Am J Transl Res 2024;16(1):200-207
www.ajtr.org /ISSN:1943-8141/AJTR0153339

Original Article

Rain Classroom and PAD class blended learning mode effectively improves teaching quality in a surgical nursing course

Hui Lv[1,2*], Lingjiao Tang[2*], Guirong Luo[2], Minglv Meng[3], Qianying Luo[2]

[1]Modern Industrial College of Biomedicine and Great Health, Youjiang Medical University for Nationalities, Baise, Guangxi, China; [2]College of Nursing, Youjiang Medical University for Nationalities, Baise, Guangxi, China; [3]College of Public Health and Management, Youjiang Medical University for Nationalities, Baise, Guangxi, China. [*]Equal contributors and co-first authors.

Received September 8, 2023; Accepted December 4, 2023; Epub January 15, 2024; Published January 30, 2024

Abstract: Objectives: To investigate the effect of Rain Classroom and Presentation-Assimilation-Discussion (PAD) class blended learning mode on a surgical nursing course. Methods: In this retrospective study, a total of 212 nursing undergraduates of Youjiang Medical University for Nationalities were selected as the research objects. There were 102 participants taking the traditional teaching model, assigned into the control group. The remaining 110 participants taking Rain Classroom and PAD class blended learning mode were assigned into the observation group. A questionnaire survey was conducted after the intervention. Results: After the intervention, the comprehensive assessment score of the observation group was higher than the control group ((83.8 ± 2.64) vs. (81.71 ± 3.74), P = 0.01). The independent learning ability ((81.61 ± 12.04) vs. (77.46 ± 4.23), P = 0.001), and self-efficacy ((27.78 ± 4.18) vs. (26.39 ± 4.67), P = 0.023) were higher in the observation group than those in the control group. The course satisfaction of the observation group was higher than that in the control group (79.09% and 65.69%, P = 0.029). Conclusions: The blended mode of Rain Classroom with PAD class effectively improves teaching quality, academic performance, self-learning ability, self-efficacy of students, and increased students' satisfaction with teaching methods.

Keywords: Rain Classroom, PAD Class, blended learning, surgical nursing course

Introduction

Nursing is a highly practical and comprehensive applied discipline [1]. Based on the previous experience in educating nursing students, the clinical nursing competence of nursing students is related to their nursing skills and the mastery of clinical professional knowledge [2]. The importance of Surgical Nursing, as a core course in the professional curriculum of senior nursing students, is exceptional. This course covered several practical techniques and theoretical knowledge [3, 4]. Some vocational colleges and universities are still implementing the traditional teaching mode in teaching Surgical Nursing because of the influence of the professional level of the teaching team and the traditional educational concepts [5-8]. This model is characterized by insufficient interest and low motivation of nursing students. Most of them have difficulty improving their innovative thinking through classroom learning and practical operation. The main teaching characteristics of the conventional education model limit the knowledge breadth and depth of the students in studying Surgical Nursing course. This is not conducive to the enhancement of the professional skills of the nursing students [9, 10]. Attracting nursing students' interest in learning achieves better teaching results. This is the challenge faced by the teaching staff.

The Presentation-Assimilation-Discussion (PAD) classroom teaching model is a new teaching model proposed by Prof. Zhang Xuexin of Fudan University in 2014 [11]. The model advocates dividing teaching into three processes: presentation, assimilation, and discussion. The PAD

teaching mode is a classroom pair of points model. This involves the process of a lecture, the realization of the whole process of teaching teachers, students in the classroom self-study, and discussion of the teaching method. Applying the chapter of the lecture to the difficulty of the task is minimal and the knowledge is relatively easy [12]. The core concept of PAD is to allocate the classroom time to teachers' lectures and students' discussions. The key innovation is that it affirms the importance of teachers' lectures and emphasizes the personalized internalization and assimilation of students both in and after the class. The PAD teaching mode emphasizes the importance of discussion. This innovative mode helps to improve students' comprehension ability [13].

