The Effect of Participatory Teaching Method Combined with Virtual Simulation System in Ultrasonic Imaging Teaching

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Abstract: Objective: To explore the effect of participatory teaching method combined with virtual simulation system in the teaching of ultrasound imaging. Method: From September 2022 to December 2022, a total of 90 students from 2 classes of Grade 2019 in the Department of Imaging were selected. 45 people in the control group will adopt the traditional teaching method, and 45 people in the experimental group will adopt the participatory teaching method + virtual simulation system, to compare the teaching effect of the two groups. Results: The teaching satisfaction of the experimental group in teaching form (95.56%), teaching content (95.56%), student learning initiative (97.78%), learning interest (95.56%), practical operation (97.78%), etc. Higher than the control group, P<0.05; the theoretical knowledge and practical operation test scores of the experimental group were significantly higher than the control group, P<0.05. Conclusion: In the teaching of ultrasound imaging, choosing participatory teaching method combined with virtual simulation system can effectively improve students' theoretical knowledge and practical operation level, and strictly grasp the characteristics of ultrasound images, which is worth adopting.
***Keywords*:** ultrasound imaging, participatory teaching method, virtual simulation system

1. Introduction

Ultrasound imaging covers a lot of content, including medicine, acoustics, computer science, etc., and is highly professional, including various basic theoretical knowledge, ultrasound imaging characteristics of various diseases, etc. In actual teaching, students are required to master the knowledge In addition, there are many changes in the characteristics of ultrasound images, there is no specific rule to follow, and it is not easy to remember, which puts forward higher requirements for students' learning ability [1]. At present, in the teaching of ultrasound imaging in China, many colleges and universities usually adopt the face-to-face classroom teaching mode, which is relatively passive. Students' ability to absorb classroom knowledge is limited, and they lack the subjective initiative of learning, which makes the overall teaching effect not good [2]. With the reform of the teaching mode, various new teaching modes have emerged. Many scholars have pointed out that the participatory teaching method combined with the virtual simulation system has a better effect in the teaching of ultrasound imaging. Teachers and students are the main body of teaching. "Teaching" and "learning" have been transformed into a model of "learning" and "teaching", aiming to further improve the quality of teaching [3]. In order to conduct a more systematic analysis, 90 cases of students majoring in imaging were treated in this paper, and the details are described as follows.

2. Materials and methods

2.1 Basic information

From September 2022 to December 2022, a total of 90 students from 2 classes of Grade 2019 in the Department of Imaging were selected. Control group: 45 people; the ratio of male to female is 24/21; 20-22 years old with an average age of (20.86±0.54) years old. Experimental group: 45 people; the ratio of male to female is 25/20; 20-22 years old with an average age of (20.92±0.56) years old. Comparing the basic information of the two groups of students, there was no significant difference, P>0.05, which was comparable.

2.2 Methods

The control group: adopt the traditional teaching method, teach in strict accordance with the teaching syllabus, teaching plan, teaching progress, etc., and teachers prepare lessons collectively before teaching. Experimental group: adopt participatory teaching method + virtual simulation system to teach, the main contents include:

(1) Participatory teaching: ① Preparation before class: In order to further mobilize students' learning initiative, teachers need to make sufficient preparations before teaching. First of all, prepare lessons in strict accordance with the content of

the syllabus, make a good teaching plan, clarify the teaching purpose, teaching requirements, etc., so as to facilitate the improvement of students' classroom enthusiasm. Teachers often set participatory questions, display pictures of common cases of ultrasound imaging, etc., so that students can understand the basic knowledge of imaging in a timely manner, integrate the knowledge learned in the past with imaging knowledge, and actively participate in the teaching courses. Common participatory questions include how to carry out pathological staging of diseases, common imaging features of diseases, and differential diagnosis of ultrasound images in difficult cases. ②Theoretical learning: At this stage, students are required to fully grasp the theoretical knowledge of common diseases, including pathogenic factors, disease process, complications, prognosis, and preventive measures. Students identify and judge based on the characteristics of ultrasound imaging, and the teacher is responsible for summarizing the important and difficult content of the course. The teacher informs the relevant literature retrieval methods to further improve the students' knowledge reserve level. ③Practice stage: The teacher explains in the form of pictures according to the questions designed before class. Students take the form of group discussion, 3-5 people in a group, and conduct group discussion on the questions raised by the teacher. After that, each group selects a representative to speak on stage, and finally the teacher summarizes the speeches of the group. During the practice process, students are required to regularly participate in group discussions and report on the learning situation of each group. Teachers adopt encouragement methods to promote communication and exchanges between students and teachers, and complete teaching task discussions within the specified time. When the group representatives spoke, they focused on the qualitative diagnosis, differential diagnosis, basis of imaging pathology, treatment measures, and the latest scientific research progress in imaging. After the speeches are finished, members of other groups can add on their own. The teacher is responsible for summarizing the important and difficult points of the class and arranging the discussion cases for the next class. This is conducive to improving students' expression ability and independent learning ability. ④Teaching feedback: After the group case discussion stage is completed, the teacher checks the teaching results in time, including the mastery of students' theoretical and practical knowledge. Feedback on teaching effects in the form of questionnaires and other forms is aimed at further improving the teaching level.

