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The Effect of Wet Lab Combined with PBL Teaching Mode in Ophthalmology Clinical Practice Teaching

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Abstract: *Objective:* To explore and analyze the effect of the Wet Lab combined with the PBL teaching mode in ophthalmology clinical practice teaching. *Methods:* Sixty interns who interned in the ophthalmology department of Daqing Oilfield General Hospital from May 2024 to December 2024 were selected and randomly divided into a control group and a research group, with 30 students in each group. The learning outcomes and satisfaction levels of the two groups of students were compared. The interns in the control group used the traditional teaching mode, while those in the research group used the Wet Lab combined with the PBL teaching mode. The internship outcomes and satisfaction levels of the two groups of students were compared and analyzed. *Results:* Compared with the students in the control group, the students in the research group showed significantly better internship outcomes and satisfaction levels in ophthalmology clinical practice teaching ($P < 0.05$). *Conclusion:* The teaching mode of the research group was superior to that of the control group in terms of intern satisfaction and internship outcomes in ophthalmology clinical practice teaching.

Keywords: Wet Lab; PBL; Ophthalmology clinical; Teaching effect

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1. Introduction

Clinical internships are an indispensable process in the university education stage for medical students, representing one of the most crucial links in medical education. They serve as an important bridge for medical students to integrate theory with practice and a necessary pathway for the transition from medical students to doctors, laying a solid foundation for future clinical work. Ophthalmology, unlike internal medicine and surgery, is a surgical discipline. Due to its precise and complex anatomical structure, with operations often performed under a microscope and limited teaching space for guidance, the difficulty of teaching has increased, resulting in suboptimal teaching effects and a long training period. To overcome these difficulties and enable interns to fully understand and develop an interest in ophthalmology within a limited time, continuous exploration and

improvement of teaching methods are necessary.

The Wet Lab represents an innovative, practical teaching model in ophthalmology. It utilizes animal eyes or computer software as surgical models to simulate a clinical surgical operation platform, equipped with microscopes, surgical operation systems, ophthalmic microscopic instruments, consumables, and more. This setup meets the practical needs of students for performing various common ophthalmic surgeries, such as debridement and suture, corneal surgery, cataract phacoemulsification and aspiration, and vitrectomy. It enables students to continuously improve their clinical operation skills through practice and gradually transition to clinical surgeries, effectively addressing the current deficiencies in clinical teaching [1,2]. PBL (problem-based learning) method is a teaching approach that facilitates student learning by presenting scenarios that help them define learning objectives. Generally, these scenarios are based on the learning content, and the process of establishing learning objectives aims to assist students in developing problem-solving abilities on the foundation of theoretical and clinical scientific knowledge. Centered around "real-world problems," this method typically selects authentic clinical cases that closely align with the professional field, rather than abstract theoretical knowledge. The problems are open-ended with no single correct answer, guiding students to explore solutions to the issues. With "students" as the primary learners, the approach shifts from passive knowledge absorption to active planning of learning objectives, organizing materials, analyzing problems, and seeking answers, while emphasizing group collaboration to foster team spirit. Set against the backdrop of "multidisciplinary integration," it breaks through the knowledge boundaries of a single discipline, integrating knowledge from multiple fields around complex problems. Teachers are repositioned as "facilitators," serving as designers, guides, and motivators who design appropriate problems, steer discussion directions, and pose insightful follow-up questions at the right time [3].

2. Materials and methods

2.1. General information

Sixty clinical medicine interns who interned in the Ophthalmology Department of Daqing Oilfield General Hospital from May 2024 to December 2024 were selected as our research subjects. All students were five-year medical students interning at our hospital and were randomly divided into a control group and a research group, with 30 individuals in each group.

