

Comparison of rain classroom teaching and traditional teaching methods in teaching undergraduate nursing students of stomatology

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Abstract

Background: Rain classroom teaching (RCT) is a current teaching method to increase the interaction between teachers and students. This paper aims to [investigate](#) the influence of rain classroom teaching and traditional teaching on the self-directed learning ability (SDLA) of nursing undergraduates.

Methods: This was a randomized controlled study. The research enrolled two classes of junior nursing undergraduates who were randomly divided into two groups. The content and time of stomatology courses were the same. The control group (n = 32) adopted the traditional teaching method and the experimental group (n = 31) used the RCT method. SDLA, satisfaction and teaching quality were evaluated by questionnaire. A final examination was used to estimate the quality of learning.

Results: The complete data showed that the rain classroom group had better results than the traditional group. The rain classroom group had higher SDLA, satisfaction, teaching measures, teaching effectiveness and final examination scores.

Conclusion: The rain classroom teaching method is more effective than the traditional teaching method in promoting SDLA and teaching quality for undergraduate nursing students in stomatology.

Background

Stomatology is a complex subject for nursing undergraduates because it has a strong practical component and fewer in-class hours. All nursing undergraduates must study stomatology to develop knowledge for the future. Compared with other internal medicine and surgery courses, stomatology has fewer class hours and places more emphasis on practice, which demands higher teaching requirements for the theoretical teaching of stomatology. Although student-centred traditional teaching is widely used, this approach easily leads to passive learning [1]. Self-directed learning (SDL) is an effective strategy to promote students' lifelong learning [2]. Medical students need to develop self-directed learning abilities (SDLA) to adapt to changing technology [3]. Therefore, new teaching methods should be applied to the teaching of stomatology to improve students' learning interest and the development of SDLA.

Teachers play a dominant role in traditional teaching methods in which teachers lecture and students listen. The theoretical content of stomatology is boring and abstract, which makes it difficult to comprehend and for students to stay concentrated. Tedious content and old teaching methods will lead to a decrease in students' enthusiasm for learning. Recently, a variety of teaching methods have emerged, such as Case-based learning, Problem-based Learning, flipped classrooms, and rain classrooms, all of which have achieved good teaching results [4-6].

The rain classroom is a teaching software and a small plug-in to PPTs. The Online Education Office of Tsinghua University and Xuetang Online jointly developed this software. With the help of WeChat, the software is designed to achieve interaction with students before, during and after class, which improves students' learning interest and enlivens the classroom atmosphere. Using rain class, we can pose single

choice questions, multiple-choice questions and voting questions, insert MOOCs, etc. in PPT, and incorporate previewing courseware and uploading review materials and exercises after class. In-class exercises, voting, barrage and random roll calls can be used to increase classroom interaction and stimulate students' enthusiasm. At the same time, class courseware is synchronized to students' mobile phones for easy learning and review. At present, it is widely used in colleges and universities.

In this study, rain classroom teaching was used to teach stomatology to undergraduate nursing students. The teaching effect was measured through a questionnaire survey and final examination results.

Methods

The Ethics Committee of Stomatological Hospital affiliated with China Medical University authorized this study in 2018 (2018-32). All methods were performed in accordance with the relevant guidelines and regulations. Students provided their written informed consent prior to responding to the survey questions.

Participants

A total of 63 junior nursing undergraduates from China Medical University were recruited as research subjects. Two classes were divided into experimental and control groups by lottery. The experimental group, namely, the rain classroom teaching group, consisted of 31 students that comprised 1 male and 30 females. The average age was 21.23 ± 0.76 years old. The control group consisted of 32 females, and the average age was 21.00 ± 0.76 years old. All students participated in the study voluntarily. The teaching content of stomatology was the same for the students in the two classes. The students of both groups did not live in the same dormitory. The learning methods of the two groups of subjects were not contaminated. Differences in the general demographic data of the two groups were not significant ($p > 0.05$).

