

Research on Teaching Method and Class Evaluation for International Online Teaching

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Abstract: The Covid-19 epidemic in 2020 posed a sudden and serious challenge to higher education where many online teachings for international students were adopted. . Based on the teaching experience of international online course, the paper review the online teaching methods and their associated problems. Firstly, based on the performance of current software and hardware used in online teaching, the characteristics of commonly used teaching software have been analysed and compared. Then, efficient combinations of teaching software for complementary advantages are recommended to ensure a high quality online teaching. Secondly, the problems inside of class existing in online lecturing and learning are studied, and corresponding teaching methods have been explored including the aspects of class interaction design and implementation, alternative method for delivering essential video information and online class management. Finally, some objective class evaluation criteria are studied in term of coverage of class content, learning effect of specialized knowledge and online class interaction. In the end, some feasible solutions are provided and it can be served as a reference to improve the online teaching.

Keywords: teaching method; class evaluation; online teaching; teaching platforms; international course

1. Introduction

At the beginning of the 2020, a worldwide Covid-19 epidemic disrupted the orders of various fields including Higher Education. Universities, colleges and schools had to close and stopped traditional face-to-face class. The adoption of online teaching, which had developed for some time and adopted relatively infrequently before Covid-19 epidemic, had a sudden explosion. More than 650,000 teachers in China had introduced nearly 1.7 million online courses. Chinese Education Department had organized 22 online teaching platforms to provide free course. The online teaching faced serious challenges, while also met a great opportunity to develop.

Online teaching or network teaching is a type of teaching model which relies on network technology. It completes the teaching process through the way of live course or recorded course by using software including special online teaching platforms and some APP software used for teaching. With the sudden arrival of the Covid-19 epidemic, the number of online teaching customers increased dramatically, and the use of various software for teaching also increased greatly [1, 2, 3]. Previously unseen problems in online teaching were exposed at that time. Pedagogical researches have studied these issues from the aspects of teaching methods [4, 5, 6], examination mode [7], online teaching evaluation [8], etc. It has greatly promoted the development of online teaching. Based on the teaching practice of international online course for overseas students and some Chinese students, this paper studies and summarizes some problems encountered in online teaching, and gives some valuable solutions.

2. Problems existing in online teaching

2.1 Problems in performance of software and hardware

The most important and basic challenge of online teaching is the strong dependence on software and network.

The logos of some well-known software for teaching are shown in Figure 1, such as Rain Classroom, DingTalk, QQ, Tencent Conference, Tencent Classroom, WeChat and so on. It includes online teaching platforms and APP software used in teaching. We call them teaching software in brief here. During the development of teaching software, the explosive growth of customer capacity caused by emergencies was not taken into account in their initial construction stage. So, on the first day of university across the country in February 2020, all software encountered problems to varying degrees without exception. Paralysis, disruption, delay and disconnection became the normal situation in the first time of online class. The fault of teaching platforms is generally very serious, and the fault of APP software is relatively minor. Obviously, faced with such a large number of network access during the sudden epidemic, online teaching software was not fully prepared.

In hardware respect, as a transmission medium of online teaching, the performance of network is undoubtedly very important, and is the basic guarantee of online teaching. During the 2020 epidemic, most networks for teachers have good performance, and can meet the requirements of online teaching due to the majority of universities having relatively strong network facilities. Sometimes, when there was delay phenomenon in wireless networks, the wired networks usually worked well for teaching activities. Network

problems mainly occurred in students. All the students took online classes at home, who scattered across different provinces, cities, counties and rural areas, and overseas students stayed outside China. The network performance in the student's location varied greatly, and usually it was not as good as that of university networks. Also many students didn't have computers at home and could only learn through their mobile phones which had much smaller screens and class interaction was not convenient. All these had a negative impact on students' learning. So the influence on students was greater than that on teachers. For example, video materials for teaching often could not be shared with students online, because video signals couldn't be transmitted and received fast enough in some areas where students lived. The percentage of major problems encountered in online teaching and learning is shown in Figure 2.



Figure. 1 The logos of some well-known software for teaching.

