

# Teaching Design and Practice of Pathogenic Biology and Immunology in Higher Vocational College

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**Abstract:** Pathogenic Biology and Immunology is a foundational course for nursing students in higher vocational education. It not only carries the responsibility of imparting professional knowledge but also serves as a bridge connecting basic medicine and clinical medicine. To improve the teaching quality of the Pathogenic Biology and Immunology course, the teaching was designed based on the job requirements of nursing students, the analysis of student conditions, teaching objectives clarifying and ideological and moral elements integration, multiple teaching methods, and a diverse evaluation system. An online and offline blended learning model was adopted through three steps of pre-class preparation, in-class teaching, and post-class expansion to expand classroom capacity, encourage student interest through diversified teaching methods, and integrate moral education elements to achieve the goal of fostering virtue. This study aims to offer new perspectives and approaches for further promoting the teaching reform of Pathogenic Biology and Immunology.

**Keywords:** Pathogenic Biology and Immunology; Teaching Design; Practice; Online and Offline Blended Learning; Higher Vocational College

## 1. Introduction

Pathogenic Biology and Immunology is a foundational and applied subject in medical school [1]. It plays an important role in diagnosing, preventing, and treating infections caused by pathogenic microorganisms and is closely related to various clinical medicine fields. Students often reflect that the course is theory-heavy, especially in the immunology section, which is abstract and difficult to understand [2]. Traditional teaching methods

always fail to spark student interest, and there is insufficient practical training, which limits the cultivation of students' independent innovative abilities [3]. The traditional teaching model focuses on teacher-led lectures and follows an "instruction-based" educational philosophy that doesn't give sufficient attention to how students learn or their learning outcomes [4]. Online and offline blended learning is an educational model that combines both online and offline teaching methods. It fully utilizes information technology tools and resources, integrating online platform-based teaching activities with offline classroom teaching. This model aims to achieve teaching objectives through teacher guidance, student interactions, and shared learning resources. It breaks the limitations of time and space and is more effective than either face-to-face classroom teaching or entirely online learning [5-7].

In this paper, the author proposes using modern information platforms to implement an online and offline blended learning model in the Pathogenic Biology and Immunology course. This model takes advantage of modern information platforms and technologies to implement a "student-centered" teaching philosophy, focusing on personalized talent development for nursing students and ultimately improving the teaching quality.

## 2. Current Challenges in Teaching Pathogenic Biology and Immunology

At present, there are several main problems in the teaching of Pathogenic Biology and Immunology. Firstly, the teaching content of Pathogenic Biology and Immunology is complex, but class hours are limited. This course involves three parts Medical immunology, Microbiology, and Parasitology, but only with 36 class hours, which makes it difficult for teachers to systematically cover all the course content, leading to incomplete and

superficial understanding by students. Secondly, as far as we know, the teaching content in the books always lags behind the forefront of the discipline, resulting from an insufficient focus on newly emerged pathogenic microorganisms and diseases. Thirdly, traditional teaching with little adoption of new teaching methods is still prevalent, causing low learning interest and poor subjective initiative in students. Conventional methods, focused mainly on teacher-led instruction, fail to follow the “student-centered” teaching philosophy, resulting in passive student engagement and attention absence [8]. Fourthly, the integration of moral education elements is not well-developed in course teaching. Teachers tend to focus more on completing the knowledge transfer within limited class hours, neglecting the integration of moral and ethical elements in teaching. Finally, Nursing students generally show low interest in this course. Compared to specialized courses, Microbiology involves more memorization, while Immunology content is abstract and difficult, making it difficult to maintain students’ interest. Therefore, expanding classroom capacity and enhancing students’ interest is crucial for achieving teaching reform in Pathogenic Biology and Immunology.

### **3. Teaching Design of Pathogenic Biology and Immunology Course**

#### **3.1 Integrate Teaching Content Based on Professional Characteristics**

According to the nursing talent training program of our school, we adhere to the integration of the curriculum content and nursing professional ability standards, follow the cognitive characteristics of students, connect with the needs of nursing professional positions, increase timely knowledge points based on “necessary and sufficient”, optimize and integrate teaching content, and develop a teaching knowledge system for Pathogenic Biology and Immunology course with professional characteristics.

#### **3.2 Accurate Learning Analysis to Support Personalized Teaching**

The target students are first-year nursing students in a three-year vocational program. At first, they are passionate about nursing and eager to become skilled professionals. Besides,

after the first semester of basic learning, students have acquired a certain level of medical knowledge and can recognize the importance of Pathogenic Biology and Immunology. Furthermore, these students are active thinkers and keen on hands-on practice, familiar with using digital resources. However, their commitment to pursuing nursing as a career is not yet stable, and their motivation for learning needs to be strengthened. Analyzing and mastering the learning situation is beneficial for the development of personalized teaching.