2.2. Teaching model

Research group: The teaching model combines Wet Lab with PBL. (1) Problem posing: Guided by problems that can stimulate students' interest, the introductory course design should not only cover appropriate thematic content but also capture students' attention and curiosity, thereby fostering their interest in learning and promoting critical thinking. (2) Pre-class preparation: Students are divided into three groups. Through researching relevant materials, books, and literature, they engage in collaborative discussions, with group leaders documenting the proceedings for presentation in class. (3) Classroom instruction: Teachers deliver theoretical explanations using PowerPoint presentations based on the course syllabus. They analyze and discuss the submitted discussion records, integrating problems with clinical cases. Students are presented with clinical scenarios and discuss them in groups, with each group represented by a student summarizing the discussion, followed by supplementary remarks from other students. Afterward, the teacher provides summaries and guidance for each group. (4) Wet Lab practical operations: Using pig eyes as surgical models, this platform simulates clinical surgical procedures, offering students an initial understanding of ocular anatomy. Equipped

with microscopes, surgical operating systems, and ophthalmic microsurgical instruments and consumables, it meets students' practical needs for performing various common ophthalmic surgeries, such as debridement and suture, corneal surgery, cataract phacoemulsification, and vitrectomy. (5) Testing and summarization: Real-time assessment of students' grasp of classroom knowledge is conducted through group discussions, presentations of findings, teacher-posed questions, quizzes, and feedback forms. Teachers promptly summarize and analyze the results, addressing individual issues with targeted explanations to enhance the quality and efficiency of classroom instruction.

Control group: The traditional teaching model is employed, adhering to the syllabus requirements. Through classroom lectures and video presentations, students are taught about ocular anatomy, with examples illustrating common diseases, their causes, symptoms, diagnostic methods, and treatment principles related to relevant structures, while being guided to engage in discussions.

2.3. Evaluation indicators

Compare the evaluations of teaching methods and teaching effectiveness between the two groups of interns using the "Teaching Evaluation Survey" for questionnaire research. The evaluation of teaching methods includes satisfaction with teaching content, teaching mode, and the ability to enhance learning enthusiasm. Additionally, the evaluation of teaching effectiveness encompasses a basic understanding of the anatomical structure of the eyeball, as well as knowledge, diagnosis, and treatment principles of related diseases.

2.4. Statistical methods

Statistical software SPSS 16.0 was used for data analysis. Measurement data were represented using mean ± standard deviation (SD), and differences were compared using the *t*-test. The chi-square test (χ^2) was employed to compare differences in count data. A *P*-value less than 0.05 was considered statistically significant.

3. Results

3.1. Comparison of teaching method evaluations

There was no statistically significant difference between the research group and the control group in terms of satisfaction with teaching content and the ability to enhance interest in ophthalmology learning ($P > 0.05$). However, in terms of satisfaction with the teaching mode and enhancing learning enthusiasm, the research group was significantly higher than the control group, with a statistically significant difference ($P < 0.05$). See **Table 1**.

Table 1. Evaluation of teaching methods by two groups of interns

Survey item	Research group ($n = 30$)	Control group ($n = 30$)	χ^2 value	*P*-value
Learning content	28 (93.3%)	26 (86.7%)	0.741	0.671
Teaching model	27 (90.0%)	17 (56.7%)	8.523	0.007
Improved learning motivation	29 (96.7%)	22 (73.3%)	6.405	0.026
Increased interest in ophthalmology	24 (80.0%)	16 (53.3%)	4.800	0.054

3.2. Comparison of teaching effectiveness evaluations

Regarding the understanding of eyeball anatomy and related diseases, the research group achieved scores of

9.30 ± 0.84 and 8.90 ± 0.99, respectively, while the control group achieved scores of 6.70 ± 1.39 and 6.60 ± 1.84, respectively. The research group significantly outperformed the control group ($P < 0.05$). See **Table 2**.

Table 2. Evaluation of teaching effectiveness by two groups of interns

Assessment item	Research group (score)	Control group (score)	*t*-value	*P*-value
Understanding of ocular anatomy	9.30 ± 0.84	6.70 ± 1.39	8.120	< 0.01
Understanding of related diseases	8.90 ± 0.99	6.60 ± 1.84	6.643	< 0.01

