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The Application of Case Teaching Combined with PBL and RISE Teaching Method in Medical Immunology Teaching

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Abstract: Undergraduate medical immunology education is an important part of the basic course of medical higher education in our country. As an important basic course for medical students, medical immunology teaching has shown all kinds of deficiencies in the teaching effect by using the traditional teaching model of classroom teaching. Combined with the teaching characteristics and teaching difficulties of medical immunology, it is found in the teaching practice that in the key stage of traditional teaching, the combination of PBL and RISE teaching method of case teaching can integrate the previous learning knowledge of medical immunology through students' independent learning, and stimulate students' interest in learning. It can improve students' ability to connect immunology theory with clinical diseases and public health immunological events, and improve students' comprehensive ability to further learn medical immunology knowledge and other related disciplines in the next stage. A good teaching effect has been achieved.

Keywords: Higher education; Medical immunology; PBL-RISE teaching method; Case teaching

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1. Introduction

Medical immunology is a basic medical discipline with rapid development. With the use of new technologies and the progress of immunological research, its overall knowledge volume and knowledge structure are constantly iterated and expanded [1]. Moreover, with the deepening of research, the role of immunology in clinical diseases, especially in complex clinical diseases, has become more and more prominent. Many previously unknown immunological pathogenesis bases of diseases have been discovered, including the mechanism of autoimmune diseases, the immune mechanism of tumors, and the mechanism of allergy.

In traditional medical immunology teaching, the teacher from immune molecules, immune organs to immune cells, and then to different immune cell mediated the inherent immunity and adaptive immunity in the process of teaching and learning in the early definition and immunological knowledge detail introduced a number of

immunology, students have not had time to fully digest, Due to the lack of sufficient class time to review and connect knowledge points in the later process of immunology teaching, students' learning difficulty is increasing. Therefore, many students reflect that the learning of medical immunology is difficult, and they lose their learning motivation in the later stage of learning, which makes the teaching and learning of medical immunology difficult [2–4].

In fact, medical immunology is not boring, but contains a large number of interesting and exciting scientific discoveries, as well as exquisite immunological strategies selected by evolution [5]. But too trivial knowledge points and long knowledge introduction front, blindfolded students' eyes, tired students' brains. In view of the fact that medical immunology is mainly taught to undergraduates of various clinical majors, it is necessary and imperative for teachers to guide students to deeply understand a large number of immunological knowledge points introduced before through clinical immunology case teaching in the later stage of teaching, so that students can deeply understand and master the overall operation logic of the human immune system [6].

2. The characteristics and difficulties of medical immunology teaching

Undergraduate medical immunology in Anhui Medical University is mainly based on the 7th edition of Medical Immunology, edited by academician Cao. Teachers can explain the previous knowledge points about immunological molecules, cells, and organs in the chapters of innate immunity, adaptive immunity, and hypersensitivity, and summarize them after the course of immunology [6]. However, due to the limited time of classroom teaching, each independent chapter has its own large number of knowledge points, so the introduction of case teaching suitable for knowledge series in these two nodes will greatly improve the teaching effect of medical immunology.

Medical immunology itself has certain teaching difficulties. The knowledge system of medical immunology is relatively complex, and the knowledge details are more, and the knowledge points before and after each other, and the knowledge defects in the former often lead to students' inability to understand the later knowledge. Medical immunology teaching is usually 40 minutes per class hour. In order to complete the teaching schedule, teachers instill too many concepts and immunological processes in the middle of a class hour, hoping that students can digest them. In the process of teaching, teachers often pay attention to whether the transmission of knowledge is logical, clear and clear, and whether the expression is easy to understand. However, they do not pay enough attention to the principle of simplicity when conveying knowledge, and often convey knowledge with too much density, too many clues, and too fast progress. This is turning the classroom the problem oriented teaching method oriented method, or literature, and artificial intelligence application the cause of the new teaching methods have been proposed [7–10]. In these new teaching methods, teachers hope that students can conduct sufficient independent learning in advance, and use classroom teaching to check the deficiencies and fill the gaps. In real life teaching, students who do well in exams tend to study in the most realistic ways to get high marks, such as brushing questions and memorizing definitions, rather than fully understanding and mastering them. Through its annual immunology teaching and research section of the graduate student admissions interview, it is found that even the medical immunology test a high score of students, while it is possible to recite the definition of the right, also do not understand some simple concepts, such as MHCI molecular function and immune adhesion function of class, etc.

So how to strengthen the overall understanding of medical immunology, teaching methods, the combination of "Problem-Based Learning (PBL) teaching method" and "Reference-Induced Self-Education (RISE) teaching method" was used to write two courses [11, 12]. A 2-hour teaching plan was written each time, which was inserted

into the course at two time nodes: before explaining innate immunity (case of COVID-19 infection) and before the end of immunology teaching (case of *Mycobacterium tuberculosis* infection), all the previous knowledge points were explained in series to deepen students' understanding of the overall process of immunology. Students are encouraged to transfer their own understanding into the online classroom database through self-study.