Teachers should exert their enthusiasm and improve students’ ability to learn independently. At the same time, it is necessary to arrange the teaching content system reasonably. This course is complex and abstract in content. It is difficult for students to remember so much knowledge in a limited time. This requires teachers to fully and systematically classify the knowledge, grasp the key and difficult points of teaching, and enable students to digest and absorb it from shallow to deep and from less to more in the learning process.

#### **3.3 Clarify Teaching Objectives and Integrate Ideological and Moral Elements into Teaching**

To cultivate students’ ability for lifelong learning and sustainable development, we adopted a student-centered approach and formulated three-dimensional teaching objectives including quality goals, knowledge goals, and ability goals. Knowledge objective: To master the main biological characteristics, pathogenicity, immunity, diagnostic methods, prevention and treatment principles of common pathogenic organisms, the structure and function of the human immune system, the laws of the immune response, medical pathological immunity, and immunological applications. Ability objective: Apply the basic theories, knowledge, and methods of Pathogenic Biology and Immunology. To disinfect, isolate, prevent, and treat infectious and other immune-related diseases. Quality objective: To foster in students a profound sense of responsibility and professional ethics in saving lives and assisting the injured, cultivate students’ beautiful emotions, strong willpower, and good characters. As a foundational subject in vocational nursing education, the Pathogenic Biology and

Immunology course holds dual significance: it not only bears the task of imparting specialized knowledge but also functions as a conduit linking basic medical sciences with clinical practice. It plays a vital role in fostering students' competencies in recognizing, preventing, and managing infectious diseases stemming from pathogenic microorganisms. Furthermore, this course is imbued with profound ideological and moral elements, making it a crucial platform for conducting professional ideological education among medical students [9].

### **3.4 Combining Multiple Teaching Methods to Cultivate Students' Innovative Thinking**

Under traditional teaching methods, students passively receive knowledge, cannot fully exert their subjective initiative, and cannot adapt to the teaching requirements of higher vocational pharmacy majors. In the process of teaching reform, teaching methods can be flexibly selected based on the training objectives and characteristics of teaching content. Alternatively, a combination of multiple teaching methods can be used to transform passive indoctrination teaching into active inquiry learning. When explaining pathogenic organisms, the morphological structure of pathogenic organisms can be displayed through graphics and text to give students a vivid and intuitive sensory understanding, which is easy to understand, master, and remember. FLASH animations can also be created for key and difficult points. For example, the virus replication and proliferation processes can be presented through vivid FLASH images, so that students can have a clear understanding of the life history of virus adsorption, penetration, uncoating, biosynthesis, assembly and maturation, and release.

Problem-based learning (PBL) is a heuristic and discussion-based teaching method that is problem-based, student-centered, and teacher-led [10]. For example, PBL teaching method can be used for teaching hypersensitivity reactions. Select typical cases such as allergic rhinitis, hemolytic disease of the newborn, and allergic gastroenteritis before class, then let students review relevant materials and preview allergy-related content; In class, group discussions will be conducted around the questions raised by the case, and teachers will asking students if they have any

abnormal reactions? What are your allergies to? What are the symptoms? Students analyze the pathogenesis and characteristics of allergic reactions and select representatives to answer the questions from each group, then the teacher will address the errors or omissions of the answers. This problem-based teaching method can not only enhance students' expression ability but also strengthen communication between teachers and students.

### **3.5 Diverse Evaluation System Comprehensively Evaluate Student Performance**

Both process evaluation and summative evaluation are integrated into the comprehensive evaluation system to assess teaching effectiveness. Process evaluation occurs throughout the course, reflecting the entire learning process. Summative evaluation takes place at the end of the course and directly evaluates student learning outcomes. The course grades were divided into three parts: (1) Classroom performance (mainly assessing students' attendance, questioning, answering questions in class, learning attitude, and homework performance, accounting for about 20%). (2) Practical training performance (including comprehensive training, mainly assessing students' experimental preparation, experimental attitude, experimental process assessment, experimental results, and experimental reports, accounting for about 20%). (3) Final exam paper score (approximately 60%). The multiple evaluations were beneficial for stimulating a passion for learning, enhancing learning efficiency and ability, and improving the experimental skills of students.

