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Research Article

Application of Student Standardized Patients Combined with Problem-Based Learning Teaching Method in Standardized Training of General Dental Residents

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Abstract

Objective: This article aims to evaluate the effect of student standardized patients combined with problem-based learning teaching method in standardized training of general dental residents.

Methods: 48 general dental residents in the 2021 grade at the first affiliated hospital of Jinan University were selected and randomly divided into a control group and an experimental group. The teacher in the experimental group used the traditional teaching mode, which consisted of the conventional clinical teaching method, small lectures and case discussion. In contrast, the teacher in the experimental group used a hybrid teaching model based on student standardized patients (SSP) combined with PBL teaching. After the learning was completed, the departmental rotation examination scores of the residents in two groups were compared. Besides, a questionnaire was adopted to investigate the residents' evaluation of the teaching effectiveness, and the results were analyzed through SPSS software.

Results: There was no significant difference between the two groups on theoretical knowledge assessment. The scores of the experimental group's medical record writing and consultation assessment were higher, and the difference was statistically significant ($P < 0.05$). The clinical competence of residents in the experimental group was higher than that in the control group, and residents had a higher evaluation on the application effect of student standardized patients combined with problem-based learning teaching method.

Conclusion: The application of SSP combined with PBL teaching mode in the standardized training of general dental residents improves the residents' independent learning ability, clinical thinking ability, doctor-patient communication ability, and operational ability.

Keyword: *Problem-Based Learning; Standardized Patients; Educational Methodology; Standardized Residency Training; Randomized Control Trial*

Introduction

Standardized residency training is an essential part of post-graduate medical education, which aims to cultivate high-quality physicians with independent working ability. As an important stage of post-graduation education for dentistry students and an essential link in the transformation of national medical education achievements into medical resources, standardized residency training plays a vital role in the development of clinical workability of dental residents and the overall improvement of their quality [1].

The application of standardized patients (SP) in clinical skills assessment has been proven to be effective in testing the clinical communication ability and clinical diagnosis and treatment ability of subjects [2]. Because SPs require a large amount of money and time to train, some scholars have tried to train medical students to serve as SPs to reduce the investment. The results showed that student standardized patients (SSP) have the characteristics of quick acceptability and significantly shortened training time, which can provide more clinical skills training opportunities for medical students and thus provides a reliable basis for clinical skills assessment [3].

Problem-based learning (PBL) is a student-centered and problem-oriented educational approach that emphasizes active learning for students [4]. The simulated standardized patient teaching is a comprehensive simulation teaching method in which the trained student standardized patient simulates the pathophysiological characteristics of a clinical patient, and the student makes a diagnosis and proposes a treatment plan for the patients based on their clinical symptoms and performance [5].

Methods

Objects and methods

In this study, the independent sample contrast method was adopted, and a total of 48 general dental residents in the 2021 grade at the first affiliated hospital of Jinan University were selected as the objects of study. The participants were randomly divided into a control group and an experimental group, with 24 residents in each group. There were no statistical differences between the two groups in terms of age, gender, and entrance grades. The previous basic dentistry courses taken by the two study groups were the same, and the grades were all passed. In the control group, the teaching mode, which consisted of the traditional clinical teaching method, small lectures and case discussion was adopted. The instructor uses courseware to teach students the relevant content of the textbook, and after the class students learn to teach clinical skills and practice them repeatedly in the open lab. During the teaching process, the clinical cases, which were the same as those in the experimental group, were presented through multimedia such as video, and the teacher gave an oral explanation and told the students the key points of clinical consultation, treatment process, precautions, and doctor-patient communication skills. In the experimental group, a hybrid teaching model based on student standardized patients (SSP) combined with PBL teaching was adopted. The teacher trained the SSPs according to the teaching content, and the students in the experimental group were set as the physicians, who were required to simulate the whole process of clinical diagnosis and treatment, including consulting, examining, diagnosing, drawing up treatment plans, and performing the necessary skills on the model. The SSPs evaluated the students' whole process and operation skills, and eventually the teacher would correct the problems and provide relevant professional guidance according to the students' performance.

Application of SSPs combined with PBL teaching modes

Construction of SSPs combined with PBL teaching mode

Common clinical oral cases such as acute pulpitis, chronic periodontitis, impacted tooth, oral aphthous ulcer, trigeminal neuralgia, etc. were selected based on the teaching program. The case library script and related examination information were completed, and the dialogue format was adopted. Besides, the content was concise, and the language was easy to understand. The case material was created and sorted based on real cases as far as possible, which be reviewed and revised by two professors after the preparation.

