

# *Research on the Surgery Teaching Model Based on Problem-oriented Learning*

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**Keywords:** Problem-oriented learning; surgery education; medical education; teaching mode

**Abstract:** This study explores the teaching model of surgery based on problem-oriented learning (PBL), aiming to improve medical students' autonomous learning, critical thinking and clinical practice skills. The study first outlined the rationale of PBL and its applications in medical education, and then analyzed the significance of introducing PBL into surgery education, including improving the classroom atmosphere and deepening the understanding of surgery content. Then, the construction of the PBL-based surgery teaching model is described in detail, including the pre-class online self-study session, the in-class q & A interaction session, and the after-class student feedback and teaching evaluation. Finally, the advantages of the model, such as promoting the development of critical thinking and problem-solving capabilities, and its limitations, such as curriculum design complexity, are discussed. Overall, problem-oriented learning models bring many benefits to surgery education, but require constant improvement and development to meet changing educational needs.

## 1. Introduction

Surgery is an important branch of medicine that requires medical students to acquire extensive knowledge and a high degree of skills to meet complex clinical challenges. With the continuous development of medical science and the continuous progress of surgical techniques, how to train and educate the next generation of surgeons effectively becomes particularly important. The traditional medical education model performs well in knowledge transmission, but there are some challenges in cultivating students' critical thinking, clinical judgment and practical skills. Problem-oriented learning (Problem-Based Learning, PBL), as a modern educational method, emphasizes the students' active learning and their ability to solve practical problems. In surgery teaching, the problem-oriented learning model has great potential to help students better cope with complex surgical scenarios. This study aims to explore the model of surgery teaching based on problem-oriented learning and the potential and challenges of this model in training surgeons.

By deepening the application of problem-oriented learning in surgery education, we expect to provide a powerful educational approach to developing surgeons with more practical competence and clinical literacy, thus providing a higher level of service for patient health care.

## 2. Overview of Problem-oriented learning (PBL)

Problem-oriented learning (Problem-Based Learning, or PBL) is an educational method designed to develop students' critical thinking, problem-solving skills, and self-directed learning skills<sup>[1]</sup>. The core idea of PBL is to promote their learning by allowing students to solve problems in the real world. PBL emphasizes the starting point of the learning process as an open question or context rather than traditional teaching goals. Students need to explore relevant knowledge and skills; in PBL, students play the role of active learning, choosing resources, asking questions, finding answers, and working with classmates. The role of a teacher is more like a mentor or mentor; PBL encourages students to synthesize knowledge and skills in different fields to solve problems, thus it is interdisciplinary; emphasizes the connection between learning and practical application, and students address problems often reflect challenges and situations in the real world. Students usually form small groups to discuss problems, exchange ideas, and work together to solve problems. This helps develop teamwork and communication skills; in PBL, feedback is a key component and students need to regularly reflect on their learning processes and outcomes to improve<sup>[2]</sup>.

Problem-oriented learning has been widely used in many fields of education, including medicine, engineering, business, and natural sciences. It emphasizes the autonomy of students and problem-solving ability, which helps to combine theoretical knowledge with practical application and cultivate students with lifelong learning ability. In surgery education, the application of PBL can stimulate students' interest, improve their professionalism, and better prepare them for future clinical practice.

## 3. Medical education model based on PBL

The PBL medical education model is a student-centered teaching approach designed to develop problem solving, collaboration, and self-directed learning among medical students. Teaching generally takes complex practical clinical situations or medical problems as the starting point, and guides students to actively ask questions and goals, so as to solve these problems as the learning goal<sup>[3]</sup>. Students are usually divided into small groups to study and solve problems together. This helps to facilitate the development of collaboration, communication, and teamwork skills. Mentors are no longer traditional knowledge imitators in the PBL model, but instead act as instructors and facilitators, encouraging students to think and learn independently. Students need to take the initiative to collect, sort out and analyze relevant information to solve problems. This helps to develop autonomous learning and information retrieval skills. Students and mentors work together to assess learning processes and outcomes and provide feedback to continuously improve learning.

The PBL-based medical education model stimulates students' interest and motivation in learning, making them more involved in the learning process; helps students develop practical medical skills such as clinical reasoning, problem solving and decision making; promotes collaboration and teamwork among students, simulates the working mode of actual medical team; cultivates students' independent learning and information retrieval ability, so that they can continue to learn and adapt to the changing medical knowledge<sup>[4]</sup>.

