

Research Progress on the Application of Student Standardized Patients and Combined Teaching Modes in Medical Education

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Abstract: In recent years, the teaching reform of the New Medical Science Initiative has been continuously promoted, and the training standards for clinical talents have become increasingly stringent. Talent cultivation not only requires students to acquire a solid theoretical foundation, but also emphasizes the comprehensive development of clinical operational skills, clinical critical thinking and clinical diagnostic reasoning, as well as humanistic competence in doctor-patient communication. The traditional single lecture-based teaching model has a fixed form and lacks practical scenarios, which cannot meet the educational needs of current medical practical teaching. Compared with professional standardized patients, Student Standardized Patients (SSP) have the advantages of low cost, easy organization on campus, and repeatable large-scale practical training. They can effectively make up for the shortage of clinical teaching resources and the lack of real consultation opportunities for students, and have been widely applied in practical training at all levels of medical education. Combined with relevant domestic and foreign teaching research in recent years, this paper summarizes and sorts out the application status of SSP combined with mainstream teaching and assessment modes including CBL, PBL, OSCE and Mini-CEX, and summarizes the implementation characteristics, applicable scenarios and practical educational effects of various combined schemes, covering many fields such as undergraduate clinical teaching, clerkship teaching, resident standardized training and nursing practical training. Existing teaching practices have verified that the multi-mode combined teaching based on SSP breaks the limitations of traditional text case teaching, can effectively consolidate students' professional foundation, improve their clinical operation, doctor-patient communication, and teamwork abilities, and achieve better overall teaching quality and student recognition. Meanwhile, there are still many practical deficiencies in domestic SSP teaching at present, including inconsistent training standards, uneven quality of case scripts, insufficient high-quality evidence-based research, high teaching organization costs, lack of targeted hierarchical training programs, weak sustainability of student participation, and limited authenticity of simulated scenarios. In view of the above deficiencies, combined with the development trend of digital teaching, continuous optimization can be realized by unifying SSP training specifications, carrying out long-term large-sample controlled studies, refining hierarchical teaching programs, integrating virtual simulation and AI technology, and perfecting the teacher training system. On the whole, the multi-combined teaching based on SSP is suitable for large-scale clinical practical training in grassroots colleges and universities with outstanding educational value, and can

provide practical references for medical teaching reform and high-quality clinical talent training.

Keywords: Student standardized patient; SSP; Medical education; Clinical teaching; Teaching mode; Research progress

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1. Introduction

Medical education is an important cornerstone for the development of health care undertakings. Competent medical practitioners must possess a solid theoretical foundation, standardized clinical thinking, and good humanistic literacy in doctor-patient communication. Optimizing clinical teaching modes and strengthening the comprehensive ability cultivation of medical students are the core priorities of medical education reform in the new era. At present, clinical teaching includes multiple modes such as CBL, PBL, Mini-CEX, and scenario simulation teaching. Restricted by limited clinical teaching resources, rising awareness of patients' rights and interests, and reduced opportunities for clinical practice, Standardized Patient (SP) teaching has become an important method for medical practical teaching.

2. Standardized patients and student standardized patients

SP teaching in China originated from clinical skill teaching and evaluation projects of three medical schools funded by CMB in 1992, and the first batch of SPs were applied in teaching and evaluation of inquiry and physical examination in Diagnostics. In 2015, the National Medical Examination Center formally introduced SP in the empirical research of staged examinations for licensed physicians, promoting the standardized development of SP teaching and assessment in China ^[1]. To date, SPs have been widely used in the teaching and evaluation of clinical skills such as medical history collection, physical examination, illness notification, and doctor-patient communication, and have become an important technical means of modern medical education. SPs are mainly divided into three categories: professional SPs, teacher SPs, and Student Standardized Patients (SSP). In view of the limitations of professional SPs, such as a long training cycle, high cost, difficult organization, and difficulty in on-demand scheduling, student SPs are increasingly widely used in teaching due to their convenience and economy.

Student Standardized Patient (SSP) refers to standardized teaching tools formed after systematic training of medical students or relevant majors to simulate patients' symptoms, signs, and psychological states. They have the advantages of economy, convenient organization, reusability, and strong scenario adaptability, and have been applied in all links of medical education. SSPs are mostly used in training in inquiry, physical examination, and doctor-patient communication, but they have deficiencies in cultivating in-depth clinical thinking and logical deduction in complex cases. Integrating PBL, CBL, Mini-CEX, and other teaching modes with SSP can realize complementary advantages and further improve teaching effects. This paper systematically sorts out the combined modes, application effects, existing problems, and development prospects of SSP and various teaching methods, so as to provide a reference for medical teaching reform.