Recruitment and training for SSPs

The SSPs were recruited for third-year residents in the Department of Stomatology of the First Affiliated Hospital of Jinan University. The following conditions were required: ① Voluntary participation, high motivation, responsibility and dedication; ② Contact with a certain number of clinical patients and have a certain degree of knowledge of the common manifestations and psychological conditions of patients; ③ Good understanding, memory, and a certain degree of performance ability; ④ Good verbal skills, be good at communicating with others, and be able to accept physical examination contact; ⑤ Healthy and no infectious diseases. After experts evaluated, 12 students were finally selected as SSPs for training. All of them were familiar with the diagnosis and treatment of common disease in stomatology, with good communication skills and performance skills. All of them had passed the examination of standardized residency training and had an understanding of standardized patients. The SSPs were trained systematically before the class. They were required to practice repeatedly according to the script so that they were familiar with the cases and could simulate the same disease condition as completely as possible to ensure their status was close to the actual patient. Finally, let SSPs come to the wards to contact actual patients and learn about the knowledge of diseases. Then according to the case script provided, the SSPs needed to present the symptoms and signs of diseases in the form of the patient's expressions, which means that SSPs should add the patient's words and behaviors to show a relatively realistic SP performance.

Application of SSP combined with PBL teaching mode

The theoretical knowledge of the students in the experimental group and the control group was taught by the same teacher, and the teaching methods were the same. The teaching contents were all common clinical oral diseases. Residents in the control group first learned the theoretical knowledge about the disease, then accepted skills training on a mock head model in the laboratory, and finally participated in the clinical internship to complete the traditional standardized residency training process. In the experimental group, the SSP combined with the PBL teaching model was introduced for the teaching trial. Residents also learned about theoretical knowledge first, followed by skills training on a mock head model in the laboratory, and then the SSP combined with the PBL teaching model was used for intensive training before participating in clinical practice.

The whole process was divided into three main steps: firstly, the residents faced the SSPs for history taking and the corresponding physical examination, and the teacher would supplement and summarize it; secondly, residents were required to use the Internet, library and other platforms to review the relevant literature and learn about the corresponding chapter of theoretical knowledge. What is more, to further deepen the residents' impression, the cases provided in the first step were discussed and analyzed, and the teachers summarized the important knowledge points comprehensively and answered the questions raised by the students; Finally, residents joined the clinical internship and completed the traditional residency training process. The specific application process and the design of SSP combined with PBL teaching cases are shown in figure 1.

Evaluation of teaching effectiveness

After the teaching was completed, the departmental rotation examination scores of the residents in two groups were compared, including the quality of medical record writing, the assessment of consultation, and the assessment of theoretical knowledge. By reviewing the literature and consulting relevant experts, we screened and determined the factors influencing the competency of dental general practice residents, and then we used them to construct a questionnaire on the competency of dental general practice residents in standardized training, including ten items: professional knowledge ability, operational skills, teamwork ability, literature review ability, knowledge updating ability, clinical thinking ability, scientific research thinking ability, stress relief ability, doctor-patient communication ability, and self-confidence. A ten-point scale was used, and each capability was assigned from 0~10 points in order from weak to strong, with a total score of 100 points. The clinical competency levels were assessed according to the total score: failed: < 60; passed: 60 - 69; average: 70 - 79; good: 80 - 89; excellent: ≥ 90. The overall Cronbach's α coefficient of the rating scale was 0.923.

