and exchange of information. A new type of teacher-student relationship will thus be built, arousing the students' interest and enthusiasm in learning.

In experiment teaching, open and research-type teaching mode are adopted. We have not only paid attention to the cultivation of the basic medical skills but also emphasized more on thinking pattern and the methods also the abilities to observe and think. We have devised the comprehensive and designing experiment that combines medicine and engineering knowledge. The anatomical physiology experiment and signal detection, image processing experiment are integrated as physiological detection and signal processing experiment. The teachers will design the experiment contents and titles such as extracting and processing the electrocardiogram, respiratory signals, electroencephalogram and electromyography signals. As required, the students will be divided into groups to choose the subjects, design and complete experiments by themselves and independently. Having grasped the basic skills of basic medicine experiment and the use of devices, the students also further understood the detecting and processing method of physiological signals. The value of engineering technology in the application of medical detection is shown. The comprehensive and designing experiment integrating subjects is realized. And the abilities of the students in analyzing and solving problems dependently are cultivated.

In practical teaching, theories, practical teaching, scientific research projects are combined to improve the students' operational abilities and teach them initial scientific research methods. To achieve the above teaching results, we have sufficiently used the second classrooms and teaching bases. We have used the long-term stable bases for practical teaching, including Qianwei Hospital, Changchun Biological Products Institute, campus hospital, engineering training center, to practice the students' using, structural designing, working principles and maintenance technologies of the medical instruments. And the graduation projects are closely combined with the scientific research projects. As the contents of the graduation projects are closely related with the scientific research, most teachers have adopted the heuristic teaching approach to let students have access to both theories and applications, hardwares and softwares. Hence, the students' scientific research ability and spirit of innovation have been improved.

## **Conclusion**

In summary, the teaching of the basic medical lessons of the universities of science and technology, we have shifted the focus of cultivating the knowledge-type talents to the ability-type ones. According to the cultivation targets and the characteristic majors of the universities of science and technology, courses should be reasonably integrated with upgraded teaching contents and reformed teaching methods and ways. The knowledge of engineering science related with medicine should be correspondingly combined with basic medical courses teaching in ways of penetration or crossing. Taking the students of math and physics as the subject, the teaching method of cramming should be replaced with dominating, comprehensive and exploratory experiments. The contents of experiments must be related with realities to enable the students to learn the comparatively formal methods, experimental facilities, scientific research and statistics method and essay writing and other knowledge. The overall qualities of students will thus be improved to lay a solid foundation for their future work related with medicine.

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