

# Application of practical training scenario simulation teaching method oriented to strengthen clinical skills in the clinical internship stage of medical students

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## ABSTRACT

In the current medical environment, Chinese medical students have fewer and fewer opportunities for practice at the internship stage, which leads to a serious lack of clinical skills to meet the demands of the real world of work. In this study, we used a practical training scenario simulation teaching method oriented to strengthen clinical skills, and systematically compared the teaching effectiveness with that of traditional internship teaching models. This study included 40 5-year clinical medicine interns who practiced in the Department of Neurology at our hospital. They were randomly divided into a control group and an observation group, with 20 participants in each group. The control group adopted the bedside teaching, and the observation group adopted the practical training scenario simulation teaching method. Students in both groups were assessed using Mini-CEX scores on comprehensive qualities related to clinical skills, including physical examination of the nervous system, humanistic care, communication skills, organizational skills, etc. And then, their learning outcomes are assessed in the form of after-department examination. After the internship, all the scores of teaching effect of students in the observation group were significantly higher than those of the control group, especially in terms of doctor-patient communication, physical examination of the nervous system, localization and nature determination, organizational skills, and overall performance ( $P < 0.05$ ). The results of students' exit exams, students' and teachers' teaching satisfaction of the observation group were significantly better than those of the control group ( $P < 0.05$ ). This method has an obvious promotion effect on the improvement of medical students' clinical skills. The method significantly improves the performance of medical students during the internship stage, and results in higher teaching satisfaction for teachers and students.

## ARTICLE HISTORY

Received 31 October 2024  
Revised 27 March 2025  
Accepted 25 April 2025



## KEYWORDS

Clinical skills; practical training scenario simulation teaching method; internship stage; neurology department; Mini-CEX

## Introduction

It is an inevitable requirement of social development for medical colleges to cultivate medical talents with good clinical skills and a spirit of humanistic care. However, the traditional medical teaching model in China is teacher-led and student-passive learning, which is not conducive to improving students' ability to solve problems independently and is particularly detrimental to the development of clinical skills [1,2]. Clinical internship is an important part of medical education and is a crucial stage for medical students to transform their professional knowledge into clinical skills. With the changes in the social and medical environment, the practical opportunities for Chinese medical students during the internship stage are increasingly decreasing, and clinical skills training is seriously insufficient, resulting in clinical skills that should be strengthened during the internship stage not meeting the actual work needs [3,4].

Practical training scenario simulation teaching oriented to strengthen clinical skills is a new type of teaching method, which enables students to carry out safe and efficient clinical skills operations in an autonomous and interactive simulated clinical environment and is conducive to improving students' communication skills. This teaching mode is based on a realistic reproduction of the doctor-patient interaction scene, together with an objective, fair, and standardized evaluation model to comprehensively assess the interns' comprehensive clinical skills, which is beneficial for students establish clinical thinking quickly, improve clinical skills and make up for the shortcomings of the traditional internship models with limited practical opportunities. The mini-clinical evaluation exercise (Mini-CEX) has been recognized as an effective method of assessing the clinical competence of medical interns [5,6]. In

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this study, the clinical medical students' internship time in the Department of Neurology was utilized to carry out practical training scenario simulation teaching oriented to strengthen clinical skills. In addition, students' comprehensive clinical competence is assessed through the Mini-CEX [7], which provides a comprehensive and objective basis for the improvement of teaching methods.

## Materials and methods

A prospective controlled experimental design of research was used in this study. The reporting of this study conforms to the CONSORT2010 Statement [updated guidelines for reporting parallel group randomised trials]. We conducted 40 5-year clinical medical students who were interns in the Department of Neurology at our hospital from January 2024 to June 2024 (the sample size of this study has been verified by formula calculations to be statistically satisfied with the minimum sample size). They were randomly divided into control and observation groups of 20 each using the computer-generated random number table method. This study was approved by the Ethics Committee of The First Affiliated Hospital of Anhui University of Chinese Medicine (batch number: 2024AH-94). Each subject and patient in the test were informed and provided written consent for the study and the publication of this report.