Design

The teaching content included oral and dental anatomy, oral and maxillofacial anatomy, dental pulp, cleft lip and palate, oral and facial infection and oral tumour care. The control group adopted the traditional teaching method, with priority given to teaching. Students listened and took notes. At the end of teaching, the teachers summarized the course and assigned homework. In this approach to teaching, the teachers were the centre of the learning environment while the students were passive learners and knowledge containers. The teachers in the two groups were the same, and each lesson lasted for 45 minutes. The total number of theoretical lessons was 20, lasting 2 months.

Rain classroom teaching was adopted in the experimental group. The rain class is a small plug-in inserted in PPTs. After downloading the rain class program to the teacher's computer, the teacher can include single-choice questions, multiple-choice questions and voting questions in the PPT. Before class, teachers developed the rain courseware, including preview courseware, teaching courseware and a review of expansion materials. The teacher paid attention to the official account of rain class in WeChat and set

up courses and classes in the rain classroom; in this way, preschool materials and after-school development exercises could be sent to mobile phones. In the classroom, the teacher logged into the rain classroom courseware with the function of WeChat and displayed the "start teaching" two-dimensional code. The students entered the classroom by scanning the QR code on WeChat so that the teacher could master the students' arrival situation. In class, using the function of random roll call, the teacher asked questions about the key teaching content randomly; each student had the possibility of being selected, so to a certain extent it mobilized the interest of students. To focus the students' attention, the teacher carried out a classroom test of 1-2 questions every few knowledge points. The teacher could view the test results of the students in real-time and display the test results on the screen. This encouraged the students to master the course material and adjust their attention and learning methods in a timely way. Students could also send questions to the teacher at any time through the barrage or contribution functions, and the teacher would explain or answer questions according to the students' situation. In the teaching process, the teacher's app was synchronized to the students' mobile phone, and students could click to collect and focus on the content they did not understand, which was convenient for reviewing and consolidating in the future. After class, teachers released review and expansion materials, including exercises, MOOCs, and literature, etc., to consolidate the classroom content, compensate for the lack of class time, and expand the teaching content. Teachers could see the preview, review and class situation of students in the background of rain class. For students who had not prepared and reviewed in time, teachers could issue announcements as reminders. Students could preview and review anytime and anywhere on their mobile phones. Compared with paper learning materials, rain classrooms were more convenient. Students' classroom learning could form a learning report after class, which helped teachers evaluate students' overall learning situation, and target teaching and the continuous improvement of teaching methods. The teaching time of each course was 45 minutes, and the total number of theoretical lessons was 20, lasting 2 months.

Effectiveness evaluation

The teaching effect of the two teaching methods was assessed in the form of a questionnaire and final examination. Questionnaires on SDLA were distributed ahead of the first course. At the end of the course, questionnaires on teaching quality evaluation and satisfaction were carried out.

SDLA questionnaire: The SDLA questionnaire [7] contained 6 subscales: learning motivation (10 items, scores 10 to 50), learning method (14 items, scores 14-70 points), learning behaviour (13 items, scores 13-65), time management (3 items, scores 3 to 15), environment management (4 items, scores 4-20), and the social dimension (8 items, scores 8 to 40), with a total of 52 items. All questions had a 5-point Likert-type option ranging from "strongly disagree" to "strongly agree". The highest total score was 260, and the lowest score was 52. The higher total score meant stronger SDLA. The Cronbach's alpha of the whole questionnaire was 0.916.

Teaching quality evaluation: The teaching quality evaluation questionnaire[8] contained 5 subscales: professional quality (5 items), teaching attitude (4 items), teaching measure (4 items), teaching ability (8

items), and teaching effectiveness (5 items), with a total of 26 items. A 5-point Likert-type scale was adopted for each item, ranging from very dissatisfied to very satisfied. The Cronbach's alpha of the whole questionnaire was 0.967. The Cronbach's alpha of each subscale was 0.938, 0.884, 0.919, 0.860, and 0.895, respectively. The Cronbach's alpha of the whole questionnaire was 0.969.

Satisfaction questionnaire: The satisfaction questionnaire had 1 item, with response categories ranging from 1 (very dissatisfied) to 5 (very satisfied). The teaching satisfaction score was the sum of each student's satisfaction score/the total number of students (full score was 5).

