Application of Simulation Teaching in Pharmacology Experimental Teaching

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Abstract—To observe the application effect of simulation teaching in pharmacology experimental teaching of pharmacy. Classes of Pharmaceutical students in grade 2013 were randomly divided into two groups: A and B group with 50 students in each group. Group A was implemented with the simulation teaching mode and Group B was implemented with the traditional experimental teaching mode. The final examination results of two groups of students were compared, and the experimental teaching effect was evaluated by questionnaires. The satisfaction survey of the students on simulation teaching mode was compared. The results of pharmacology experimental teaching in the simulation teaching group were significantly higher than those in the traditional teaching group. Questionnaire results show that the students in the simulation teaching group generally believe that the mode are superior improve their self-study learning interest and have a high satisfaction degree. The simulation teaching mode can better mobilize students’ initiative in self-learning, and have better teaching effect than traditional teaching mode in pharmacology experimental teaching.

Keywords—simulation teaching, pharmacology, experimental teaching

I. INTRODUCTION

Virtual simulation technology is a new cross-technology which combines computer human-computer interaction, multimedia, simulation technology and other technologies. With the advantages of high efficiency, low cost, rich content and security, it has been more and more popularized and applied [1]. The application of virtual simulation technology in pharmaceutical experimental teaching can display the experimental principle and operation process from all directions and angles through multimedia materials such as video, animation and audio. The virtual experiment teaching carries out experiment operation by constructing a realistic and visual virtual environment, which is beneficial to strength students' theoretical knowledge and enhance their operational ability [2].

Weifang Medical University has recently strengthened the construction of virtual simulation experiment center, and constructed a virtual simulation experiment teaching platform featuring modularization, functionalization, systematization and overall optimization. In order to further improve the quality of pharmacology experiment teaching and enhance students’ interest, we make full use of the advantages of simulation laboratory resources. The "simulation teaching" mode is introduced into the experimental teaching course to explore the teaching reform. The reform of teaching mode aims to improve students' autonomous learning ability and innovation ability. It gives full play to the advantages of virtual simulation teaching platform and makes up for the shortcomings of traditional teaching mode.

II. OBJECTS AND METHODS

A. Objects and Students Analysis

Objectives: The students majoring in pharmacy in Weifang Medical University in 2013 were selected as the research objects. In pharmacology experiment teaching course, one class was randomly selected as the experimental teaching group of "simulation teaching" mode, with a total of 50 students. Another class was selected as the control group adopted by the traditional teaching mode, with a total of 50 students. Both groups of students passed the national college entrance examination and were randomly divided into classes.

B. Teaching Methods of Experimental Group

In the class of the experimental group, the experimental teaching mode of "simulation teaching" is implemented in pharmacology experiment teaching.

The main teaching process is divided into two parts: in-class teaching and after-class teaching as shown below.

In class, teachers visually introduced the principles, methods and operation steps of the experiment by using virtual simulation experiment platform. Students could watch the operation video repeatedly before the operation, or learn the key technology pertinently. After forming a visual understanding of the experimental operation, they would carry out the experiment operation. In the course of the experiment, teachers gave guidance in time to facilitate students to use and learn the resources of virtual teaching platform.
After class, teachers published the contents of experimental teaching projects in advance to inform students before the experiment class. The students made remote access through the network terminal and entered the virtual simulation experimental platform for preview. They watched experimental teaching videos, and carried out experimental operation simulation on the platform. At the end of the experiment, the students who failed in the experiment could carry out simulation exercises on the virtual simulation experimental teaching platform, and discuss with their classmates. On the interesting experimental module, the simulation experimental platform is used to study deeply and expand the scope of learning.

In the control group, the teaching class was divided into two parts: in-class teaching and after-class teaching. In class, teachers explained the main theoretical knowledge, experimental principles and methods. Then students carried out experimental operations according to the experimental steps. After class, the students previewed the experiment and finished the report.

C. Practical Examples in Experimental Group

Take the pharmacological experiment "The effect of lidocaine on arrhythmia induced by electrical stimulation" as an example.

1) In class

Teachers guided students to enter the virtual simulation experiment platform. There the students watched the operation video of the comprehensive experiments about isolated heart perfusion. They learned experimental principles, operation methods and steps of arrhythmia induced by electricity in toads. Students could watch and learn the experimental video repeatedly, and learn the experiments steps themselves according to the experimental video. The experimental groups were divided into groups and discussed. According to the video learning, the students could basically complete the design of the experimental steps. In the details of the implementation of the experiment, the teacher intervened in time to guide the students to make appropriate choices such as the intensity and location of the stimulation induced by electricity. In the course of the experiment, the teacher corrected the non-standard operation in time and answered the students' questions. After the experiment, the teacher guided the students to have a deep discussion, and analyzed the problems in the experiment and the factors influencing the results.

