Journal of Contemporary Educational Research, 2022, Volume 6, Issue 5
http://ojs.bbwpublisher.com/index.php/JCER
ISSN Online: 2208-8474
ISSN Print: 2208-8466

Teaching Effect of Online Live Broadcasting with Screen Sharing and PowerPoint Recording and Broadcasting on Medical Students' Learning of Obstetrics and Gynecology

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Abstract: *Objective:* During the prevention and control of the outbreak of the new coronavirus, an upsurge of online teaching was set off in various teaching institutions. There is a relatively new online teaching method that has stood out, namely the screen sharing method. The purpose of this study was to compare the effectiveness of live broadcasting and PowerPoint recorded lectures in terms of medical students' mastery of knowledge. *Methods:* The study was carried out among medical students of class 1806 from the First Affiliated Hospital of Xi'an Medical University who were in their clinical years. The students were randomly divided into two groups, in which 15 students were enrolled in the live broadcast lecture group, while 13 were in the PowerPoint recorded lecture group. Each group underwent two weeks of teaching in obstetrics and gynecology. After the second week of the course, a knowledge post-test and satisfaction survey were carried out, and the same test paper was used again 14 days after the previous test. The knowledge post-test and satisfaction survey were carried out using the Dingding intelligent form. *Results:* With regard to the post-test knowledge, the scores of the students under the two teaching methods were high, indicating that the learning effects from the two methods are similar ($p > 0.05$). In terms of satisfaction, students showed more acceptance to screen sharing lectures ($p < 0.01$). *Conclusion:* In small-scale online teaching, live lecture with screen sharing is a better and more effective teaching method, and students are more likely to accept this teaching method.

Keywords: Medical education; Live lecture; Recorded lecture; Online teaching; Teaching effect

Online publication: May 30, 2022

1. Background

In the last 10 years, with the development of medical and health systems, medical education is facing many challenges [1,2], mainly focusing on two aspects: limited teaching time and saturated curriculum. In order to deal with these issues, the focus in medical education has begun to shift from the guidance of teachers to active learning [3,4]. Many studies have shown that teaching in the context of "Internet +" (online teaching) is an effective way to solve the aforementioned issues [5-7]. The characteristics of online teaching are able to meet the needs of medical education. In view of its extensive resource sharing capabilities, students are able to receive information from teachers easily [8]. The teaching resources generated under the "Internet +" mode are suitable for autonomous learning [9,10]. Its ease of use engenders a possibility for students to use

it anytime and anywhere. At present, students are using the online learning mode even outside the course, indicating that they have accepted online teaching. At the same time, the role of online teaching in medical education has also been recognized by major colleges and universities. Many teachers in colleges and universities have fully realized the status of online teaching in medical education. They are already using hybrid teaching methods or classroom-based online teaching methods. In several medical schools in the United States, attending online classes instead of physical classes has become a common phenomenon [11]. There are recorded lectures and live lectures. In the wide range of online teaching, there are different types of teaching modes, in which recorded lectures are only one of them. At present, many studies have described the effectiveness of online teaching as a whole, but only a number of studies have compared the differences between the effects of different types of online teaching methods.

The year 2020 is one to remember. The whole country was focused on the prevention and control of the COVID-19 pandemic. In this context, major teaching institutions have set off an upsurge of online teaching [12-14]. A relatively new online teaching method has stood out, that is the "class live broadcast" of a nailing platform, Dingding. Teachers can selectively appear on the screen, and multimedia can be displayed on the screen in real time, with a "blackboard" and interactive panel set next to it. Teachers can write on the "blackboard" in real time, while both, students and teachers can interact with each other by using the interactive panel; video interactions can also be carried out through the "Lianmai" function, which assist learners in focusing on the teaching process. Compared with the standard PowerPoint recorded and broadcasting lectures, live broadcasting lectures with screen sharing allow information to be conveyed more effectively [15].

