Application of Case-Based Flipped Classroom Teaching Mode in Experimental Teaching of Pathology

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Abstract. To determine the effectiveness of case-based flipped classroom teaching model in the experimental teaching of pathology. Clinical medicine students from Weifang medical University were selected and randomly divided into control group and experimental group. Case-based flipped classroom teaching mode was performed in experimental group students, whereas teaching was conducted using traditional method in the control group. The final examination score and comprehensive score of the experimental class were higher than that of the control class. Case-based flipped classroom can cultivate students' autonomous learning, clinical thinking, analyzing and solving problems ability, the spirit of cooperation and stimulate enthusiasm for learning. Case-based flipped classroom teaching model can improve the teaching effectiveness and enhance the autonomy and learning flexibility of pathology experimental course greatly.

1 Introduction

Pathology is a medical basic subject to study the law of the occurrence and development of diseases which plays a major role in the medical knowledge system. Experimental teaching is indispensable to pathology course system and it trains students' ability to apply theory to practice. Experimental teaching plays an important role in the process of training the innovation ability and comprehensive practice of medical students. For many years, the traditional teacher-centered classroom lectures method has been used in the pathology experimental teaching of most medical universities in China. This traditional teaching method cannot reflect the teaching advantages, nor meet the discipline characteristics of pathology and the teaching requirements of clinical medical students. In order to improve the quality of teaching effectively and cultivate the comprehensive quality and ability of students, the case-based flipped classroom teaching method which emphasizes "student-centered" is introduced into the experimental teaching of pathology in clinical medicine students since 2017. The results are reported as follows.

2 Subjects and Methods

(1)Subjects

Students majoring in clinical medicine in 2017 of Weifang medical university are the subjects. Two classes (n=109) were randomly selected as experimental group and the teaching mode of case-based flipped classroom was applied, while the other two classes (n=112) were randomly selected as control group and adopted the traditional teaching method. Both experimental group and control group were divided into 10 groups. Four teachers with rich teaching experience and strong sense of responsibility were assigned to track entire process.

(2)Methods

The teaching process of case-based flipped classroom included three stages: knowledge learning before class, knowledge internalization in class and knowledge consolidation after class.

Knowledge learning before class: In ten days before class, the teachers selected representative clinical cases with appropriate difficulty carefully on the basis of the teaching arrangement and distributed them to students. Teachers created digital materials such as teaching video, audio and electronic textbooks, and students watched these digital materials in their spare time. Group
discussed 3 times before class and each group resolved 2 questions. Students prepared slides around the questions set by the clinical case.

**Knowledge internalization in class:** in the classroom students communicated with teachers face-to-face and teachers helped students consolidate what they had learned by answering questions and discussing related knowledge. The teacher graded each group by reviewing their performance in clinical case analysis, content presentation and question answering.

**Knowledge consolidation after class:** At the end of the semester, the teaching effect was tested and estimated by examination and questionnaire survey. The final examination was performed to evaluate the students’ mastery of the pathology knowledge. Students’ abilities to analyze and solve clinical questions were also assessed. Comprehensive score = the final examination results (70%)+score of experimental report (15%) +performance in experimental class (15%). Questionnaires were distributed in the experimental class and the control class, and questions were set up to understand the students’ opinions and suggestions on the teaching mode and evaluate the teaching effect qualitatively. Investigation included the following three aspects: (1) learning interest and learning efficiency; (2) self-evaluation of learning ability training; (3) opinions and suggestions on case-based flipped classroom teaching mode.

3 Results

(1) Comparison of final experimental examination results

The final examination score of the experimental class (79.64±11.12) was higher than that of the control class (72.36±10.56) ($P < 0.05$).

(2) Comparison of comprehensive score

The comprehensive score of the experimental class was higher than that of the control class (Table 1, $P < 0.05$).

| group                  | score of experimental report (15%) | performance in experimental class (15%) | the final examination results (70%) | comprehensive score |
|------------------------|------------------------------------|----------------------------------------|------------------------------------|---------------------|
| experimental class ($n=109$) | 13.38±1.98                        | 12.72±1.02                             | 55.75±7.78                        | 81.85±8.23          |
| control class ($n=112$)  | 12.05±1.78                        | 11.53±0.76                             | 50.65±7.39                        | 74.23±7.79          |

(3) Results of questionnaire

A total of 221 questionnaires were distributed in the survey and 215 questionnaires were valid, the effective recovery rate was 97.3% (See table 2). The survey results showed that students in the experimental class were higher than those in the control class in stimulating enthusiasm for learning, cultivating autonomous learning ability, cultivating clinical thinking ability, improving the ability of analyzing and solving problems, and cultivating the spirit of cooperation.
Table 2. Comparison of self-evaluation results of learning effect ($\bar{x} \pm s$).