Both groups of clinical medicine interns completed a 4-week training placement in our neurology department. The control group adopted bedside teaching: admission education and Mini-CEX assessment of comprehensive clinical skill levels were carried out in week 1. In weeks 2–4, first review the theoretical knowledge related to the taught cases briefly, and then traditional bedside teaching methods were adopted by taking clinical patients in the department as an example. The observation group adopted the practical training scenario simulation teaching method oriented to strengthen clinical skills. The training content of the first week was the same as that of the control group, and the practical training scenario simulation teaching method was conducted from the second to fourth weeks. After the completion of the internship teaching, the instructor selected actual cases to assess the comprehensive clinical skill level of the interns in both groups by Mini-CEX for 20 minutes, and evaluated their mastery of theoretical knowledge related to clinical skills by subject tests. The Mini-CEX cases are actual patients and the Mini-CEX raters are blinded to which groups the medical students were in. Afterward, students and teachers evaluated their satisfaction with teaching separately.

The questionnaire 'Evaluation of Student Satisfaction with Teaching' includes five aspects: stimulating interest in learning, enhancing teacher-student communication, improving self-learning ability, improving clinical thinking, and improving team collaboration capabilities. The questionnaire 'Evaluation of Teacher Satisfaction with Teaching' includes five aspects: improving theoretical knowledge, improving operation skills, enhancing doctor-patient communication, improving clinical thinking, and improving learning efficiency. These options are set on a 5-point scale, ranging from very satisfied to very dissatisfied, with scores ranging from 5 to 1. The internal consistency reliability coefficient Cronbach's  $\alpha$  for the two satisfaction questionnaires are 0.964 and 0.973, respectively, indicating that the instrument has high internal consistency and reliability. The final pedagogical task of this training is to establish a more practical and efficient model for training internships.

The practical training scenario simulation teaching method is oriented to strengthen clinical skills: The teaching cases cover common neurological disorders such as cerebral hemorrhage, cerebral infarction, migraine, epilepsy, sleep disorders, Parkinson's disease, etc. Before the class, the instructor selects a typical clinical case and assigns the problems to be solved in the case diagnosis and treatment to the interns. Every 5 students were divided into 1 group and there were 4 groups. Review theoretical content before class, browse pre-provided materials and training guides. In addition, search for information and references through medical websites, and carefully discuss relevant issues. After the unified diagnosis and treatment plan, the practical training scenario simulation teaching begins. The members of each group played the roles of the physician, the patient and the patient's family. Students conduct group discussions based on the cases provided by the teacher, and complete the role assignments. In the simulation ward, the observation group performs simulated operations according to the cases discussed beforehand. The teacher supervises the whole process and pays close attention to each student's role-playing, promptly pointing out any deficiencies in the operation. At the same time, the teacher set up potential problems and emergencies during the diagnosis and treatment, and instructed the students in the observation group to solve them one by one. Finally, the group discusses theoretical knowledge, skill points, and the teacher summarises.

## Statistical analysis

Statistical analysis was performed using SPSS 25.0 (IBM Corp., Armonk, NY, USA). Continuous variables were expressed as means  $\pm$  standard deviation ( $\bar{x} \pm s$ ). Comparisons between groups were made

using the paired-samples t-test for within-group comparisons, one-way ANOVA followed by Dunnett's test for multiple group comparisons. Comparison of the categorical variables between groups was performed using the  $\chi^2$  test or Fisher's exact method. The *p*-value was corrected for multiple hypothesis testing using the Benjamini-Hochberg (BH) method, which controls the false discovery rate (FDR) and is more suitable for handling a large number of comparisons. After applying the BH correction, an FDR-adjusted *p*-value  $\leq 0.05$  was considered statistically significant at the  $\alpha = 0.05$  level. While an a priori power calculation was not conducted, our sample size determination was informed by similar educational intervention studies in this field.

## Results

Both student and faculty feedback are anonymized. Prior to receiving instruction, there was no significant difference in the comparison of the Mini-CEX scores related to clinical skills between the two groups of students (The *P*-value are 0.501, 0.487, 0.735, 0.735, 0.660, 0.528, 0.580, respectively). After receiving the teaching, all the scores of Mini-CEX increased in both groups, and the scores in the observation group had significantly higher scores than the control group (*P*-value are all  $< 0.0001$ ) (Table 1). In terms of humanistic care and communication skills, the Mini-CEX scores of the observation group were 25% and 22% higher than those of the control group after teaching, while the scores of doctor-patient communication, physical examination of the nervous system, localization and nature determination, organizational skills, and overall performance were even more markedly elevated, being more than 30% higher (Figure 1).