How to efficiently promote students' internalization and absorption of knowledge and how to effectively supervise students' group discussions are problems that need to be solved in the implementation of the PAD teaching model. Rain Classroom is an intelligent teaching tool jointly researched by Xue Tang Online and the Office of Online Education of Tsinghua University [14]. This tool integrates IT tools into Powerpoint and mobile terminals. It plays the role of a bridge, connecting extracurricular learning and classroom learning well. Through pre-study, courseware push, class check-in, classroom live broadcast, random roll call, pop-up interaction, time-limited question and answer, classroom data collection, real-time Q&A after class, and lecture feedback. It realizes the consistency of the teaching process throughout pre-course, class, and post-course, that help reform and innovate the teaching activities. The study on the teaching effect of the combined teaching mode of Rain Classroom and PAD teaching mode is scarce.

The present study intended to evaluate the feasibility and effectiveness of the PAD combined with Rain Classroom teaching model in nursing courses, with a view to improve the teaching quality of nursing, and to extend the results of the study to provide a reference basis for the related studies.

Methods

Study design

In this retrospective study, a total of 212 students from Youjiang Medical University for Nationalities were included in this study. There were 102 participants assigned into the control group to take the traditional teaching model. The remaining 110 participants were assigned into the observation group to take the Rain Classroom and PAD class blended learning mode. All the students voluntarily participated in this study. The study was approved by the Ethics Committee of Youjiang Medical University for Nationalities. All methods were performed in accordance with relevant guidelines and regulations.

Intervention strategies

The control group received traditional teaching model, and the observation group received the Rain Classroom and PAD class blended learning mode. (1) Teachers were responsible for pushing preview content, MOOC videos, self-test questions, assessing preview results, and answering questions online in the Rain Classroom. Students were responsible for completing the preview and solving problems in the Rain Classroom through independent study. (2) Teachers deliver key learning points, display PPTs, and host pop-up interactions in the virtual classroom. Students actively attended and took tasks and tests in real time and interacted with feedback. (3) Teachers pushed self-study resources, assigned case analysis homework, and provided online correction and feedback. Students learned independently, searched and read literature, and completed and submitted assignments online. (4) Students discussed in groups, evaluated each other, shared presentations, and showed results of discussions under the guidance of the teacher. (5) The teacher pushed post-course case study questions and learning resources through Rain Classroom to inspire advanced thinking. Students completed the revision of case study questions, interactive submission, and feedback on effectiveness (**Figure 1**).

Measurement

The primary indicators included the learning effects and self-efficacy. Formative assessment methods [15] were used to comprehensively assess the learning effects of the two groups of students (comprehensive assessment score = online score × 40% + offline score × 60%). Online scores included Rain Classroom preview completion, classroom atten-