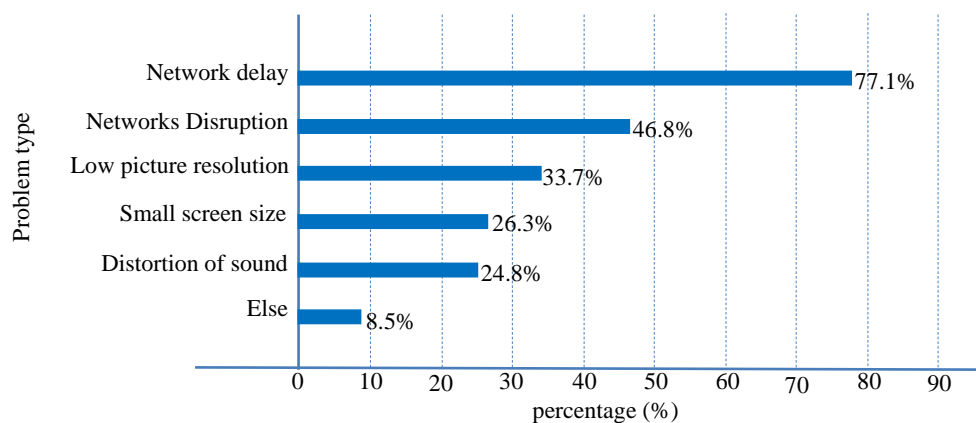


Figure. 2 The percentage of major problems encountered in online teaching and learning.

2.2 Problems in teaching and learning

Before the outbreak of 2020 epidemic, although the online teaching had been developing for quite a long time in China, the number of teachers who were familiar with online teaching was actually small. The majority of teachers did not have online teaching experience and never used the platform software. Face-to-face teaching in classroom was still the dominant form. When school started during the epidemic, faced a sudden change to an unfamiliar teaching mode, both teachers and students were difficult to adapt. Some problems emerged.

➤ In terms of teaching:

(1) Online class is a special "no-one classroom". Although the teacher and students are in the same class, they are separated in space unlike traditional classroom teaching. Generally, in order to reduce network traffic and provide better condition for smooth teaching, all cameras are turned off. In this case, facing the cold computer screen or mobile phone, teachers cannot get feedback from students' facial expressions. They are not clear about how students understand and master the knowledge.

(2) It is inconvenient for teachers to manage the class. When teachers speak passionately during the class, they do not know whether the students can follow their ideas in time. This is easy to lead to the deviation in the rhythm of lecture.

(3) At the end of a course, many of the previous exam formats are no longer suitable.

➤ In terms of learning:

(1) Students are also just facing a device screen. Instructional guidance from teacher declines, and learning effect decreases obviously.

(2) With the time extension of online teaching, the freshness of students for online courses gradually fades away, the enthusiasm of online learning is not high and learning motivation is lacked. The phenomenon of being late for class and leaving early is much more than the traditional teaching in classroom. It even appeared that the students left the computer after he signed in for the class. This is one of the reasons that the online teaching effect is hard to be guaranteed.

(3) Online class at home has a comfortable environment. Correspondingly, it is difficult to create a good learning atmosphere like that at school, and is easily disturbed by family members.

According to the survey [9], the major problems of the online learning during the epidemic period include excessive learning interference, easy distraction, difficulty in-depth learning and low learning efficiency. One student is often troubled by multiple problems. In addition, learning interests, learning methods, learning objectives, depth and breadth of learning and whether to make learning plans also have certain impacts on learning. The percentage of each problem is given in Table 1.

Table 1. The proportion of problems with online learning

SN	Problems with online learning	Proportion
1	excessive learning interference	60.98%
2	easy distraction	57.72%
3	difficulty in-depth learning	46.34%
4	low learning efficiency	45.53%
5	learning interests	33.33%
6	learning methods	32.52%
7	learning objectives	29.27%
8	depth and breadth of learning	29.27%
9	whether to make learning plans	26.83%

3. Solutions to problems of online teaching

Online teaching is an interactive activity between students and teachers, which depends heavily on online teaching conditions including hardware, software and online teaching resources. It is a comprehensive process of interaction by students, teachers, online teaching conditions, online learning environment and even other social factors as shown in figure 3. Subjective and objective factors influence each other and cannot be clearly separated. Therefore, in view of the problems existing in the development of online teaching, we make a comprehensive analysis of them considering the subjective and objective factors together. Some solutions to improve the quality of online teaching are proposed as follows.

