

Application of Combined PBL Teaching Method in Postgraduate Oral Implantology Teaching

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Abstract: Oral implantology is a discipline that combines theory and practice, and its research involves many fields such as ecology, psychology, and genetics. In view of the clinical application of this subject, this article will discuss the practice of combined PBL (problem-based learning) teaching method, introduce the background and significance of this topic in detail, and analyze the current status and development trends of related research at home and abroad. Next, this article combines PBL teaching method to design a model for oral implantology teaching at the postgraduate level, and discovers problems through experimental results and actual situations. The experimental results showed that the average score of the experimental class was 89.3 points, while the average score of the control class was 74.3 points; the participation rate of the experimental class ranged from 93% to 96%, while the participation rate of students in the control group ranged from 82% to 88%. The overall performance of students in the experimental group who have been trained by PBL teaching method is better than that of students who have not been trained, which shows that this method is feasible and can improve the effect of oral implantology teaching.

1. Introduction

Oral implantology is a highly applied natural science, involving many fields such as biology and chemistry, and is highly comprehensive. With the accelerated aging of China's population, the continuous improvement of medical technology, and the vigorous development of traditional Chinese medicine, Chinese graduate-level oral biology students have more urgent requirements for clinical practice capabilities. This study aims to study the practical teaching of oral implantology by using the combined PBL experimental method, conduct teaching effect testing, evaluation analysis, and explore specific measures to promote this method, thereby promoting the teaching of theoretical knowledge and skills in oral implantology.

The focus of this article is on the use of combined PBL teaching method for oral implantology teaching. First, the theoretical basis of this method in clinical practice is explained. Secondly, the impact of this method on student learning outcomes is introduced, and how to improve the efficiency and quality of collaborative oral implantology classroom teaching is discussed. Finally, a specific and feasible improvement plan is proposed, that is, grouping the team members into groups.

The innovation of this article is to integrate, sort out and summarize the knowledge learned by students during the internship stage by combining the teaching content of oral implantology and using the combined PBL experimental method as a guiding method. This article combines theory with practice and jointly promotes the cultivation of students' application ability of basic technologies related to oral biology through group cooperation and exchange. This article combines theory with practice, and jointly promotes the cultivation of students' ability to apply basic technologies related to oral biology through group cooperation and exchanges, at the same time, discovers problems and proposes solutions in practical work. By using the combined PBL teaching method to conduct systematic exploration and analysis of oral implantology teaching at the postgraduate level, and proposing corresponding countermeasures, this article aims to provide reference and reference for the clinical practice of future research interns, and contribute a small amount to promote the development of the oral implantology profession in China, this also lays a solid foundation for oral implantology graduate students to improve their comprehensive quality.

2. Related Work

In recent years, with the rapid rise of China's economy and society, people's living standards have gradually improved, and medical and health services have also continued to improve. Therefore, people are paying more and more attention to health issues and have put forward higher requirements for the means and methods of treating their own diseases. It is particularly noteworthy that in recent years, experts and scholars at home and abroad have begun to pay attention to and study oral implantology and its applications, developing it into an independent discipline, and conducting in-depth discussions on its theoretical and technical scope. Research by Alexandre Almeida Del Savio and others aims to use project-based learning to teach virtual design construction. Their research found that students' comprehensive abilities and practical skills could be promoted through the PBL method, thereby improving their learning outcomes in virtual design and construction [1]. Jianhua Ma's research explored the impact of PBL based on building information modeling on civil engineering students' learning outcomes. Their research found that by using BIM to build specific engineering cases, a positive learning experience could be provided, thereby improving students' academic performance and teamwork ability [2]. The research by Yi Huo et al. focused on the impact of PBL-based virtual reality courses on the design abilities of preparatory teachers under the COVID-19 epidemic. According to their research results, courses based on PBL and VR technology can help improve students' design abilities and innovative