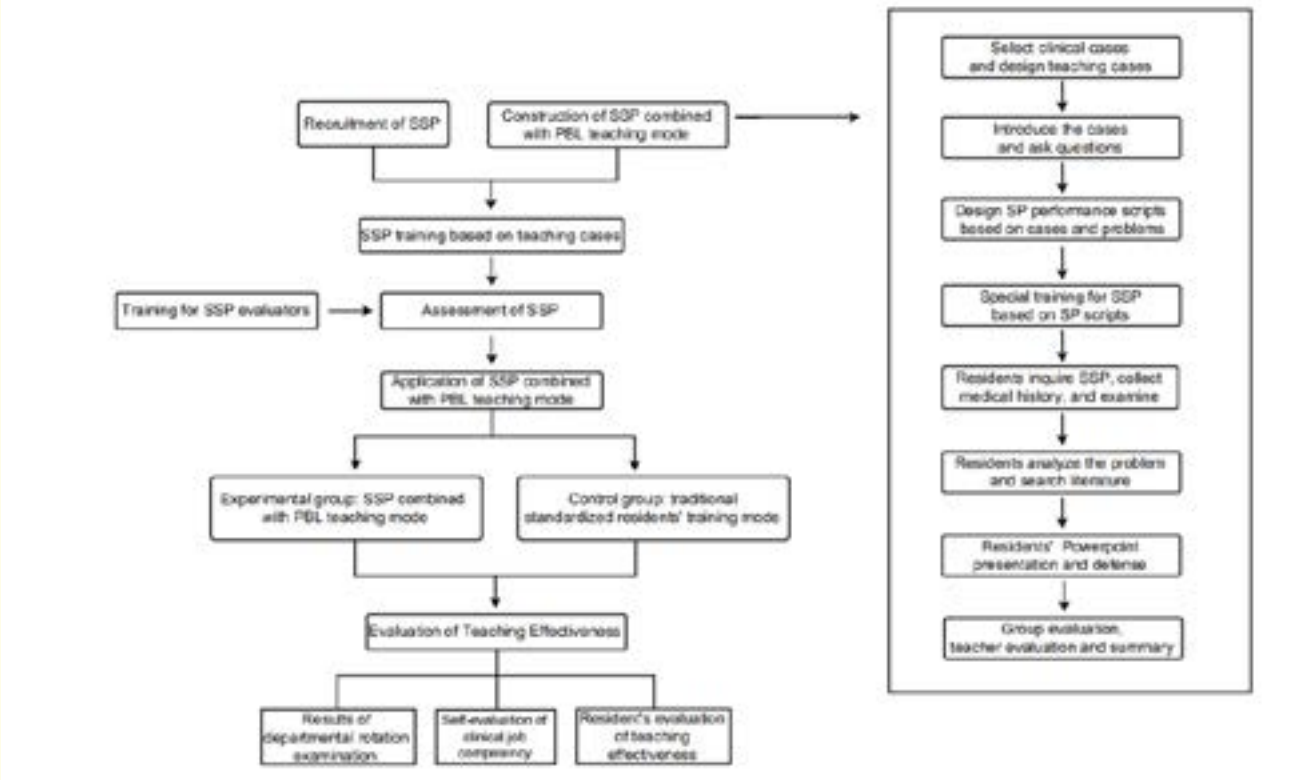

Figure 1: *Application process of SSP combined with PBL teaching modes.*

The information survey and feedback for the teaching effectiveness were adopted in the form of a questionnaire to investigate the residents' evaluation of the teaching effectiveness. The questionnaires were distributed anonymously and included eight aspects: significantly improve own interest, enthusiasm and motivation for learning, significantly improve clinical assessment and operational skills, significantly improve clinical response skills, significantly improve diseases observation skills, significantly improve understanding and memory of the consultation content, significantly improve medical record summarizing and writing skills, significantly improve critical thinking skills, and significantly improve doctor-patient communication skills. Each aspect is ranked into four levels: strongly agree, agree, uncertain, and disagree, and the scores are recorded as 4, 3, 2, and 1. The total score is counted.

Statistical methods

SPSS Statistics version 22.0 was used to statistically analyze and process the data. The measurement data, such as clinical operation scores, were expressed as ($x \pm s$), and the t-test was used for comparison between the two groups. The comparison of the qualitative data was adopted by the χ^2 test, and the difference was considered statistically significant at $P < 0.05$.

Results

Results of departmental rotation examination

The number of patient receiving in the outpatient department was 6 times per resident in both groups. Compared with the scores of medical record writing and consultation assessment scores in the control group, the text scores of the experimental group were higher

and the difference was statistically significant (P < 0.05). In terms of the scores of theoretical knowledge assessment, the difference between the assessment scores of the experimental group and the control group was not statistically significant (P > 0.05), as shown in table 1.