| Items                          | experimental class ($n=109$) | control class ($n=112$) |
|-------------------------------|-------------------------------|-------------------------|
| Enthusiasm for learning       |                               |                         |
| high                          | 56*                          | 43                      |
| general                       | 37                            | 40                      |
| poor                          | 16                            | 29                      |
| Learn efficiency              |                               |                         |
| high                          | 51*                          | 37                      |
| general                       | 40                            | 49                      |
| poor                          | 18                            | 23                      |
| Autonomous learning ability   |                               |                         |
| high                          | 38*                          | 29                      |
| general                       | 43                            | 55                      |
| poor                          | 21                            | 28                      |
| Memory ability                |                               |                         |
| high                          | 22                            | 26                      |
| general                       | 61                            | 56                      |
| poor                          | 26                            | 30                      |
| Clinical thinking ability     |                               |                         |
| high                          | 40*                          | 28                      |
| general                       | 52                            | 54                      |
| poor                          | 17                            | 30                      |
| Ability of analyzing and solving problems |                 |                         |
| high                          | 32*                          | 19                      |
| general                       | 52                            | 57                      |
| poor                          | 25                            | 36                      |
| Ability of cooperation        |                               |                         |
| high                          | 36*                          | 17                      |
| general                       | 46                            | 59                      |
| poor                          | 27                            | 36                      |

* $P<0.05$

4 Discussion

Pathology is a bridge course between basic disciplines and clinical disciplines. For clinical medical students, pathology lays a strong foundation for learning clinical professional courses. Experimental teaching is a vital part of pathology course and is an important way to cultivate students' ability of scientific thinking. The traditional experimental teaching of pathology has many
shortcomings, for example, students are passive in the process of learning; there has less communication and lack of interaction between teachers and students; the learning process is found to be boring; the traditional teaching method makes students produce dependent psychology, which is not conducive to the cultivation of students’ autonomy and creativity; and students’ individual differences are not considered which can make some students feel frustrated and gradually lose their enthusiasm for learning.

"Flipped Classroom or Inverted Classroom” is the reform of teaching mode which pays attention to students' individualized learning and student-centered learning[1]. Aaron Sams and Jonathan Bergmann developed the flipped classroom teaching mode in 2007 for students who couldn’t attend class because of some reasons[2]. Case-based learning teaching method is a group discussion teaching method that is clinical case oriented and student-centered on the basis of clinical problem. According to the teaching content, the teachers select the clinical cases, compile the problems, guide the teaching process with the problems, inspire the students to study and think independently through the case analysis and group discussion. This study combines clinical case teaching with flipped classroom. Case-based flipped classroom has become increasing prevalent in higher medical education. Teachers create digital teaching materials through the network platform, so that students can learn outside the classroom independently and students can digest and absorb the important and difficult knowledge at differential levels. In class, through the interaction between teachers and students, students can solve the difficult problem, thus deepening the students’ understanding and exploration of knowledge[3]. In order to raise students' interest in learning and improve the efficiency of experimental teaching, case-based flipped classroom teaching mode is applied in experimental teaching of pathology in clinical medicine students since 2017. Case-based Flipped classroom changes the traditional teaching structure completely and realizes the role transformation of teachers and students effectively, thus enhances the autonomy and flexibility of learning greatly[4].

Although case-based flipped classroom plays an important role in training students’ learning ability and improving learning efficiency, we find that there are some disadvantages to the case-based flipped classroom. First, like many new teaching methods, case-based flipped classroom is only suitable for small class teaching, and it is difficult to apply in large class, which needs improvement in the future work. Second, this teaching method also puts forward higher request for teachers, which requires teachers not only to have excellent teaching skills and classroom control ability, but also to master excellent professional knowledge and bring various disciplines together and understand thoroughly. Third, this teaching mode depend mainly on students' autonomous learning and those students with poor active learning ability get less done[5]. Continuous improvement should be made in the process of implementation.

5 Conclusion

Case-based Flipped Classroom is the reform of teaching mode which pays attention to students' individualized learning and student-centered learning. Case-based flipped classroom changes the traditional teaching structure completely and realizes the role transformation of students from passive participants to positive involvement effectively, thus enhances the autonomy and flexibility of learning greatly. The application of case-based flipped classroom teaching mode is beneficial to stimulate students’ interest in learning and arouse their enthusiasm in study. Combine case-based learning with flipped classroom teaching method will definitely play an important role in providing high quality education for clinical medicine students.

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