thinking [3]. The study by Juebei Chen et al. explored factors that promoted academic well-being among first-year engineering students in a PBL environment. Their research found that teacher support and active participation, peer collaboration and atmosphere, and the relevance of course content were all important factors that influenced students' academic well-being [4]. A PBL intervention study conducted by Oscar I. Higuera-Martinez et al. aimed at cultivating the creativity of first-year engineering students found that PBL-based interventions can significantly improve students' creative performance and problem-solving abilities [5]. The study by Mario Alberto de la Puente Pacheco et al. aimed to understand the effectiveness of PBL methods in different regional contexts, using Colombia as an example. This study found that the PBL method was feasible and adaptable in different regions, but it also faced some challenges during implementation [6]. The study by Hsu-Chan Kuo et al. explored the impact of the design thinking PBL robotics course on college students' learning motivation and creative thinking. Their research results showed that the course helped improve students' learning motivation and creative thinking ability [7]. Julián Espinosa-Giménez et al. conducted a 5-year quantitative study focusing on the scientific output of oral implantology journals. They analyzed the scientific research output and impact factors of the journal [8]. Lee Y H's research focused on oral care of oral implants during COVID 19 [9]. Meer S et al. conducted a comparative analysis of oral and non-oral plasma cell lymphoma and explored the characteristics and clinical manifestations of oral and non-oral plasma cell lymphoma [10]. These research contents mainly focus on how to improve students' learning interests and skill levels, and put forward rational suggestions based on clinical practice experience.

3. Method

3.1 PBL Teaching Method

PBL(Problem-Based Learning) teaching method is a problem-driven teaching method that aims to promote students' inquiry and learning by solving practical problems. The first step in PBL teaching method is to identify a challenging and inspiring problem as a learning goal and guide. This question should be related to the subject knowledge and be able to stimulate students' interest and thinking. The determination of the problem needs to take into account the students' learning goals and background knowledge to ensure the rationality and feasibility of the problem [11-12]. In terms of problem determination, the following formula can be used to evaluate the difficulty of a problem:

$$D = \frac{\text{average difficulty of subtasks}}{\text{average difficulty of skills}} \quad (1)$$

Among them, D represents the difficulty of the problem, average difficulty of subtasks represents the average difficulty of subtasks, and average difficulty of skills represents the average difficulty of the required skills. PBL teaching method encourages students to work in groups and solve problems together. Students can communicate with each other, share ideas and knowledge, and form an atmosphere of cooperative learning. Group work promotes interaction and collaboration among students and expands their thinking and perspectives. During group work, it can use the following formula to evaluate team member participation:

$$P = \frac{\text{number of contributions by student A}}{\text{total number of contributions by all student}} \quad (2)$$

Among them, P represents the evaluation index of team member participation, number of contributions by student A represents the number of contributions by student A, and total number of

contributions by all students represents the total number of contributions by all students. Once students have solved a problem, PBL teaching method requires them to present their solution and results to others. This can be done through oral presentations, group discussions, or presentation of manuscripts [13-14]. Through the presentation of results, students can consolidate their learning results, improve their expression skills, and gain further learning and improvement from feedback from other students. In terms of presentation of results, the following formula can be used to evaluate student performance and effectiveness:

$$E = \frac{\text{quality} \cdot \text{of} \cdot \text{presentation}}{\text{expected} \cdot \text{outcome}} \quad (3)$$

Among them, E represents the student's performance and effect, quality of presentation represents the quality of presentation, and expected outcome represents the expected result. The implementation process of PBL teaching method includes problem identification, group cooperation and result presentation. Mathematical formulas can be used to evaluate problem difficulty, team member engagement, and student performance and effectiveness.