The effect of learning is the key to evaluating different teaching methods. Some studies have pointed out that online teaching is not as efficient as classroom-based teaching, which mainly depends on how the existing teaching resources are used in combination with the teaching design to carry out teaching [16]. However, a large number of studies have shown that effective online teaching resources can still improve the quality of online teaching. It is believed that compared with PowerPoint recorded and broadcasting lectures, live broadcasting lectures with screen sharing can better meet these basic principles. The purpose of this preliminary study was to quantitatively evaluate and compare the teaching effects of live broadcast lectures with screen sharing and PowerPoint recorded lectures in terms of medical students' mastery of knowledge.

2. Methods

2.1. Research subjects

The research subjects were 29 students of class 1806 from the First Affiliated Hospital of Xi'an Medical University. The students participated in the study on a voluntary basis.

2.2. Course materials and production

The teaching materials were based on Obstetrics and Gynecology of the People's Medical Publishing House (Ninth Edition). The course contents included anatomy and physiology of the female reproductive system during the first week (2 class hours) as well as diagnosis and physiology of pregnancy during the second week (2 class hours). The teaching was conducted using two methods: live broadcast lectures with screen sharing, and PowerPoint recorded and broadcasting lectures. The PowerPoint recorded and broadcasting lectures were made in advance. The two methods were undertaken by the same teacher, and the teaching design was reviewed and approved by the Director of the Teaching and Research Office of Obstetrics and Gynecology, in order to ensure compliance with the teaching standards. For PowerPoint recorded and broadcasting lectures, the teacher used an Apple iPad and Apple Pencil; the built-in screen capture function of the iPad was used to record the video, a recording pen was used to record the audio, Apple iMovie was

used for video editing, and a laptop was used to upload the final PowerPoint recorded and broadcasting lecture video onto the "Superstar" learning platform. For the live broadcast lecture group, screen sharing was selected on Dingding's "class live broadcast" platform. The teacher used Microsoft Surface Pro for the live broadcast and Microsoft Surface Pen to write on the "blackboard."

2.3. Study design

Before the course, 29 students from class 1806 were invited to participate in the study. All 29 students agreed to participate in the study. A pre-test was carried out to evaluate students' mastery of the course content through a self-reported survey. The self-reported score was divided into five levels (1 = none, 2 = basic, 3 = intermediate, 4 = advanced, and 5 = expert). Students who reported as advanced or expert in terms of knowledge mastery were excluded from the study. The purpose of this study was to compare the teaching effects between the two groups. A random number generator in Microsoft Excel was used to divide the students into two groups (live broadcast lecture group and PowerPoint recorded lecture group). The course contents of the first and second weeks were taught to the two groups using the corresponding teaching methods. A knowledge post-test was carried out immediately after the second week of the course, and 14 days after the previous test, the same test paper was used again. The test paper included 20 multiple-choice questions, with 1 point for each question, and a total of 20 points. During the first knowledge post-test, a satisfaction survey was also distributed, which included 10 items. For each item, 5 options were given based on the 5-point Likert scale (1 = unsatisfied and 5 = very satisfied). The knowledge post-test and satisfaction survey were carried out using the Dingding intelligent form.

2.4. Statistical analysis

Statistical analysis was carried out on the knowledge post-test results and the satisfaction of the live broadcast lecture group and the PowerPoint recorded and broadcasting lecture group. All data were analyzed by using SPSS 24.0. All measurement data were indicated with mean ± standard deviation ($\bar{x}$ ± s), and t-test is used. Rank-sum test and statistical test standard were used for grade data $\alpha = 0.05$.

3. Results

All 29 students volunteered to participate in the study, and none were excluded because of their mastery of course content. The students were randomly divided into two groups: live broadcast lecture group (n = 16) and PowerPoint recorded lecture group (n = 13). Due to network issues, one student, from the live broadcast lecture group, failed to complete the study as required, but the remaining 28 students (live broadcast lecture group, n = 15; PowerPoint recorded lecture group, n = 13) successfully completed the requirements of the study.