(2) Virtual simulation system: The ultrasound imaging virtual simulation system is selected for teaching. The basis of the network layer is the school's education network, and students can access the school's server 24 hours a day. The platform layer includes the virtual operating system mobile phone client and the imaging virtual network experimental teaching platform of our hospital. After logging into the platform, students can give virtual manipulations. Simulation layer: Choose simulation measures, including ultrasonic three-dimensional interactive anatomy software, etc., so that students can practice in person. Implementation layer: The content includes related courses of imaging, which is convenient for students to learn multi-disciplinary and improve learning efficiency. The relevant courses are convenient for students to learn multi-disciplinary and improve learning efficiency. ①Before class, students are guided to find out the ultrasonic imaging characteristics, imaging principles, disease physiology and pathology knowledge of common diseases, etc., and learn with the help of 3D interactive anatomy software. ②Teachers choose classic cases, such as: the ultrasonic imaging characteristics of breast diseases. The cases are imported into the multimedia video in advance and played in the classroom for the discussion in the student group and the teacher's comments. ③Finally, the students use the mobile client to log in to the virtual simulation system for operation practice, and the teacher guides them, including the scanning signs of the disease and how to express them in standardized terms etc., students are required to complete independently, the teaching background checks the students' operation results, the teacher evaluates the students' virtual operation results, and the students strengthen corrections.

2.3 Observation indicators

Teaching Satisfaction Questionnaire Survey: After the teaching is completed, a questionnaire survey will be conducted in the form of a questionnaire. A total of 90 questionnaires will be issued and 90 copies will be collected. After the last course is completed, they will be distributed on the spot and returned after filling in; satisfaction scoring mode: adopt a percentage system, very satisfied ≥ 85 points, satisfied ≥ 60 points and < 85 points, dissatisfied < 60 points, satisfaction = (very satisfied cases + satisfied cases) / total cases × 100%.

Examination score: After the last class is over, it will be evaluated by means of test paper assessment, including theoretical scores and practical operation scores. The full score is 100 points.), choose the form of double-blind marking, and compare the differences in scores between the two groups.

2.4 Statistical processing

Statistical software SPSS23.0 was used to record the data, the teaching satisfaction was represented by [n (%)], the X^2 test was used, the test score was represented by ($\overline{x}\pm S$), and the T test was used. If there was a significant difference between the two groups of data, it was statistically Significance, expressed as $P<0.05$.

3. Results

3.1 Teaching satisfaction

See Table 1 below. The teaching satisfaction of each content in the experimental group was significantly higher than that in the control group, P<0.05.

Table 1. Evaluation of teaching satisfaction between the two groups [n (%)]

Comment content	Control group (n=45)	Experimental group (n=45)	X^2	P
The teaching form is novel and acceptable	37 (82.22)	43 (95.56)	4.050	0.044
The teaching content is rich and easy to understand	36 (80.00)	43 (95.56)	5.075	0.024
Improve students' learning initiative	37 (82.22)	44 (97.78)	6.049	0.014
Improve learning fun	36 (80.00)	43 (95.56)	5.075	0.024
Improved practical ability	38 (84.44)	44 (97.78)	4.939	0.026

3.2 Exam results

See Table 2 below. The test scores of the experimental group were significantly higher than those of the control group, P<0.05.

