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# Exploring the Integration of Case-Based Learning (CBL) with a Flipped Classroom Approach in Teaching Leadership in Pediatric Infectious Diseases

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**Abstract:** *Purpose:* This study aims to investigate the potential benefits of combining case-based learning (CBL) with a flipped classroom approach in the context of education in the infection ward. *Methods:* The study involved the selection of 50 intern students from hospital infection wards between January 2021 and December 2022. A random computer selection was employed to divide the students into two groups: the control group ($n$ = 25) which received traditional teaching, and the research group ($n$ = 25) which received CBL combined with a flipped classroom approach. The teaching outcomes of the two groups were subsequently compared and analyzed. *Results:* The research group demonstrated significantly higher scores in both basic theoretical knowledge and practical operation assessments compared to the control group ($P < 0.05$). Additionally, the research group reported higher levels of satisfaction with the teaching method than the control group ($P < 0.05$). *Conclusion:* The implementation of CBL combined with a flipped classroom approach for interns in the infection ward was found to be an effective method for improving interns' theoretical knowledge and practical operation scores, as well as achieving higher levels of teaching satisfaction. These findings have significant clinical value.

**Keywords:** Infectious diseases teaching; Case-based learning (CBL); Flipped classroom approach; Assessment results

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## 1. Introduction

Clinical teaching of junior doctors is an essential process that bridges the gap between theoretical knowledge and its practical application. It serves as the foundation for consolidating and enhancing the theoretical knowledge acquired during medical studies and the development of diagnostic and therapeutic skills when working with patients. High-quality clinical medical education plays a pivotal role in delivering excellence in clinical practice. Teaching interns in a clinical setting is vital for their ability to analyze and resolve issues and acquire clinical skills. Furthermore, the quality of the teaching they receive significantly influences their future

professionalism and clinical competence [1].

Pediatric infections are characterized by rapid onset, quick progression, and atypical prodromal symptoms. Clinical manifestations are often nonspecific, leading to delayed diagnoses and necessitating a high level of professional competence amongst pediatric infectious disease physicians. Additionally, there is a growing demand for effective teaching due to the evolving nature of these diseases.

Case-based learning (CBL) is a learning method that emphasizes a case-centered approach, guiding students in the analysis and management of specific cases using relevant clinical and foundational knowledge. The flipped classroom model (FCM) is a student-centered teaching approach that reverses the traditional process of classroom lectures and assignments, a practice commonly used in foreign educational contexts. The combination of the two elements has the potential to enhance the quality of education and support students' learning.

This research aims to assess the practical applicability of the CBL combined with the flipped classroom approach in the context of teaching in infection wards. The integration of these two elements holds promise for raising the quality of education and facilitating students' learning.

## 2. General information and methods

### 2.1. General information

This study examined 50 interns from the Department of Nosocomial Infections selected between January 2021 and December 2022. The participants were randomly assigned to either the control group (25 participants, with 12 males and 13 females, aged 24.45 ± 2.11 years old) or the research group (25 participants, with 11 males and 14 females, aged 24.21 ± 1.89 years old). Baseline information collected before the study did not reveal any significant differences between the groups ($P > 0.05$).

### 2.2. Research method

The 25 participants in the control group underwent traditional instruction in which the instructors utilized multimedia to explain theoretical concepts and later accompanied the students in performing ward check-up duties at the end of the semester.

The 25 students in the study group were instructed using the CBL combined with a flipped classroom approach. (1) Before entering the ward, the instructors based their teaching materials, such as PowerPoint (PPT) and micro-videos, on the actual situation of the infection ward. They integrated this with the syllabus to cover common diseases, diagnostic methods, treatment plans, and emergency procedures, among other topics. Additionally, they established WeChat or QQ groups to distribute teaching videos, PPTs, study tasks, supplementary materials, and discussion cases. This facilitated students' comprehension of the theoretical knowledge before attending the course. With access to these materials, students had the opportunity to self-learn and refer to them as needed. Students viewed the teaching videos and PPTs independently, used supplemental materials to reinforce their understanding, completed assigned learning tasks before class, and took comprehensive study notes. (2) During practical teaching, teachers incorporated students' questions to enhance their understanding. Teachers promoted in-depth learning by providing objective explanations and addressing students' raised issues. Students then discussed these problems in small groups, focusing on essential knowledge points, and received feedback on their discussions. Information sharing and feedback took place through platforms such as QQ group or WeChat to facilitate further study and discussion. Each week, trainees were provided with representative cases from new patients and medical records. It was their responsibility to thoroughly collect medical records and perform physical examinations of patients. They then used the gathered data to make a preliminary diagnosis and develop a corresponding treatment plan, which involved referencing

designated textbooks and consulting medical literature. Any diagnoses requiring differentiation were also addressed during this process. After completing the necessary tasks, participants engaged in a group discussion led by the instructors, where they analyzed the diagnosis, differential diagnosis, and treatment methods of the clinical case. These discussions consisted of five members and lasted for 30 minutes, with a focus on the content covered in the lectures. Following the discussion, relevant questions were addressed through responses from the group or guidance from the instructors. The participants reviewed the clinical knowledge of this disease once more to ensure a connection between theory and practice.