Theory test: Two weeks after the end of the semester, a theory test was conducted, with a full mark of 100. The test of the theoretical teaching content used question types that included single choice, a right/wrong judgement, English-Chinese translation, short answer questions, fill-in-the-blank questions, and concept questions. The test was reviewed by the same teacher who had taught the students.

Statistical analysis

All data were analysed by SPSS version 13.0 software. Demographic and satisfaction data are expressed as frequencies and percentages. Pearson chi square test or two independent samples t test were used to compare the demographic data of the two groups. Descriptive data were used to describe the level of SDLA, the teaching quality and theory tests. Independent-samples t-tests were used to compare the differences in SDLA, teaching quality and theory test scores between the two groups. The Mann–Whitney U test was used to compare the satisfaction of the two groups. $P < 0.05$ was regarded as the significant difference.

Results

Demographic data of the two subjects

The demographic data of the two subjects are as follows. See Table 1.

Table 1. Demographic characteristics of the control and experimental groups

Variable	Control group (n = 32), N (%)	Experimental group (n = 31), N (%)	t/c^2	p
Sex			0.000	0.987
Male	0	1 (3.2)		
Female	32 (100)	30 (96.8)		
Age (years), mean (SD)	21.00 (0.76)	21.23 (0.76)	-1.176	0.244
Community			0.390	0.532
Rural	18 (56.3)	15 (48.4)		
Urban	14 (43.7)	16 (51.6)		
Student leader			0.011	0.916
Yes	13 (40.6)	13 (41.9)		
No	19 (59.4)	18 (58.1)		
Primary learning method			3.361	0.186
Internet	4 (12.5)	8 (25.8)		
Textbook	27 (84.4)	20 (64.5)		
Library or other	1 (3.1)	3 (9.7)		
Reasons for choosing nursing science			5.895	0.052
Personal reasons	26 (81.2)	18 (58.1)		
Parents' reasons	2 (6.3)	9 (29)		
Others	4 (12.5)	4 (12.9)		
Mother's highest level of education			0.152	0.697
High school and below	27 (84.4)	25 (80.6)		
College and above	5 (15.6)	6 (19.4)		
Father's highest level of education			0.918	0.338
High school and below	26 (81.2)	22 (71.0)		
College and above	6 (18.8)	9 (29.0)		
Truancy experience			0.009	0.926
Yes	11 (34.4)	11 (35.5)		
No	21 (65.6)	20 (64.5)		

Comparison of SDLA between the two subjects

The initial SDLA scores of the two subjects were not significantly different ($p > 0.05$). The data are shown in Table 2. The experimental group's total SDLA scores, learning motivation scores, learning methods and learning behaviour dimensions were significantly higher than those of the control group ($p < 0.05$). The SDLA scores are shown in Table 3.

Table 2. Comparison of self-directed learning ability between the two groups before the course (score, $\bar{x} \pm s$)

Group	Learning motivation	Learning methods	Learning behaviour	Time management	Environmental management	Sociality	Total score
Control group (n = 32)	32.81 ± 3.69	53.69 ± 5.40	43.91 ± 3.32	11.56 ± 1.63	16.78 ± 2.04	31.88 ± 4.05	190.63 ± 15.50
Experimental group (n = 31)	34.29 ± 4.63	53.45 ± 7.27	43.71 ± 4.64	11.16 ± 2.40	16.23 ± 2.73	31.42 ± 4.49	190.26 ± 22.28
t	-1.403	0.147	0.194	0.780	0.916	0.423	0.076
p	0.166	0.884	0.847	0.438	0.363	0.674	0.940

Table 3. Comparison of self-directed learning ability between the two groups at the end of the course (score, $\bar{x} \pm s$)

Group	Learning motivation	Learning methods	Learning behaviour	Time management	Environmental management	Sociality	Total score
Control group (n = 32)	34.56 ± 3.99	53.53 ± 4.86	44.75 ± 4.04	11.56 ± 1.59	15.91 ± 1.89	31.78 ± 4.56	192.34 ± 15.94
Experimental group (n = 31)	36.71 ± 4.00	56.74 ± 5.29	47.97 ± 4.63	12.26 ± 1.13	16.45 ± 1.59	33.06 ± 2.50	203.19 ± 12.28
t	-2.130	-2.511	-2.942	-2.003	-1.238	-1.379	-3.020
p	0.037*	0.015*	0.005**	0.050	0.220	0.173	0.004**