Evaluating index	Experimental group (n = 24)	Control group (n = 24)	t	P
Quality of medical record writing	77.18 ± 6.26	71.34 ± 7.33	2.968	0.002
The assessment of consultation	87.56 ± 7.61	79.84 ± 7.55	3.528	0.000
The assessment of theoretical knowledge	76.44 ± 6.89	77.37 ± 6.42	0.484	0.315

Table 1: *Comparison of examination results of residents in two groups.*

Self-evaluation of clinical competency

A total of 48 questionnaires were sent to the two groups of students, and all were returned (100% response rate). The results were shown in table 2. The self-ratings of the residents in the experimental group were higher than those of the residents in the control group in six areas, including teamwork ability, literature review ability, clinical thinking ability, stress relief ability, doctor-patient communication ability, and self-confidence (P < 0.05). The differences between the self-ratings of the residents in the experimental group and the control group in the four aspects were not statistically significant (P > 0.05), which included professional knowledge ability, operational skills, knowledge updating ability, and research thinking ability. In the overall self-assessment of clinical competency, the scores of the experimental group were 7.65 points higher than those of the control group, and the difference was statistically significant (P < 0.05).

Evaluating index	Experimental group (n = 24)	Control group (n = 24)	t	P
Professional knowledge ability	7.49 ± 1.17	7.38 ± 1.29	0.246	0.403
Operational skills	8.26 ± 1.16	7.94 ± 1.19	0.943	0.175
Teamwork ability	8.87 ± 0.78	7.96 ± 1.24	3.043	0.001
Literature review ability	8.69 ± 0.94	7.55 ± 1.36	3.378	0.000
Knowledge updating ability	8.32 ± 1.08	7.99 ± 1.17	1.015	0.158
Clinical thinking ability	8.57 ± 0.86	7.83 ± 1.24	2.402	0.010
Research thinking ability	8.12 ± 1.17	7.89 ± 1.22	0.666	0.254
Stress relief ability	8.88 ± 0.34	7.24 ± 1.48	5.291	0.000
Doctor-patient communication ability	9.01 ± 0.26	7.54 ± 1.55	4.582	0.000
Self-confidence	8.43 ± 1.12	7.67 ± 1.69	1.836	0.036
Overall score	84.64 ± 8.88	76.99 ± 13.43	2.328	0.012

Table 2: *Comparison of self-evaluation of residents' clinical competence between two groups.*

The average competency of the residents in the experimental group reached a good level based on the overall score, while the average clinical competency of the residents in the control group was a average level. As shown in table 3, 25% of the residents in the experimental group rated themselves as having an excellent level of clinical competency, and 50% rated themselves as having good clinical competency, while only 12.5% of the residents in the control group rated themselves as having an excellent level of clinical competency, 20.83% rated themselves as having good clinical competency, and 58.33% rated themselves as having an average level of clinical competency. The Chi-square test was used to analyse the data, and the difference was statistically significant (P < 0.05).

Evaluating index	Experimental group (n = 24)	Control group (n = 24)	χ^2	P
Excellent: ≥90	6	3	9.438	0.024
Good: 80~89	12	5		
Average: 70~79	4	14		
Passed: 60~69	2	2		
Failed: < 60	0	0		

Table 3: *Comparison of clinical competency levels of residents between two groups.*

Resident's evaluation of teaching effectiveness

A total of 48 questionnaires were sent to the two groups of students, and all were returned (100% response rate). The results were shown in table 4. The evaluation scores of the residents in the experimental group were higher than those of the residents in the control group in six areas: significantly improve own interest, enthusiasm and motivation for learning, significantly improve clinical response skills, significantly improve diseases observation skills, significantly improve understanding and memory of the consultation contents, significantly improve medical record summarization and writing skills, and significantly improve communication skills between doctors and patients (P < 0.05).

Evaluating index	Experimental group (n = 24)	Control group (n = 24)	t	P
Significantly increase interest, enthusiasm and motivation for learning	3.23 ± 0.64	2.79 ± 0.87	1.996	0.026
Significantly improve clinical assessment and operational skills	3.16 ± 0.58	2.96 ± 0.89	0.922	0.181
Significantly improve clinical response skills	3.16 ± 0.58	2.83 ± 0.73	1.734	0.045
Significantly improve diseases observation skills	3.34 ± 0.42	2.91 ± 0.88	2.160	0.018
Significantly improve understanding and memory of the consultation content	3.11 ± 0.66	2.74 ± 0.79	1.761	0.043
Significantly improve medical record summarizing and writing skills	3.19 ± 0.56	2.83 ± 0.84	1.747	0.044
Significantly improve critical thinking skills	3.12 ± 0.67	2.89 ± 0.82	1.064	0.146
Significantly improve doctor-patient communication skills	3.28 ± 0.49	2.93 ± 0.83	1.779	0.041
Overall score	25.59 ± 4.60	20.05 ± 6.65	3.175	0.001

Table 4: *Comparison of residents' evaluation of teaching effectiveness between two groups.*

There were no statistically significant differences between the evaluation scores of the experimental group and those of the control residents in the two areas: significantly improve clinical assessment and operational skills and significantly improve critical thinking skills (P > 0.05). The overall teaching evaluation scores of the experimental group were significantly higher than that of the control group by 5.54 points, and the difference was statistically significant (P < 0.05).