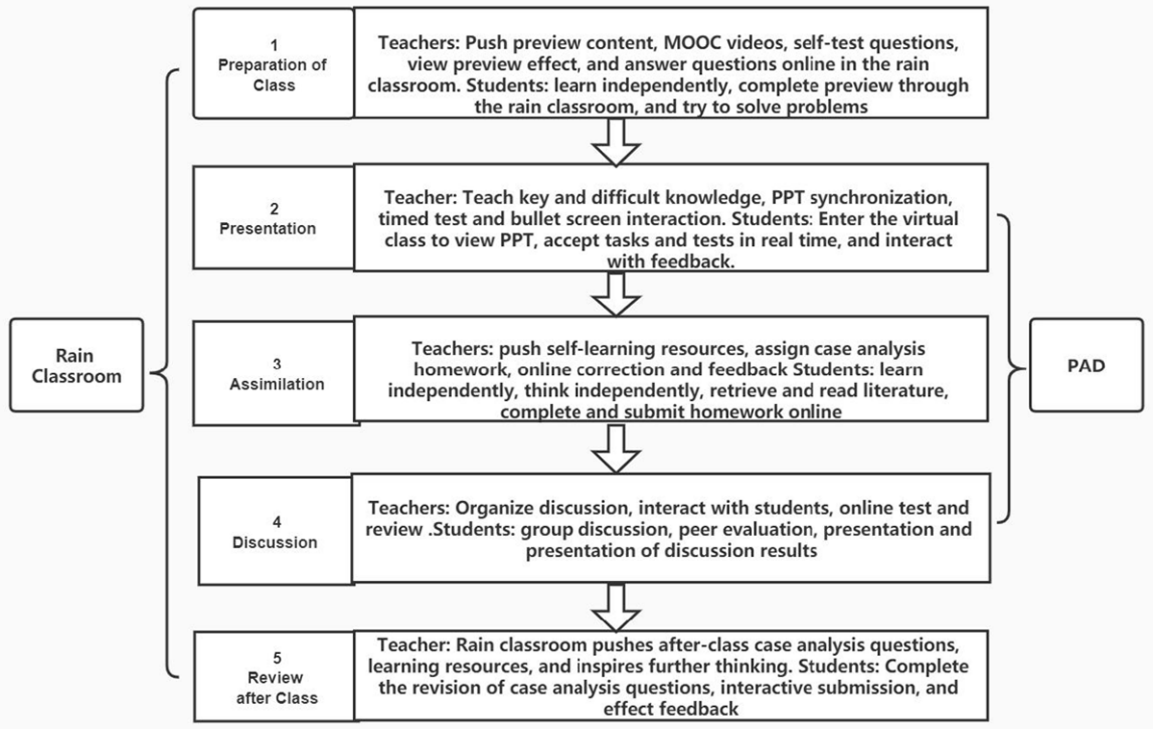

Figure 1. The process of Rain Classroom and PAD class blended learning mode. PAD class: Presentation-Assimilation-Discussion class.

dance, classroom test and after-class homework completion, classroom participation, and performance. Offline scores included end-of-period scores, skill evaluation, virtual simulation operation scores, and case discussion assignments. The independent learning abilities of the two groups were evaluated using an independent 30-item learning capacity rating scale [16]. Items were scored on a five-point Likert scale (1 = completely inconsistent; 5 = completely consistent). Items 14, 20, 21, and 28 were scored reversely. The total score was 30-150, with higher scores indicating more powerful independent learning ability. Cronbach's α coefficient of the scale was 0.822 and split-half reliability was 0.788. The ten-item Chinese version of the General Self-Efficacy Scale (GSES) was used to assess self-efficacy [17]. Answers were rated on a four-point Likert scale (1 = completely inaccurate; 4 = completely accurate). The total score was 10-40, with higher scores indicating higher self-efficacy. Cronbach's α coefficient for this scale was 0.81.

The secondary indicators included students' satisfaction. The satisfaction included teaching methods, the effectiveness of knowledge acquisition, case suitability, teaching enlightenment, degree of knowledge mastery in the classroom, and overall curriculum satisfaction.

Data collection

Online questionnaires were issued to the participates through the Star platform (https://www.wjx.cn/), and the data were collected. Before completing the questionnaires, participants were informed of the study's purpose and criteria for removing invalid questionnaires. To ensure data reliability, questionnaires were considered invalid when: the question were partially completed, the same answers were selected for successive questions, and the answers were presented in the form of "Z". A total of 212 questionnaires were collected from March 15 to June 5, 2022.

Data analysis

Data were analyzed using SPSS 26.0. The characteristics were analyzed with descriptive statistics. Measured data were expressed as (mean ± SD) and independent sample t test

Table 1. Participant characteristics

Index	Control group	Observation group	t/χ^2	P
Age	20.30 ± 0.84	20.27 ± 0.80	0.277	0.782
Gender			0.019	0.890
Male	24 (23.53)	25 (22.73)		
Female	78 (76.47)	85 (77.27)		

and paired t test were used for comparison between groups or comparison before and after the observation within the group. The counted data were expressed as number or percentage and comparisons were performed using the χ^2 test. P<0.05 was considered significant.

