

An Innovative Course “The Comprehensive Experiments and Experimental Design of Basic Medicine”: A Case of Third Military Medical University in China

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ABSTRACT

An important goal of contemporary medical education is to cultivate and improve the comprehensive and innovative abilities of medical students. One significant way to fulfill this goal is to explore the course reform of experimental teaching in basic medicine. A new course named “The Comprehensive Experiments and Experimental Design of Basic Medicine”, is developed targeting the senior students in Chinese medical university in recent years. As an independent experimental course, it is a good teaching platform in the pre-clinic years to enhance students’ comprehensive and innovative abilities. Meanwhile, it has completely altered the situation of experimental teaching affiliating to theory teaching in most Chinese medical universities, making experimental teaching significant in undergraduate medical education.

Keywords: Medical education; Course reform; Experimental design; Innovative ability.

INTRODUCTION

A common phenomenon in Chinese medical education is that students are overburdened with lecture sessions and there exists an overemphasis on didactic teaching and examinations in the five-year medical education programs. In addition, because of China's one-child policy, most of the students now are the only child in their families, and tend to be self-centered, lacking team spirit. Hence, the present challenge for both our government and medical universities is how to improve the quality of medical education and to train qualified students in limited academic hours, who can adapt to a rapidly changing world and simultaneously meet the needs of the Chinese people.¹

The independent course with integrated and innovative experiment has been lacking for long in most Chinese medical universities.

In 2007, based on the experimental teaching reform in our university, we set up an independent and innovative experimental course for the third-year undergraduate students. It was named “The Comprehensive Experiments and Experimental Design of Basic Medicine”, which has become an integral part of core course in our university, and completely altered the situation of experimental teaching affiliating to the theory teaching for a long time in most Chinese medical universities. There is a consensus that the ultimate goal of this course, and even of medical education as a whole, is to create ‘doctors with comprehensive ability.

CHARACTERISTICS AND CONTENTS OF THE COURSE

To transform the theories into practice and consolidate the learning, various experimental courses for different medical disciplines

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have been established, which affiliate to the theory lessons. Students, however, do not pay attention to experimental courses. Some simple experiments are repeated, taking too much time and reducing students' interest in basic medicine. The new course focuses on integrated multidisciplinary experiments of basic medicine and connects the common clinical diseases, which is assumed to have a potential for "bridging the gap between the classroom teaching and the clinical setting". As a "bridge course", it is characterized by being tightly correlated with clinic diseases and having more applied experiments, and can alleviate a remarkable contradiction that the juniors contact the clinical diseases late in China.²

The course is divided into three sessions: Theory Lesson, Experiment Practice and Experimental Design. In Theory Lesson, we start to train the juniors to have the basic knowledge of medical research, such as the view of methods for medical scientific research, literature retrieval, the disciplinary frontier and how to design an experimental procedure. The Experiment Practice contains 8-9 medical comprehensive experiments, including some comprehensive research-based experiments, application-oriented experiments and animal model with clinical diseases. According to teaching results and feedback of students, we will adjust experimental contents partly next year (A recommendatory contents of this course in our university in 2012 is shown in Table). Experimental Design is one of the largest highlights of the course. In this session, students with training in the first two sessions work in pairs to design an experimental procedure, and then present the design for oral defense. Each pair of students must conceive how to

find their innovative idea in the latest study of a certain field by reading a lot of literature. Students' comprehensive abilities in reading, thinking, writing and oral expression are trained in this session.

HOW TO ORGANIZE THE COURSE

There are 90 academic hours in total in this course. Among them, theory lessons account for 25 academic hours, which are given by the senior associate professors from different departments of our university. Interdisciplinary collaboration is essential in the organization of this course. The teaching aims to train students to acquire the basic research approaches and ideas. The students can learn how to get useful information from literature, how to design a research project, what is the latest progress in the concerned fields in general, which is the foundational knowledge for their self-designing later.

The experimental practice consists of 55 academic hours in total, which are given by teachers from the Experimental Centre of Basic Medicine Department in our university. It requires a high-quality teaching team to give this course. All the teachers in our center have master's degree in medicine, and are experienced in experimental teaching. Almost 18 students in each class are divided into six small groups. It usually takes almost 40 minutes to explain the overview of experimental principles, experimental procedures and crucial steps. Modern teaching technologies, such as multimedia and virtual experimental teaching systems, which are generally integrated with traditional teaching aids, have been widely adopted.³ We try to create a learning environment

Table Recommended Contents of the Course in our University (2012)

