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Application of standardized patients simulation teaching supported medical history collection thinking training in TCM internal medicine teaching

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Research Article

Keywords: Traditional Chinese Medicine internal medicine, Medical history collection, Standardized patients, Simulated teaching, Clinical thinking

Posted Date: April 14th, 2026

DOI: https://doi.org/10.21203/rs.3.rs-8979230/v1

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Additional Declarations: No competing interests reported.

Abstract

Objective

To explore the impact of medical history collection thinking training supported by SP simulation teaching on the teaching of Traditional Chinese Medicine (TCM) internal medicine.

Methods

Two classes of acupuncture and massage therapy majors were randomly selected as the experimental group (n = 40) and the control group (n = 40). During the practical teaching process of internal medicine in TCM, the experimental group employed a medical history collection thinking training method supported by SP simulation teaching, while the control group received case-based teaching. Both groups underwent assessments on medical history collection skills for lung, heart, brain, spleen and stomach, liver and gallbladder, kidney, qi-blood-body fluid, and limb meridian system diseases in TCM internal medicine; The final practical skills exam; The first simulated exam, the second simulated exam, and the formal exam of the first stage medical history collection exam for the competence of TCM practitioners. Additionally, the experimental group's teaching effectiveness was evaluated through methods such as questionnaire surveys.

Results

Compared with the control group, the scores of the experimental group students in collecting medical history of lung, heart, brain, spleen and stomach, liver and gallbladder, kidney, qi-blood-body fluid, and limb meridian system diseases in TCM internal medicine were significantly increased (all $P < 0.05$). The experimental group scored better than the control group in the final practical skills exam, the first simulated exam, the second simulated exam, and the formal exam of the first stage medical history collection exam for the competence of TCM practitioners (all $P < 0.05$).

Conclusion

The teaching method of medical history collection thinking training and inquiry skills supported by SP simulation teaching can improve students' ability to collect medical history and clinical thinking in TCM, and enhance their level of diagnosis in TCM.

Introduction

Internal medicine of Traditional Chinese Medicine (TCM) is the core course of Chinese medicine, acupuncture and moxibustion and massage, and its teaching quality directly affects the training level of Chinese medicine talents. The cultivation of clinical thinking ability is the core goal of medical education[1], and "dialectical thinking and dialectical treatment" is the core of TCM education[2]. Especially in the teaching of TCM internal medicine that emphasizes holistic concepts and dialectical treatment, how to effectively train

students to collect medical history, analyze pathogenesis, and form systematic clinical dialectical diagnosis and treatment ideas in the teaching process has always been a key challenge.The traditional teaching mode of TCM internal medicine often focuses on teacher centered lectures and typical case demonstrations, emphasizing the imparting of theoretical knowledge during the teaching process and neglecting the cultivation of students' clinical thinking ability [3], practical skills, and doctor-patient communication ability[4]. Although students can master theoretical knowledge, they generally lack opportunities to interact with real patients and construct clinical thinking in dynamic consultations.This disconnect between "theory" and "practice" reduces students' enthusiasm and initiative in learning, resulting in students often feeling confused and unsure of how to analyze complex and changing clinical situations[5]. They do not know how to conduct analysis, incomplete consultations, and rigid thinking in dialectical diagnosis, which affects the quality of talent cultivation. With the widespread use of Simulation based teaching (SBT) in medical education [6, 7], Simulation Based Medical Education (SBME) provides students with a safe, standardized, high fidelity, and reproducible medical simulation environment to acquire and hone various clinical related skills without causing any harm to patients[8, 9]. Simulated teaching can make up for the lack of early clinical practice and communication skills between doctors and patients, and is an effective method for systematically training TCM clinical thinking. It has become an urgent need for modern TCM education reform.

Standardized Patient (SP) is a simulation teaching tool that has undergone systematic training and can accurately simulate the clinical manifestations of real patients. It has been proven to effectively improve students' consultation skills, communication abilities, and clinical confidence, and has been widely used in Western medicine education worldwide[10]. In 1992, Student Standardized Patients (SSPs) were introduced into the field of medical education [11, 12]. Using students as SPs can more accurately and stably simulate clinical symptoms, signs, and psychology, providing students with reproducible, standardized, and highly clinical simulated patients[13]. Medical history collection, as an important part of diagnosis, is not only the main way to obtain medical history data, but also a key step in cultivating clinical thinking ability [14]. However, TCM diagnosis and treatment have unique characteristics. Its medical history collection not only focuses on symptoms, but also emphasizes exploring the pathogenesis through the combination of "observation, hearing, questioning, and palpation". Its deep exploration of symptoms (such as cold and heat, sweating, diet, bowel movements, emotions, etc.) and identification of pulse and tongue images put forward higher requirements for the "standardization" and "authenticity" of simulation training. Introducing SP into the teaching of TCM internal medicine not only creates a safe and risk-free practice environment, but also provides specialized reinforcement training for the core thinking of disease differentiation and syndrome differentiation, such as "treating the same disease differently" and "treating different diseases with the same treatment". It is a key bridge to bridge the gap between theory and practice.

Although SP has been widely used in Western medicine education, its application value in TCM education, especially in TCM thinking training, has not been fully explored[2]. At present, most relevant research is still in the stage of experience summary, lacking an objective evaluation of how SP medical history collection thinking training specifically affects students' TCM clinical thinking process (such as medical history collection, disease diagnosis, differential diagnosis, TCM disease differentiation and syndrome differentiation ability). Therefore, the aim of this study is to design and implement a training program for TCM medical history collection and disease differentiation and syndrome differentiation thinking based on SP simulation

teaching support, accompanied by a pre class medical history collection assurance process. The teacher constructs a case library of TCM internal diseases, trains students on SP and medical history collection, releases group tasks, supervises and guides to ensure quality, students independently complete the group medical history collection activity task. Students learn independently through online platforms and learning materials, using disease case libraries to deduce relevant content for medical history collection. The process of collecting medical history on their own may not be absolutely objective, true, accurate, and detailed, but under the guidance of teachers, problems are discovered and solved through discussions during and after class. Through comparative research, scientifically evaluate its application effect in the teaching of TCM internal medicine, and focus on exploring the role of this model in improving students' clinical thinking ability, medical history collection ability, disease differentiation and syndrome differentiation ability, and medical humanities literacy, in order to provide evidence-based basis for innovating TCM teaching models and improving the quality of talent cultivation.

