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The construction and application of a blended teaching model under the strategic background of healthy China

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Abstract

In order to cultivate the ability of independent learning and lifelong learning of medical students, improve the ability of students to analyze and solve problems, improve the competence of medical talents and cultivate high-level and innovative talents, we have constructed the blended teaching model of "Clinical Case Investigation-Online Open Course Learning-Classroom PBL Seminar-After-Class Health Education". At the same time, an ability-oriented performance evaluation system improved the teaching quality feedback system has also established. This article introduces the construction and application of the blended teaching model, as well as the problems it faces, provides a theoretical basis for the optimization and improvement of this model. It also provides a model theory and practical basis for creating a blended online and offline "golden course" for the professional courses of medical laboratory technology.

KEYWORDS

application, blended teaching model, clinical biochemistry, construction, MOOC

INTRODUCTION 1

The major of medical laboratory technology is the forefront of cultivating senior medical professionals for medical laboratory work, and "Clinical Biochemistry" is one of the main courses of medical laboratory technology. The traditional teaching model of the course has drawbacks, the teaching methods and teaching model is too simple to stimulate the interest of students in learning, and to cultivate the ability of students in independent learning, lifelong learning, and innovation. "Blended learning" is gradually formed with the development of E-learning. The research on E-learning first appeared in "Training" Magazine in the United States in 1996, which refered to a teaching model that combines online and offline teaching.¹ Relying on the China University Massive Open Online Course (MOOC) platform, we have built an online course of "Clinical Biochemistry ", construted a blended online and offline teaching model, established an ability-oriented performance evaluation system and improved the teaching quality feedback system, strived to improve students' ability of independent learning and lifelong learning, and improve their ability to analyze and solve problems, with a view to providing new ideas and experience for classroom teaching reform.²

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After the 19th National Congress of the Communist Party of China put forward the "implementation of the Healthy China Strategy", modern medicine has gradually developed in the direction of "prevention first, combined with prevention and treatment". For the education and development of medical laboratory technology, it should also be in line with social requirements. The concept of "health-centered" is implemented in the process of education reform and innovation to deliver new high-level compound medical laboratory talented person to the society. Therefore, a heuristic teaching model that combines online and offline teaching with epidemiological investigations, PBL discussions, and general health education concepts will be the direction of future reforms.

2 | THE CONSTRUCTION OF BLENDED TEACHING MODEL

Implement the concept of "health-centered" into the education reform and innovation process, in the context of the Healthy China Strategy, the blended learning is pulled into the teaching of "Clinical Biochemistry". Centered on typical clinical cases, and through the analysis of



FIGURE 1 The flow chart of blended teaching model. From community epidemiological investigation to online self-learning to offline seminar learning to lectures and posters, realized the conversion of perceptual knowledge learning to ability transformation. A new education model centered on "preventiondisease-health" has been realized. First, we organized students to enter the community before class, and conducted interviews and questionnaire surveys on some common diseases and chronic diseases, so that students formed a perceptual understanding. Second, we used high-quality network resources to allow students to preview first, and then used offline classrooms to explain important and difficult knowledge combined with PBL, so that students could discuss relevant cases. This was the process of rational thinking. Finally, they returned to the clinic and conducted health education activities through practice, lectures, posters, and other forms. This was also the real link in their ability transformation and enhanced their sense of social responsibility

cases, allows students to master relevant epidemic investigations, clinical significance, evaluation of biochemical indicators and related knowledge of health education. In this process, three levels of integration from basic to clinical, theory to practice, and prevention to health and wellness were realized. Follow the cognitive law, it will realize the innovation of online and offline, in and out of class "integrated + blended" teaching model and open up a more vivid, happier and more autonomous learning space³ (Figure 1).

2.1 | Investigation of clinical cases

"Clinical biochemical tests of glucose metabolism" is an important chapter in "Clinical Biochemistry". Take this chapter as an example to explain the construction method and specific application of this blended teaching model. First, divide the class into groups with 8-10 students in each group. Each group of students nominates a group leader, who is responsible for calling everyone to participate in all kinds of extracurricular activities, division of labor and coordination within the group. Second, each group of students collaborates to collect diabetes cases, mainly including: (1) The situation when the patient came to the community service center; (2) medical history data, the current lifestyle of patients, exercise, diet, etc., to understand the existence of relevant risk factors, and pay attention to guiding students to notice whether there are clinical manifestations of diabetesrelated complications; (3) the results of the patient's physical examination and laboratory examination; (4) the community health management plan and implementation process, etc.