Results

General characteristics

This study included 212 participants. The control group contained 102 participants including 78 female students (76.47%) and 24 male students (23.53%). Their average age was 20.30 years old. The observation group comprised 110 people including 85 female students (77.27%) and 25 male students (22.73%). Their average age was 20.27 years old. The age and gender were not statistically different between the two groups (all P>0.05; **Table 1**).

Comparison of comprehensive assessment score between the two groups

The average scores for the comprehensive evaluation was (81.71 ± 3.74) in control group. This was significantly lower than the (83.8 ± 2.64) in the observation groups (P<0.05) (**Table 2**).

Comparison of independent learning ability scores between the two groups

Before implementation, there was no significant difference in the independent learning ability between the two groups (P = 0.661). After implementation, the students' self-learning ability was significantly higher in the observation group than that in the control group (P = 0.01; **Table 3**).

Comparison of self-efficacy between the two groups

Before implementation, there were no significant differences in the GSES scores between the two groups (P>0.05). After implementation, the GSE score in the observation group was significantly elevated and significantly higher than that in the control group (both P<0.05). There were no significant differences in the GSES scores in the control group before and after implementation (P>0.05; **Table 4**).

Satisfaction with teaching methods

The satisfaction toward the teaching model of the observation group was significantly higher than that of the control group (79.09% and 65.69%, P = 0.029; **Table 5**).

Discussion

Improving academic performance

Our results demonstrated that Rain Classroom + PAD Class was more helpful for students on knowledge mastery and academic performance than Rain Classroom alone. This was consistent with previous studies [18-20]. Teachers can communicate with students in real-time through Rain Classrooms and urge students to complete the preview. Students who participated in interactive communication during the lecture were more active in thinking. Some students rarely participated in speeches and discussions [21-23]. With the implementation of PAD Class, all students think, discuss, and display PPT. The discussion and assimilation stages of the PAD Class included teacher guidance, group analysis, and self-thinking. This gradually transformed students from passively accepting knowledge to actively asking and answering questions, improving knowledge acquisition [24-26]. The constructivist theory holds that student-centered cognitive subjects are active constructors of knowledge structure, and teachers help and promote the construction of students' knowledge [27-29]. The key lies in emphasizing learners' active exploration, knowledge discovery, and structure construction of the learned knowledge. In this study, the teaching mode provided students with a good learning environment, including independent learning, assisted learning, and learning effect evaluation. The process of students proposing problems, thinking independently, and solving problems in this artistic conception embodied active construction.

Independent learning ability

For nursing students, self-learning ability refers to the ability to use metacognition, objective

Table 2. Comparison of academic performance between the two groups

Evaluation index	Control group	Observation group	*P*-value
	M ± SD	M ± SD	
1. Online scores (40%)	93.29 ± 4.71	93.57 ± 2.36	0.002
2. Offline scores (60%): A+B+C+D	83.01 ± 2.91	84.42 ± 2.83	0.016
A. End-of-period scores (36%)	65.39 ± 7.68	67.79 ± 6.1	0.001
B. Skills assessment (12%)	81.96 ± 5.8	87.16 ± 8.84	0.014
C. Virtual simulation scores (6%)	97.69 ± 2.65	98.7 ± 3.47	0.02
D. Case discussion (6%)	84.6 ± 3.39	86.44 ± 1.66	0.01
Comprehensive assessment scores (100%): 1+2	81.71 ± 3.74	83.8 ± 2.64	0.01