3.2 Oral Implantology Teaching Model Based on PBL Teaching Method

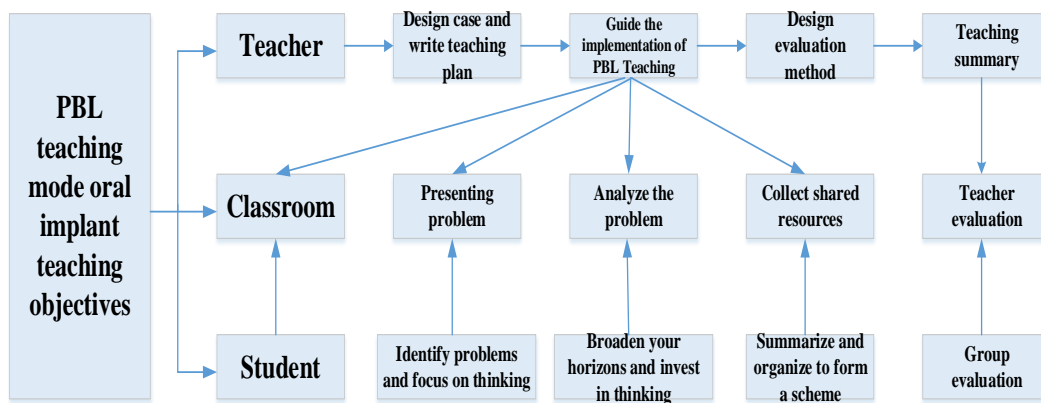


Figure 1: The teaching model of oral implantology

The design of this teaching method is based on the PBL teaching method. In the oral implantology course, students preview their chosen courses and complete classroom learning tasks through group cooperation, independent inquiry and other methods. Teachers play a leading role in guiding new ideas: guiding students to have a basic knowledge and understanding of relevant content with questions as the core, guiding each student to ask corresponding questions and list solutions [15-16]. The teacher will also help each team member solve the problems they encounter and analyze the solutions and results.

The oral implantology teaching model based on PBL teaching method (its structure diagram is shown in Figure 1) is composed as follows: The model includes five important links: curriculum design, student group formation, problem scenario formulation, resource provision and evaluation. The first step is course design. Teachers need to design a specific learning project based on teaching objectives and subject requirements to determine the scope of required knowledge and skills. In oral implantology, a project can be designed that requires students to study implant failure cases under different scenarios, analyze the causes and propose solutions. The second step is the formation of student groups. Teachers will divide students into groups, each group consisting of 4-6 students of different ability levels, and encourage them to work together and solve problems together. Such a setting can promote cooperation and communication among students and improve problem-solving

abilities. The third step is problem scenario formulation. The instructor provides each group with a specific problem situation involving real issues in oral implantology practice [17-18]. A problem situation might be: A patient's dental implant fails and complications develop. How to resolve this? Such situations can stimulate students' interests and challenge their thinking and abilities. The fourth step is resource provision. Teachers need to provide students with necessary learning resources, including relevant literature, materials, experimental equipment, etc., to help students solve problems. Students can learn about the theoretical knowledge of implantology by reading relevant literature, and at the same time, they can also use models for practical operations to improve their skills. The fifth step is evaluation. Teachers will formulate evaluation standards to evaluate students' learning outcomes [19-20]. The evaluation content includes students' teamwork ability, problem-solving ability, and the quality of oral and written reports. The purpose of evaluation is to comprehensively understand students' learning situation and help them improve their learning results. The advantage of this oral implantology teaching model based on PBL teaching method is to stimulate students' learning interest and initiative and cultivate their problem-solving ability. Through the design of group cooperation, problem scenarios, resource provision and evaluation, students can gain a more in-depth learning experience from practice and cultivate lifelong learning abilities. This teaching model can promote the cultivation of students' thinking ability, innovation ability and teamwork spirit, and improve the quality of oral implantology teaching.

4. Results and Discussion

4.1 Testing Steps of Teaching Model

The testing steps of the teaching model are an important link to ensure that the teaching model can be effectively implemented and achieve the expected results. This step includes four key steps: teaching implementation, data collection, data analysis and improvement measures.

(1) Teaching implementation. According to the teaching model design, teachers implement the predetermined teaching plan and course content. In the teaching of oral implantology, teachers may introduce the basic concepts of implantology, technical operation points and typical cases, etc., combined with PBL teaching method, to cultivate students' problem-solving ability and teamwork spirit.