2.2 | Construction of online open class

The teaching team of this course keeps up with the forefront of subject knowledge, and has highly refined the knowledge points of the course. With biochemical detection technology and disease as the main line, we determine the teaching content of the online course firstly. There are 21 chapters of online courses. The chapters cover the main knowledge points such as "the evaluation of test methods", "application technology of biochemical testing", "biochemical testing of tissue, organ and system diseases" and "biochemical testing of diseases at specific growth stages"(Table 1). Reference materials mainly include classic foreign language textbooks such as "Clinical Biochemistry" published by Science Press,⁴ "Clinical Biochemical Laboratory Technology" published by People's Medical Publishing

TABLE 1 The knowledge points of the online course

	Chapter	Chapter name
	Chapter One	Introduction
The evaluation of test methods	Chapter Two	Quality Management of Clinical Biological Laboratory
	Chapter Three	Performance evaluation of Methodology and reagent kits
	Chapter Four	Diagnostic performance evaluation of diagnostic items
The application technology of biochemical testing	Chapter Five	Enzymology test technology
	Chapter Six	Automated analysis technology
	Chapter Seven	Clinical Biochemical Tests of Plasma Protein and Amino Acid Metabolism
	Chapter Eight	Clinical Biochemical Tests of Glucose Metabolism
	Chapter Nine	Clinical Biochemical Tests of Lipid Metabolism
	Chapter Ten	Clinical Biochemical Tests of Acid-base Balance
	Chapter Eleven	Clinical Biochemical Tests of Trace Elements and Vitamin Metabolism
	Chapter Twelve	Clinical Biochemical Tests of Serum Enzymes
The biochemical testing of tissue, organ, and system diseases	Chapter Thirteen	Clinical Biochemical Tests of Bone Metabolism
	Chapter Fourteen	Clinical Biochemical Tests of Hepatobiliary Diseases
	Chapter Fifteen	Clinical Biochemical Tests for Kidney Diseases
	Chapter Sixteen	Clinical Biochemical Tests of Cardiovascular Diseases
	Chapter Seventeen	Clinical Biochemical Tests for Endocrine Diseases
The biochemical testing of diseases at specific growth stages	Chapter Eighteen	Clinical Biochemical Tests for Pregnant Women and Fetuses
	Chapter Nineteen	Clinical Biochemical Tests for Childhood Diseases
	Chapter Twenty	Clinical Biochemical Tests for Geriatric Diseases
Experiment course	Chapter Twenty-one	Clinical Biochemical experiments

House.⁵ In addition, it also includes classic foreign language textbooks, such as Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics (7th ed.).⁶ The teaching team jointly developed a list of 57 theoretical knowledge points and 10 experimental knowledge points. Each knowledge point forms a video, and the duration of each video is controlled within 15 min. It was officially launched on March 12, 2020 on the MOOC of Chinese universities, providing high-quality pre- and after-school resources for our students.

2.3 | Classroom PBL seminar

PBL study and discussion just on diabetes cases collected by students in community hospitals. During the discussion, guide students to discuss diabetes-related risk factors; the results of physical examination and laboratory examination, especially the significance of results for further diagnosis; the health management plan of patients, patients the community health management plan of patients, implementation process, establishment of health records, implementation of health education, comprehensive intervention measures; assessing the risk of complications and death of patients, how to apply modern bio-psycho-social medicine model, and adopt effective comprehensive intervention measures to reduce the risk of death, prevent and delay the occurrence of complications, prolong the life of patients, improve the quality of life, and promote the health of patients and community residents. It aims to cultivate the ability of students to ask questions, analyze the problems and solve problems.

2.4 | Post-class health education

Apply the knowledge to epidemic science propaganda and health education, organize students to make the PowerPoint of "the goal of diabetes management, the control of risk factors, the measures and methods of health education, the implementation of health risk assessment, intervention measures and effect evaluation", conduct publicity exercises, and participate in the publicity work of community hospitals after class.