Table 3. Comparation of independent learning ability between the two groups

Item	Before class				After class			
	Control group	Observation group	t	P	Control group	Observation group	t	P
Independent learning ability	72.11 ± 6.19	72.48 ± 4.40	0.510	0.611	77.46 ± 4.23	81.61 ± 12.04	3.394	0.001
Learning motivation	8.34 ± 1.98	8.55 ± 0.89	0.947	0.345	8.50 ± 1.54	9.05 ± 2.17	2.123	0.035
Self-management ability	39.78 ± 4.42	39.33 ± 3.92	0.510	0.611	39.43 ± 3.50	41.31 ± 8.55	2.121	0.036
Learning cooperation ability	13.87 ± 1.33	13.93 ± 1.57	2.74	0.784	13.69 ± 2.72	14.42 ± 2.32	2.114	0.036
Information quality	10.11 ± 1.93	10.66 ± 1.63	2.270	0.024	15.84 ± 1.76	16.84 ± 3.30	2.761	0.06

Table 4. Comparison of self-efficacy between the two groups

Group	Before class	After class	T-value	*P*-value
Control group	25.77 ± 4.40	26.39 ± 4.67	0.95	0.35
Observation group	25.32 ± 3.27	27.78 ± 4.18	4.58	0.001
T-value	0.86	2.29	-	-
P-value	0.39	0.023	-	-

workforce, and material resources to obtain the knowledge and skills necessary for high-quality nursing services. Components included self-management ability, information acquisition ability, and learning cooperation capability [30]. According to the national standard of nursing teaching quality, students should have the basic ability of independent learning, critical thinking, communication, cooperation, and innovative development. The present results indicated that the self-learning abilities of both groups improved after the intervention. The total score of independent learning abilities was higher in the observation group than in the control group. Teachers issued learning tasks and associated learning materials to students through Rain Classroom one week before class. Students previewed the materials on their own time, strengthening their learning and time management abilities. This helped them understand their mastery of knowledge, identify questions through preview and pre-class self-evaluation, and seek answers through online and offline channels. Students could seek help from teachers, improving their problem solving ability. Students' critical thinking and communication skills were cultivated during the course through group learning, discussion, and reporting. Students improved their literature retrieval, information acquisition abilities, information analysis, and processing skills through discussion and writing reports. The course cultivated students' team consciousness in the learning process.

Self-efficacy

Self-efficacy is an individual's judgment of their capability to organize and execute the courses of action required to achieve desired performance [31]. Within the academic context, self-efficacy is described in terms of Academic Self-Efficacy (ASE). This defines learner judgments about their ability to successfully attain educational goals [32]. The main predictor of academic success among nursing students was performance self-efficacy. Based on the constructivist teaching model, Rain Classroom

Table 5. Comparison of satisfaction with teaching methods between the two groups

Item	Control group (n = 102)		Experimental group (n = 110)		X^2	P
	Satisfied [n (%)]	Dissatisfied [n (%)]	Satisfied [n (%)]	Dissatisfied [n (%)]		
Teaching methods	75 (73.53)	27 (26.47)	93 (84.55)	17 (11.45)	3.905	0.048
Effectiveness of knowledge acquisition	78 (77.45)	23 (22.55)	98 (89.09)	12 (10.91)	5.202	0.023
Case suitability evaluation	65 (63.73)	37 (36.27)	85 (77.27)	25 (22.73)	4.694	0.030
The teaching of enlightenment	68 (66.67)	34 (33.33)	91 (82.73)	19 (17.27)	7.281	0.007
The mastery of the classroom knowledge	66 (64.71)	36 (35.29)	86 (78.18)	24 (21.82)	4.736	0.030
Total satisfaction	67 (65.69)	35 (34.31)	87 (79.09)	23 (20.91)	4.785	0.029

realizes the efficient connection of online and offline teaching, promoting students' enthusiasm and initiative in learning. PAD Class incorporates the teacher's leadership and the students' subjectivity. Each student had a clear learning goal. Case analyses, critical thinking, independent learning, group discussion, reporting, group mutual evaluations, and cooperative learning and teaching mobilized students' learning passion and initiative. Students were more confident as they mastered knowledge through discovering and solving problems. During class, teachers' comments and encouragements promoted students' affirmation of their ability, improving self-efficacy. The present results revealed that students in the observation group had a higher sense of self-efficacy after the intervention.