## 4. The application significance of problem-oriented learning in surgery education

### 4.1 Improve students' independent learning ability, critical thinking ability and clinical practice ability

The application of problem-oriented learning (PBL) in surgery education provides students with unique opportunities to help develop their self-directed learning skills, critical thinking skills, and

clinical practice skills<sup>[5]</sup>. The PBL model requires students to actively participate in the problem-solving process, and they need to proactively seek information, think independently, and propose solutions<sup>[6]</sup>. This stimulates the initiative of the students and cultivates their habit of independent learning. In surgery, self-directed learning ability is essential for continuously updated medical knowledge as the techniques and practices in the surgical field continue to evolve and evolve. PBL cases are often challenging and require deep analysis and thinking by students. Through discussion and reflection with classmates, students learn to ask questions, research evidence, make reasoning and debate ideas. This critical development is a critical skill required by surgeons because they often need to make decisions in complex clinical situations. PBL cases often reflect clinical problems in the real world, and students need to use their knowledge to address them. This opportunity for practical application helps students to translate theoretical knowledge into practical competence and familiarise themselves ahead with clinical decision making and surgical operations. With PBL, students can accumulate clinical experience in a relatively safe educational environment.

#### **4.2 Improve the classroom atmosphere of surgery and deepen students' understanding of surgical content**

The application of PBL in surgery education is also of great significance to improve the classroom atmosphere and deepen students' understanding of surgery content. The group discussion and collaboration sessions in the PBL improved the classroom atmosphere<sup>[7]</sup>. The interaction between students promotes knowledge sharing, the exchange of different viewpoints and the cultivation of cooperative spirit. Surgery education often has a high, stressful and stressful atmosphere, but PBL can create a more open and supportive learning environment that makes students easier to handle challenges and mistakes. The practical nature of the PBL case enables students to not only understand the theoretical knowledge, but also to apply it to practical situations. This deep learning approach helps students to have a more comprehensive and profound understanding of the core concepts and principles of surgery. They not only learn how to perform the surgery, but also understand why and how to deal with the complications of the surgery<sup>[8]</sup>.

In short, the application of problem-oriented learning in surgery education has remarkable significance. PBL by improving students' abilities for autonomous learning, critical thinking and clinical practice, as well as improving the classroom atmosphere and deepening, the understanding of surgery content, provides powerful educational tools for developing future surgeons. This educational approach helps to ensure that medical students are competent for the complex tasks and challenges in the field of surgery.

### **5. Construction of teaching mode based on problem-oriented learning in surgery teaching**

#### **5.1 Online self-study link before class**

Pre-class online self-study is an important part of the problem-oriented learning teaching mode, which aims to stimulate students' interest in learning, cultivate the ability of independent learning, and lay a foundation for classroom interaction and in-depth learning<sup>[9]</sup>. Students can obtain relevant learning materials through online platforms before class, including textbook chapters, academic papers, multimedia resources, etc<sup>[10]</sup>. These materials are designed to guide students in understanding specific surgery issues or topics. Each pre-class self-study session will clarify the learning objectives and problem statements to help students understand the problems they need to solve and provide direction for subsequent classroom interactions. Students will receive challenging questions related to specific surgery questions before class. These questions are designed to

stimulate students' thinking and guide them to do the necessary research and preparation before class. Students will have access to diverse learning resources, including online tutorials, video lectures, and simulated surgical procedures, to meet different learning styles and needs. Students have enough time to independently study and explore relevant content before class, and develop the habit of independent learning. Students can participate in online discussions, share questions, opinions and discoveries with classmates and teachers, and promote academic exchanges and collaboration. In order to test students' preview level, short pre-class quizzes can be designed to encourage students to study actively for class discussion.

Taking "hemorrhoids" disease in the surgery of traditional Chinese medicine as an example, teachers choose the five aspects of etiology, pathogenesis, clinical manifestations, diagnosis and differentiation diagnosis, syndrome differentiation and treatment, and make pre-class learning materials and theoretical explanation videos. The teacher also selected a clinical case of external hemorrhoids, uploaded it to the network platform, pushed it to the students, and put forward the following questions: (1) What kind of anal disease is diagnosed in this case? (2) Which kinds of anal diseases should be identified? (3) What is the best treatment for this disease? (4) Which prescription should be chosen? Students will study independently on the network platform according to the video and pre-class learning materials, and think about the answers to the questions, and record their own doubts. Teachers can check students' learning time and completion degree on the network platform to supervise students' learning progress.

## 5.2 Interactive q & A session in class

The interactive part of q & A in class is a key link in the problem-oriented learning and teaching mode, which aims to strengthen students' active participation, in-depth discussion and problem-solving ability<sup>[11]</sup>. In class, students will have in-depth discussions on the questions raised before class. Teachers play the role of guides to promote interaction and cooperation among students; by analyzing practical surgical cases, students combine theoretical knowledge with practical application to improve problem solving ability; divide students into groups to discuss problems, develop solutions, and present their research results within the group. This encourages students' collaboration, communication, and leadership; teachers provide timely feedback and guidance to help students better understand complex surgery concepts and guide them to improve during problem solving; some courses can include simulated surgical practices to experience the surgical process to better understand the knowledge.