3. Combined modes and application effects of SSP and various teaching methods

3.1. Combination of SSP and CBL

Case-Based Learning (CBL) is a classic mature teaching mode widely applied in medical education in China. It has been explored and gradually popularized in China since the 1980s. Its core relies on real cases to carry out seminar-based teaching, focusing on cultivating students' clinical critical thinking and comprehensive literacy^[2]. Traditional CBL takes static text cases as carriers and lacks real clinical scenarios, leading to insufficient immersive experience for students and disconnection between theories and practical operations. The combined teaching of SSP and CBL can effectively make up for this deficiency. Through role-playing by medical students, abstract text cases are transformed into concrete clinical scenarios to build an immersive practical training environment. The teaching mode has standardized procedures: in the early stage of teaching, teachers screen typical cases and complete standardized training of SSPs; during teaching, SSPs simulate real consultation scenarios to guide students to independently complete inquiry, physical examination, condition analysis, diagnosis, and treatment plan formulation; after group discussion and report as well as teachers' comments and summary, a complete teaching closed-loop is formed. Multiple multi-center studies have confirmed that compared with traditional teaching and single CBL teaching, the combined mode of SSP and CBL can effectively consolidate students' theoretical foundation, improve their clinical operation, doctor-patient communication, clinical critical thinking and teamwork abilities, and boost teaching satisfaction and teaching quality^[3-5]. This mode has strong adaptability and can be widely applied in multi-level clinical teaching scenarios such as clinical clerkship and resident standardized training, with good promotion value^[6,7].

3.2. Combination of SSP and PBL

Problem-Based Learning (PBL) is a student-centered autonomous inquiry teaching mode, which guides students to independently consult materials, carry out group discussions, and solve clinical problems through questions, and can effectively exercise students' autonomous learning and clinical thinking abilities. Combining SSP scenario simulation with PBL teaching can build a complete teaching closed loop of "scenario perception—problem inquiry—thinking improvement" and enrich the scenario and operability of PBL teaching. The teaching process of this mode is clear: teachers design case questions and train SSPs in the early stage; during teaching, SSPs restore clinical consultation scenarios to guide students to complete medical history collection and physical examination, extract core clinical problems, and carry out group discussions; finally, teachers make summary comments. Multiple studies have shown that compared with traditional teaching and single PBL teaching, the combined teaching mode of SSP and PBL has remarkable advantages. It can effectively improve students' autonomous learning ability, teamwork ability, and curriculum satisfaction, and consolidate professional theories and clinical skills^[8,9]. This mode has a wide range of adaptability and can significantly improve teaching quality in many fields such as Western medicine teaching of endocrine diseases, traditional Chinese gynecology teaching and psychiatric nursing teaching, strengthen students' clinical practice, communication and humanistic care literacy, and meet the training needs of medical talents at all levels^[10-12].

3.3. Combination of SSP and OSCE

Objective Structured Clinical Examination (OSCE) is a standardized assessment system centered on multi-station examination for comprehensively evaluating core clinical abilities of medical students and clinicians

such as medical history collection, clinical operation, and clinical thinking. It has been applied in graduation examinations of resident standardized training in many domestic hospitals and achieved good evaluation effects^[13–15]. In the field of international medical education, the combined assessment mode of SP and OSCE has been widely promoted and applied in European and American medical colleges^[16]. Existing studies show that the combined mode of SP and OSCE is applicable to multiple scenarios such as pre-examination training of medical students, standardized assessment, and daily clinical teaching, covering many fields such as physician training and nursing teaching. In pre-graduation training, this mode can effectively improve the graduation skill examination scores of anesthesiology residents, optimize the quality of resident training, and boost teaching satisfaction; meanwhile, it can strengthen the professional ability of nursing interns and gain high recognition from nursing students, laying a solid foundation for their subsequent clinical work. In daily clinical teaching, compared with the traditional teaching mode, the combined mode of SP and OSCE can significantly improve the examination scores and clinical operation level of TCM nursing interns, and comprehensively improve students' overall quality. At the same time, this mode can be targeted for application in special assessments such as daily medical history collection and clinical skills. It can consolidate students' clinical foundation and improve their abilities in medical history collection and practical operation, which is an effective means to optimize daily teaching and standardized assessment of medicine^[17–20].

3.4. Combination of SSP and Mini-CEX

Mini Clinical Evaluation Exercise (Mini-CEX) is a phased clinical skill assessment tool optimized and improved by the American Board of Internal Medicine on the basis of traditional clinical evaluation tools in 1995. Different from centralized summative examinations, it relies on real clinical scenarios to carry out short-term and multiple process evaluations. Through direct observation of students' clinical diagnosis and doctor-patient interaction by teachers, it focuses on core diagnosis and treatment links and gives structured feedback in a timely manner. It can comprehensively evaluate students' clinical skills, diagnostic judgment, communication and collaboration, and humanistic care, and has been gradually applied in resident standardized training with good results. At present, the Mini-CEX evaluation system is often combined with SP scenario simulation in clinical teaching. Teaching cases are designed guided by Mini-CEX assessment standards. SPs are relied on to simulate real clinical consultation scenarios, guiding students to independently complete a full set of clinical work, including inquiry, physical examination, condition research, and diagnosis plan formulation. Teachers observe and evaluate the whole process and give targeted feedback and guidance, forming a closed-loop teaching mode of “simulated training + process evaluation + timely improvement”. Multiple studies have verified the remarkable teaching advantages of this composite mode: in resident training of neurology, the combined teaching method of Mini-CEX and SP can effectively polish residents' clinical diagnosis thinking and is an excellent teaching method for cultivating clinical thinking^[21]; in multi-disciplinary clinical teaching, SP scenario teaching based on Mini-CEX can comprehensively improve students' clinical operation, emergency disposal and comprehensive literacy, and raise teaching satisfaction^[22]; in specialized teaching of rheumatology, the diversified teaching mode integrating SP, CBL and Mini-CEX can deepen medical students' understanding of specialized diseases, continuously strengthen clinical diagnosis thinking and comprehensive medical literacy, and meet the training needs of specialized clinical talents^[23].