(2) Data collection. Teachers collect data by observing students' learning performance, listening to students' opinions and feedback, and using methods such as classroom tests and homework assessments. This article uses an experimental comparison method to collect data on students' teamwork, problem solving, and learning motivation. As shown in Table 1, this article conducts a sample survey of students in three classes, which are divided into experimental groups and control group.

Table 1: Test the experimental data

Experimental subject	Experimental group	Control group
A class	10	10
B class	15	15
C class	20	20

(3) Data analysis. Teachers analyze the collected data, including qualitative and quantitative analyses. Qualitative analysis can understand students' learning status and confusion points from aspects such as student performance, feedback and discussion records; quantitative analysis can evaluate students' overall performance and satisfaction through performance statistics, questionnaire recovery rates and other indicators.

(4) Improvement measures. Based on the data analysis results, teachers formulate corresponding improvement measures for the problems found. If it is found that students have deficiencies in teamwork ability, the project can be redesigned to increase cooperation opportunities and discussion sessions to cultivate students' sense of teamwork. Teachers adjust teaching resources based on students' feedback and needs and provide educational tools that are more suitable for students' learning needs.

4.2 Analysis of Teaching Effects

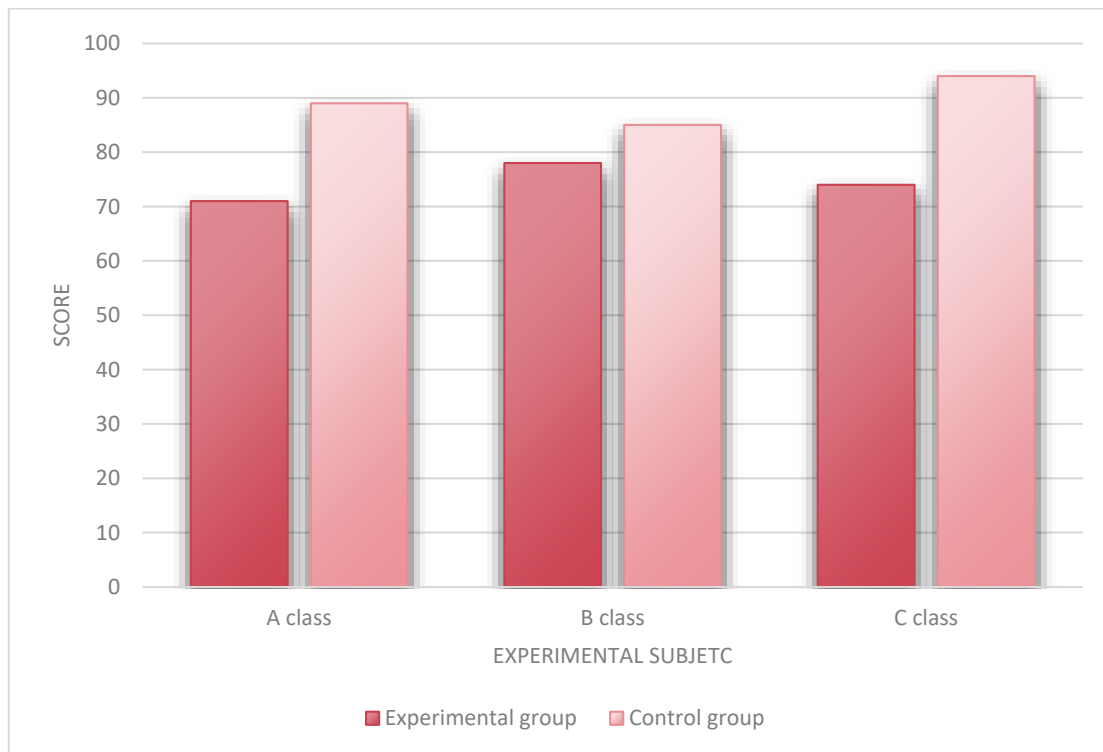


Figure 2: Student performance test comparison

