

# Teaching Reform and Practice of Medical Microbiology Course Based on Innovative and Entrepreneurial Talent Training Mode

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## ABSTRACT

In the context of innovation and entrepreneurship education, medical microbiology is characterized by close connection with clinical practice and strong practicality. In this work, innovation and entrepreneurship education was integrated with medical microbiology. It is conducive to improving teachers' innovation and entrepreneurship education literacy, scientifically infiltrate innovation and entrepreneurship education in classroom teaching and practice teaching, and participate in various innovative entrepreneurship practice activities. On the other hand, the corresponding course assessment mechanism was adopted to promote the deep integration of innovation and entrepreneurship education and subject teaching, thus cultivating new medical talents with innovative spirit.

**Keywords:** *Innovation and entrepreneurship education; Medical microbiology; Teaching reform*

## 1. INTRODUCTION

In 2014, Premier Li Keqiang proposed "mass entrepreneurship and innovation". In 2015, the State Council issued "the implementation opinions on deepening the innovation and entrepreneurship education reform in colleges and universities". All of them clearly put forward the core talent training mechanism based on innovation and entrepreneurship, and build an ecological environment for innovation and entrepreneurship education. Innovation and entrepreneurship education is integrated into the process of talent training in higher education, and students' innovation consciousness, entrepreneurship and creativity are cultivated and shaped [1-2]. Medical microbiology is a life science closely related to clinic, which mainly studies the morphology, structure, pathogenic mechanism, laboratory diagnosis and specific prevention and control of pathogenic microorganisms. It is characterized by close connection with clinical practice and strong practicality. At the same time, the professional knowledge of this course can be applied to the practical life and transformed into the theoretical basis of innovation and entrepreneurship. Therefore, it is more conducive to integrate innovation and entrepreneurship education in medical microbiology, so that students have a certain degree of innovation and entrepreneurship literacy on the basis of mastering solid professional knowledge [3]. At present, professional teachers lack the concept of innovation and entrepreneurship, neglect innovation and entrepreneurship education, and can't effectively combine it with theory and practice courses. Moreover, the innovation and entrepreneurship education has not been

linked with the second classroom. The course evaluation mechanism is single, and students' entrepreneurship, innovation concepts and abilities cannot be cultivated. Therefore, it is of far-reaching significance to reform medical microbiology teaching and explore a scientific and reasonable way to integrate the two in the context of innovation and entrepreneurship education.

## 2. ACTIVELY UPDATING TEACHERS' IDEAS AND IMPROVING INNOVATION AND ENTREPRENEURSHIP EDUCATION LITERACY

Some teachers lack the relevant concept and knowledge of innovation and entrepreneurship education, and fail to realize the importance of innovation and entrepreneurship education to the cultivation of students' innovation spirit and practical operation ability. In the teaching of medical microbiology, they only impart professional knowledge, and do not integrate innovation and entrepreneurship education with it well. Therefore, teachers should learn the theoretical knowledge of innovation and entrepreneurship; understand the national entrepreneurship and innovation policy, thus infiltrating the innovation and entrepreneurship education into the classroom and outside teaching activities. Consequently, students' entrepreneurship, innovation ideas and abilities are cultivated, and students' entrepreneurship and innovation activities are guided [4]. Professional teachers should update their teaching ideas, broaden their teaching horizons, and improve innovation and entrepreneurship education literacy by actively participating in internal and

external innovation and entrepreneurship education training and related meetings. In recent two years, our school has increased its efforts in innovation and entrepreneurship education training, and hired entrepreneurs and innovation and entrepreneurship experts and professors to give training lectures for teachers. 20 backbone teachers are selected to participate in the qualification certification program of innovation and entrepreneurship higher education teachers in Shenzhen University and Tsinghua University. This program is sponsored by China University Innovation and Entrepreneurship Education Alliance. Some professional teachers in the teaching and research office are involved in it.

### **3. SCIENTIFICALLY INFILTRATING INNOVATION AND ENTREPRENEURSHIP EDUCATION AND CONSTRUCTING NEW CLASSROOM TEACHING MODE**