After receiving teaching, the total score of the observation group's graduation assessment, as well as the scores of case analysis, treatment plan, and extension of relevant knowledge, were significantly

higher than those of the control group (Table 2). In addition, all the scores of teaching satisfaction of interns and instructors in the observation group were significantly higher than those of the control group (Tables 3 and 4).

## Discussion

Clinical internship is a necessary stage for cultivating medical talents, and how to improve the clinical skills of medical students during the internship is an urgent problem for medical schools in China. The traditional narrative teaching mode can no longer meet the needs of modern society [8]. Nowadays, how to improve teaching methods and make full use of the valuable practical opportunities in the internship phase to improve the clinical skills of medical students have become an important task for medical schools.

Practical training scenarios simulation teaching is a method, with the standardized patient or simulated patient as the main body, through group collaboration, using simulation skills training aids to carry out intensive training. This method broadens students' horizons through self-study and inspiration, achieving the integration of basic theories and clinical practice, and comprehensively improving the clinical skills of medical students during their internship stage [9]. Simulation scenarios allow students to continuously verify the accuracy of practice through simulation exercises, effectively stimulate the curiosity of medical students, and fully mobilize their learning motivation. This method is more flexible than traditional clinical teaching methods and can enhance the clinical skills of medical interns in multiple dimensions [10,11]. Mini-CEX is a formative assessment tool developed by the American Board of Internal Medicine (ABIM) [12]. In this study, Mini-CEX assessment was conducted before and after the simulation teaching of practical training scenarios, which can provide timely feedback on medical

**Table 1.** Results of Mini-CEX assessment before and after teaching in both groups of interns ( $\bar{x} \pm s$ ).

	Number of students	Doctor-patient communication		Physical examination of the nervous system		Localization and nature determination		
		Before teaching	After teaching	Before teaching	After teaching	Before teaching	After teaching	
Control group	20	3.18 $\pm$ 0.67	5.22 $\pm$ 0.34	3.11 $\pm$ 0.23	5.19 $\pm$ 0.88	3.92 $\pm$ 0.72	6.44 $\pm$ 0.74	
Observation group	20	3.31 $\pm$ 0.52	7.15 $\pm$ 0.22	3.03 $\pm$ 0.43	7.35 $\pm$ 0.45	4.03 $\pm$ 0.21	8.67 $\pm$ 0.38	
<i>t</i> -value		0.68	41.21	0.70	16.49	0.34	10.86	
<i>P</i> -value		0.501	<0.0001	0.487	<0.0001	0.735	<0.0001	
	Humanistic care		Communication skills		Organizational skills		Overall performance	
	Before teaching	After teaching	Before teaching	After teaching	Before teaching	After teaching	Before teaching	After teaching
Control group	3.02 $\pm$ 0.12	6.03 $\pm$ 0.56	2.82 $\pm$ 0.55	5.11 $\pm$ 0.49	3.26 $\pm$ 0.61	5.45 $\pm$ 0.53	4.78 $\pm$ 1.01	6.41 $\pm$ 0.89
Observation group	3.05 $\pm$ 0.31	7.54 $\pm$ 0.27	2.91 $\pm$ 0.67	6.21 $\pm$ 0.36	3.12 $\pm$ 0.78	7.37 $\pm$ 0.48	4.59 $\pm$ 1.12	8.35 $\pm$ 1.05
<i>t</i> -value	0.34	10.86	0.44	15.42	0.64	20.11	0.56	9.12
<i>P</i> -value	0.735	<0.0001	0.660	<0.0001	0.528	<0.0001	0.580	<0.0001