Satisfaction with teaching methods

Satisfaction was higher in the observation group than in the control group, particularly for effectiveness of knowledge acquisition, teaching of enlightenment, mastery of the classroom knowledge, and case suitability evaluation. Students considered this teaching model effective. It could be beneficial in surgical nursing teaching.

Limitations and recommendations

Some limitations of this study should be noted. We cannot rule out the possibility of students answering questions in a way of using network retrieval. These study results cannot be generalized to all students because this was a small sample research on a surgical nursing course. Future studies should explore whether a Rain Classroom and PAD class blended learning mode serves the learning goals of other courses in the curriculum.

Conclusion

Rain Classroom and PAD Class blended learning utilizes network technology and mobilizes students' enthusiasm and learning initiative. This method focuses on students, with teachers as guides, to facilitate active and collaborative learning of students. This method could improve the teaching effect, students' academic performance, and stimulate students' independent learning abilities.

Acknowledgements

This work was supported by the 2021 Guangxi Higher Education Undergraduate Teaching Reform Project (grant number: 2021JGB302), the 2021 Guangxi Vocational Education Teaching Reform Research Project (grant number: GXGZJG2021B210), and High-level Talent Scientific Research Projects of Youjiang Medical University for Nationalities (grant number: yy2019rcky023).

Written informed consent was obtained from participants to contribute to the study (grand number: 2022072301).

Disclosure of conflict of interest

None.

Address correspondence to: Qianying Luo, College of Nursing, Youjiang Medical University for Nationalities, Baise, Guangxi, China. Tel: +86-18907762708; E-mail: lvhuiphd@163.com

References

[1] Upadhyay N, Upadhyay S, Abed SS and Dwivedi YK. Consumer adoption of mobile payment services during COVID-19: extending meta-UTAUT with perceived severity and self-efficacy.