Method

The 2022 and 2023 junior college acupuncture and moxibustion and massage major classes studied in Hunan College of TCM from September 2021 to July 2024 were selected as the research objects. The students in the 2022 and 2023 classes were randomly selected and the students in the class voluntarily participated in the study. The early core courses of the students in the two classes were the same, with the students in the 2022 class as the experimental group (n = 40) and the students in the 2023 class as the control group (n = 40).

The teaching of TCM Internal Medicine in the experimental group and control group will be arranged in the third semester according to a unified syllabus, with a teaching duration of 72 class period each, including 20 practical class period. To evaluate the teaching effectiveness of medical history collection thinking training supported by SP simulation teaching, this study used a combination of controlled experiments and questionnaire surveys. Both groups are taught by equally experienced teachers. During the practical teaching process, the experimental group adopted the SSP simulation teaching method to support the training of medical history collection thinking for medical history collection, while the control group adopted the case-based teaching method, which integrates real typical clinical cases into the practical classroom process, and students in each group engage in case discussions and independent medical history collection exercises. Meanwhile, the control group was evaluated for teaching effectiveness through a questionnaire survey. Flowchart of the research process (Fig. 1). By comparing the medical history collection scores of two groups of students in TCM, including lung, heart, brain, spleen and stomach, liver and gallbladder, kidney, qi-blood-body fluid, and limb meridian system diseases, as well as the final practical skills exam and the first stage medical history collection exam for TCM practitioners' job competency, a questionnaire survey was conducted to evaluate the impact of SSP simulation teaching supported medical history collection thinking training methods on students' clinical thinking ability and diagnostic level in TCM.

Experimental group intervention methods

The training of medical history collection thinking supported by SP situational teaching in TCM internal medicine teaching consists of the following three stages (Fig. 2):

Preparation for pre-class medical history collection assurance

Teachers build a case library of TCM internal medicine diseases. The disease case library is the script of SP. According to the requirements of the teaching syllabus and curriculum standards of TCM Internal Medicine, and with reference to the qualification examination syllabus for TCM Practicing Assistant Physicians, common and typical cases of TCM Internal Medicine in clinical practice are selected. A clinical teaching teacher with medium-grade professional title or above and years of teaching experience is responsible for compiling a case library of TCM Internal Medicine. Each disease case consists of chief complaint, current medical history, past medical history, personal history, menstrual history, marriage and childbearing history, family history, TCM observation, smelling, and palpation, key physical examination, and auxiliary examination. It mainly describes the current medical history of the disease, including the characteristics, development and evolution of the main symptoms, accompanying symptoms, and diagnosis and treatment process. The case library of TCM internal medicine diseases is jointly discussed and revised by the associate professor teams of various majors in the teaching and research department of TCM internal medicine. The patient's medical history, laboratory test results, and imaging examination data are in line with clinical practice, ensuring authenticity and credibility.

The instructor provides SP training to the students. SSP training includes:

(1) Training on basic theoretical knowledge of SSP, including the concept of SSP, required qualities, responsibilities and significance, responsibility, content, and basic principles to be followed.

(2) SSP training as a simulated patient role: One week before the practical training class, typical medical record scripts involved in the teaching will be distributed. The teacher will select 2 students from each group as SSP to receive simulated patient role training based on the needs of the medical record roles. Adopting individual training methods, SSP understands and familiarizes with medical records and medical scenario scripts under the guidance and explanation of teachers, identifies key points, and remembers the medical history, symptoms, physical signs, and imitation points in the medical records and medical scenario scripts. Some symptoms and physical signs need to be expressed by SSP through facial expressions, expressions, language, emotions, and physical reactions. Tongue diagnosis, pulse diagnosis, vital signs, auxiliary examination results, and positive signs that cannot be simulated by SSP can be supplemented through oral, visual, or written forms similar to laboratory tests. Ensure that SSP can proficiently, completely, and accurately retell medical history, perform accurately and accurately, be faithful to medical records, and not exaggerate, imply, or induce. Require SSP to strictly keep the medical records confidential before class.

(3) Training for SSP as an Evaluator: As an evaluator, SSP evaluates medical students' humanistic care and language communication skills in real-time, assesses whether medical history collection is comprehensive and organized, and evaluates whether physical examinations are complete and correct.

Teachers provide training on medical history collection for students. The training mainly covers the basic process and skills of medical history collection. Medical humanistic care and doctor-patient communication skills must be integrated into the process of medical history collection. The basic process of medical history collection includes:

(1) Inquiry of current medical history (inquiry about the cause and urgency of onset based on the chief complaint, inquiry about the main symptom, inquiry about the differential diagnosis of related diseases and syndromes, inquiry about the diagnosis and treatment process (past medication use and auxiliary examinations), and inquiry about the general situation since the onset of the disease.

(2) Relevant medical history inquiry (past medical history, personal history, menstrual history, marriage and childbearing history, family history).

(3) TCM observation, smelling, and palpation.

(4) Physical examination.

(5) TCM prescription medication ideas and key points for regulation and care.

(6) Writing Standards for TCM Outpatient Medical Records.

The training of medical students as evaluators by the instructor. As evaluators, medical students evaluate whether SSP is familiar with the script (medical records), whether they can proficiently, completely, and accurately retell the medical history, whether they can express symptoms and signs through language, expressions, and physical reactions, whether their language can be colloquial, avoid medical terminology, simulate patients accurately, without exaggeration, implication, or induction.

Teachers use a learning platform called "Xuexitong" to group students, publish group tasks, assignments, and course guidance. Xuexitong is not only a platform that provides students with online self-learning resources, but also a tool for teachers to organize teaching activities and manage learning. Teachers provide advice or guidance as needed.