In order to guide students to establish the awareness of innovation and entrepreneurship, a new classroom teaching environment with students as the main body is a powerful guarantee for innovation and entrepreneurship education. The new multi-element interactive teaching mode with information technology as the carrier is adopted to build the medical microbiology course website, which organically combines PBL teaching method, case analysis method, role-playing method, discussion teaching method, etc. Different chapters, contents and teaching objects should adopt different teaching modes, instead of being stereotyped and stuck in one mode. Therefore, the introduction, bacteria morphological structure, physiology, heredity and variation, and virus basic characteristics in this course are theoretical for the clinical medicine major. The content is abstruse and difficult to understand, and it is mainly based on teaching method. At the same time, it is necessary to pay attention to preview after class combined with the group discussion method, heuristic teaching, etc. Before each class, students should study by themselves, search relevant learning content on the Internet, and have targeted lectures to help them understand this part of the content. The pathogenic mechanism of bacteria and virus, disinfection and sterilization and biosafety bacteria, drug resistance of bacteria and virus, and prevention principle of bacteria and virus infection are closely related to clinical diseases. Therefore, the teaching mode is based on the website of medical microbiology course. At the same time, it can combine role-playing method, case analysis method, teaching method, discussion method, heuristic teaching, etc., to teach. For other chapters, PBL teaching method is the main teaching method combined with case analysis method, heuristic teaching, etc. Therefore, each class will send typical representative cases to students through the class QQ group. Through the teaching resources such as teaching videos, cases, exercises, etc., provided by the medical microbiology course website,

students can carry out independent learning after class. In the classroom, new knowledge is learned through group discussion, role play and teacher guidance. Taking the cultivation of innovative thinking as the starting point and case analysis and practical research as the premise, the hybrid teaching mode can focus on the organic combination between theory and application based on the course website [5]. Students should actively discover and analyze problems, and learn the skills to collect and organize knowledge, and students' analysis and judgment ability should be trained [6]. Consequently, students' innovation and entrepreneurship inspiration is stimulated, and students' innovative thinking is cultivated to promote students' independent learning and teaching learning [7]. The teaching form has changed from teaching-oriented to learning-oriented. It is necessary to optimize the quality and efficiency of teaching and cultivate new talents with innovative spirit and practical ability. This new teaching mode has been practiced in the clinical excellent doctor class since 2015, and the teaching effect is good.

### **4. STRENGTHENING PRACTICE TEACHING LINK AND STIMULATING INNOVATION AND ENTREPRENEURSHIP INSPIRATION**

Medical microbiology is a subject with strong practical operability based on scientific experiments. Therefore, medical microbiology experiment course, as a platform combining theoretical knowledge with scientific practice, is an effective way for students to master innovation and entrepreneurship knowledge and practical operation ability. According to the different professional needs and training objectives, the experimental syllabus is revised combined with innovation and entrepreneurship literacy. The experimental class hours of clinical and rehabilitation majors are 22 hours. However, the experimental class hours of oral, nursing and inspection majors are 16 hours. In the past, the experimental course was arranged according to the content and schedule of the theoretical course to verify the learning content of theoretical course. This arrangement lacks continuity and can't stimulate the enthusiasm and ability of students' independent learning. Therefore, the experimental course was arranged after the completion of the theoretical course. The teaching method is students' independent study and group discussion instead of students' operation after teachers' explanation. The experiment is divided into two parts. The first part is to exercise the basic operation skills and comprehensive application ability of medical microbiology. It includes isolation and culture of bacteria, drug sensitivity test, virus culture and serological examination, isolation and culture of blood specimen, identification of pus specimen, isolation and culture and identification of intestinal specimen, etc. The other part is a comprehensive design experiment which mainly stimulates students' creativity and entrepreneurial passion. Students divided themselves into groups, consulted the literature, designed the

experiment scheme in the form of group discussion, and completed the whole experiment operation process independently. Finally, the conclusion is drawn through discussion, reasoning and comparative analysis, and the experimental report is written [8]. This form of experimental class greatly stimulates students' enthusiasm for learning, improves their ability of autonomous learning and problem-solving, and enables students to have innovative awareness and ability.

## **5. PARTICIPATING IN VARIOUS PRACTICAL ACTIVITIES THROUGH INNOVATION AND ENTREPRENEURSHIP PLATFORM**

Various forms of innovation and entrepreneurship practice activities inside and outside the school are direct and effective ways to stimulate students' innovative thinking and entrepreneurship awareness [9]. Through the practice platform, students' knowledge application and entrepreneurial ability are improved combined with theoretical learning. The students' passion for scientific research is cultivated, and students are encouraged to set up a second classroom scientific research practice group and voluntarily participate in teachers' scientific research experiments. With the help of the basic medical experiment center platform in Jiamusi University, teachers should guide students to actively apply for the unique president innovation and entrepreneurship fund project and school level innovation and entrepreneurship training program project in Jiamusi University. Among them, excellent works are selected to apply for national and provincial innovation and entrepreneurship training program. Three national innovation and entrepreneurship training programs and five provincial innovation and entrepreneurship training programs are approved. Students are encouraged to participate in various competitions. In the fall of 2016, a competition for medical microbiology knowledge and skills was held in grade 14 clinical medicine industry, achieving good teaching results. The guided students won one first prize and one second prize in the "Internet +" college students innovation and entrepreneurship competition in Heilongjiang Province, and won one third prize in the 15th "Challenge Cup" Heilongjiang university students' extracurricular academic and technological works competition. Through various competitions, students' subjective initiative can be fully exerted, and they can actively observe, think, analyze, reason, innovate and practice. It can also enhance learning initiative, stimulate the process of students' creativity, and cultivate students' innovative consciousness and innovative thinking [10]. For clinical medical undergraduates, the innovation and entrepreneurship forum on medical microbiology, scientific research introductory training, literature retrieval, experimental design lectures, etc., are carried out. This gradually forms a good ecological environment for innovation and entrepreneurship teaching of this course, and promotes the deep integration of