International Journal of Bank Marketing 2022; 40: 960-991.
[2] Pan LY, Cao MM, Huang BL, Luo K and Tang Y. Online teaching pattern in the application of the surgical nursing teaching. Journal of Mudanjiang Medical College 2021; 2021: 162-164.
[3] Ouyang XP, Shu L, Chen D and Zhang Q. Application of classroom teaching in surgical nursing. Chinese Nursing Education 2017; 7: 496-498.
[4] Tang YZ. Research on the application effect of mixed teaching based on information technology in surgical nursing teaching. Contemporary Nurse 2019; 2: 176-177.
[5] Jerry W. The maturing of constructivism instructional design: some basic principles that can guide practice. Educational Technology Research and Development 2000; 40: 5-16.
[6] He KK. A new theory of constructionism-criticism, absorption and innovative development of Western constructionism by Chinese scholars. Chinese Educational Science 2021; 4: 14-29.
[7] Wang ZX, Wang L, Zhao XL and An Q. Application of PAD Class + Rain Classroom mixed teaching model in the biochemistry of nursing speciality. Journal of Higher Education 2021; 10: 93-97.
[8] Zeng RX. School held an online press conference to announce the launch of intelligent teaching tools-rain classroom. Asia-Pacific Education 2016; 24: 3.
[9] Wang SG. Rain Classroom: the wisdom teaching tool in the context of mobile internet and big data. Modern Educational Technology 2017; 27: 26-32.
[10] Li P, Li ZL and Yi SM. Application of whole-process blended teaching based on Rain Classroom in surgical nursing teaching. Journal of Nursing 2019; 33: 72-74.
[11] Xie F. Design and practice of a blended teaching model based on "Rain Classroom": taking the courses of pathogen biology and immunology as an example. Health Vocational Education 2019; 37: 63-64.
[12] Li N, Wang S, Yang J and Zhang L. Application of blended teaching based on Rain Classroom in biochemical lipid metabolism teaching. Basic Medical Education 2018; 20: 491-493.
[13] Liu A, Luo Y, Zhang X, Tian QX, Li YF and Cao WZ. Application of TBL teaching method based on Rain Classroom in emergency clinical teaching of nursing undergraduates. PLA Nursing Journal 2021; 38: 87-90.
[14] Zhou P, Guan JC, Gao SX and Xia YH. Application of Rain Classroom in medical microbiology teaching. Basic Medical Education 2018; 20: 399-402.
[15] Lv YL, Su H and Wu Z. The application of Rain Classroom in professional English teaching. Education and Teaching Forum 2019; 1: 168-169.
[16] Wang L. Discussion on the biochemistry blended teaching mode based on Rain Classroom. Journal of Hexi University 2019; 35: 125-128.
[17] Xiong J. Research on internet online teaching problems and countermeasures. Fortune Times 2020; 11: 128-129.
[18] Zhang XX. PAD Class: a new attempt in university teaching reform. Fudan University Education Forum 2014; 12: 5-10.
[19] Liu XY and Guo XY. Research on the teaching mode of college English writing based on dynamic evaluation and PAD class concepts. Journal of Zhejiang Foreign Studies University 2017; 1: 47-53.
[20] Gu J. Practical research on online teaching of surgical nursing in PAD class. Journal of Jiamusi Vocational College 2021; 37: 135-136.
[21] Ma JS, Sun Q and Wang YJ. The application of the paired classroom teaching mode in the teaching of introductory nursing. Journal of Nursing 2018; 25: 5-7.
[22] Yang HL, Nie L, Li JW, Xiao X and Zi D. The application effect of the paired classroom teaching method in the teaching of clinical skills in obstetrics and gynecology. Journal of Guizhou Medical University 2020; 45: 122-124.
[23] Guo YX, Liang X and Zhang M. The application of flipped classroom combined with PAD class teaching mode in geriatric nursing teaching. Journal of Nursing 2020; 35: 72-74.
[24] Feng JB, Zhou X and Li JP. The application of the two-part class in the pharmacology teaching of nursing undergraduates. Zhonghua Nursing Education 2021; 18: 45-49.
[25] Sun Y, Zhang QJ, Liu LL and Tan HM. Research and practice of the CBL+PBL model integrated into the dual-class classroom in nursing teaching in obstetrics and gynecology. Continuing Medical Education 2018; 32: 37-39.
[26] Tao H, Yuan Y, Wu L, Yang QR and Xu KJ. The application of the paired classroom in the teaching of introductory nursing. Comparative Research on Cultural Innovation 2020; 4: 100-102.
[27] Tian G, Gao H, Zhang N, Li JZ and Li KY. Application of PAD class combined with WeChat interactive classroom in teaching. China Continuing Medical Education 2021; 13: 68-71.
[28] Guo SR. Research and practice based on the "Internet + Paired Classroom" hybrid teaching model. Heilongjiang Education (Theory and Practice) 2017; 3: 39-41.
[29] Qu TF. An empirical study of the teaching mode with a combination between rain class and PAD class in the teaching of college English

writing. Journal of Neijiang Normal University 2020; 35: 89-94.
[30] Xu HW and Hu Y. The teaching of "traditional Chinese medicine nursing" based on constructivism theory: application of the "Rain Classroom + PAD Class". Higher Vocational Education and Modern Nursing 2020; 3: 402-406.
[31] Edgar E, Franz F and Axel B. GPOWER: a general power analysis program. Behav Res Methods Instrum Comput 1996; 28: 1-11.
[32] Zhang XY and Li XH. Manufacture of an evaluation tool for the self-learning ability of nursing specialty students. Chinese Nursing Research 2009; 23: 639-640.