Discussions

Standardized Patients, which also called Simulated Patients, refers to normal people or patients engaged in nonmedical work who are trained to realistically simulate clinical situations and patient problems. SP teaching mode play the role in acting as an assessor, patient

and instructor. Besides, SP teaching mode can not only develop students' communication skills with patients and reinforce students' understanding of knowledge, but also increase students' confidence and reduce students' anxiety in dealing with patients [6]. SP teaching mode has been used for decades in the medical education in the U.S. Barrows noted that the value of SP teaching mode in medical education is to train and assess the clinical skills of medical students [7].

SP teaching mode was introduced in China in the 1990s. Among domestic higher medical schools, West China University of Medical Sciences, Zhejiang Medical University, and Shantou University Medical College were the earlier schools to start SPs training and use it for assessment. Some scholars believed that the use of SP teaching mode for medical students' consultation skills training could enable students to get systematic training on consultation content and skills and promote the development of doctor-patient communication skills [8]. SP teaching mode can reduce nervousness and build confidence in facing patients. However, the training and application of SPs involve manpower, material resources and financial problems, which seriously restrict the wide application of SPs in clinical practice teaching. Medical schools in the U.S. have explored the feasibility of using medical students as SPs. Escovitz reported that the results of using senior medical students to imitate patients to teach and assess junior students showed that the application of student standardized patient (SSP) not only saved money, but also shortened the training time compared with professional SPs, with a group instruction of 1h, thus saving the time and expense of trainers [9].

Although SSP has some advantages over SP, it is impractical to train SSPs to be used for the practice of beginner clinic students because what they mostly need is continuously practicing. Troncon has done a new experiment in which three students form a group, two of whom simulated the patient and the consulting doctor, and one of whom acted as an observer. After the consulting was completed, the observer gave an assessment of the consultation of the doctor's role, and then the others also gave a self-evaluation of the previous consulting simulation exercise. Subsequently, the three students took turns changing roles, and finally, the teacher gave feedback on the students' consulting exercises and organized a discussion [10]. This method is easy to implement during class time, but class time is limited after all.

PBL teaching in China started in 2000, and in the past two decades of medical education in China, one of the significant problems revealed in PBL teaching is that the quality of "problems" is still lacking. In PBL teaching mode, realistic scenarios of doctors communicating with patients should be simulated as much as possible so that students can find out the real problems they may encounter in the process of communicating with patients, including the uncertain attitude of patients in expressing their problems and the contradictions before and after they expressed their concerns, thus improving students' ability to translate patients' actual problems into medical issues [11]. Introducing standardized patients can improve the shortcomings of PBL teaching [12-14]. Standardized patients can enhance the quality of PBL in two ways. On the one hand, when standardized patients are introduced into PBL courses, the "problems" are placed in almost real clinical situations. Students can obtain information through communication with standardized patients, and thus the "problems" discovered are close to students' cognitive level and come from their actual confusion. Presenting the critical information in the case in the form of a simulated real-life situation makes students think about the "problem" actively. They are more eager to solve the "problem". The quality of the "problem" raised is also higher. Besides, early exposure to the roles of "doctor" and "patient" creates a stronger motivation and interest in the later discussions, reviewing materials, and setting learning goals. On the other hand, standardized patients can also ask important questions as "patients" that can provoke students' thinking and are easy to miss. Because of the unique advantages of SSP in the development of medical students' clinical skills, SSP has gradually become a hot topic of medical education reform in recent years.

In this study, we introduced SSP into the standardized residency training and increased the content of clinical case teaching. We used SSP combined with PBL teaching mode to allow residents to contact more real patients before the standardized residency training, which is conducive to improving residents' understanding and mastery of theoretical knowledge, as well as cultivating perfect clinical thinking and more standardized treatment procedures [15]. This simulation teaching mode can simulate the clinical environment without worrying about the occurrence of doctor-patient disputes [16], and residents can put forward their opinions and ideas with confidence and boldness, which can make residents gain a sense of accomplishment and enhance their self-confidence [17]. Besides, the use of SSP leads

residents to practice what they have learned on the SSP, promotes the integration of theory and practice, improves their comprehensive analysis and problem-solving skills, and helps residents to effectively regulate their learning process [18].