Student academic performance measures their learning outcomes. By comparing the improvement in student performance before and after teaching, the effectiveness of teaching can be evaluated. Therefore, the main task of this internship is to enable students to master the application process of PBL teaching method in oral implantology. According to the data results in Figure 2, this article analyzed the students' scores after the method was taught in the classroom and found that the average score of the experimental class was 89.3 points, while the average score of the control class was 74.3 points. This shows that the combined PBL teaching method can make the problem concrete and practical to solve the difficulties encountered in the process of oral implantation. Students can apply skills to solve problems based on their professional theoretical knowledge and their understanding of their job content. The implementation of oral implant skills teaching at this stage is both practical and innovative, and has basically achieved the expected goals.

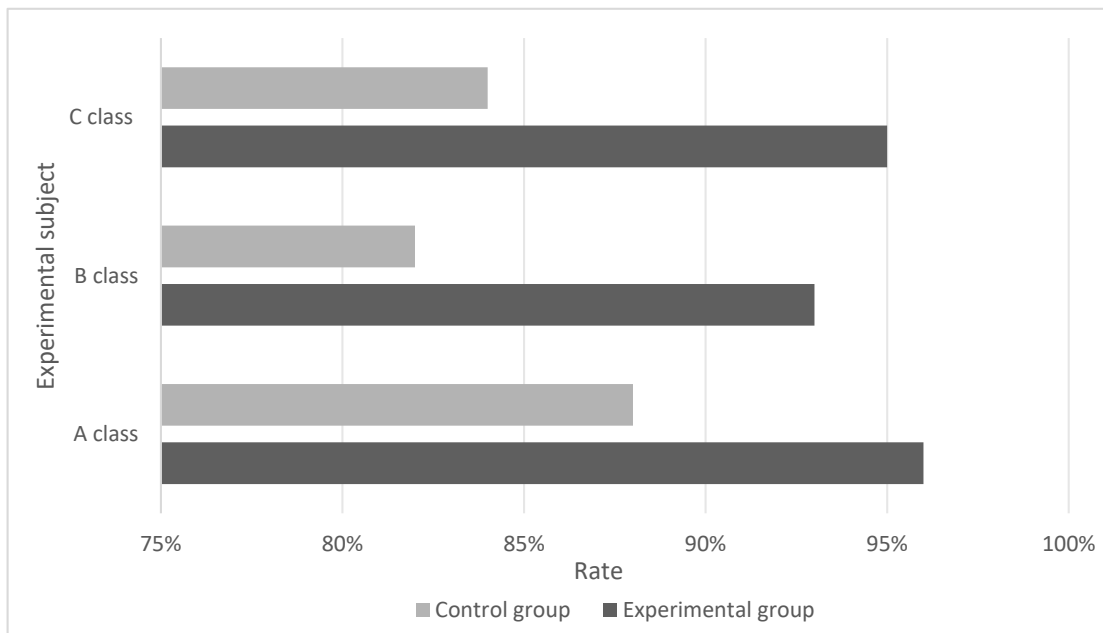


Figure 3: Comparison of the student engagement test

Students' active participation can be assessed in several ways, looking at how frequently they answer questions, the number of questions they ask, and how much they participate in group discussions. Judging from the data in Figure 3, the participation rate of the experimental class is between 93% and 96%. The participation rate of students in the control group ranged from 82% to 88%. In this stage of oral implantology teaching, students showed a high degree of participation. However, the participation of students in the experimental group was higher than that of students in the control group. Within the group, each student has his or her own independent learning time and tasks, which puts forward higher requirements for cultivating the spirit of cooperation and collaboration ability. Throughout the teaching session, students showed a strong sense of participation and collective honor.