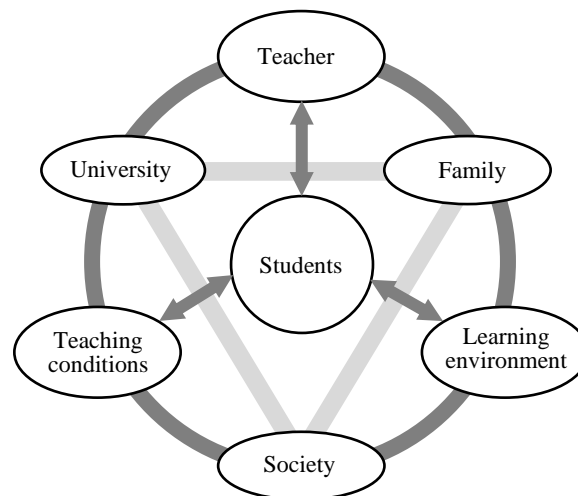


Figure. 3 The interaction relationship among the factors of online teaching.

3.1 Comprehensive use of multiple software for complementary advantages to ensure a high quality online teaching

Although there are several kinds of online teaching software which are used by a large number of users because of their relatively good performance, in the special emergency situation of Covid-19 Epidemic, none of the online teaching software can fully meet the requirements of a high quality teaching. A piece of software usually shows prominent performances in some respects and obvious deficiencies in the other. The common phenomenon is that: some kinds of online teaching software run stably and smoothly, but lack of interactive functions needed in teaching; some kinds of software have powerful functions for teaching, but they crash very easily.

In order to ensure the online teaching effects under present network performance, teachers have made various explorations and attempts [10]. It is a common attempt that using different software at the same time and combining their advantages together to complete the teaching task. This is an effective way at present to solve

the above problems. Adopting two pieces of software is the most common approach at present, and they can make up for each other's shortcomings and sharing their strength. The following will summarize and analyse the main characteristics of several pieces of software commonly used in online teaching, and then discuss some efficient combination modes.

3.1.1 Main characteristics of several kinds of software commonly used in online teaching

(1) QQ

In QQ, the “Share Screen” function is often used to show students PPT and other teaching materials, and the “Demo Whiteboard” function is used to show the content that the teacher writes impromptu in class. The transmission of picture, voice and text information is very fast in QQ, and it can meet the needs of almost all the basic operation functions in teaching. At the same time, QQ has excellent fluency during the online class and rarely appears the delay phenomenon. It is a very important advantage of QQ to meet both the common functional requirement and teaching fluency requirement.

(2) Tencent Conference

The APP system has high stability. When there are several opened files and windows on the desktop of the computer screen, it can choose any one to share online. Also it has whiteboard function for the teacher's writing in class. While, Tencent Conference has no function of group management and file transmission. This is very inconvenient for teaching.

(3) Tencent Classroom

Compared with QQ, Tencent Classroom is more stable when the number of students in class exceeds 100, and functions for teaching are powerful. However, both sound and graphics have a relatively large delay. Some details were not very good, such as the experience of mouse and display.

(4) DingTalk

The stability is basically the same as that of Tencent conference. While it also has the problem of delay, and the interactive function of teaching is in the middle level.

(5) Rain Classroom

Rain Classroom has many good functions for teaching, such as various types of teaching interaction and classroom information statistics, which are incomparable to other software. However, when the number of users increases, the platform often crash badly and the class cannot continue. This problem was very serious in the early days of online class when the Covid-19 broke out and the number of users increased dramatically, and it already resulted in the loss of a large number of users.

(6) WeChat

For the teaching requirement, the function of WeChat is too simple. It is not convenient for teaching and is less used in class.

3.1.2 Efficient combinations of online teaching software

In order to ensure the class effect, it is an effective way to use different kinds of teaching software together. The following are several combination modes:

(1) Mode A: QQ and Rain Classroom are used at the same time.

In this case, Rain Classroom runs just on the teacher's computer. Students do not need to log in Rain Classroom. This helps to reduce network congestion. “Share Screen” function in QQ is used to show students the information displayed on the teacher's computer screen. In this mode, the rich and powerful interactive functions developed specifically for teaching in the Rain Classroom is maximized. All interactions can be displayed to students through QQ's “Share Screen”. This approach reduces the crash probability of Rain Classroom and makes the best use of its excellent interactive function.