### 2.3. Research indicators

This study employed a combination of teaching content, basic theory development, and practical operation assessment questionnaires, with a maximum score of 50 points [2]. In addition, a network anonymous survey method was used to collect data on teaching satisfaction, categorized as satisfactory, general, or unsatisfactory [3].

### 2.4. Statistical analysis

This research study utilized SPSS 21.0 statistical software as a data processing tool. Percentages were used to represent count data, while *t* calculations were used to analyze measurement data expressed as mean ± standard deviation (SD). Statistical significance was set at $P < 0.05$.

## 3. Results

### 3.1. Comparison of basic theory and practical operation assessment scores between the two groups.

**Table 1** displays the basic theory and practical operation assessment scores for both the research and control groups. The research group achieved higher scores compared to the control group ($P < 0.05$).

**Table 1.** Comparison of the basic theory and practical operation assessment scores between the two groups (points in mean ± SD)

| | Basic theory | Practical operation |
|---|---|---|
| Research group ($n = 25$) | 46.25 ± 2.13 | 40.25 ± 1.25 |
| Control group ($n = 25$) | 41.22 ± 1.56 | 36.33 ± 2.45 |
| *t*-value | 6.5682 | 5.6487 |
| *P*-value | < 0.05 | < 0.05 |

### 3.2. Comparison of teaching satisfaction between the two groups

**Table 2** illustrates the teaching satisfaction between the groups, with the study group reporting higher satisfaction compared to the control group ($P < 0.05$).

**Table 2.** Comparison of teaching satisfaction between the two groups [*n* (%)]

| | Satisfactory | General | Unsatisfactory | Satisfaction |
|---|---|---|---|---|
| Research group ($n = 25$) | 13 (52.00) | 10 (40.00) | 2 (8.00) | 23 (92.00) |
| Control group ($n = 25$) | 9 (36.00) | 8 (32.00) | 8 (32.00) | 17 (68.00) |
| $\chi^2$ | - | - | - | 4.7678 |
| *P*-value | - | - | - | < 0.05 |

## 4. Discussion

Case-based learning (CBL) is an instructional method that emphasizes the use of specific cases to develop student's analytical abilities and their ability to handle real-life scenarios by applying clinical and fundamental knowledge. This approach focuses on individual case examples and promotes the use of technical language, encouraging students to think critically and make informed decisions. The flipped classroom model (FCM) is a student-centered teaching approach. Its core concept is to reverse the traditional process of in-class lectures and out-of-class assignments. This model has been extensively implemented in foreign educational contexts [4-7]. It effectively assists trainees in rapidly acquiring expertise in diagnosing and treating common infectious diseases in children, thereby enhancing their understanding of these issues, providing quality education, and improving the overall teaching standard.

Following the study, the research group achieved higher scores in both theoretical and practical assessments compared to the control group ($P < 0.05$). Additionally, the research group reported greater satisfaction with their learning experience compared to the control group ($P < 0.05$).

In clinical diagnosis and treatment, each patient is considered a unique case. CBL centers on clinical cases, encouraging students to research, discuss, and answer a series of questions. It emphasizes the cultivation of practical skills. FCM serves as the foundation for research during the teaching practice, promoting an abstract-to-concrete approach to course concepts. In CBL, students are encouraged to make judgments and decisions based on their exploration and independent analysis of cases [8]. This approach facilitates the bridging of the gap between theoretical knowledge and practical evidence, enhancing students' ability to apply textbook knowledge to resolve clinical issues.

The survey results demonstrate that incorporating CBL with FCM can benefit medical students during their internship by facilitating textbook study and referencing relevant literature. This stimulates their interest in active learning and improves their mastery of theoretical knowledge and practical skills [9-10].

In conclusion, the implementation of the CBS combined flipped classroom approach can enhance the operational performance of pediatric infectious diseases interns, both in theoretical and practical aspects. This leads to high levels of teaching satisfaction and significant clinical benefits.

## Disclosure statement

The authors declare no conflict of interest.

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