In-class medical history collection activity

Carry out practical teaching. This classroom teaching lasted for 80 minutes. The process of the medical history collection thinking training activity supported by SP simulation teaching is as follows:

(1) Assign roles. The students in the experimental group were divided into 6 large groups, which were further divided into 2 small groups, for a total of 12 groups. Each group member is randomly assigned different roles, such as doctor, doctor's assistant, student simulated patient, and patient's family.

(2) Students engage in medical history collection activities. Each group of students will collect medical history for 15 minutes in the TCM internal medicine training classroom through internal division of labor and team collaboration. Each large group is assigned a different case of illness, and simulated medical history collection exercises are conducted between groups. Doctors inquire about SSP medical history, conduct relevant physical examinations, and perform laboratory tests based on the training content of medical history collection. Physicians and physician assistants record patients' medical history, including patients and their families presenting and describing symptoms and signs of the disease. After the medical history collection is completed, the physician and physician assistant conduct a collective consultation, comprehensively analyze the condition, formulate a diagnosis and treatment plan, including disease differentiation and syndrome

differentiation, establish treatment methods, prescribe medication, and explain medical orders. The outpatient medical record writing is completed within 10 minutes. The teacher provides guidance on student feedback throughout the medical history collection activity.

(3) Students engage in discussions and evaluations. The completed outpatient medical records of each group will be projected onto the screen through the Xuexitong, and doctors will share the diagnosis and treatment of each group's medical records in class for a total of 30 minutes. Next, SSP and medical students will conduct real-time self correction and evaluation of the medical history collection process; SSP provides timely comments and feedback to medical students, medical students to SSP, and among medical students. Teachers will conduct group discussions on customized questions related to medical history collection, and guide students to find and apply appropriate basic theoretical knowledge of TCM and Western medicine to analyze clinical problems, for a total of 15 minutes.

(4) Students give presentations. Using the Xuexitong app on their mobile phones, one student was randomly selected. Under the supervision of the teacher, the student used the pre class medical history collection mind map to summarize the content of medical history collection and check their mastery of the medical history collection process for a total of 5 minutes.

(5) Teachers conduct evaluations. The teacher provides an overall evaluation of the quality and rationality of the medical history collection process, with a focus on whether the medical history collection process is complete and orderly; Is the collection of medical history comprehensive and focused; Whether TCM observation, smelling, palpation, Western medicine examination, disease differentiation and diagnosis, and prescription and medication are accurate and reasonable; Evaluate whether the medical record writing is standardized, and evaluate the use of humanistic care, doctor-patient communication skills, etc. during the reception process. Provide guidance on areas that need improvement, totaling 5 minutes.

After-class feedback and reflection

Complete homework after class. In the discussion section of Xuexitong, the teacher organized a medical history collection reflection discussion, where students can express their opinions or have private conversations with the teacher. After class, medical students and SSP role transitions randomly and repeatedly practice medical history collection independently, and upload a "medical history collection" video.

Questionnaire survey

After the teaching is completed, an anonymous and confidential questionnaire survey will be conducted. The questionnaire is compiled based on existing literature and is mainly divided into six parts: (1) demographic information (Items 1–2), collect the gender and age of the experimental group; (2) clinical professional competence in TCM (Projects 3–7); (3) TCM thinking and comprehensive ability (Projects 8–11); (4) learning ability (projects 12–14); (5) humanistic literacy and communication and collaboration skills (Projects 15–17); (6) satisfaction with teaching methods (Item 18) (Supplementary Table 1). Conduct pre testing before the investigation to verify the clarity and rationality of the project, and optimize based on feedback results. Finally, 18 projects were determined to adopt a hybrid structure. Among them, 16 Likert three-point scales (1

= agree 2 = disagree 3 uncertain) were used for attitude measurement, and the other 2 items were demographic information (Items 1–2).

Table 1
Application effect of medical history collection thinking training supported by SP simulation teaching in the teaching of TCM Internal Medicine: summary of questionnaire

1	**What is your gender?**	**A: Male**			**B: Female**		
2	How old are you?	A: 18	B: 19	C: 20	C: 21	C: 22	C: 23
From Question 3 to 18: A: Agree; B: Disagree; C: Uncertain							
3	Does it help to improve the ability to comprehensively obtain medical history?						
4	Does it help to deepen the diagnostic ability of TCM internal medicine diseases?						
5	Does it help to improve the ability of TCM internal medicine disease differentiation and diagnosis?						
6	Does it help to promote the ability of TCM to differentiate diseases and syndromes?						
7	Does it help to improve the four diagnostic abilities of TCM?						
8	Does it help to improve clinical comprehensive ability?						
9	Does it help train clinical thinking in TCM?						
10	Does it help to increase the ability to apply what has been learned?						
11	Does it help to integrate and connect learned knowledge?						
12	Does it help to enhance learning interest						
13	Does it help to improve learning motivation and initiative						
14	Does it help improve self-directed learning ability						
15	Does it help to enhance medical humanities literacy and improve humanistic care capabilities						
16	Does it help improve doctor-patient communication skills						
17	Does it help cultivate team collaboration awareness						
18	Do you wish to continue using this teaching method						

Control group intervention methods

The control group of students employed case-based teaching. The teacher releases the same learning materials and requirements as the experimental group before class, but without SSP and medical history collection training and role-playing tasks. Therefore, there were no students playing SSP in the classroom practice, no medical students conduct medical history collection for SP, and no immediate structured and multi-dimensional feedback. During the teaching process, students are divided into groups to independently practice medical history collection and case discussions based on different typical clinical cases. Teachers will ask questions based on clinical issues in medical records to facilitate students' thinking and discussion. After class, the same homework and medical history collection were discussed and exchanged, without

randomly repeating the practice of medical history collection for medical students or SSP role transitions, without the need to upload a "medical history collection" video (Fig. 2).