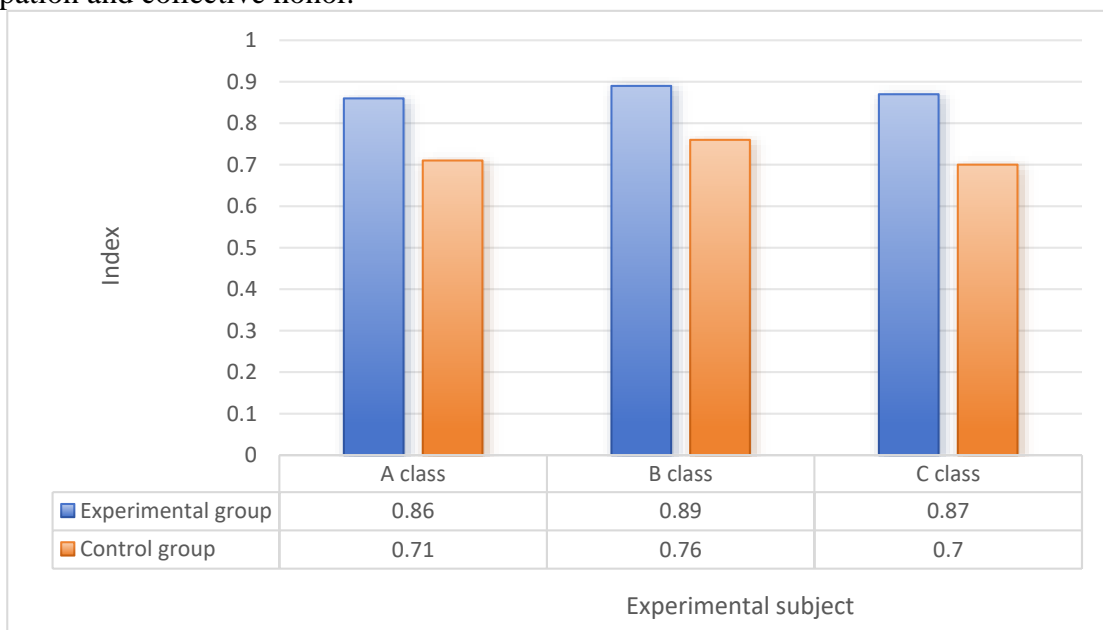


Figure 4: Students learn motivation

Students' motivation to learn refers to their interest and motivation in learning. Assessing students' learning motivation can be carried out by observing their participation level, learning attitude and homework completion. During the dental learning stage, students have a high degree of mastery of the specific processes and requirements of the subject. After long-term cooperative group discussions, exchanges and observations, it was found that the combined PBL teaching method can effectively improve the classroom atmosphere. Combined with the experimental results in Figure 4, the experimental group has a higher degree of participation and a higher degree of homework completion than the control group. Through comprehensive comparison, it can be concluded that the overall performance of students in the experimental group trained by PBL teaching method is better than that of students without training, which shows that this method is feasible.

5. Conclusion

Oral implantology is a discipline that integrates theory and practice. Its guiding principles are based on scientific methodology and comprehensively apply a variety of advanced ideas and methods such as ecology and biotechnology. This article first introduces the research background and significance, highlights the importance of the topic, and then analyzes the development status of joint PBL teaching methods at home and abroad, and elaborates on their respective advantages, shortcomings, and existing problems. This article also conducts a survey on the traditional root therapy (implant therapy) widely used in current basic dental education and the oral cultivation courses combined with modern apprenticeships, collects data for statistics and analysis, and finally draws conclusions. There is room for improvement in the design of artificial implants in oral implantology. Although a variety of implant configurations and materials are available, individual design for a specific patient is still insufficient. Future development can use digital technology for implant design and use computer-aided design and manufacturing methods to achieve accurate matching and improve the long-term stability of the implant. There is still room for further improvement in bone grafting technology in oral implantology. Most of the bone graft materials currently used is synthetic materials. Although they have certain biocompatibility and stability, their effectiveness in promoting bone tissue regeneration and repair is still limited. More bioactive materials can be studied to promote better bone tissue regeneration and improve the success rate of bone grafting.

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