From the knowledge post-test results immediately after the second week of the course, it can be seen that the scores of the students under the two teaching methods were high, indicating that the learning effects of the two methods are similar ($p > 0.05$). In terms of satisfaction, the students showed more acceptance to the screen sharing method (live broadcast lecture group: 17.20 ± 1.42; PowerPoint recorded lecture group: 16.77 ± 1.36). The knowledge post-test results after 2 weeks from the previous test showed that the scores of the two groups were still similar (live broadcast lecture group: 15.47 ± 1.81; PowerPoint recorded lecture group: 15.15 ± 1.46). However, both groups showed a decline in knowledge (live broadcast lecture group: 1.73 points; PowerPoint recorded lecture group: 1.62 points), as shown in **Figure 1**. There was no significant difference between the two groups in terms of the first (immediate) knowledge post-test scores ($p = 0.42$), and even the second knowledge post-test scores ($p = 0.62$). However, the decline in knowledge based on the post-test scores from the first knowledge post-test conducted immediately after the course to the second knowledge post-test after two weeks was significant under both teaching methods, indicating a

rapid decline in information storage regardless of the teaching method (live broadcast lecture group: $p < 0.001$; PowerPoint recorded lecture group: $p < 0.001$), as shown in **Table 1**.

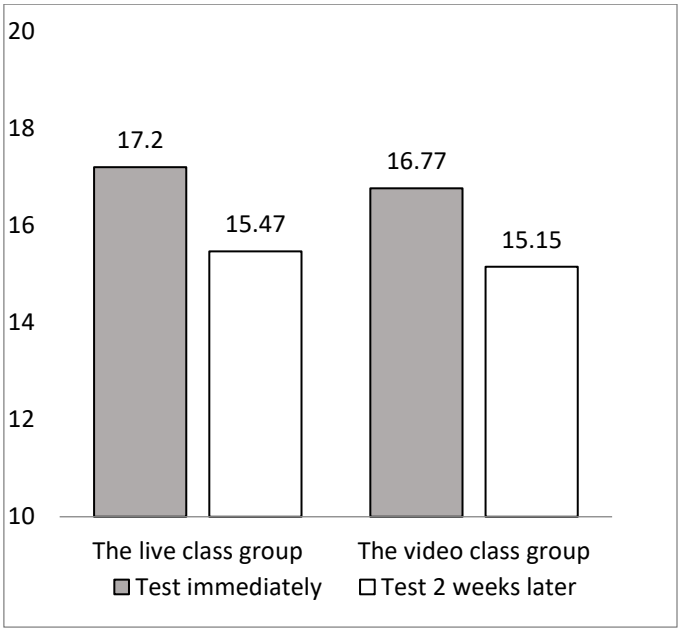

Figure 1. Tests results of both the groups

Table 1. Comparison of the two post-test scores and the difference between the live broadcast lecture group and the PowerPoint recorded lecture group

Score	Live broadcast lecture group (2 weeks) 15.47 ± 1.81	PowerPoint recorded lecture group (now) 16.77 ± 1.36
Live broadcast lecture group (now) 17.20 ± 1.42	Paired t-test: t = 8.404, $p < 0.001$	t-test: t = 0.841, $p = 0.423$
PowerPoint recorded lecture group (2 weeks) 15.15 ± 1.46	t-test: t = 0.498, $p = 0.623$	Paired t-test: t = 11.502, $p < 0.001$

In terms of teaching satisfaction, the first component was the students' evaluation of the teaching process (items 1-6 of the questionnaire). The recognition of the live broadcast lecture group was significantly higher than that of the PowerPoint recorded lecture group (live broadcast lecture group: 4.07 ± 0.39; PowerPoint recorded lecture group: 3.49 ± 0.42; $p = 0.003$). The second component was the students' evaluation on knowledge acquisition (items 7-10 in the questionnaire). The recognition of the live broadcast lecture group was also higher than that of the PowerPoint recorded lecture group (live broadcast lecture group: 3.61 ± 0.40; PowerPoint recorded lecture group: 3.19 ± 0.21; $p = 0.002$), as shown in **Table 2**.