Assessment and evaluation methods

Assessment of Medical History Collection Ability

All students participated in the assessment of medical history collection skills for lung, heart, brain, spleen and stomach, liver and gallbladder, kidney, qi-blood-body fluid, and limb meridian system diseases in TCM internal medicine, as well as the final practical skills exam and the medical history collection exam in the first tier competency assessment of TCM practitioners. The medical history collection section was scored on a 20 point scale. The diseases for medical history collection and assessment are all aligned with the outline of the TCM Practitioner Assistant Physician Qualification Examination, which is a teaching content of TCM Internal Medicine. The difficulty of the questions is equal, and each student is randomly tested for one item, which is randomly assigned by drawing lots. By conducting statistical analysis on the scores of the medical history collection skills assessment, final practical skills examination, and the first tier competency assessment for TCM practitioners in the course of TCM Internal Medicine for two groups of students, the differences in scores between the experimental group and the control group were compared.

Survey and evaluation methods

After the teaching is completed, an anonymous questionnaire survey will be conducted to understand the satisfaction of the experimental group students with the use of the teaching method. The investigation includes: whether the medical history collection skills have been mastered through learning, whether the communication and exchange abilities between doctors and patients, self-learning ability, clinical thinking ability, application ability, and medical humanities literacy have been improved.

Ethics

This study has been approved by the Ethics Review Committee of Hunan Traditional Chinese Medicinal College (Approval No. : YXLL202109001) and implemented in accordance with the Helsinki Declaration. All participants provided written informed consent forms. In order to reduce bias in evaluating students' medical history, teachers and examiners are not aware of whether students have participated in the study. The potential benefits, possible discomfort or risks have been fully explained to the participants, and their informed consent has been obtained prior to the study.

Statistical analysis methods

SPSS 26.0 software was used for statistical analysis of the data. The measurement data is represented by (mean ± SD), which conforms to normal distribution and homogeneity of variance. The comparison between groups is conducted using t-test; Non parametric tests, including Mann-Whitney *U* rank sum test, are used for

non conformities and/or homogeneity of variance. Count data is represented as N (%), and inter group comparison is performed using X^2 test. A difference of $P < 0.05$ is considered statistically significant.

Results

Baseline Characteristics of students

The basic characteristics of the two groups of students are that the experimental group consists of students aged 19 to 22 years old, with an average of 20.30 ± 0.12 years old. There are 28 females (70.0%) and 12 males (30.0%). The age range of the control group students was 19–22 years old, with an average of 20.30 ± 0.11 years old. There were 29 females (72.5%) and 11 males (27.5%). There was no statistically significant difference in age ($z = 2.16$, $p = 0.829$) and Sex ($\chi 2 = 0.061$, $p = 0.805$) between the two groups of students (Table 2).

Table 2
Baseline Characteristics of the students.

Characteristic	students, No (%)	
	Experimental (n = 40)	Control (n = 40)
Age, mean ± SD, y	20.30 ± 0.12	20.30 ± 0.11
Sex		
Male	12 (30)	11 (27.5)
Female	28 (70)	29 (72.5)

Comparison of medical history collection scores between two groups of students in different disease and syndrome systems

The results of medical history collection for each disease system of two groups of students (Table 3). The medical history collection scores of each disease system in the experimental group were higher than those in the control group, with pulmonary diseases accounting for 15.25 ± 0.40 *vs* 10.35 ± 0.33, $p = 0.000$; Heart disease syndrome 14.88 ± 0.38 *vs* 10.17 ± 0.38, $p = 0.000$; Brain disease syndrome 15.30 ± 0.34 *vs* 10.52 ± 0.37, $p = 0.000$; Spleen and stomach disease syndrome 14.55 ± 0.39 *vs* 10.49 ± 0.37, $p = 0.000$; Liver and gallbladder disease syndrome 14.50 ± 0.40 *vs* 10.56 ± 0.38, $p = 0.000$; Kidney disease syndrome 15.32 ± 0.35 *vs* 10.65 ± 0.37, $p = 0.000$; Qi-blood-body fluid disease syndrome 14.82 ± 0.44 *vs* 10.54 ± 0.35, $p = 0.000$; Limb meridian disease syndrome 15.09 ± 0.40 *vs* 9.91 ± 0.36, $p = 0.000$; The difference is statistically significant.

Table 3
Medical history collection skills scores for two groups of disease syndrome systems

Variables	Experimental (n = 40)			Control (n = 40)			*z*	*p*
	Maximum score	Minimum score	Average score mean ± SD	Maximum score	Minimum score	Average score mean ± SD		
Pulmonary disease syndrome	18.5	5	15.25 ± 0.40	14.0	6.5	10.35 ± 0.33	-6.762	0.000
Heart disease syndrome	18.0	6	14.88 ± 0.38	14.5	5	10.17 ± 0.38	-6.589	0.000
Brain system disease syndrome	18.0	7	15.30 ± 0.34	15.5	6	10.52 ± 0.37	-6.680	0.000
Spleen and stomach disease syndrome	17.5	6	14.55 ± 0.39	15.0	5	10.49 ± 0.37	-5.943	0.000
Liver and gallbladder disease syndrome	18.0	5	14.50 ± 0.40	16.0	5.5	10.56 ± 0.38	-5.860	0.000
Kidney disease syndrome	18.5	7	15.32 ± 0.35	14.5	5	10.65 ± 0.37	-6.765	0.000
Qi-blood-body fluid disease syndrome	19.0	6	14.82 ± 0.44	15.5	5.5	10.54 ± 0.35	-6.024	0.000
Limb meridian disease syndrome	18.5	8	15.09 ± 0.40	14.0	5	9.91 ± 0.36	-6.620	0.000

Comparison of final practical skills exam scores between two groups of students

The results of the final practical skills exam for two groups of students (Table 4). The final practical skills exam scores of the experimental group were higher than those of the control group (95.05 ± 0.29 *vs* 82.17 ± 0.58, $p = 0.000$), The difference is statistically significant.

