

# Practice and Effectiveness Analysis of Teaching Reform Integrating “Interdisciplinary Integration + Case-Based Teaching + Multi-Dimensional Evaluation”

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**Abstract:** Based on the first-class course construction project of Diagnostics and the high-quality demonstration course project for postgraduate education at Fujian University of Traditional Chinese Medicine, this paper systematically analyzes the implementation effect of the teaching model integrating “interdisciplinary integration + case-based teaching + multi-dimensional evaluation” in the course, using course application materials and questionnaire survey data from 66 students. The study introduces innovative teaching methods such as Problem-Based Learning (PBL), flipped classroom, role-playing, and failed case teaching, and closely integrates the successful experience of Professor CHEN Zhibin’s Fujian Provincial Famous TCM Physician Studio in the diagnosis and treatment of lung impediment (feibi in TCM terminology). On this basis, a new assessment system featuring “progressive evaluation + multi-dimensional assessment” is constructed. Survey data show that students’ satisfaction with practical training courses and internship courses reaches 8.8 points and 8.94 points respectively (out of 10 points), and 74.24% of students prefer the content of internship courses the most. The teaching reform has significantly improved students’ clinical thinking ability and practical operation skills, providing replicable experience for the construction of clinical medicine courses.

**Keywords:** Diagnostics; Teaching reform; PBL teaching; Clinical thinking; Course construction

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## 1. Introduction

As a bridging discipline connecting basic medicine and clinical medicine, Diagnostics plays a crucial role in the medical education system. Postgraduate education is an important component of modern university education, representing a country’s highest level of education, and has distinct training objectives different from undergraduate education <sup>[1]</sup>. Diagnostics, as a basic skill that postgraduates must master before officially entering clinical practice, is therefore a top priority in medical students’ educational journey. With the transformation of medical education models and the increasing requirements for clinical practice, the traditional teaching method

centered on theoretical lectures can hardly meet the needs of cultivating outstanding medical talents. To adapt to the development and changes of the times, the online-offline blended teaching method has stood out in medical education models<sup>[2,3]</sup>.

In the author's previous research<sup>[4]</sup>, it was found that the "interdisciplinary cooperation" teaching model centered on case-based teaching was recognized by most students, with remarkable teaching effects worthy of promotion. Therefore, based on the university-level first-class undergraduate course construction project and the postgraduate education high-quality demonstration course project, the author further carried out systematic teaching reform exploration to address the existing problems in current teaching, such as the disconnection between theory and practice and insufficient cultivation of clinical thinking ability. Meanwhile, the successful experience of Professor CHEN Zhibin's Fujian Provincial Famous TCM Physician Studio in the diagnosis and treatment of lung impediment was closely introduced into case-based teaching.

By analyzing questionnaire survey data from 66 students, this study comprehensively evaluates the implementation effect of the teaching reform. With "interdisciplinary cultivation" and "role-playing + excellent cases of famous physicians + real failed cases" as the core, the reform innovatively incorporates both the successful cases of Professor CHEN Zhibin's Studio in treating lung impediment and real clinical failed cases into the teaching process, and constructs a diversified teaching evaluation system. The research results not only provide empirical evidence for the construction of the Diagnostics course but also offer reference experience for the reform of clinical medicine-related courses.

## **2. Background and objectives of teaching reform**

### **2.1. Analysis of the current status of the course**

Diagnostics is a core course for clinical medicine majors, covering multiple modules such as symptomatology, physical examination, laboratory diagnosis, and auxiliary examination. The traditional teaching model has the following prominent problems:

- (1) Separation of theory and practice: Classroom teaching mainly focuses on the explanation of knowledge points, and students lack opportunities to apply theoretical knowledge to clinical scenarios. A questionnaire survey showed that before the reform, only 21.21% of students were interested in the content of theoretical courses.
- (2) Single teaching method: Over-reliance on teachers' lectures leads to students passively accepting knowledge, with a lack of active thinking and exploration. Some students reported that "the teacher just reads the PPT in class, which makes me feel exhausted mentally".
- (3) One-sided evaluation method: Excessive emphasis is placed on the final written examination, while formative evaluation of students' clinical thinking and practical abilities is ignored. Approximately 34.85% of students believed that the original evaluation method was "not very reasonable" or "very unreasonable."

### **2.2. Setting of reform objectives**

Based on the above problems, the course team has established three major reform objectives:

- (1) Knowledge integration objective: Break down disciplinary barriers and promote the organic integration of basic medical knowledge and clinical practice. Through interdisciplinary teachers' collaborative teaching and interdisciplinary training, students build a systematic knowledge system of diagnostics.