(2) Mode B: Tencent Conference and Rain Classroom are used at the same time.

This is similar to mode A. Tencent Conference also has excellent fluency. Under the important support, screen sharing function of Tencent Conference combining with the excellent interactive function of Rain Classroom can also achieve a satisfactory teaching effect.

(3) Mode C: QQ runs on computer and mobile phone to meet common needs in software function for teaching.

In this mode, teachers need to use two devices: one computer and one mobile phone. On the computer, teachers can use QQ's “Share Screen” to show students PPT, and use “Demo Whiteboard” to write improvised ideas for students. At the same time, teachers can put forward questions to students and discuss them with students in QQ group by mobile phone. In this way, it is also easier for teachers to attract students' attention, and the proportion of students participating in class discussions is also high in this mode.

3.2 Exploring teaching and management ways of online class

Characteristics of online teaching are different from face-to-face teaching in classroom. Some teaching methods can no longer be used, and need to be adjusted to adapt the new teaching model. Several methods have been researched, and they have been proved to be feasible through teaching practice.

3.2.1 Class organization ways of online teaching

(1) New ways of class interaction

In online teaching, students' microphones are usually off during the class to avoid noise from home or environment. Only the teacher can speak freely. In this case, face-to-face discussion way is no longer appropriate and needs to be adjusted. An alternative method is that the teacher asks questions and students type and send their answers to the discussion area of teaching software. This is obviously more difficult to communicate than face-to-face class when the issues are slightly complex. In order to improve the communication efficiency between teacher and students in the limited class time and realize a real-time discussion, we have explored and tried a way for online teaching. The key points are as follows:

(a)Decomposition of problems: when raising and discussing questions in class, divide the questions into several small questions of logical interlink. The level of decomposition is determined by the criterion that students can finish answers quickly.

(b)Answer design: there are two ways to answer questions: one is the choice mode, such as choosing the answer from "Yes/No", "1/0" or "A/B/C" and so on. The other is words mode. That means the question can be answered clearly in several words.

In this solution, students can instantly respond to the teacher's questions by typing. It can ensure the maximum degree of real-time interaction between the teacher and students in class. During the class, the teacher throws out each small question in turn, and students can respond rapidly without a break like that in face-to-face class. According to students' feedback, the teacher can adjust his lecture content in time. Through this kind of interlocking rapid response, a complex discussion can be completed in a fluent and clear manner. The efficiency of classroom interaction has been greatly improved.

(2) Alternative method for efficient presentation of video information

According to the analysis in Section 2.1, video materials can't be played to students in real time in most cases under current network conditions. In order to convey the essential information of videos to students, it is an effective solution to extract the key frame images and make them into PPT. In class, this PPT will be presented to students accompanied by the teacher's supplementary explanations. Videos themselves can be sent to students and watched after class by downloading them locally. In this way, the main content of the course is almost unaffected, and it is also adapted to different situations of students.

3.2.2 Class management methods of online teaching

Both teaching at home and learning at home are subject to many restrictions, the management methods of online class need to change. According to the characteristics of online teaching, teachers can dig deeply into the functions of teaching software and use them to explore and develop flexible and diverse class management methods, such as sign in with hand gestures before class, random award-winning questions and answers in class, online brainstorming discussion, after-class team video conference, etc. These measures are conducive to effectively improve students' learning attention and interest in class. In addition, in order to ensure the attendance rate and learning effect of online teaching, some of previous methods used in face-to-face class can still be adopted, such as supervisors' random attending class, randomly checking students' learning status and so on.

4. Class evaluation criteria for international online teaching

Some representative class evaluation models are: traditional expert model, Tyler's objective model, Sufflebeam's CIPP model, Stake's Countenance model and Ethnographic evaluation etc. These evaluation models have different features in the value orientation, method and participant. Modern education theory considers that knowledge is a process and knowledge system always in a state of flux. People must pay attention to the specific performance of students during the learning process and then implement a process evaluation.