Table 4
Final Practical Skills Exam Scores of Two Groups of Students

Groups	Count	Maximum score	Minimum score	Average score mean ± SD
Experimental	40	100	92	95.05 ± 0.29
Control	40	88	78	82.17 ± 0.58
z				−7.803
p				0.000

Comparison of Medical History Collection Exam Scores in the First Stage of TCM Practitioner Competence between Two Groups of Students

The results of the medical history collection exam for the first stage of competence in the position of TCM practitioner (Table 5). The score of the first stage disease history collection exam for the competence of TCM practitioners in the experimental group was higher than that in the control group, with a score of 15.35 ± 0.33 *vs* 10.41 ± 0.36 in the first simulated exam, $p = 0.000$; The second mock exam score was 16.90 ± 0.31 *vs* 10.96 ± 0.39, $p = 0.000$; The official exam score is 17.41 ± 0.29 *vs* 15.42 ± 0.28, $p = 0.000$; The difference is statistically significant.

Table 5
Results of the first stage medical history collection examination for the competence of TCM practitioners in two groups of students

Variables	Experimental (n = 40)			Control (n = 40)			*z*	*p*
	Maximum score	Minimum score	Average score mean ± SD	Maximum score	Minimum score	Average score mean ± SD		
The first mock exam	19.0	9.2	15.35 ± 0.33	15.0	6.0	10.41 ± 0.36	-6.799	0.000
Second mock exam	20.0	12.2	16.90 ± 0.31	18.5	5.0	10.96 ± 0.39	-7.062	0.000
Official Exam	19.9	14.0	17.41 ± 0.29	18.4	12.0	15.42 ± 0.28	-4.255	0.000

Evaluation of the effectiveness of medical history collection thinking training supported by SP simulation teaching

The survey results show that 98.31% of students have mastered the skills of medical history collection through the SP medical history collection thinking training teaching method. 94.92% to 100% of students believe that learning through this system can improve the communication and exchange ability between

doctors and patients, the four diagnostic abilities of TCM, the diagnosis and differential diagnosis ability of internal medicine diseases in TCM, as well as the clinical thinking, application ability, medical humanities literacy, and humanistic care ability of TCM. More than 90% of students hope to continue using this teaching method (Table 6).

Table 6
Evaluation of Students' Medical History Collection Thinking Training Supported by SP Simulation Teaching

Content	students, No (%)		
	Agree	Disagree	Uncertain
Helps improve the ability to comprehensively obtain medical history	38(95.0)	2(5.0)	0
Helps deepen the diagnostic ability of TCM internal medicine diseases	40(100)	0	0
Helps to improve the ability of TCM internal medicine disease differentiation and diagnosis	39(97.5)	0	1(2.5)
Helps promote the ability of TCM to differentiate diseases and syndromes	40(100)	0	0
Helps to improve the four diagnostic abilities of TCM	40(100)	0	0
Helps to improve clinical comprehensive ability	39(97.5)	0	1(2.5)
Helps train clinical thinking in TCM	39(97.5)	0	1(2.5)
Helps to enhance learning interest	38(95.0)	1(2.5)	1(2.5)
Helps to improve learning motivation and initiative	40(100)	0	0
Helps improve self-directed learning ability	40(92.5)	0	3(7.5)
Helps to increase the ability to apply what has been learned	40(100)	0	0
Helps to enhance medical humanities literacy and improve humanistic care capabilities	40(100)	0	0
Helps improve doctor-patient communication skills	40(100)	0	0
Helps to integrate and connect learned knowledge	39(97.5)	0	1(2.5)
Helps cultivate team collaboration awareness	39(97.5)	0	1(2.5)
Do you wish to continue using this teaching method	39(97.5)	0	1(2.5)

Discussion

This study found that the medical history collection thinking training teaching method supported by SP simulation teaching can improve students' abilities in medical history collection, TCM syndrome differentiation thinking, clinical communication skills, and self-confidence. A questionnaire survey showed that this method was well received by students.

The Current Challenges in Teaching TCM Internal Medicine

As a core course of TCM education, the teaching objective of TCM Internal Medicine aims to cultivate students to establish a systematic TCM clinical thinking mode of disease differentiation and syndrome differentiation. Modern medical education emphasizes student-centered approach and focuses on cultivating students' clinical thinking and practical abilities[15]. Currently, there is a common problem in the teaching of TCM internal medicine that emphasizes theory over practice. The characteristic of TCM's clinical thinking is "syndrome differentiation and treatment" [16], emphasizing "external diagnosis and internal treatment" and "four diagnostic methods combined with reference". However, the traditional teaching model mainly relies on classroom lectures, where students passively receive knowledge [17]and lack opportunities for active thinking and clinical practice. Classroom teaching mainly focuses on teachers teaching theories and analyzing typical medical cases, with limited opportunities for students to interact with real patients, resulting in a serious disconnect between theory and practice. This "talk on paper" teaching method is difficult to train students in the ability to interact with patients, dynamically collect medical history, and form disease differentiation and syndrome differentiation ideas in real time through "external guidance and internal guidance" and "four diagnostic methods". Students often master fragmented knowledge points, but are unable to effectively integrate and apply them in complex clinical scenarios, resulting in the dilemma of "knowing but not acting", which restricts the cultivation of their clinical confidence and job competence. In addition, the existing teaching of TCM internal medicine lacks sufficient emphasis on the cultivation of medical history collection skills. Comprehensive and systematic medical history collection is the foundation of clinical diagnosis [14, 18] and an important manifestation of clinical thinking ability. However, in current teaching, medical history collection is often seen as a simple task of collecting diagnostic data, lacking systematic thinking training and method guidance. This often leads to students being unable to collect medical history comprehensively and accurately during clinical internships and future work, which affects the accuracy of diagnosis and treatment outcomes. How to break through this bottleneck and create an efficient and safe clinical thinking training environment is the focus of current reform in TCM education. Therefore, reforming the teaching mode of TCM internal medicine and strengthening the training of medical history collection thinking have become urgent needs to improve the quality of TCM talent cultivation.