3 | ESTABLISH AN EVALUATION SYSTEM FOR CONTINOUS IMPROVEMENT

3.1 | Academic performance evaluation system

This teaching model will use "comprehensive index evaluation" as the evaluation method of students' total score. Specific scoring items include: formative evaluation (including pre-class case collection, pre-class online learning, offline PBL in class, after-class health education) and summative evaluation (test paper assessment) as a comprehensive score. Multi-dimensional evaluation methods can be used in formative evaluation, including teacher evaluation of students, student evaluation of students, and student evaluation of teachers, etc.⁷

3.2 | Teaching quality feedback system

The students' evaluation of teaching adopts the student evaluation system, and the teacher uses questionnaire surveys for students, peer teachers and teaching supervision, such as develop a teaching quality evaluation form for blended teaching model, and a blended teaching quality supervision expert evaluation form for teaching model, etc. At the same time, information is collected, sorted, and counted regularly, and a standardized feedback system is established.

4 | TEACHING OUTCOME

4.1 | The survey of student recognition

We conducted an online questionnaire survey on the blended courses of "Clinical Biochemistry". A total of 178 students from the 1701 to 1705 class of medical laboratory technology participated in the questionnaire. Among them, 91.8% of the students thought that the instructor took seriously to the course, 32.2% of students thought that through this blended model, independent learning ability has been significantly improved, and 67.2% of students thought that it has improved; 54.1% of students were very satisfied with the effect of blended teaching, and 44.2% were basically satisfied (Figure 2).

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Students also have positive feedback on the blended learning. For example, "This course combines online and offline, more interaction and communication, online courses could be reviewed multiple times, which promotes the understanding of the content." "This kind of blended teaching could encourage us to improve our ability to learn independently, and the teachers are also very responsible and conscientious." "The analysis and discussion of clinical cases make us more clinically relevant; online Q&A is more timely and convenient.", and so on.

4.2 | The statistics of student performance

From the perspective of performance distribution, students who had taught by this new teaching model had a better grasp of the course content. Among 74 students, 25 students had scores above 80, accounting for 33.79% (Figure 3a). From the perspective of performance distribution, of the 104 students who had gone through the traditional teaching mode, only 22 students scored above 80, accounting for 21.15% (Figure 3b).

5 | THINKING AND PROPECTS OF IMPLEMENTING BLENDED TEACHING MODEL

5.1 | Optimize the traditional teaching model

This kind of new teaching model has changed the traditional teaching model of "Clinical Biochemistry", such as



FIGURE 2 Online questionnaire survey. (a) Whether instructor took seriously to the course, (b) has the independent ability been improved, and (c) satified with blended teaching



FIGURE 3 Score distribution statistics. (a) Students who had taught by this new teaching model, 74 students in total. (b) Students who had gone through the traditional teaching model, 104 students in total

the disconnection between clinical and technical disciplines, the disconnection between theory and practice, the disconnection between basic and clinical practice, the disconnection of detection indicators, technology and the logical thinking of clinical diagnosis, and many other shortcomings.

5.2 | Improve the learning ability of students

Encourage students take the initiative to explore unknown scientific issues, and organically combine learning, inquiry, and practice. Clinical-related case investigations have cultivated students' comprehensive capabilities such as teamwork, clinical thinking, and clinical diagnosis; online open course learning and classroom PBL seminars have improved students' enthusiasm and initiative in learning, application and analysis of knowledge. After-school health education and popular science publicity have established the concept of preventive health and well-being of students, enhanced the professionalism of humanistic care and doctor-patient communication, and ultimately enhanced the ability of independent learning and lifelong learning of students.8

Enhance the teaching ability of 5.3 teachers

Firstly, it has improved the ability of teachers in teaching design. Through careful classroom design, students' learning autonomy is stimulated, students' participation is improved, and a good learning atmosphere is formed. Secondly, it has strengthened the communication and exchanges between teachers and students. Thirdly, it has improved the teachers' ability of informatization teaching, including the use of network platforms and the information-based softwares.

5.4 Promote the research of teaching theory system

Recently, the Ministry of Education of the People's Republic of China, National Health Commission of the People's Republic of China have gradually realized the importance of blended teaching in higher education. The Ministry of Education's Ten-Year Development Plan for Informatization of Education (2011-2020) mentioned that "Basically formed internationally advanced level, the integration of information technology and education integration and innovation development of informatization education with Chinese characteristics. Blended teaching has become a hot spot in the practice and research of current educational informationization. Blended teaching currently mainly focuses on the research of design and development, and the links of analysis, implementation and evaluation need to be further improved. The research on the theory system of blended teaching is not yet perfect. For different courses, the theoretical system and teaching design are different, so relevant research is needed.^{9,10}

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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