* $p < 0.05$

** $p < 0.01$

Comparison of teaching quality between the two subjects

The scores of teaching measures and teaching effectiveness of the traditional teaching group were significantly lower than those of the rain classroom group ($p < 0.05$). The total teaching quality score in the traditional teaching group was also lower than that in the rain classroom group, as shown in Table 4.

Table 4. Comparison of teaching quality between the two groups (score, $\bar{x} \pm s$)

Group	Professional quality	Teaching attitude	Teaching measure	Teaching ability	Teaching effectiveness	Total score
Control group (n = 32)	22.69 ± 3.04	18.13 ± 2.15	17.28 ± 2.45	36.53 ± 4.49	21.41 ± 2.51	116.03 ± 13.58
Experimental group (n = 31)	22.77 ± 4.10	18.74 ± 1.90	18.55 ± 2.23	37.48 ± 4.03	23.35 ± 2.48	121.42 ± 11.56
T value	0.096	-1.206	-2.142	-0.885	-3.095	-1.693
P value	0.924	0.233	0.036*	0.379	0.003**	0.096

* $p < 0.05$

** $p < 0.01$

Comparison of the satisfaction and test score between the two groups

The satisfaction of the traditional teaching group was lower than that of the rain classroom group, while there were no significant differences ($p > 0.05$). The final examination scores of the experimental group were also higher than those of the control group ($p < 0.05$). See Table 5.

Table 5. Comparison of the two groups' satisfaction with the course and examination scores (score, $\bar{x} \pm s$)

Item	Control group	Experimental group	Z/T value	P value
	(n = 32)	(n = 31)		
Satisfaction (N%)			-1.897	0.058
Neutral	3 (9.4)	3 (9.7)		
Satisfied	15 (46.9)	6 (19.4)		
Very satisfied	14 (43.8)	22 (71)		
Examination score	75.56±7.86	80.03±7.68	-2.282	0.026*

$p < 0.05$

Discussion

The rain classroom was jointly researched by Xuetang Online and the Online Education Office of Tsinghua University. It was officially open to the public free of charge in April 2016. The rain classroom is a hybrid teaching software based on PowerPoint and WeChat. It helps to connect teachers and students effectively through the internet. Rain classrooms combine PowerPoint and WeChat with complex information technology, enabling teachers and students to establish interactions and connections before, during and after class. Preclass preview courseware, such as MOOC videos, exercises and voice recordings, can be pushed to students' mobile phones. Teachers can arrange preview tasks, understand students' preview situations, and prepare targeted teaching. In class, real-time questions, answering, bullet screen interactions and random roll calls can improve students' enthusiasm for learning. Students receive PPTs and test questions in real-time on the mobile terminal and can provide feedback on the knowledge points they do not understand to the teachers through the "do not understand" button, which helps teachers understand the learning status of students in a timely fashion and provide targeted explanations. After class, the teacher will provide MOOC after-class review courseware in which videos, exercises and voice recordings are pushed to students' mobile phones to arrange review tasks after class, expand on advanced material of the discipline and broaden students' understanding. Rain classrooms are effective at helping curriculum reforms in colleges that are committed to increasing the interaction between teachers and students and improving students' self-directed learning [9].