2) After class

Teachers timely gave feedback to the students about the problems in the experiment, and put forward rectification requirements. At the same time, students were required to evaluated the effect of experimental teaching. According to the teachers' feedback, the students made further study by logging the platform, found and analyzed the problems in the experiment process. They could simulate the operation in the platform to deepen the learning effect. On the interested experimental module, they would expand the learning, such as methods of arrhythmia induction in addition to electrical stimulation and electrocardiogram record using frog heart perfusion experiment, etc.

3) Teaching in the control group

In the control group, the traditional teaching mode is adopted. In the class, the teachers taught the experimental principles, methods and procedures. The field operation demonstration was also carried out. The students imitated the experiment according to the teacher's operation and completed the experiment report after the experiment.

4) Evaluation of teaching effect

At the end of the semester, the teaching effect was evaluated by means of pharmacological experiment examination and questionnaire survey. The total score of pharmacology experiment test is 20, including 5 points of experiment report, 5 points of experiment design and 10 points of experiment skill operation (an independent experiment skill operation). The students in the experimental group were investigated by anonymous questionnaires. The students evaluated the effect of teaching reform, the improvement of their abilities and the convenience of operation, which provided data reference for evaluating the effect of teaching reform and subsequent improvement measures.

D. Data Analysis

Data were expressed as mean ± standard deviation. SPSS 15.0 software was used for data processing and statistical analysis. The t test was used for comparison between groups, P < 0.05 considered as the difference with statistical significance.

III. RESULTS

A. Analysis of the Achievements

Compared with the control group, the scores of experimental report, design and operation of experimental group were significantly higher than those of control group. The total scores of the control group and experimental group were (16.14 ± 1.10) and (17.01 ± 1.18) respectively. The results of experimental group were significantly better than those of the control group. The difference was statistically significant, which indicated that the reform of "simulation teaching" mode had a better effect.

| Group          | Experiment report | Experiment design | Operation test | Total       |
|---------------|-------------------|-------------------|----------------|-------------|
| Experimental group | 4.29 ± 0.37       | 4.36 ± 0.35       | 8.37 ± 0.73    | 17.01 ± 1.18|
| Control group  | 4.05 ± 0.33       | 4.11 ± 0.41       | 7.98 ± 0.72    | 16.14 ± 1.10|
| t value       | 5.329             | 3.159             | 3.756          | 4.985       |
| P value       | 0.0000            | 0.0021            | 0.0003         | 0.0000      |
### B. Evaluation of Teaching Satisfaction

At the end of the semester, an anonymous questionnaire survey was conducted on the teaching satisfaction of the classes implementing simulation teaching. A total of 100 questionnaires were sent out and 100 points were recovered, with a recovery rate of 100%. As shown in Table II, the students’ satisfaction is high when the simulation teaching mode is used in experimental teaching.

| Group           | Very satisfied | Satisfied | Dissatisfied | Very dissatisfied |
|-----------------|----------------|-----------|--------------|-------------------|
| Experimental group | 32             | 56        | 12           | 0                 |
| Control group   | 14             | 54        | 32           | 0                 |

### C. Evaluation of Teaching Effect

The results of evaluation of experimental teaching effect based on simulation teaching mode are shown in Table III. The results showed that students generally hold a positive attitude towards the experimental teaching of simulation teaching mode. They believed that the new mode was beneficial to arouse students' in learning interest, facilitate knowledge mastery and improve self-learning ability and efficiency.

|                          | Very satisfied | Satisfied | Dissatisfied | Very dissatisfied |
|--------------------------|----------------|-----------|--------------|-------------------|
| Whether it’s helpful to stimulate interest in course learning | 36             | 22        | 16           | 6                 |
| Whether it’s helpful to improve self-learning ability      | 52             | 30        | 14           | 4                 |
| Whether it’s helpful to improve learning efficiency        | 54             | 32        | 10           | 4                 |
| Whether it’s helpful to master knowledge                   | 40             | 54        | 2            | 2                 |
| Better than traditional teaching mode                       | 50             | 44        | 6            | 0                 |

### IV. DISCUSSION

The virtual simulation experiment platform can simulate pharmacology experiment operation by means of 3D animation. The students of Pharmacy can understand and design the experiment more vividly using the platform. This lays a good foundation for the study of Pharmacology. Pharmacological experiments involve many contents. Due to the limitation of teaching time and funds, it is impossible to carry out all pharmacological experiments in the semester [3]. Virtual simulation experiment teaching can simulate the real experimental environment through information technology. It can realize some teaching functions that are difficult to complete in real experiments. Virtual simulation experiment platform can make up for the limitation of traditional teaching. Students' autonomous learning and innovation ability are exercised by using network terminal to access platform resources.