3. The combination of PBL and RISE teaching methods

PBL teaching method is a problem-based teaching method, which has been widely used in medical education [13, 14]. The core elements of PBL teaching method include: learning is centered around problems; Encourage students to collaborate and discuss in small groups; Encourage students to study independently and find the knowledge they need to solve problems; And teachers act as mentors rather than traditional information providers. Based on this, students' abilities of problem-solving and clinical reasoning can be enhanced. Promote the development of teamwork and communication skills; And improve students' ability of self-directed learning and research.

RISE teaching method mainly emphasizes the development of students' self-learning ability, knowledge acquisition ability, and analysis ability. Its core elements include students being encouraged to ask their own questions; Students are encouraged to search for information to answer these questions; Teachers are no longer instilling knowledge to students, but guiding and supporting students' autonomous learning to help students improve their autonomous learning ability. On this basis, students' independent learning and research ability can be cultivated. Arouse students' curiosity and exploration spirit, and the ability to support lifelong learning as students learn how to access and evaluate information.

By combining the teaching structure of PBL and RISE, we can establish a teaching model and write case teaching plans based on it. The combined model mainly includes: (1) The start-up stage: after putting forward a question related to the course content or a case, students initially understand and discuss the problem, and propose their own questions; (2) Independent inquiry stage: students study the problem by themselves or in a group, find relevant information and solutions, and then find and learn theoretical knowledge independently to understand and solve the problem; (3) In-depth discussion stage: students share their findings and solutions in a group and discuss them. After the discussion, students propose new and deeper problems and study independently again; (4) the presentation and feedback stage: groups present their findings and solutions and receive feedback from their peers and teachers, who provide instructive feedback and may introduce new questions to further promote students' thinking and learning. Throughout the teaching process, students need to always participate in the whole learning process with an active attitude and have their own role in each stage. At the end of each stage, the teacher can summarize the achievements of the stage and give evaluation. In traditional teaching, teachers usually use teaching, questioning and checking to complete the course teaching, which is not conducive to students' active participation in the discussion. However, in the combination of PBL and RISE teaching, teachers guide students to complete the course teaching by independent learning, cooperative learning, and research learning, which is conducive to the cultivation of students' independent learning and research ability. Therefore, the combination of PBL and RISE teaching model can effectively improve students' independent learning ability, cooperative spirit, and ability to analyze and solve problems.

This model combining PBL and RISE aims to take advantage of the strengths of both approaches: the structured, case-centred approach of PBL and the autonomous, exploratory learning approach of RISE. In this model, students are not only able to learn and apply knowledge, but also to develop independent learning and

problem-solving skills. In the process of teaching, teachers should grasp the following principles: (1) Students must be clear about their role and participate in the course teaching with an active attitude, rather than passively accepting and answering questions; (2) Teachers should provide students with necessary information and materials to help them understand and solve problems; (3) Teachers should encourage students to raise new and deeper questions in the discussion; (4) Teachers should provide feedback and guidance according to the questions raised by students in the discussion to help students solve problems; (5) Teachers should pay attention to guide students to think, understand and apply what they have learned. Of course, in order to ensure that the combination of PBL and RISE teaching model can be successfully implemented, there are also certain prerequisites, that is, teachers have the basic quality of PBL and RISE teaching methods, and are familiar with the teaching discipline and related disciplines.

4. The preparation before class

Since only 2 hours of teaching plan learning are planned in each node, the preparation of students before class is particularly important. Based on this, the corresponding teaching preview courseware is designed, which is sent to students through Rain Classroom to help students prepare in advance and teachers guide in advance. Taking the COVID-19 infection as an example, the following slide outline is planned:

(1) Slide 1: The interaction between COVID-19 and the immune system-Understanding our immune response; Provide microscope images including COVID-19 and immune cells to stimulate interest. S

(2) Slide 2: Introduction to the immune system; Preview requirements and goals; Preview of class activities.

(3) Slide 3: Case introduction: Basic information about COVID-19; Brief description of a specific clinical case; And questions related to the case.

(4) Slide 4: Introduction to the Immune System: Basic functions of the immune system; The main components of the immune system (immune cells, immune molecules, immune organs).

(5) Slide 5: Making preview requests: Read the assigned preview material (e.g., the basics of the immune system); Think ahead of time about issues related to the case. Prepare a short list of questions about the immune system or parts of the case that you don't understand.

(6) Slide 6: Propose learning objectives: List the main learning objectives of the course, which is to review previous knowledge on immune molecules, immune cells, and immune organs.

(7) Slide 7: Preview of class activities: A brief overview of the main activities and objectives of each class hour; Prompts students about how to prepare for these activities.