SP Simulation Teaching: Building a Bridge between Theory and Practice

Scenario simulation teaching method allows students to consolidate medical knowledge and acquire clinical skills through simulating real medical scenarios in practice[19, 20]. The results of this study are highly consistent with the broad consensus in the global medical education field regarding the value of simulated teaching, and further highlight its unique significance in the specific context of TCM. The core advantage of simulated teaching lies in its ability to provide opportunities for deliberate practice, allowing learners to repeatedly practice, make mistakes, and learn from immediate feedback in a "risk-free" environment[21, 22]. This is a key link in internalizing clinical skills and building clinical confidence. This study further deepens this consensus and reveals the unique advantages of SP in the specific context of TCM history collection. The integration of SP teaching mode provides innovative solutions to solve the above difficulties. SSP refers to a

simulator who, through systematic and standardized training, can accurately and consistently simulate the clinical manifestations and emotional responses of specific diseases[8]. In the context of TCM, the core value of SSP lies in its ability to highly replicate the complex scenarios of TCM consultations. Unlike Western medical consultations that focus on localization and qualitative diagnosis, the collection of medical history in TCM is not simply a list of information, but a dynamic and exploratory clinical thinking process. It requires medical students to be able to use TCM theory to guide and systematically question patients based on their initial complaints, in order to uncover hidden key information with dialectical value (such as patients' subjective feelings of "cold and heat", "sweating", "taste", "emotion", "bowel movements" and physical signs (such as tongue and pulse), etc.). Although traditional teacher oral teaching can impart knowledge, it cannot vividly convey these subtle and complex information, making it difficult to simulate this dynamic and interactive thinking process. The SSP used in this study, after careful design and training, can stably, accurately, and repetitively simulate the demeanor, tone, chief complaint details, and response content that specific syndromes should have, creating a high fidelity simulation environment that enables students to truly practice the art of "medical history collection" in a controlled, safe, and tolerant environment, training their ability to quickly capture key pathological points from chaotic information, and providing students with a risk-free, almost real "clinical" experience. This is the fundamental reason for the significant improvement in the "logicality" and "accuracy" of medical history collection.

The cultivation of clinical reasoning ability is the core of medical education[23–26]. Modern medical education emphasizes student-centered approach and focuses on cultivating students' clinical thinking and practical abilities[15]. SSP uses highly standardized deduction to transform abstract TCM syndromes (such as "liver depression and spleen deficiency", "yin deficiency and fire excess") into concrete and perceptible clinical manifestations, enabling students to connect theoretical knowledge in textbooks with the symptoms, signs, and behaviors of "real" patients, thus deeply understanding the concept of "syndrome" and mastering the methods of "differentiation". The results of this study indicate that the experimental group students have significantly better completeness, accuracy, and logicality in medical history collection than the control group, which is a direct reflection of the effectiveness of SSP teaching. It effectively trains students to capture key pathological information from scattered symptoms and closely links it with the "thinking process" of TCM theory and thinking of "treating external symptoms with internal symptoms" and "integrating the four diagnostic methods". This coincides with the concept that simulated teaching can help students develop "clinical reasoning" [27]. This immersive learning experience that combines theory with practice greatly stimulates students' interest and intrinsic motivation in learning. At the same time, it transforms students from passive knowledge receivers to active clinical explorers, internalizing TCM theory into clinical skills in practice. This is directly reflected in the extremely high satisfaction level of the questionnaire survey. The feedback from students that they have "deepened their understanding of theoretical knowledge" and "improved their ability to distinguish diseases and syndromes" is a direct proof of the effective training of medical and clinical thinking.

SP simulation teaching: multi-dimensional improvement of teaching effectiveness

The contribution of SP goes far beyond training in medical history collection techniques. Its deeper value lies in promoting the early construction and solidification of students' clinical reasoning patterns. This study comprehensively evaluated the effectiveness of SP teaching from two dimensions: objective skill assessment and subjective perception.

In terms of objective skills, the excellent performance of the experimental group in the medical history collection of the "First Step Assessment of TCM Practitioner Job Competence" proves that SSP training can be directly transformed into higher clinical competence by integrating more advanced simulation techniques and high fidelity script design. This improvement is not only reflected in students' simple listing of symptoms, but also in their sorting of logical relationships between symptoms and capturing of core pathological information, achieving the completeness, logicality, and accuracy of medical history collection, which is precisely the core of TCM dialectical thinking.

In terms of subjective feelings, the high satisfaction and recognition of the questionnaire survey are strong evidence of the success of SP teaching. Student feedback indicates that this model greatly stimulates learning interest and initiative, deepens understanding of abstract TCM theories (such as syndrome concepts), and significantly enhances clinical practice ability and confidence in disease differentiation and syndrome differentiation. This positive learning experience aligns with Edward Deci and Richard Ryan's "Self Determination Theory (SDT) [28–31]", where SP teaching effectively promotes students' intrinsic learning motivation by providing satisfaction with autonomy (active medical history collection), competence (successful completion of medical history collection and feedback), and relevance (interaction with the "patient").

The core role of SP simulation teaching: building feedback loop and metacognitive ability

The success of SP teaching goes beyond simple simulations of clinical scenarios, and its essence lies in constructing a complete learning loop that includes "practice→feedback→reflection→re-practice". The real-time structured feedback of SSP in simulated teaching is another key mechanism driving students' ability improvement. Bokken et al. emphasized that providing effective clinical and communication skills feedback to students through SP can enable students in simulated teaching to demonstrate better skills [32]. Philosopher and educator John Dewey placed reflection at the core of education[33]; In addition, Schön's[34, 35] practical epistemology of "Reflection-in-Action" states that practitioners can pause or control some daily obstacles in the experimental context of the virtual world to engage in rigorous reflective actions. Feedback is an important component of the teaching process [36, 37], and timely feedback plays a crucial role in promoting the development of students' clinical reasoning abilities. Throughout the simulation teaching process, students can continuously receive timely feedback from SP, reflect on it, adjust their medical history collection strategies in a timely manner, improve the strategies in the medical history collection process, and enhance clinical thinking. In the design of this study, after each medical history collection, SSP provides immediate, structured, and multi-dimensional feedback that not only evaluates students' communication and empathy abilities from the patient's perspective, but also points out omissions in the process of medical history collection from the perspective of TCM, such as not asking about sweating, ignoring emotional