It’s reported that the construction and application of virtual simulation platform has achieved a good effect in the process of experimental teaching [4]. We carried out experimental teaching and achieved good effects by use of the platform resources of the virtual simulation experiment center in our university. To some extent, the application of simulation teaching made up for the shortcomings of traditional teaching and improved students' learning interest [5]. Students can watch experimental animation videos repeatedly, refine the experimental steps, think about the principles and mechanisms of the experiment, and solve the problems through discussion at the same time. In this process, students have more opportunities to use their brains, desire to learn knowledge and improve their self-learning ability to access information. The survey found that students were generally interested in the simulation teaching mode, and even some students will carry out the simulation operation as long as they had free time. Some students operated on animals firstly and simulate to make up for their technical deficiencies. This series of learning made many students feel that Pharmacology learning was lively and interesting. The simulation operation is risk-free, which can effectively improve their level and be helpful for them to learn again and with practical experience. The application of simulation teaching also enhances the communication between teachers and students. Students can raise questions to teachers in the laboratory and Internet platform. It is a meaningful process for the improvement of teachers' teaching methods and the improvement of their level [6].

The application of simulation teaching in Pharmacology experiment teaching has also improved the teaching level of teachers to a certain extent By the use of simulation teaching, as instructors and important participants, we should fully change the role of the classroom and give the initiative of experimental courses to students, which is in line with the modern student-centered teaching concept. In order to achieve better teaching guidance, we have put forward high requirements for the improvement of teachers' own abilities, so as to keep pace with the times and conform to the modern educational model [7].

### V. CONCLUSION

The simulation teaching mode enables pharmaceutical students to master pharmacological experimental skills and basic operating methods more comprehensively and systematically. It stimulates students' interest in Pharmacology learning and improves students' ability of independent learning, independent innovation and individualized learning. The advantages of strong mobility of network terminals are fully brought into play. Of course, students' practical operation ability still needs to be acquired in practice. As a supplement to experimental teaching, virtual simulation teaching can make up for the shortcomings of traditional experimental teaching, which is worthy of further application and promotion.
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REFERENCES

[1] Y.F. Liu, L.J Yu, Q.W. Lu, L. Su, Y.X. Wu, The construction scheme of virtual simulation teaching resource under the background of education information, Experiment Science and Technology, vol.16, pp. 195-198, 2018.( In Chinese).

[2] L.E. Curley, M. McDonald, T. Aspden, Use of a fictitious community-based virtual teaching platform to aid in the teaching of pharmacy practice skills: Student perspectives after initial implementation, Journal of Pharmaceutical Policy and Practice, vol.9, pp. 24, 2016

[3] X.B. Guo, Y.X. Peng, J. Song, L. Yang, Y. Shen, Thoughts on the reform of Pharmacology experiment teaching in Pharmacy, China Continuing Medical Education, vol.11, pp. 1-2, 2019. (In Chinese).

[4] M.J. Tan, Application of virtual simulation experiment in natural medicine chemistry experiment teaching, China Continuing Medical Education, vol.11, pp. 30-32, 2019. (In Chinese).

[5] S. Shuang, G.L. Zhou, Current situation analysis of virtual simulation technology in Pharmacology, Education Modernization, vol.5, pp. 129-130, 2018. (In Chinese).

[6] S.L. You, J. Zhu, L.P. Cao, Z.L. Zhang, Practice of simulation teaching in improving the Pharmacy teaching level, Systems Medicine, vol.2, pp. 162-164, 2017. (In Chinese).

[7] J. Cheng, H. Lv, Y. Shen, S.W. Yue, Y.H. Wang, X.M. Hu, Research on the cultivation model of talents for Pharmaceutical strategy and emerging industries in colleges and universities, China Continuing Medical Education, vol.10, pp. 36-58, 2018. (In Chinese).