Conclusion

The combination of SSP and PBL teaching in this study can improve the inadequacy of actual clinical patients' uncooperation and solve the problem of insufficient resources for clinical practice teaching. This method advocate problem-based learning and independent learning and form a teacher-led, student-centered, and ability-enhancing teaching mode, which is conducive to the improvement of students' operational skills, analytical ability, problem-solving ability and clinical thinking skills. Our study shows that the application of SSP combined with PBL teaching mode in the standardized training of general dental residents improves the residents' independent learning ability, clinical thinking ability, doctor-patient communication ability, and operational ability.

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Conflict of Interest

The authors declare that there is no conflict of interest.

Authors Contribution

Zejian Li and Chunting Lu contributed equally to this work.

Bibliography

1. Wenshu Ge., *et al*. "The Establishment and Evaluation of the Standardized Training Assessment System for General Practice Residency Program in Dentistry". *Chinese Journal of Medical Education* 41.7 (2021): 652.
2. Levine Adam I and Mark H Swartz. "Standardized Patients: The "Other" Simulation". *Journal of Critical Care* 23.2 (2008): 179-184.
3. Richardson Luann., *et al*. "Undergraduate Students as Standardized Patients to Assess Advanced Practice Nursing Student Competencies". *Nurse Educator* 34.1 (2009): 12-16.
4. Savery John R. "Overview of Problem-Based Learning: Definitions and Distinctions". *Interdisciplinary Journal of Problem-Based Learning* 1.1 (2006).
5. Wallace Jeremy., *et al*. "Simulated Patients and Objective Structured Clinical Examinations: Review of Their Use in Medical Education". *Advances in Psychiatric Treatment* 8.5 (2002): 342-348.
6. Beischel Kelly P., *et al*. "Using a Standardized Patient to Teach Fall Safety". *Clinical Simulation in Nursing* 10.4 (2014): e183-e190.
7. Barrows Howard S., *et al*. "An Overview of the Uses of Standardized Patients for Teaching and Evaluating Clinical Skills. Association of American Medical Colleges". *Academic Medicine* 68.6 (1993): 443-453.
8. Carter Mary B., *et al*. "Didactic Lecture versus Instructional Standardized Patient Interaction in the Surgical Clerkship". *The American Journal of Surgery* 189.2 (2005): 243-248.

9. Escovitz Ellen Strober. "Using Senior Students as Clinical Skills Teaching Assistants". *Academic Medicine* 65.12 (1990): 733-734.

10. Troncon Luiz EA. "Structured, Three-Way, Role-Play Activity for Improving History-Taking Skills". *Medical Education* 43.11 (2009): 1097-1097.

11. Kuang F., *et al*. "How the "problem" of PBL comes up in the medical education". *Chinese Journal of Anatomy* 43.05 (2020): 452-453.

12. Nagoshi Michael H. "Role of standardized patients in medical education". *Hawaii Medical Journal* 60.12 (2001): 323-324.

13. Chang Ching-Chih., *et al*. "A Pilot Study of Integrating Standardized Patients in Problem-Based Learning Tutorial in Taiwan". *Journal of the Chinese Medical Association* 82.6 (2019): 464-468.

14. Jin Yan., *et al*. "Exploration of PBL Combined with Standardized Patient in the Teaching of Ophthalmology". 2017 International Conference on Social Science, Education and Humanities Research (ICSEHR 2017), Atlantis Press (2017): 28-31.

15. Yoon Bo Young., *et al*. "Using Standardized Patients versus Video Cases for Representing Clinical Problems in Problem-Based Learning". *Korean Journal of Medical Education* 28.2 (2016): 169-178.

16. Li-na Shao., *et al*. "Application of PBL Combined with SP Method in During-Course Practice of Endodontics for Undergraduate Dental Students". *Shanghai Journal of Stomatology* 25.5 (2016): 621-625.

17. Nagoshi Michael H., *et al*. "The Impact of Curricular Changes on the Geriatrics Knowledge, Attitudes and Skills of Medical Students". *Gerontology and Geriatrics Education* 28.3 (2008): 47-58.

18. Kong Weijia., *et al*. "The Establishment of Paired-Standardized Patients and Its Application in the PBL Teaching of Otorhinolaryngology". *Journal of Clinical Otorhinolaryngology, Head, and Neck Surgery* 22.16 (2008): 764-765.

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