Table 2. Comparison of students' satisfaction with the teaching methods between the two groups

Grouping	Teaching effect satisfaction		Learning effect satisfaction	
	$\bar{x} \pm s$	Statistical value (Z, *p*)	$\bar{x} \pm s$	Statistical value (Z, *p*)
Live broadcast lecture group	4.07 ± 0.39	-3.020, 0.003	3.61 ± 0.40	-3.037, 0.002
PowerPoint recorded lecture group	3.49 ± 0.42		3.19 ± 0.21	

4. Discussion

Medical students must acquire a great deal of knowledge within a short period of time. Looking for effective teaching methods without sacrificing the teaching quality is crucial. Since online teaching has such features, it has taken the interest those related to this field [17,18]. However, there are only a few studies comparing the teaching effect of different types of online teaching methods. In this research, the students' performance under the two teaching methods is similar. According to the survey, students tend to be more interested in live lectures with screen sharing, as reflected in the high satisfaction scores.

Recording a PowerPoint video is potentially limited by the teachers' ability in making videos. Most of the PowerPoint recorded and broadcasting lectures are produced by untrained teachers who use mainstream, free software [19,20]. There is a variety of software that can be used to produce this type of video, but the functions are limited. There is no denying that producing a fantastic PowerPoint video takes a lot of effort and time, and it is still unclear whether the end result will be a better teaching effect. It is worth thinking about the types of lectures that are suitable for PowerPoint videos and the ways to improve teachers' ability in making these videos. However, a fantastic PowerPoint video lecture is deserving of our attention, and it is necessary for students to engage in self-study on a regular basis. In the long run, it is necessary to first guide and encourage teachers to invest more time and to strike a balance between cost and income in the production of high-quality PowerPoint video lectures.

Compared with PowerPoint recorded and broadcasting lectures, the basic requirement for live broadcast lectures with screen sharing are easily attainable, in which only a laptop and live broadcasting platform are needed. With this online teaching mode, teachers can still implement their usual teaching style. Therefore, teachers are more inclined to opt for live lectures with screen sharing. In this online method, the most important aspect is the immersive interaction between teachers and students, which deepens students' understanding. However, the video resources acquired through this method are not widely distributed because they are better suited as initial teaching materials.

An incidental finding of this study is the significant decline in the test scores from the first post-test to the second post-test under both teaching methods. In other words, in just two weeks, there was a significant loss of knowledge. Although it is beyond the scope of this study, this finding shows that it is necessary to further investigate how teaching can be carried out so as to improve students' long-term knowledge reserve. This study has many limitations. First, the subjects were recruited from only one institution. Second, the study's sample size was small (n = 28), which reduces the effectiveness of statistical differences. In addition, the study only selected four class hours of the first two weeks of obstetrics and gynecology to obtain ideal research data; whether these data can be applied to other medical subjects or not, especially those that pose a challenge in displaying teaching contents via videos, remains to be investigated. Fourth, the study did not adopt a double-blind design, so there is a risk of selection bias. Fifth, the results are considered objective, but whether these data can be extrapolated to other medical schools and medical subjects requires further investigation.

5. Conclusion

According to the research results, live broadcasting with screen sharing is a better and more effective teaching method compared with PowerPoint recording and broadcasting; in addition, the study showed that the students were more satisfied with the teaching through live broadcast with screen sharing. Due to the limited sample size in this study and the fact that the study was not conducted in several teaching centers, future consideration should be given to investigating the effectiveness of live lectures with screen sharing in a larger and more diverse study population.

Funding

Shaanxi Undergraduate and Higher Continuing Education Teaching Reform Research Project in 2021 by Shaanxi Education Department "Construction and Practice of Faculty Construction and Quality Assurance System Based on Online Learning Platform for Clinical Faculty of Western Medical College" (Grant Number: 21BZ066)

Education and Teaching Reform Research Project in 2020 by Xi'an Medical University "Construction and Practice of 'Double-Qualified' Teaching Staff Construction and Quality Assurance System in Affiliated Hospitals Based on 'Clinical Teachers Online Learning Platform'" (Grant Number: 2020JG-02)

Disclosure statement

The authors declare no conflict of interest.

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