innovation and entrepreneurship education and medical microbiology.

## **6. REFORMING COURSE ASSESSMENT MECHANISM AND PROMOTING THE DEEP INTEGRATION OF INNOVATION AND ENTREPRENEURSHIP EDUCATION AND SUBJECT TEACHING**

The course assessment and evaluation method is an effective way to measure the teaching effect of teachers and the learning result of students [11]. The assessment and evaluation method not only directly affects the learning effect and method of students, but also is an important reference for teachers to improve classroom teaching [12]. In order to cultivate students' innovative thinking and ability, the assessment and evaluation methods of medical microbiology pay more attention to teaching interactive process and students' practical ability training. Therefore, this course adopts the comprehensive evaluation mechanism combining process evaluation and final evaluation, which can pay more attention to the evaluation of students' innovation ability and practical ability. It is composed of three parts: the traditional examination paper assessment method, the process assessment and the experimental course assessment (see Table 1). The examination paper accounts for 60% of the total score. After the course, the whole class will have a unified closed book examination. The process evaluation focuses on the assessment of learning process in stages, and teachers adjust teaching strategies based on the assessment results. This part of the score accounts for 40% of the total score. Specifically, it includes four aspects. First, the evaluation of classroom learning effect, which includes answering questions in class, attendance at ordinary times and completion of homework, accounting for 10%. Second, the evaluation of group learning activities (comprehensive performance such as group speech, discussion, role play, etc.) accounted for 10%. Third, the evaluation of participating in extracurricular activities (the knowledge and skills competition of medical microbiology, the training program of college students' innovation and entrepreneurship, and various innovation and entrepreneurship competitions held every semester) accounted for 10%. Fourth, the results of experimental courses account for 10%. The experimental course focuses on training students' practical operation ability and innovative thinking, including experimental report, attendance in the experimental course, performance of comprehensive design experiment, etc. This assessment and evaluation method enables students to continuously discover new problems, master new knowledge, exercise new thinking, and comprehensively improve the practical ability of innovation and entrepreneurship [13].

**Table 1.** Evaluation mechanism

Mode	Method	Percentage of assessment score in total score (%)	Assessment function
Final evaluation	Examination papers	60	Focusing on basic theory knowledge
Process evaluation	Evaluation of classroom learning effectiveness	10	Cultivating innovative thinking
Process evaluation	Evaluation of group learning activities	10	Inspiring innovative inspiration
Process evaluation	Evaluation of extracurricular activities	10	Cultivating innovative thinking Fostering entrepreneurship
Process evaluation	Experimental results	10	Hands-on ability and new thinking

## 7. CONCLUSION

In the three rounds of teaching application, good teaching effect has been obtained. After training and learning, teachers have updated their teaching ideas, and can integrate innovation and entrepreneurship education into teaching practice, so that they can pay equal attention to theory and practice, and in class and out of class. At the same time, they lead the students to participate in the innovation and entrepreneurship competition and achieve great success, thus integrating innovation and entrepreneurship education in medical microbiology teaching through various channels. The results of questionnaire survey show that 85.63% of the students think that this teaching form has cultivated students' innovative thinking and entrepreneurial consciousness, and it is necessary to carry out innovative and entrepreneurial education in the teaching of medical microbiology.

Adapting higher education to new economic development is a new mission for higher education reform. It is an inevitable trend for social development to integrate innovation and entrepreneurship education scientifically and reasonably into higher education [14]. Professional courses are the cornerstone of innovation and entrepreneurship education. It should not only pay attention to the study of theoretical knowledge, but also stress the cultivation of innovation and entrepreneurship practice ability. Under the ecological environment of innovation and entrepreneurship education, it is necessary to explore effective teaching methods of medical microbiology. The training of students' innovative spirit, creative thinking and innovation and entrepreneurship practical ability should be carried out in every link of the major. Teaching reform should be carried out scientifically and effectively to promote the integration of the two, stimulate students' enthusiasm for innovation and entrepreneurship, and cultivate new medical talents with innovative spirit.

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