There are three evaluation models in Chinese universities: expert evaluation, peer evaluation and student secret ballot. Expert evaluation has limitation to accurately reflect teacher's teaching situation because the limited amount of attending class of the expert. In addition, experts' personal teaching style, teaching habits and thinking patterns also have an influence on the evaluation results. Peer evaluation takes the form of attending class each other among colleagues. This evaluation model may be influenced by the relationship between colleagues. For the secret ballot, Students' cognitive ability is more in the perceptual stage, so the evaluation tends to be mixed with some random ego factors [11].

Problems of the three evaluation models are obvious. In addition, Differences exist in online and offline class, and also exist in native teaching and non-native teaching. So, class evaluation of international online

teaching is studied in this paper to achieve an objective result, in which evaluation criteria reflect the behaviour and learning effect of students in the learning process. The considerations are as follows:

- Percentage of class content to the syllabus;
- Learning effect of specialized knowledge in online class taught in English;
- Interactive activities of online class between learning and teaching.

4.1 Percentage of class content to the syllabus

In the course of online teaching, the interaction between teachers and students is affected to some extent because of space separation. Teaching tends to slow down, and class content may not be sufficient to meet the requirements of the syllabus. This paper studies evaluation criteria to evaluate the class effect considering three respects: Important content, required content and understanding content. For important content, students are required not only to understand the concepts and principles, but also have the ability to apply, analysis and design. In required content, students have an obligation to have a thorough understanding of concepts and principles. For understanding content, students are only needed to understand the basic concepts.

First, in order to quantify the class content into an objective value, formula (1) is designed for calculation:

$$S = \lambda_1 \sum_{i=1}^N I_i + \lambda_2 \sum_{i=1}^N M_i + \lambda_3 \sum_{i=1}^N E_i \quad (1)$$

Where, i is the chapter number; N is the total number of chapters; I_i , M_i and E_i are the numbers of important content, required content and understanding content of chapter i respectively; λ_1 , λ_2 and λ_3 are the weights of each item respectively, and can be assigned different values to distinguish the importance of each item, such as 10, 3, and 1. S is the score of the class content.

On the syllabus: $I_i=I_{im}$, $M_i=M_{im}$, $E_i=E_{im}$, That is, I_i , M_i and E_i are all their maximum values, indicating that the syllabus includes all class contents. In this case, $S=S_m$, which is the highest score of the class content.

Then, the percentage of class content to the syllabus can be calculated by formula (2):

$$\begin{aligned} R_c &= \frac{S_m - S}{S_m} \times 100\% \\ &= \frac{S_m - (\lambda_1 \sum_{i=1}^N I_i + \lambda_2 \sum_{i=1}^N M_i + \lambda_3 \sum_{i=1}^N E_i)}{S_m} \times 100\% \end{aligned} \quad (2)$$

R_c is called coverage of class content. At this time, I_i , M_i and E_i in formula (2) are the numbers of important content, required content and understanding content of chapter i that are actually taught in online class respectively, so S is the score of actual teaching content. R_c can be used as a reference to analyze the class effect and adjust the teaching progress.

4.2 Learning effect of specialized knowledge in online class taught in English

Due to the use of original English textbooks and the use of non-native language as teaching language, students have certain obstacles in thinking and lag in understanding. Therefore, more explanations are needed in the teaching process. However, the class time is bounded. Sometimes some topics cannot be fully discussed, and students may not be able to comprehend them clearly. So, it is necessary to evaluate the effect of students' professional learning in time. Available methods include: Check students' mastery of specialized knowledge through flexible forms such as classroom discussions, quiz and so on. The results are quantified by score, and it can compare to that of students who are taught in the native language of the same course. We assume that the whole knowledge consists of different knowledge points, and design formula (3) firstly to evaluate the learning effect of students on knowledge point k :

$$P_k = \frac{1}{N} \sum_{i=1}^N s_i \quad (3)$$

Where N is the number of students, s_i is the score of the i -th student for the knowledge point k , and P_k is the average score of all students on the knowledge point k . Assume that the average score of students taught in native language for the knowledge point k is P_{kn} , then the learning efficiency of students taught in English on knowledge point k can be obtained by formula (4):

$$\eta_k = \frac{P_k}{P_{kn}} \times 100\% \quad (4)$$

When $\eta_k < 1$, it indicates that students taught in English have lower learning effect on knowledge point k than those taught in native language. When $\eta_k > 1$, it indicates that students taught in English have better learning effect on knowledge point k . If student's score for all knowledge points is to be calculated, the overall learning

efficiency η can be calculated as formula (5) :

$$\eta = \frac{\frac{1}{C} \sum_{k=1}^C \left(\frac{1}{N} \sum_{i=1}^N s_i \right)_k}{P_n} \times 100\% \quad (5)$$