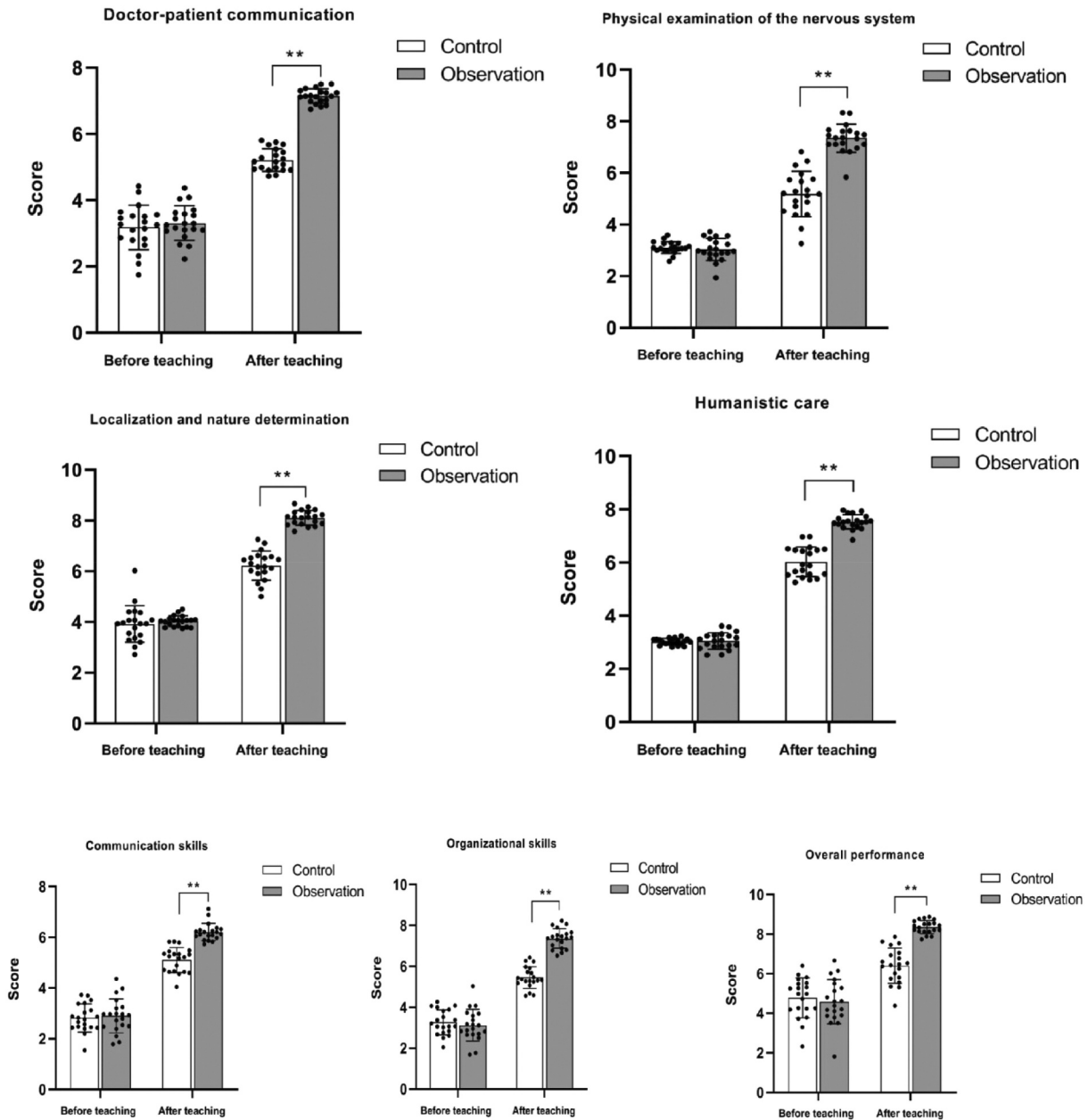


Figure 1. Results of Mini-CEX assessment before and after teaching in both groups of interns ( $\bar{x} \pm s$ ).

Table 2. Results of interns' graduation assessment scores in both groups ( $\bar{x} \pm s$ ).

	Number of students	Case analysis	Therapeutic schedule	Extension of relevant knowledge	The total score
Control group	20	31.49 ± 2.99	21.70 ± 2.69	22.12 ± 3.09	75.31 ± 5.92
Observation group	20	37.46 ± 2.19	27.05 ± 1.47	28.10 ± 1.39	92.61 ± 3.63
t-value		7.205	6.967	7.649	10.582
P-value		<0.0001	<0.0001	<0.0001	<0.0001

Table 3. Results of teaching satisfaction evaluation for both groups of interns ( $\bar{x} \pm s$ ).