3.5. Multi-mode combined teaching based on SSP

Clinical teaching practice shows that a single teaching mode has limitations and cannot meet the diversified

training demands for the comprehensive abilities of modern clinical medical talents. Composite teaching modes integrating multiple mainstream teaching methods based on SP/SSP scenario simulation can realize superposition of teaching effects and better adapt to the development demands of clinical teaching. As student-centered mainstream teaching methods, PBL and CBL can be deeply integrated with SP teaching. Cases are presented visually through SSP, and teaching is carried out in combination with PBL and CBL procedures to further strengthen classroom teaching effects. Meanwhile, the multi-mode integration of SP, CBL, Mini-CEX, and scenario demonstration can comprehensively polish medical students' clinical analysis and practical abilities, and facilitate the cultivation of high-quality medical professionals. Relevant teaching studies have confirmed that the multi-teaching mode integrating SP, CBL, and PBL can effectively improve students' clinical thinking and practical abilities in reproductive health teaching, and play a positive role in optimizing obstetrics and gynecology teaching quality and specialized talent training effects^[24]. In thoracic surgery clerkship teaching, the multi-mode integrated teaching plan of CBL based on student SPs can significantly improve interns' examination scores and autonomous learning ability and gain wide recognition among students. In general, the comprehensive multi-mode combined teaching is significantly superior to single traditional teaching in cultivating medical students' clinical thinking and comprehensive clinical abilities, with higher application value in clinical teaching^[25].

4. Existing problems in the application of SSP combined teaching methods

Although the composite teaching mode based on SSP has remarkable teaching advantages, there are multiple deficiencies in actual implementation. Although professional SPs have professional evaluation and feedback, they suffer from high training and operation costs and difficulty in large-scale popularization. As a low-cost alternative on campus, SSPs mainly have seven existing problems: First, there is no unified national training standard for SSPs, leading to inconsistent simulation performance and difficulty in guaranteeing the objectivity of teaching assessment. Second, the design of teaching case scripts is too simple, lacking difficult and complex scenarios, which is not conducive to high-level clinical ability training. Third, most existing relevant research is single-center and short-term, small-sample experiments, lacking long-term multi-center follow-up data and evidence-based support for long-term teaching effects. Fourth, teaching organization consumes a large number of teachers and class hours, making it difficult for grassroots colleges to carry out standardized implementation. Fifth, the existing teaching plans are too universal without hierarchical design for students of different specialties and training stages, leading to insufficient targeted education. Sixth, students are prone to burnout from long-term role-playing as SSPs, with no salary subsidies and heavy academic pressure, resulting in declining participation enthusiasm. Seventh, students have limited life and clinical experience, making it difficult to truly restore severe cases and complex psychological states of patients, leading to insufficient simulation degree of practical training scenarios.

5. Prospect and suggestions

Foreign countries have formed mature and perfect SP teaching and assessment systems, while domestic SSP teaching relies on campus resources with low cost and convenient organization for large-scale promotion. It can make up for the deficiencies of traditional practical teaching and meet the training requirements of new medical disciplines in students' clinical skills, clinical thinking, and humanistic literacy. At present,

domestic SSP teaching case resources are increasingly abundant, yet refined teaching plans adapted to different teaching scenarios and training levels are still insufficient. Three aspects can be improved in follow-up work: First, carry out multi-center long-term follow-up studies with large samples, explore the optimal combined teaching plans by specialty and level, and enrich evidence-based data. Second, integrate artificial intelligence and virtual simulation technologies to build a new training mode combining AI assistance and virtual-reality integration, reduce teaching costs, and improve simulation teaching effectiveness. Third, carry out systematic teacher training to improve teachers' abilities in SSP training, teaching design, and classroom implementation, ensure standardized implementation of various combined teaching modes, and continuously optimize the clinical talent training system.

6. Conclusion

Traditional single teaching mode has obvious limitations and cannot meet the diversified training demands of modern composite medical talents. The multi-mode combined teaching centered on SSP has the application advantages of low cost and easy large-scale implementation. It transforms abstract book cases into immersive practical training scenarios. Combined with PBL, CBL, Mini-CEX and other teaching and assessment modes, it can comprehensively improve medical students' clinical operation, clinical thinking, doctor-patient communication and humanistic care abilities, with outstanding application value in clinical teaching. Such composite teaching modes are suitable for the practical teaching demands of various medical colleges in China and can provide feasible paths for medical teaching reform.

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