Normally, students tend to review digital resources about two weeks before the exam [10]. Information and the internet develop exceedingly fast, and various social networks have emerged and dominated at different stages (i.e., QQ, microblogs, WeChat, Tiktok). Social network software has greatly influenced college students' behaviour, playing an increasingly irreplaceable role in college students' lives and learning. WeChat is the most popular social media platform in China [11] and the main social software used by Chinese college students [12]. WeChat has many functions, not only for social intercourse but also for health education [13–15] and teaching [9, 16]. Educational reforms should be carried out by integrating social media [17]; the combination of WeChat and software programs in teaching has been

executed well, helping to facilitate students' self-directed learning ability [18]. Rain classrooms have established seamless connections between teachers and students, which makes up for the lack of class time. Students can control learning hours, places, and learning progress via WeChat and the internet. In the rain class, preview materials and preview questions are released before class. During class, the courseware is synchronized to the mobile terminal, and random roll calls and interactive online answers are carried out. After class, development materials and review questions are released to enable students to prepare before the following class. In class, teachers explain and synchronize exercises to deepen the students' knowledge and development of skills. After class, frontier knowledge can be expanded, and the knowledge learned can be consolidated. Teachers can support students' participatory learning by providing guiding support and conditions that are conducive for learning [19].

The SDLA approach is that individuals make use of all learning resources, determine learning objectives, formulate learning methods, and evaluate learning effects. It is active, whether with or without help from others [20]. Nursing made great efforts to explore SDL readiness from the mid-1980s to 1998[21]. The SDLA has been regarded as an important contribution to nurses' professional careers [22]. The complexity of the conditions of patients and the speed with which medical knowledge is updated require nurses to have the ability of self-directed learning [23–25]. Nursing students must develop self-directed learning abilities in school, and the rain classroom teaching method is conducive to the improvement of self-directed learning. Rain classrooms provide students with digital learning resources, and learning is not restricted by time or place. In this study, the self-directed learning ability of the rain classroom teaching group was greatly improved, and students' final exam scores were significantly higher than those of the traditional teaching group. Some researchers have proven that greater self-directed learning abilities have a positive impact on academic results [26–27]. The satisfaction scores of the two groups were not significantly different, but the scores of the teaching effect and teaching measure dimensions in the rain classroom group were significantly higher than those of the traditional teaching group ($p < 0.05$). While self-directed learning is correlated with personal characteristics and demography [28], teachers should adopt individualized teaching methods. Rain classroom teaching stimulates the enthusiasm of students for learning, so it achieves a positive teaching outcome. At the same time, rain classroom teaching requires students to have sufficient mobile phone power and fast and stable network speed to ensure effective interaction with teachers. Both administrators and educators should reasonably configure power sockets and improve network speed to facilitate this type of learning.

The lack of a large sample size and multicentre large sample study is one of the limitations of this study. The two groups of students were from the same school, which may lead to contamination of the data. Second, we only observed the short-term teaching effect of rain classroom teaching; the long-term influence of rain classroom teaching on students' self-directed learning ability is not clear.

Conclusion

In this study, the rain classroom teaching method was used in the teaching of stomatology to nursing undergraduates. The novel teaching method not only enhanced the study interests of students and

improved the mood of the class but also promoted the SDLA and students' satisfaction. There are several reasons why nursing undergraduates like classroom teaching. First, students do not need to take notes during class with the help of rain classrooms, and they can concentrate on learning. Second, the preview and review materials pushed before and after class can help students effectively direct their class preparations and reviews. Third, exercises are sent to each student's mobile phone so that students can answer at the same time. The random roll call function of the rain classroom makes students feel fortunate to be called on. Finally, the rain classroom breaks the learning limitations of time and space; students can study anytime and anywhere using the phone and internet.

Multicentre, large sample and mixed research methods are needed to further explore the long-term influence and teaching effects of rain classroom teaching and traditional teaching on students' self-directed learning ability.

Abbreviations

Self-directed learning: SDL

Self-directed learning ability: SDLA

Rain classroom teaching: RCT

Declarations

Ethics approval and consent to participate

All study materials were approved by Committee on Human Experimentation of China Medical University (2018-32). All methods were performed in accordance with the relevant guidelines and regulations. Students provided their written informed consent prior to responding to the survey questions.

Consent for publication

Not applicable.

Availability of data and materials

The underlying datasets are available from the corresponding author on reasonable request.

Competing interests

The authors declare no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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Authors' contributions:

YJW , JBL and YQG were responsible for conception and design of the study. YJW and CL performed data extraction and data analysis. YJW and JBL wrote the manuscript. LLY and CL contributed to the revision of the manuscript. All authors have reviewed the manuscript and given final approval of the version to be published.

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