	Number of students	Stimulating interest in learning	Enhancing teacher-student communication	Improving self-learning ability	Improving clinical thinking	Improving team collaboration capabilities
Control group	20	3.02 ± 0.34	3.12 ± 0.36	3.23 ± 0.33	3.62 ± 0.19	3.45 ± 0.27
Observation group	20	4.14 ± 0.33	4.16 ± 0.29	3.91 ± 0.31	4.37 ± 0.29	4.26 ± 0.21
t-value		11.678	9.208	6.791	9.324	9.816
P-value		0.001	0.001	0.002	0.002	0.001

**Table 4.** Teaching satisfaction evaluation results of two groups of teachers ( $\bar{x} \pm s$ ).

	Number of students	Improving theoretical knowledge	Improving operation skills	Enhancing doctor-patient communication	Improving clinical thinking	Improving learning efficiency
Control group	20	3.13 ± 0.31	3.33 ± 0.32	3.57 ± 0.31	3.35 ± 0.32	3.25 ± 0.34
Observation group	20	3.88 ± 0.34	4.07 ± 0.41	4.12 ± 0.40	3.98 ± 0.30	3.88 ± 0.41
t-value		8.59	6.379	4.448	6.466	6.402
P-value		0.001	0.002	0.003	0.002	0.002

students' knowledge and skill acquisition. This method has high credibility and effectiveness, which can achieve a comprehensive evaluation of students' clinical practice skills. It is worth mentioning that, as teachers are fully involved in the teaching and learning process, they have invested a great deal of time and emotion, which may have an impact on the results of the teacher satisfaction questionnaire.

In this study, it was found that simulating real clinical scenarios can effectively enhance interns' interest in learning clinical knowledge and quickly establish correct clinical thinking patterns. In addition, medical interns can be facilitated to discover the deficiencies in the clinical diagnosis and treatment process by the different role-plays, so as to improve their clinical skills effectively. The teaching method can effectively improve teacher-student communication, and make up for the patterned and procedural deficiencies of traditional clinical teaching during internships. Moreover, the method can cultivate students' ability to raise and solve problems, and significantly improve the teaching effect of clinical internships. The high score achieved by a medical student implies that he has high diagnostic and therapeutic ability, which is conducive to further improving patient outcomes and the efficiency of medical practice, as well as promoting the development of the medical profession.

### Limitations and recommendations

Although this study has great clinical teaching value, it still has many shortcomings. Firstly, the limited number of clinical medicine interns in the department of neurology resulted in a low number of participants in this study. In order to increase the generalisability of the findings, the sample size will be expanded in the future to assess the comprehensive effectiveness of this teaching method with interns from different medical disciplines. Secondly, due to the limitations of the neurology clinical placement syllabus and policy, the simulation of the practical training scenarios in this study was only conducted for 3 weeks. In fact, a longer training period may result in better teaching and learning outcomes for medical

interns. Further longitudinal studies could be conducted in the future, such as following graduates as they transition to residency, thereby assessing the retention of skills learned through the simulation method, and the long-term benefits of the approach and its impact on real-world clinical performance could be evaluated. Thirdly, the feedback on the teaching effectiveness of this study showed that although most teachers agreed with the value of the teaching method, there were still some difficulties in implementation, including more pre-course preparation, longer course time, and difficulty in grasping the course progress. Henceforth, we will develop standardized templates for case scenario simulations or use digital platforms, thus simplifying the preparation process and making the method more accessible and scalable. To sum up, in the future, we will expand the number of participating interns, further optimize teaching methods, improve teaching efficiency, and provide more reasonable and sufficient time for teaching training and knowledge digestion. These optimizations were made to obtain more reliable and convincing results, providing a reference for the teaching of clinical medical students in the internship stage.

### Conclusion

This study adopts the practical training scenario simulation teaching method oriented to strengthen clinical skills, which can effectively improve the clinical practice ability of medical interns, reduce potential medical risks, and avoid unnecessary doctor-patient conflicts. It is worth promoting and applying in teaching hospitals.

### Acknowledgments

We sincerely thank all the staff of the First Affiliated Hospital of Anhui University of traditional Chinese Medicine.

### Disclosure statement

No potential conflict of interest was reported by the author(s).

## Funding

This work was supported by the [Quality engineering project of higher education institutions in Anhui province] under Grant number [2021jyxm0831].

## Contributorship statement

X F, S J: acquisition and interpretation of data, drafting and revising the article;  
ZZ S: conducting the assessment.

## Data availability statement

The datasets for this article are not publicly available due to concerns regarding participants' anonymity. Requests to access the datasets should be directed to the corresponding author.

## Ethics approval statement

This study was approved by the Ethics Committee of The First Affiliated Hospital of Anhui University of Chinese Medicine (batch number: 2024AH-94). The participants were informed and provided written consent for the study and the publication of this report.

## Trial registration

The study was registered at the Clinical Research Center, The First Affiliated Hospital of Anhui University of Traditional Chinese Medicine (Registration code: 2021jyxm0831).

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