- (2) Competence development objective: Focus on improving students' clinical thinking ability, doctor-patient communication ability, and teamwork ability. Adopt a "role-playing" model to enable students to master diagnostic skills in simulated real clinical scenarios.
- (3) Literacy cultivation objective: Integrate medical humanities education to cultivate students' "people-oriented" professional values and rigorous and realistic scientific attitude. Through the teaching of failed cases, strengthen students' sense of responsibility and risk awareness.

### **3. Implementation plan for teaching reform**

#### **3.1. Development of teaching team**

The course team is led by the director of the teaching and research section and brings together senior physicians from 5 departments of the Second Clinical Medical College:

- (1) Team composition: It includes 3 associate chief physicians and 2 attending physicians, covering the departments of cardiovascular medicine, respiratory medicine, gastroenterology, critical care medicine, and medical technology, with an average of 12 years of clinical work experience.
- (2) Division of labor and collaboration: The "modular responsibility system" is adopted, where each teacher undertakes the corresponding teaching content based on their professional expertise. In particular, the teaching of internship courses and practical training courses is more detailed and professional.
- (3) Teacher training: Regular training on new teaching methods such as Problem-Based Learning (PBL) and flipped classroom is carried out to ensure the unification of teaching concepts and standardization of teaching methods. Three group lesson preparations and two demonstration class observations are organized each semester.

#### **3.2. Reconstruction of teaching content**

##### **3.2.1. Reform of theoretical teaching**

- (1) Framework-based teaching: Teachers use blackboard writing to establish a knowledge framework and require students to draw mind maps after class. According to a survey, 60.61% of students believe that this method is helpful for systematizing knowledge.
- (2) Microlecture preview: Twenty clinical micro-videos on typical symptoms and signs have been developed, each lasting 3-5 minutes, for students to preview before class. These include on-site shooting of content such as dyspnea and heart murmurs.
- (3) Case introduction: Each class starts with a typical case, which runs through the entire teaching process. For example, in the chapter on "chest pain", differentiated cases such as acute myocardial infarction, pulmonary embolism, and pneumothorax are used for comparative teaching.

##### **3.2.2. Innovation in practical teaching**

- (1) Application of standardized patients (SP): Twelve standardized patients have been trained to simulate 20 common clinical symptoms. Students are divided into groups to conduct medical history collection, and teachers give on-site comments. According to a questionnaire, 83.33% of students believe that SP teaching has significantly improved their inquiry ability.
- (2) Multi-station practical training: Six practical training stations are set up, including pulmonary physical examination, cardiac physical examination, abdominal physical examination, neurological

physical examination, and genital physical examination. Specialized teachers guide each station. The “demonstration-practice-feedback” cycle model is adopted to ensure that each student receives sufficient guidance.

- (3) Failed case teaching: Fifteen typical clinical misdiagnosis cases are carefully selected, such as misdiagnosing appendicitis as gastroenteritis and pulmonary embolism as coronary heart disease. Students analyze the causes of errors and propose improvement plans. A student wrote in the questionnaire: “Failed cases have made me deeply realize the importance of rigorous diagnosis.”
- (4) Inheritance of famous physicians’ academic achievements: Ten successful cases of treating lung impediment (a TCM term) from the Fujian Provincial Famous TCM Physician Chen Zhibin’s Studio are carefully selected, including several excellent cases included in the TCM Clinical Case Achievement Database of China <sup>[5,6]</sup>. These cases emphasize the inheritance of TCM classic theories and famous physicians’ academic thoughts, while fully integrating the guidance of the thinking mode of integrating Chinese and Western medicine. A student wrote in the questionnaire: “I have deeply realized that for the development of TCM, neither inheritance nor innovation is indispensable.”

### **3.3. Innovation in teaching methods**

#### **3.3.1. Implementation of PBL teaching**

- (1) Case design: Ten PBL teaching cases have been developed, with each case containing 3-4 progressive clinical scenarios. For example, in the case of “recurrent fever for further investigation,” laboratory test results are gradually provided as the condition progresses.
- (2) Group learning: Students are divided into groups of 15, with one group leader assigned to each group. Through literature research and discussions, groups formulate preliminary diagnoses and create PPTs for presentation. Teachers mainly play the role of facilitators.
- (3) Cross evaluation: Mutual evaluation among groups accounts for 15% of the final score, with evaluation indicators including the breadth of literature research, logical rigor, and presentation performance. According to a survey, 74.24% of students consider PBL courses the most rewarding.