## **4. Application of Online and Offline Blended Learning Model in the Course of Pathogenic Biology and Immunology**

To address teaching challenges, the author implements online and offline blended learning model in the Pathogenic Biology and Immunology course.

### **4.1 Pre-Class Preparation**

Before class, teachers use the learning platform to release preview content one week in advance, including videos, PPT presentations, and "group tasks", to guide students in previewing course content and stimulate interest. Students

complete the pre-class tasks independently, and teachers monitor the process through task points. Students can participate in online discussions, and teachers can answer questions in time. Teachers set up dedicated discussion boards to encourage students to raise questions, share insights, and engage in discussion. Teachers provide targeted feedback to help students grasp key points and expand their knowledge base. Pre-class content selection should be scientific and closely aligned with teaching objectives. Online resources include academic papers, multimedia content, and relevant materials, all of which should be scientifically reliable [11]. For instance, when studying the “structures of bacterial cell walls”, students are asked to review basic concepts such as peptidoglycan, lipopolysaccharides, endotoxins, and the principles of Gram staining before class. The teacher checks students’ login to the platform for preview at any time. A preview test is prepared to check the students’ understanding of online resources. If students do not pass pre-class tests, they are reminded to complete the tasks, laying a foundation for the offline lessons. Meanwhile, students can provide feedback on any problems they encounter during the preview process, and teachers should answer them promptly. Through this interactive communication, it can greatly promote the advancement of learning and make up for the lack of class hours.

#### 4.2 In-Class Teaching

The in-class teaching follows a flipped classroom model, where the teacher facilitates deeper knowledge internalization, guiding students through problem-based learning and group discussions. Teachers also use formative assessments (e.g., quizzes and random questioning) to check students’ learning progress and adjust teaching strategies timely. This approach trains students’ problem-solving abilities. In areas with complex or abstract content, teachers focus on in-depth explanations and integration of innovation. For example, when discussing the “structures of bacterial cell walls”, teachers guide students through specific difficulties, such as differences in cell walls between Gram-positive and Gram-negative bacteria, and the mechanisms behind Gram staining. Teachers also extend the discussion to practical issues, such as the selection of antibiotics affecting bacterial cell

walls. In addition, the story of Alexander Fleming’s discovery of penicillin was shared to guide the students to learn the scientific spirit of perseverance, courage to explore, and the importance of teamwork.

#### 4.3 Post-Class Expansion

After class, assignments and online quizzes are given to assess students’ mastery of key points and reinforce difficult concepts. Assignments may include chapter tests, mind map creation, or writing short reviews. Students use mind maps to organize their knowledge and submit short reviews based on research papers. Teachers also answer students’ questions using online platforms such as QQ and WeChat to eliminate the doubts that students may have during the learning process. Additionally, students are encouraged to participate in experimental design competitions to enhance their comprehensive abilities. Teachers can provide feedback and reflections to improve teaching.

Additionally, teachers can motivate students to upload their study notes, reflect on their learning, and guide them to discuss the problems and experimental results they encounter during the learning process. For individual students who do not like to communicate and interact and dare not express their opinions, teachers can actively engage in one-on-one communication to protect the learners’ enthusiasm.

#### 5. Teaching Reflections on the Application of Online and Offline Blended Teaching Mode in the Pathogenic Biology and Immunology Course

The blended learning model addresses the challenge of limited classroom hours, expanding both the depth and breadth of the course. Blended learning provides students with flexible learning methods and schedules by utilizing teaching platforms and technology [12]. Pre-class preparation and post-class learning have significantly expanded course content, overcoming the time limitations of traditional teaching. Moreover, this model encourages independent learning and promotes the integration of cutting-edge research with clinical practice, motivating students intrinsically. Online discussions and Q&A sessions further deepen student engagement and foster teacher-student interaction. This

requires teachers to design questions carefully, encouraging open-ended discussions and critical thinking. The interactive nature of the model also helps students develop problem-solving skills.

However, there are also some students with low completion rates in pre-class preparation and homework assignments after class. How to improve the enthusiasm and initiative of these students in learning, and how teachers can supervise each student to effectively consolidate knowledge without taking up too much of their post-class time and minimizing their learning burden, are the problems that need to be solved in the future teaching practices.

## 6. Conclusion

This study optimizes the content and teaching methods of Pathogenic Biology and Immunology courses, exploring the online and offline blended learning model to effectively expand classroom capacity, encourages student interest. The online and offline blended learning model successfully improves the teaching quality and helps achieve the talent training goals, which is promising and worthwhile for further application.

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