(8) Slide 8: Tutoring with Reference Materials: Provide some additional reading and learning materials, including books, articles, online resources, etc.

(9) Slide 9: Practice after Class: Prepare for the end-of-class activities and new learning material.

(10) Slide 10: Teacher feedback: Provide an online collaborative learning activity for a small group of students to discuss the content of the next class.

PPT outline is sent in the rain class, the teacher can see that some students have read these materials in advance and have completed the preview, and the teacher can also adjust the next learning content according to the students' preview. In the rain classroom, the teacher needs to check the preview situation of the students in time to understand the degree of students' mastery of knowledge points and possible problems in class. The teacher can publish learning tasks through Rain Classroom, and let the students enter the learning interface after completing

the tasks. There is also a "challenge" and "submit" function in the learning interface, where teachers can ask students to answer questions or submit questions.

The teacher uses the Rain Class report to make sure that the student has read or watched all of the previewed material and has taken notes. Encourage students to record their queries during the preview process and to volunteer them in class. Remind students to actively participate in group discussions and share their thoughts and perspectives. Encourage students to explore their questions and what they don't understand, and actively seek answers. Through the above PPT outline and preparation work, it is hoped to provide students with a clear learning direction, help them to establish a basic understanding and interest in the course content before class, to improve their participation in class.

5. Implementation of the course

According to the arrangement of 2 hours, the course is mainly divided into two parts:

5.1. Lesson 1

Understanding the Case and the Basics of Immunization (40 minutes): Introduce a clinical case of COVID-19 infection and briefly review the basic components and related functions of the immune system. First, a case presentation (10 minutes) by the teacher describes the clinical symptoms and diagnostic process of a patient with COVID-19 infection. The teacher then asks open-ended questions related to the case, such as: "How did the immune system respond?", "Which immune cells and molecules are involved in the defense response?", "What is the process of immune cell movement in various organs and for what purpose?" "Etc. Then, organize a group discussion (15 minutes) to divide students into small groups to discuss the problems raised in the case and analyze the relationship between the case and the immune system. After the group discussion, knowledge sharing and problem discussion were carried out (10 minutes). Each group of students shared their discussion results, and the teacher gave feedback and supplement. Finally, the teacher summarized the key knowledge points and logical clues of the basis of the immune system (5 minutes).

5.2. Lesson 2

In-depth understanding of the immune system and self-directed learning training (40 minutes): Guide students to understand the specific composition and function of the immune system and promote the development of self-directed learning ability. Each group is required to learn about the immune system independently (15 minutes). Student groups are required to find the information related to the case in the materials, and provide more in-depth learning experience about the immune system (immune cells, immune molecules, and immune organs) after the learning. After that, students were encouraged to ask questions about the immune system and find the answers by themselves. Students then share their findings and interesting learning results (10 minutes). Finally, the teacher will make a summary and evaluation.

6. Evaluation and discussion of teaching effect

Medical immunology teaching is a subject that needs memorization, and the traditional examination method cannot fully reflect students' mastery and understanding of medical immunology. Students often start from interest

in basic medical subjects, confused by the complexity of knowledge points in the learning process, and then to the surprise memorization before the examination, and finally forget it soon after the examination. Since this year, the proportion of comprehension-oriented multiple choice questions in the examination of medical immunology in Anhui Medical University has been gradually increased to 60%. In the scoring standard of subjective questions (short answer questions and essay questions), the openness of questions and answers has also been strengthened to reflect the understanding degree of students, so as to adapt to the evaluation of the new teaching method.

The case teaching combined with PBL and RISE is mainly to help students consolidate knowledge and deepen understanding at the middle point of the teaching process from basic concepts to immunology and at the two time points after the teaching is completed, and to provide a way for students to learn independently, learn for a long time, understand and master complex immunology knowledge [15]. Some people think that this teaching method will make students with weak knowledge unable to adapt, but the fact shows that students with weak knowledge are also full of interest in such teaching activities, and find a logical clue and interest point that can be cut into immunology learning to deepen the degree of knowledge mastery. Some students with good academic performance will also find deficiencies in this kind of learning, open their eyes, and prompt their interest. It is believed that this preliminary attempt will be beneficial to the development and improvement of medical immunology teaching.

7. Conclusion

The integration of the PBL and RISE teaching methods into traditional classroom instruction has proven effective in addressing the challenges of undergraduate medical immunology education. By encouraging independent learning and case-based discussions, this combined approach enhances students' understanding of immunology concepts, fosters their interest in the subject, and strengthens their ability to connect theoretical knowledge with clinical and public health applications. Furthermore, it equips students with the foundational skills necessary for advanced studies in immunology and related disciplines. These improvements demonstrate the value of innovative, student-centered teaching strategies in optimizing medical education outcomes.

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