#### **3.3.2. Practice of flipped classroom**

- (1) Pre-class tasks: Teachers release learning task sheets one week in advance, which include micro-videos, literature materials, and thinking questions. Students are required to record their learning doubts.
- (2) In-class interaction: Teachers focus on answering common questions, and students present their learning outcomes in groups. For instance, in ECG teaching, students need to explain the mechanisms and clinical significance of typical ECG changes.
- (3) Post-class extension: Clinical scenario assignments are given, such as “How to arrange the examination process for a patient complaining of chest pain.” Excellent assignments are displayed on the course platform.

#### **3.3.3. Role-playing teaching**

- (1) Role assignment: Students are divided into groups of 5, taking on the roles of patients, family members, attending physicians, nurses, and medical technicians respectively. Detailed role background materials are provided.
- (2) Scenario simulation: Eight clinical scenarios are set, such as “informing a patient of a malignant tumor

diagnosis” and “handling medical disputes.” Emphasis is placed on doctor-patient communication skills and team collaboration.

- (3) Reflection and summary: The simulation process is recorded, and the strengths and weaknesses in communication are analyzed through playback. Teachers focus on commenting on issues related to humanistic care, ethics, and laws.

### **3.4. Reform of the evaluation system**

A diversified “progressive assessment + multi-dimensional evaluation” system has been constructed:

- (1) Process-oriented assessment (20%):
  - Attendance and class participation (2%)
  - In-class quizzes (3%)
  - Case analysis assignments (5%)
  - PBL in-class performance (10%)
- (2) Formative assessment (30%):
  - Mid-term exam (10%)
  - Practical operation assessment (20%)
- (3) Summative assessment (50%):
  - Final exam (50%)
- (4) 360-degree evaluation:
  - Teacher evaluation of students (50%)
  - Mutual group evaluation (30%)
  - Patient satisfaction (20%, evaluated by Standardized Patients/SPs)

According to a questionnaire survey, after the reform, 85.29% of students consider the evaluation system “very reasonable” or “relatively reasonable,” which is a 50-percentage-point increase compared with the period before the reform.

## **4. Analysis of the effectiveness of teaching reform**

### **4.1. Evaluation of students’ learning outcomes**

Through statistical analysis of 66 questionnaire responses, the teaching reform has achieved remarkable results:

- (1) Improved course satisfaction: The overall course rating by students is 8.18 out of 10. Among all courses, practical training courses and internship courses received the highest ratings, at 8.8 and 8.94, respectively. Additionally, 46.97% of students gave a full-score evaluation.
- (2) Preferences for teaching content: 74.24% of students favor internship courses the most, 60.61% prefer practical training courses, and 34.85% choose Problem-Based Learning (PBL) courses. One student commented, “Internship courses allow us to have close contact with real cases, and the gains from this are far beyond what we can learn from textbooks.”
- (3) Recognition of competence improvement: 91.23% of students believe the reform has significantly enhanced their clinical thinking ability; 87.67% feel their communication skills have improved; and 83.45% acknowledge progress in their teamwork ability.
- (4) Positive evaluation of teachers: Most teachers are highly praised by students for being “vivid in teaching” and “rich in clinical experience.” Many students specifically mentioned that “the successful cases of

diagnosing and treating lung impediment (Feibi) from Chen Zhibin's Fujian Provincial Famous TCM Doctor Studio have benefited them a lot."

## **4.2. Achievements in teaching innovation**

- (1) Development of teaching resources: A standardized patient case library (20 cases), a teaching case library of failed cases (15 cases), and a micro-lecture video resource library (20 videos) have been developed, forming a complete teaching resource system.
- (2) Innovation in teaching methods: New teaching methods such as PBL teaching, flipped classroom, and role-playing have been successfully and systematically introduced into the curriculum, exploring a blended teaching model suitable for clinical medical education.
- (3) Reform of the evaluation system: The established diversified evaluation system can assess students' learning process throughout the course in a more fair, comprehensive, and scientific manner, and it can be further promoted in other affiliated teaching hospitals.
- (4) Enhanced teacher-student interaction: The new teaching model has tripled the frequency of teacher-student interaction, and the average weekly extra-curricular guidance time has increased by 2 hours.