Table 2. Evaluation of the test scores of the two groups ($\bar{x}$±S, points)

group	theoretical knowledge	practical operation
Control group (n=45)	32.60±2.45	53.27±2.56
Experimental group (n=45)	38.20±1.16	58.69±1.15
T	13.858	12.955
P	0.000	0.000

4. Discussion

Medical imaging diagnostics is an important discipline for the diagnosis of various diseases. Imaging diagnosis is closely related to the diagnosis and treatment methods and pathophysiological characteristics of diseases. Scientific and reasonable imaging diagnosis is convenient for patients to obtain timely identification and diagnosis of diseases., to help patients improve their prognosis [4]. The goal of ultrasound imaging teaching is to help students analyze the characteristics of ultrasound imaging, including imaging principles, lesion analysis, common disease manifestations, etc., and cultivate students' habits and abilities of independent film reading [5]. The internship period is the key stage of teaching, in which the traditional teaching mode is relatively single, mainly adopting "cramming duck" teaching, teaching according to the content of the syllabus, lacking the ability to train students to think independently. In addition, the content involved in diagnostic imaging is complicated. The theory is relatively abstract. Many students are unable to independently complete film reading and differential diagnosis after completing their studies. The teaching results are not good, which leads to a certain impact on the teaching quality. Therefore, how to adopt a better teaching model is of great significance [6].

In this study, a total of two groups of students were admitted for ultrasound imaging teaching. The control group followed the traditional teaching mode, and the experimental group followed the participatory teaching method + virtual simulation system teaching. The results showed that the experimental group was innovative and acceptable in terms of teaching forms. In terms of rich and easy-to-understand teaching content, and in terms of improving learning interest, the teaching satisfaction was 95.56%, and in terms of improving students' learning initiative and practical operation ability, the satisfaction rate was 97.78%, which were significantly higher than the teaching satisfaction of the control group. In addition, the theoretical knowledge and practical ability of the experimental group were significantly higher than those of the control group. Many scholars have pointed out that participatory teaching has obvious advantages compared with traditional teaching. Participatory teaching will teach medical imaging diagnosis content through pre-class preparation, theoretical study, practical operation, teaching feedback and other stages. In the preparation stage, the teacher prepares lessons in advance by retrieving relevant imaging knowledge, so as to facilitate orderly teaching during teaching. The teaching takes the form of student group discussion. The teacher raises questions, the group members are responsible for the discussion, and a representative is selected to speak on stage, After the speech is finished, the teacher will comment on it, point out the deficiencies in time and actively correct them. This kind of teaching mode abandons the disadvantages of traditional

teaching. The form of group discussion fully exerts the enthusiasm of students for active learning. Students discuss problems with each other, which facilitates timely information sharing and cultivates the ability of students to unite and cooperate. It is well received and highly recognized by students and teachers.[7] In addition, although imaging diagnostics involves more content and difficult points, and students are under greater learning pressure, the experimental group integrates students and teachers into the teaching work through participatory teaching, which further improves students' interest in learning. By searching the literature and making adequate preparations, the teaching quality and learning efficiency are improved. In actual teaching, the overall classroom atmosphere is relatively active, which is conducive to students' concentration, creates a harmonious teacher-student relationship, fully combines "teaching" and "learning", takes students and teachers as the main body of teaching work, and promotes students' active learning [8].

The virtual simulation system creates a virtual operating environment for imaging diagnostics for students, which is a preliminary attempt of our school's imaging simulation operation training system combined with Web technology. During the actual operation, the real scene is simulated, and the clinical needs are set as the guide to help students improve the practical ability of ultrasonic diagnostic instruments. Combining the teaching process of ultrasound diagnosis with the teaching syllabus guides students to learn the knowledge of ultrasound imaging independently and systematically, and improves the students' operational skills [9]. The combination of virtual simulation system and participatory teaching method fully reflects the flexibility and advancement of our school's teaching mode. Evaluate students' learning effects from many aspects, and pay more attention to students' practical ability, not just stick to the content of traditional teaching. Students' ability to read films, ultrasound theory test scores, and clinical work ability have been significantly improved [10-11].

In summary, in the teaching of ultrasound imaging, it is feasible to integrate participatory teaching and virtual simulation system teaching methods. This improves students' practical ability and enables them to master relevant theoretical knowledge efficiently. Compared with traditional teaching, participatory teaching and virtual simulation system teaching methods are rich and varied and interesting. Students' learning initiative has been significantly improved, and it is worth adopting and promoting.

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