Sessions	Contents
Theory Lesson	1.An introduction to medical experiments
	2.How to write articles of medical scientific research
	3.Literature retrieval and disciplinary frontiers
	4.How to select scientific research topics and design medical experiments
Experiment Practice	1.Depressor nerve and Phrenic nerve discharge and their influencing factors
	2.Hyperkalemia leads to arrhythmias in rabbits and its treatment
	3.Influencing factors of arterial blood pressure and urine formation
	4.Animal models of cerebral hemorrhage and its treatment
	5.Animal models of organic phosphorus toxication and its treatment
	6. In vivo myocardial cell action potential and ECG in recording and analysis
	7.Observation and treatment measures of pneumothorax in animal model
	8.Microscopic morphological observation about movement of ciliary epithelium cells
	9.Different influencing factors on learning and memory in mice
Experimental Design	1.Self-design an experimental procedure
	2.Oral defence

which features resource sharing and open experimental teaching in our university. After explanation, we assign 3–4 students to be in one group, and each student will take turn to perform the animal operation in different experiments, while the other assist in and observe the operation, and record the experimental data during the process. Experimental animals include rabbits, rats, mice and guinea pigs. When different experimental phenomena and results occur, small group discussion will be organized. Teachers should arouse students' enthusiasm and initiative, leading students to explore principles and relate them to clinical phenomena during the whole process, which meets the requirements of the modern medical education.⁴

Ten academic hours are distributed to experimental design, which is the last session of this course. Based on some basic scientific theories, students decide on the research areas of interest by searching in library, browsing on the web and reading literature. Then they finish the experimental self-designing. Two students form a group. After preparing the design with great care, students are asked to demonstrate their design by PPT (PowerPoint) slides for half an hour in front of the class, and to answer questions about the design from experts and classmates. Experts who are invited as the judges give the final mark according to feasibility and innovation of the design.

HOW TO ASSESS THE COURSE

The examination is mainly for the evaluation of course quality. How to establish an objective, impartial and truly effective examination system is a key factor to a well-designed course.⁵ The basic method used to assess students' achievement is the written examination for most Chinese medical curricula. It usually takes the form of a paper and pen evaluation. However, this is disadvantageous to develop and assess the comprehensive and innovative abilities of students. To break through the traditional assessment, an objective evaluating mode (100%) is devised in this course, which is subdivided into four parts, including Usual Performance (20%), Experimental Report Writing (20%), Practical Operating Examination (20%), Experimental Design and Oral Defense (40%). The scores of two students in pair in the Experimental Design and Oral Defense is same, the other parts are individual according to each student's performance.

Usual Performance requires students to practice positively and earnestly during the whole experimental process. In Experimental Report Writing, students are requested to follow the writing standards, and focus on the experimental data analysis and discussion part. Practical Operating Examination values the normalization

manipulation and operation cooperation ability on animals, especially the ability of showing humanistic care to animals. In the Experimental Design and Oral Defense, students should try their best to prepare PPT according to the design. The presentation provides students a stage to develop organization abilities, team spirit and presentation skills, which enhance the self-innovation atmosphere among the undergraduate students. This part is rated based on the six factors: innovation, rationality, practicability, correct application of experimental methods, aesthetic property of PPT, presentation and question answering abilities. As a whole, the sum of the scores of the above items is viewed as the final score of each student.

THE SIGNIFICANT EFFECTS OF THE COURSE

This course has completely altered the situation of experimental teaching affiliating theory teaching in most Chinese medical universities since the setting up of this course several years ago. According to our research, we found that students lay stronger foundation on theories and apply them more conveniently after this course compared to other experimental courses, which is the ultimate aim of the experimental curricula. The integrated and innovative experiments reduce some repeated experiments. Thus students can have more creative thinking and show great interests in basic medicine. Students said this course was what they are most interested in and improved in all experimental courses, they can learn more from this course, not just application of theoretical knowledge like other basic medical experiments.

The course can foster students' team spirit. During animal operations, they must learn how to cooperate with each other. When the different experiment results were occurred, they will discuss each other and analyze the reason. When designing an experiment, they must work together and share idea with his partner. All of these are particularly important to the young students born during 1990s in China. This course also gives an opportunity for students to initially understand some clinical diseases and their treatments before they contact with clinical courses.

Most importantly, innovative consciousness of students, which most students lack under current Chinese educational system, has been enhanced by this course. After this course, students can learn how to read literature, how to design a research project and early engage in scientific researches. Teachers found the students' comprehensive ability are enhanced, not just study in the textbook, so they are glad to welcome some outstanding undergraduate students to join his research team. So far, some juniors have participated in some research

projects in different disciplines. Some published articles in SCI journals, and some obtained Chinese invention patents. A few students have received various municipal awards, or even national awards. Several students were invited to present their findings at the international conferences in 2009–2012.

Our medical undergraduates are striving to be doctors with comprehensive ability, which is an urgent requirement of the undergraduate medical education in China. Significantly, this course can not be implemented without interdisciplinary collaboration, and it relies on not only the overall strength of the teaching staff, but also the teaching experimental conditions. Despite that this course is only established in a few

Chinese medical universities, it is reasonable to predict that it will be carried out in an increasing number of medical universities in China.

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