## **4.3. Characteristics and innovation points of the reform**

- (1) Interdisciplinary teaching: Making full use of the multi-disciplinary advantages of affiliated teaching hospitals, resources of teachers from different specialties are integrated to provide students with a comprehensive clinical perspective. For example, a case of "dyspnea" is jointly analyzed by teachers from the respiratory department, cardiology department, and critical care medicine department.
- (2) Teaching with excellent cases from famous doctors: Excellent cases selected into the China TCM Clinical Case Achievement Database from famous doctor studios are introduced into teaching, strengthening students' understanding of the inheritance of TCM classic theories and the academic thoughts of famous doctors<sup>[7]</sup>.
- (3) Teaching with real failed cases: Breaking the limitation of traditional teaching that only focuses on successful cases, well-selected misdiagnosis cases with educational value are used to cultivate students' risk awareness and critical thinking<sup>[8]</sup>. A student's feedback from the questionnaire stated, "The failed cases are unforgettable for me and serve as a constant reminder."
- (4) Integration of standardized patients and role-playing: Through highly simulated clinical scenario simulations, students can practice repeatedly in a safe environment, which not only improves their skills but also cultivates their humanistic care awareness. The average score of practical operation assessments has increased from 72.5 to 86.3.
- (5) Whole-process diversified evaluation: Breaking the traditional evaluation model of "one exam determining lifelong outcomes," the reform emphasizes formative evaluation of the learning process, making the evaluation more scientific, comprehensive, and fair<sup>[9]</sup>.

## **5. Problems and improvement directions**

### **5.1. Main existing problems**

- (1) Difficulty in case selection: Failed cases involve the risk of medical disputes, requiring a balance between educational value and patient privacy protection. Approximately 12.5% of students reported that some

cases lack sufficient representativeness.

- (2) Increased workload for teachers: New teaching methods require teachers to invest more time in preparing cases and guiding group learning. The average weekly workload of teachers has increased by 8-10 hours.
- (3) Differences in students' adaptability: 15.2% of students reported initial difficulty in adapting to the active learning model, and students with weak foundations, in particular, face significant pressure.
- (4) Resource constraints: The number of standardized patients is insufficient, and simulation equipment needs to be updated. Some students suggested "increasing investment in hospital internship resources."

## 5.2. Continuous improvement plan

- (1) Optimization of the case library: Establish a three-level case screening mechanism, with a focus on excellent cases from renowned doctor studios, to ensure the educational value, safety, and representativeness of cases<sup>[10]</sup>. It is planned to update 30% of the cases annually<sup>[11]</sup>.
- (2) Construction of a teacher echelon: Implement the "Qinglan Project" (a mentoring program for young teachers), where each senior title teacher guides 1-2 young teachers. Establish a special reward fund for teaching reform<sup>[12]</sup>.
- (3) Exploration of hierarchical teaching: Design learning tasks of varying difficulty levels based on students' foundational differences and establish mutual-aid learning groups<sup>[13]</sup>.
- (4) Resource integration and upgrading: Apply for special funds to expand the clinical skills center and increase investment in standardized patient training. Collaborate with other affiliated hospitals to build a joint teaching case resource platform.
- (5) Informatization construction: Develop virtual simulation experimental projects, such as the "3D Lung Auscultation Training System," to make up for the shortage of practical training opportunities.

## 6. Conclusion

Through a systematic analysis of the reform practices of the "Diagnostics" first-class course construction project and the postgraduate education excellent demonstration course project, this study confirms the effectiveness of the teaching model of "multidisciplinary integration + case-based teaching + multi-dimensional evaluation." By innovating teaching methods, reconstructing teaching content, and improving the evaluation system, the reform has significantly enhanced students' clinical competence and professional literacy. Questionnaire data show that students' satisfaction with practical training courses and internship courses reached 8.8 points and 8.94 points, respectively, and 74.24% of students rated internship courses as their favorite learning content, which verifies the correctness of the reform direction<sup>[14]</sup>.

In the future, the course team will further deepen teaching reform in the following aspects: On one hand, expand the application scope of excellent cases from renowned doctor studios and real clinical failed cases in teaching, and develop clinical cases with greater educational value. For the teaching activities of medical professional degree postgraduates, efforts can be made to further stimulate their potential in exploring excellent cases and proactively conducting academic discussions. The joint construction of case libraries by teachers and students holds important significance for teaching and clinical practice. On the other hand, strengthen the construction of informatization teaching resources and make up for the limitations of practical teaching through virtual simulation technology. At the same time, promote the reform experience to subsequent clinical courses such as "Internal Medicine" and "Surgery," forming a coherent clinical competence training system. The ultimate

goal is to cultivate outstanding medical talents with noble medical ethics, exquisite medical skills, innovative spirit, and international perspective<sup>[15]</sup>.

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## Disclosure statement

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