4. Discussion

As a practical teaching method applied in hands-on instructional laboratories, Wet Lab is grounded in microscopic skills and centered on practical operations. Currently in China, Wet Lab teaching has been adopted as a method for clinical skill training in ophthalmology at many large teaching hospitals. It involves processing fresh pig eyes (or animal eyes) using specific methods and is equipped with professional surgical microscopes, phacoemulsification systems, and other equipment, as well as microsurgical instruments and consumables, to realistically simulate a clinical surgical operation platform, meeting students' practical needs for performing eye surgeries. Students can personally engage in hands-on practice, repeatedly practicing under the microscope to experience the mastery and handling of details until they achieve proficiency [4]. PBL, as a teaching method that enables students to learn by describing scenarios and setting learning objectives, incorporates critical thinking. By solving practical problems, it cultivates students' critical thinking and analytical abilities, encouraging questioning and exploring a deeper understanding of knowledge. Generally, scenarios are based on learning content, and the process of establishing learning objectives aims to help students develop problem-solving abilities on the basis of building theoretical and clinical scientific knowledge [5,6]. Studies have shown [7] that integrating PBL can guide students to conduct systematic analyses from history-taking and auxiliary examinations to differential diagnosis, and deepen their understanding through group presentations and expert evaluations. During the teaching process, teachers need to play the role of facilitators, avoiding directly providing answers but instead stimulating deep thinking through probing questions. The openness of the Wet Lab teaching model, combined with the PBL teaching method, places higher demands on teachers' practical communication skills. To continuously improve teachers' own qualities, on the one hand, teachers should be encouraged to actively participate in practical activities and engage in teaching practice exchanges among themselves; on the other hand, teachers also need to be urged to establish harmonious learning-promoting partnerships with students, enabling this teaching method to proceed smoothly [8]. Teachers design different teaching methods based on students' mastery of knowledge. The combination of the Wet Lab teaching model and the PBL teaching method stimulates students' thinking, self-reflection, and summarization, guiding them to learn independent analysis and problem-solving skills. Students integrate theoretical knowledge with practical operations, achieving a comprehensive understanding of medical knowledge. This approach cultivates students' clinical thinking, doctor-patient communication skills, teamwork abilities, and innovative capabilities [9]. In this study, regarding satisfaction with teaching content and the ability to enhance interest in ophthalmology learning, although there was no statistically significant difference between the two groups, the research group demonstrated markedly superior outcomes compared to the control group. In terms of satisfaction with the teaching model and boosting learning motivation, the Wet Lab combined with the PBL teaching model achieved more desirable results. When it comes to understanding eye anatomy and related diseases, the Wet Lab

combined with the PBL teaching model exhibits unique advantages in ophthalmology teaching, offering a better and more optimal choice for future ophthalmology clinical teaching methods.

There is a need to improve the practical operational skills of ophthalmology among clinical medical interns, address the deficiency of a singular teaching model in ophthalmology practical skills training, and strengthen medical talent cultivation to enhance competency. Traditional skill training models often rely primarily on offline centralized instruction, resulting in a relatively monotonous teaching approach. This, in turn, leads to low student participation in class and diminished learning interest. In response to the issues of weak student skill operations, poor hands-on abilities, and inadequate clinical thinking skills observed in traditional skill training, this study constructed a new ophthalmology clinical practical skills training system for clinical medical students by integrating the Wet Lab teaching model with the PBL teaching method. This approach emphasizes guiding practice with theory and consolidating theory through practice, aiming to enhance the quality of skill training for clinical medical interns, improve medical students' job competency, and cultivate high-standard medical talents [10].

The integration of the Wet Lab teaching model with the PBL teaching method can transform traditional clinical skill training models. Despite challenges such as resource and time constraints, these can be gradually addressed through strategies such as optimizing model design, implementing tiered teaching, and integrating technology. Future research should further validate the long-term effects and explore applications in more subspecialties (e.g., retinal diseases, ocular trauma). A diverse teaching approach leverages available data resources, mobilizes subjective initiative from practical experiences, and rapidly establishes clinical thinking and practical skills operations [11].

5. Conclusion

The Wet Lab teaching model, combined with the PBL approach, was employed in this study for ophthalmic practical research exclusively among clinical interns. However, medicine is a highly practical discipline, with all medical specialties involving hands-on procedures. Therefore, this skill training method is applicable to all medical specialties and can serve as a catalyst to drive reforms in medical teaching models.

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Disclosure statement

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