triggers. This direct, specific, and contextualized feedback from the "patient" is more impactful and memorable than third-party comments from teachers, allowing students to immediately recognize their own thinking blind spots, such as missing inquiries about specific "Ten Questions Song" items, which is a key mechanism driving students' ability improvement. This practice based feedback mechanism aims to cultivate students' metacognition ability– the ability to monitor and regulate their own thinking processes [38, 39], which is a core trait of mature clinical physicians. Through repeated SSP training and feedback during the practical process, students are able to reflect on and internalize a more comprehensive, systematic, and rigorous framework for collecting TCM medical history and dialectical thinking in a timely manner, thereby avoiding the omission of key dialectical elements in subsequent practice and future real clinical situations, ultimately achieving self optimization and spiral learning effects.

Limitations and further improvements

Although this study has achieved positive results, there are still certain limitations. Firstly, the research was conducted within a single institution with a relatively limited sample size. In the future, multi center, large sample studies will be needed to validate the generalizability of the results. Secondly, the success of SP simulation teaching highly depends on the quality of medical case scripts and the level of SP training. The development of medical case scripts, student standard patient training, and quality control require continuous funding and manpower investment, which may be a practical challenge for widespread promotion. Finally, this study mainly evaluated the teaching effectiveness in the short and medium term, and the impact of SP training on students' long-term clinical ability maintenance and development, which still requires long-term follow-up research.

Looking ahead to the future, there is still great potential to explore the application of TCM teaching models supported by SP simulation teaching in TCM education. The next step of research can focus on: 1) Develop an SP medical case library covering different levels of difficulty from single syndrome to complex compound syndrome, and construct a progressive TCM thinking training curriculum system; 2) Explore the integration of artificial intelligence (AI) and augmented reality (AR) technology into SP for simulating objective signs with more TCM characteristics such as tongue and pulse, further enhancing the authenticity of the simulation; 3) Further integrate SP with Objective Structured Clinical Examination (OSCE) to establish a more scientific and objective evaluation standard for TCM clinical thinking ability.

Conclusion

In summary, the medical history collection thinking training supported by SP simulation teaching is an efficient and reliable teaching method for TCM internal medicine, and an effective innovation to address the challenges of traditional teaching. It can not only significantly improve the completeness, accuracy, and logicality of students' medical history collection, but also enhance their TCM dialectical thinking ability, clinical communication skills, and confidence, and gain high recognition from students. More importantly, it creates a bridge between theory and practice for students by providing high fidelity simulation environments and structured feedback, effectively promoting the construction of their TCM clinical thinking patterns and the development of their metacognitive abilities. Despite the challenges in terms of cost and promotion, its

enormous potential in cultivating high-quality and capable clinical talents in TCM that meet the requirements of the new era makes it an important direction for promoting the modernization reform of TCM education.

Declarations

Acknowledgements

Not applicable.

Authors' contributions

Huiping Ou: Data organization, formal analysis, investigation, and initial draft writing; Hui Lin: Supervision, proofreading, writing review, and editing. Hui Xu and Linglan Mo: conceptualized and designed this study; Duo Yuan, Chuang Fang and Li Liu: Collecting data and analyzing results; Enjin Zeng and Xing Huang: Data management, investigation, methodology. Ge Fang and Xiaoxiao Xiao: Contributed to manuscript revision and methodology. All authors have read and approved the final manuscript.

Funding

This study was funded by the Hunan Vocational College Education and Teaching Reform Research Project (ZJGB2022010)

Data availability

The data used and/or analyzed in this study are available from the corresponding author on reasonable request.

Ethics approval and consent to participate

The study has been approved by the Ethics Review Committee of Hunan Traditional Chinese Medicinal College (Approval No. : YXLL202109001), and all participants provided written informed consent forms.

Consent for publication

Participants were assured in the consent form they signed the publication of the data will not indicate their names or any identification information.

Competing interests

The authors declare no competing interests.