Where, C is the total number of knowledge points, and P_n is the average score of the students taught in native language for total knowledge. Similarly, When $\eta < 1$, it indicates that the overall learning efficiency of students taught in English is lower than that of students taught in native language. When $\eta > 1$, the overall learning efficiency of students taught in English is better than that of students taught in native language.

Through observation of learning efficiency η_k and the overall learning efficiency η , teachers can analyse and find problems in different levels from some knowledge points to whole knowledge. It provides useful hints for improving teaching in time to avoid the decline of students' learning effect.

4.3 Interactive activities of online class between learning and teaching

Online teaching utilizes computer, network, mobile phone and other hardware as carriers, and relies on teaching software to realize long-distance and real-time teaching and learning. Online teaching makes students study different courses in front of the computer or mobile phone from morning to night every day. Students tend to feel sleepy when they use devices for a long time. In addition, studying at home, students can't feel the restriction and learning atmosphere as that in the classroom. The lack of "presence" and "reality" leads to easy distraction. Interactive activities in online class have a significant effect on improving students' attention and learning interest.

In general, the more teaching interaction occurs in class, the better the teaching effect is. But too frequent interaction may slow down the teaching progress. Also, continuous intensive activities will make students unresponsive and easy to fatigue. At this time, interaction is easy to cause distraction instead. Considering the positive and negative effects, we study the teaching interaction incentive function to indicate the influence of teaching interaction on students' learning effect. The definition of teaching interaction incentive function is shown in Formula (6):

$$\xi_q = 1 + \sin \left(\frac{A_{qr}}{A_q} \pi \right) \quad (6)$$

Where, q represents the number of a teaching activity; ξ_q represents the incentive function value of the q -th teaching activity; A_q is the total number of knowledge points in the q -th teaching activity; A_{qr} is the total number of knowledge points implemented with interaction in the q -th teaching activities. $0 \leq A_{qr} \leq A_q$, and $1 \leq \xi_q \leq 2$. The greater value of ξ_q means the greater incentive effect of interaction in the q -th teaching activities. In typical cases, when there is no interaction in class, $A_{qr}/A_q = 0$ and ξ_q has a minimum value of 1; When A_{qr} reaches half of A_q , ξ_q has a maximum of 2. At this time, the class atmosphere is most active and the teaching effect is the best; When all the knowledge points are carried out with interaction, $A_{qr}/A_q = 1$, and ξ_q returns to the minimum value of 1. This implies that too much interaction will make negative effect counteract the positive effect. Assuming that the total number of teaching activities is N , the definition of the average teaching interaction incentive function ξ is as shown in Equation (7) :

$$\xi = \frac{1}{N} \sum_{q=1}^N \xi_q \quad (7)$$

This function reflects the law that the incentive effect of teaching interaction increases from small to large and then decreases with the change of interaction from less to more.

By comprehensive considering the above criteria, an objective class evaluation of international online teaching can be achieved.

5. Conclusion

In view of the problems existing in current online teaching, we study the issue from several respects: 1). analyse and discuss the performance problems of software and hardware in present online teaching; 2). discuss the class problems in online teaching and learning; 3). recommend corresponding feasible solutions to discussed problems, including comprehensive use of multiple software for complementary advantages, class interaction design and implementation, alternative method for delivering video information and class management method; 4). develop several class evaluation criteria for an objective class evaluation of international online teaching. A relatively complete online teaching operation system is formed. In the future, with the development of new technologies such as 5G, big data, Artificial Intelligence and Internet of Things, etc., online teaching might be

gradually adapted more and more. The mode of online teaching might also become diverse, for example 5G live class, Ultra HD video interaction, holographic live, VR live, AI teacher and so on. The study provides some valuable information for present online teaching research and practice, and is also beneficial to its continuous development.

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