Taking the "hemorrhoids" disease in traditional Chinese medicine surgery as an example, the teacher gave questions and answers to the students at the beginning of the class, and randomly selected the students to answer the questions about "hemorrhoids", so as to check their knowledge of the etiology, classification, clinical manifestations, diagnosis, treatment and other knowledge. This helps the teachers to understand the students' preschool independent learning situation. Next, the teacher will guide the students to discuss the four questions of the first case (external hemorrhoids) assigned before class. During the discussion, students can express their personal opinions, negotiate within the group to get the answers, and then report in small groups. For the controversial or unclear knowledge points, teachers will guide students to further communicate or answer questions. After the discussion of case 1 (external hemorrhoids), the teacher will use the class courseware to show case 2 (internal hemorrhoids), and ask new questions: (1) How long is this case for internal hemorrhoids? (2) How to treat traditional Chinese medicine based on syndrome differentiation? Teachers will organize students to continue analyzing case (3) Students can compare and analyze cases 1 and 2 to explore the similarities and differences between different cases. Subsequently, the teacher provided the other four cases for students for more in-depth

analysis and discussion. These cases will cover different types of hemorrhoid disease, helping students to understand the topic more comprehensively. Finally, before the end of the class, the teacher will combine the theoretical difficulties of "hemorrhoids" with the students' doubts before and in the class. This helps to consolidate the students' knowledge and ensure that they gain a clear understanding in the class. Through this interactive and problem-oriented teaching method, students will have a deeper understanding of the "hemorrhoids" disease and develop problem-solving and teamwork skills.

### **5.3 After-class student feedback and teaching evaluation**

After-class student feedback and teaching evaluation can contribute to the continuous improvement of teaching quality and students' learning experience<sup>[12]</sup>. Students can be encouraged to provide feedback on courses, teaching methods and resources through online surveys, discussion forums or face-to-face feedback meetings; Teachers will collect and analyze their learning outcomes, including classroom performance, group cooperation, paper or project outcomes, to evaluate their overall performance; based on student feedback and evaluation results, teachers will adjust the course content, teaching methods and learning resources to improve teaching quality and meet students' needs.

For example, after the end of the "hemorrhoids disease" course in traditional Chinese medicine surgery, students need to consolidate and improve their knowledge learned during the class through after-class activities. The role of a teacher is to assign homework, pay close attention to students' learning progress, and provide timely evaluation and feedback. First of all, students need to summarize the knowledge points of "hemorrhoids" disease and easy to make mistakes. This process can be used in different ways, including notes, mind maps, verbal summaries, etc., in an unrestricted form. Teachers can provide an after-class "hemorrhoids" self-test question to test the students' mastery of the topic. Self-test questions should include a variety of questions, such as multiple choice, fill-in-blank and short answer questions, to comprehensively assess students' knowledge. After the students complete the self-test questions, the teacher will correct the answers and provide feedback. This feedback could include interpretation of correct answers, emphasis on error-prone areas and advice to improve students' learning methods. Teachers can also identify and record common mistakes that students may have for correction and reinforcement in subsequent classes. In this way, students will be able to study independently after class and strengthen their mastery of the knowledge of "hemorrhoids" disease. At the same time, teachers can adjust the follow-up teaching plan according to the students' performance to ensure that every student can achieve better learning results.

## **6. The continuous improvement and development of problem-oriented learning mode in surgery teaching**

The problem-oriented learning model has potential in surgery teaching, and requires continuous improvement and development to continuously improve its effectiveness and adapt to the needs of modern medical education. In the future, virtual reality technology and surgical simulators can be used to provide students with a more realistic surgical practice experience. This will help them practice surgical skills while reducing risk to patients; surgery covers not only surgical techniques but also anatomy, biomedical engineering, imaging and other fields. Continuous improvement should include interdisciplinary elements to develop students' skills more comprehensively. This can be achieved by combining problem-oriented learning with practical clinical practice to enable students to apply what they learn in real clinical settings. Providing more internship opportunities and practical surgical experience would be beneficial in this regard.

Additionally, personalized learning paths and resources should be made available to students to meet their different needs and learning speeds. It is also important to establish effective feedback and evaluation mechanisms to understand students' progress and provide them with necessary guidance and support.

Problem-oriented learning should focus on cultivating students' clinical judgment, enabling them to make informed decisions in complex patient situations. Furthermore, students should be encouraged to participate in surgery research and innovation projects to develop their scientific research abilities and creative thinking.

## 7. Conclusion

Problem-oriented learning models have great potential in surgery teaching, but need to be continuously improved and developed to accommodate the evolution of medical education and changes in the field of surgical medicine. Through the continuous improvement of teaching methods and resources, surgeons with solid knowledge and clinical skills can be better developed.

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