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Figures

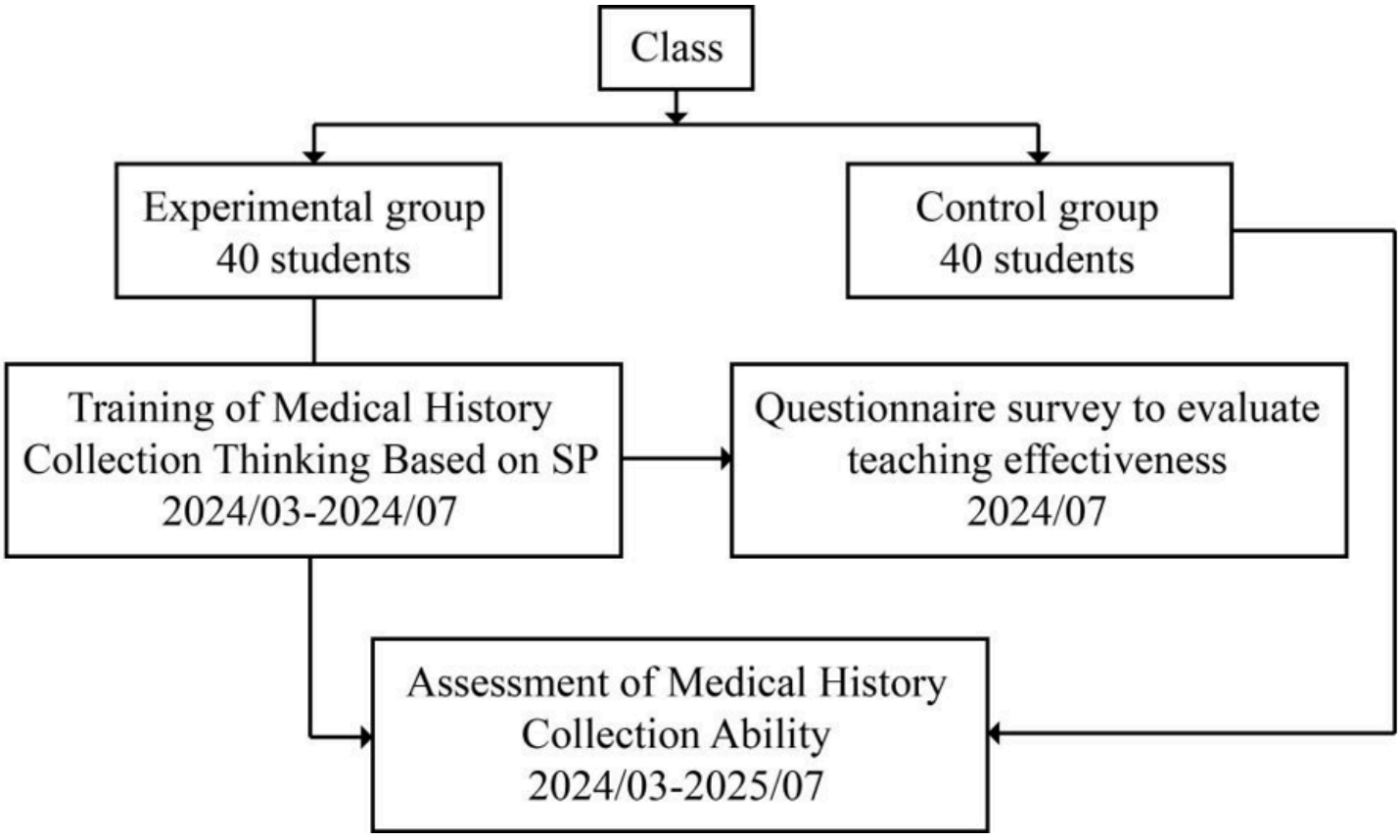


Figure 1

Flowchart of the research process

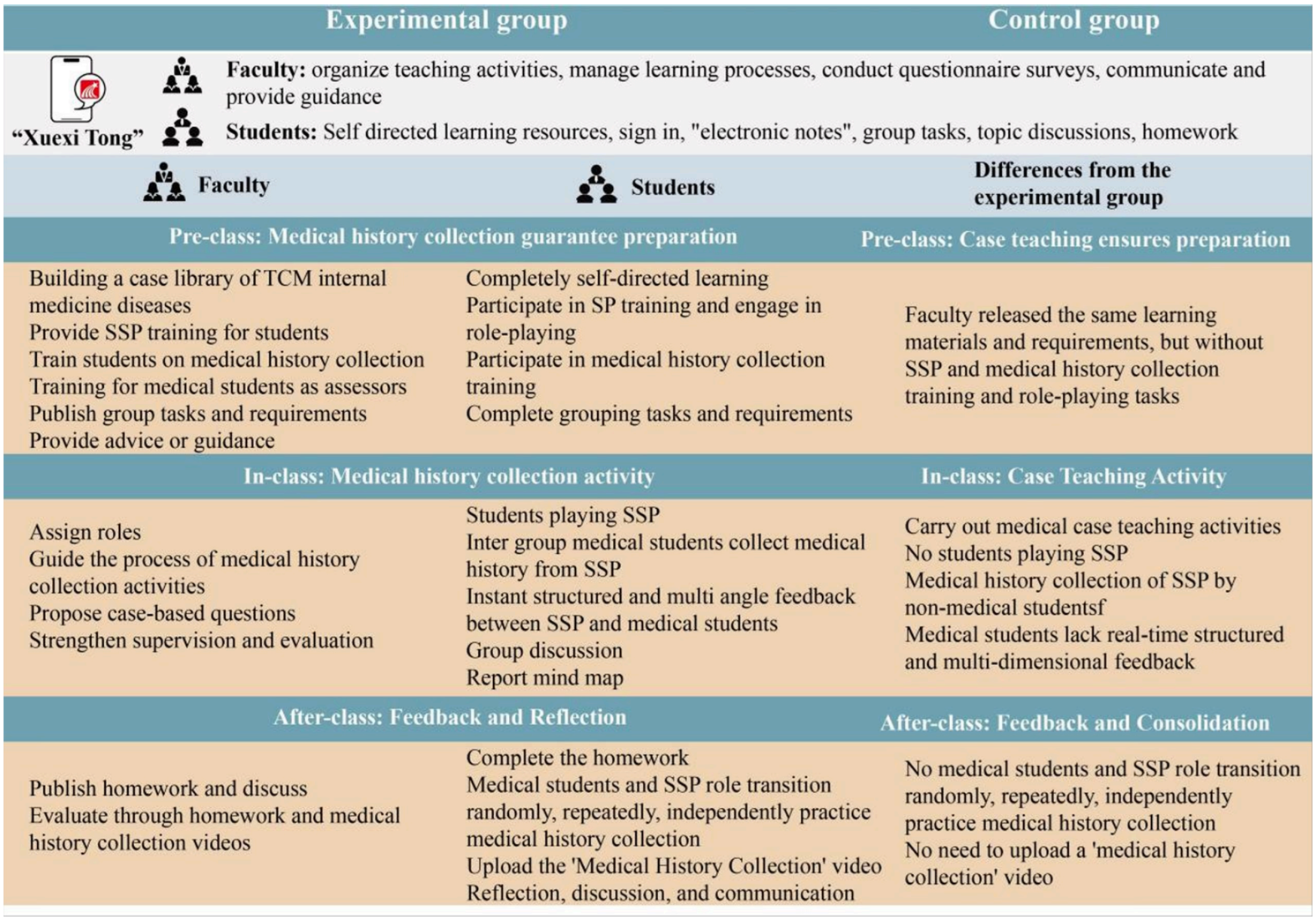


Figure 2

Teaching design of Medical History Collection thinking training

Supplementary Files

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- SupplementaryTable1.docx