Countermeasures for Improving Online Teaching Effect in Chinese Colleges and Universities during the Epidemic Period

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***Abstract*—During the epidemic period, colleges and universities in China have launched online teaching practices. Online teaching can break through geographical restrictions, with flexible class times and locations, and students can watch it repeatedly after class, which is an important advantage compared with traditional classroom teaching. However, in teaching practice, the teaching effect of online teaching is not very good. Through literature research and interviews with teachers and students, it is found that the inconsistent and imperfect functions of online teaching platforms, the poor autonomy and self-discipline of students' online learning, and the low online teaching ability of teachers are important factors that affect the effect of online teaching. Based on this, corresponding countermeasures from the perspectives of colleges, students and teachers are proposed to help the development of online teaching in the future and improve the effect of online teaching: First, to strengthen the support of colleges and universities for teaching platforms and course resources, and accelerate the construction of a stable and efficient unified online teaching platform. The second is to strengthen the guidance of students to enhance their autonomy and self-discipline in online learning. The third is to improve teachers' online teaching level and information technology literacy to ensure the quality of online teaching.**

***Index Terms*—Countermeasures, online teaching, teaching effect**

I. Introduction

Traditional classroom teaching has always been the mainstream teaching form in colleges and universities, and it is the normal choice for teachers and students to carry out teaching activities. For many years, online teaching for full-time students in colleges and universities in China is basically in the exploratory stage. The sudden epidemic in 2020 has brought unprecedented opportunities to the development of online teaching, in response to the sudden outbreak of COVID-19 impact to the teaching order, the Ministry of Education issued. "Guiding opinions on the organization and management of online teaching in ordinary colleges and universities during the period of epidemic prevention and control", "online teaching" has become a "daily" activity that all college teachers and students must face from the previous "exploratory" educational reform activities. The Ministry of Education organized 22 online course platforms to develop a variety of online teaching solutions, and opened 1291 national high-quality online open courses and 401 national virtual experimental courses for free, covering 12 undergraduate subject categories and 18 major categories of junior college and vocational college. Subsequently, colleges and universities around the country have formulated online teaching organization and implementation plans according to the school situation, and the learning situation, online teaching quickly has been carried out orderly and effectively in colleges and universities, but at the same time, there are also some problems, such as serious network congestion, some teachers are not skilled in online teaching, students are not adapted to online learning and so on. Large-scale online teaching has brought great challenges to students, teachers, and universities, but it also brings opportunities for students' self-growth, teachers' professional development, and teaching reform in universities.

Faced with this unprecedented online teaching, many scholars have carried out research. When Wang *et al.* [1] conducted a nationwide survey on teachers' online teaching ability, they found that teachers had a lot of anxiety in three aspects: teacher-student interaction, equipment operation and teaching organization. According to the online teaching quality report of Peking University, Le and Xu [2] concluded that the teaching methods of online courses are basically similar to offline courses, and teachers need to reconstruct the classroom system according to the characteristics of online teaching. Tianjin University's online teaching quality report found that teachers also exist transplant offline teaching phenomenon, teachers failed to understand the difference between online teaching and traditional classroom teaching. When Liu and Zhang [3] surveyed college students about their adaptability to online learning, they concluded that nearly half of the students reported doing things unrelated to learning in the process of online teaching, and a small number of students said they never or seldom actively studied at home. In terms of the lack of understanding of online teaching, Xie [4] and others believed through case investigation that some teachers just move offline courses to online teaching, and the so-called online teaching is just a simple addition of teaching activities and Internet technology. Hu and Xie [5] analyzed the advantages and challenges of online teaching in colleges and universities under the epidemic situation based on online teaching quality reports of 57 colleges and universities in China and statistical reports of curriculum platforms in Fujian and Shandong provinces. Wang and Li [6] took teachers and students of China University of Geosciences (Beijing) as the research object, and specifically explored the situation of college students' participation in online teaching. Through analysis, the advantages and disadvantages of online teaching are pointed out, and improvement measures and solutions are proposed.

Most of the previous studies are based on third-party online teaching quality reports, course platform data statistics

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reports, etc. to grasp the current situation of online teaching in colleges and universities. There is a lack of survey data directly from front-line teachers and students that can fully reflect the current status of online teaching in colleges and universities. There is not much discussion on the effect of online teaching in the existing research. Under the background of full practice of online teaching in colleges and universities, through literature research and interviews with teachers and students in the author's university, this paper explores the reasons affecting the effect of online teaching, and puts forward improvement measures from the perspective of universities, students and teachers. Hope to provide assistance for the development of online teaching in the later period.

II. Methodology

The effect of online teaching is influenced by students, teachers, teaching platforms and network conditions. In order to understand the actual situation of online teaching during the epidemic prevention and control period, the author conducted a one-to-one interview with 40 teachers and 80 undergraduates of her school. In the sample of teachers, 18 teachers are from the author's college, and the other 22 teachers are from other colleges and majors. In the student sample, there are 26 freshmen, 26 sophomores, 28 juniors, a total of 42 boys and 38 girls. The student sample covers many majors such as science, engineering and literature and history. During the online teaching period, 35 students live in urban areas, and 45 students live in rural areas. Since the course for fourth-year university students has basically ended, they were not selected for interview. Table I was the basic information of the students interviewed

TABLE I: Basic Information of the Students Interviewed

	Gender		**Address**	
Grade	**Female**	**Male**	**City**	**Rural Areas**
Freshman	12	14	35	45
Sophomore	13	13		
Junior students	13	15		

The interview content of teachers mainly includes four parts: first, basic information, such as the subject, age, gender, etc.; Second, the situation of online teaching, such as the use of teaching platform, teaching methods and teaching effects; Third, the experience of online teaching, such as classroom interaction between teachers and students, teaching content setting, etc. The fourth part is the existing problems and suggestions, mainly to understand the difficulties, solutions and relevant suggestions existing in the current online teaching of teachers.

The interview content of students mainly include three aspects: First, basic information, such as gender, home address, equipment used for online learning, etc.; Second, online learning situation, such as online learning effect, teacher-student interaction, online learning satisfaction, etc. Third, the completion of homework, such as homework completion degree, review of learning content, online learning difficulties and other aspects. Table II is obtained by arranging the interview data. We numbered the students and teachers according to the order of the interview. The paper will use qualitative analysis to draw conclusions.

TABLE II: The Interview Data Collected

Themes	Frequency	Sample Responses
Platform or Software	Teachers: 28 Students: 42	"Generally, Tencent Conference or DingTalk are used, and when one is unstable, the other is replaced; each platform has its own advantages, and other teaching platforms will also be switched according to the course content." (teacher 1) "Teachers choose different teaching platforms. We often need to switch platforms, which is a bit troublesome. We hope to unify the teaching platforms." (student 4)
Instructional Design or Content Settings	Teachers: 22 Students: 30	"The teaching method and content are similar to traditional classroom teaching, without online teaching design." (teacher 9) "It feels similar to the traditional classroom. The teacher shows the courseware and explains the knowledge to us." (student 11)
Interaction or Participation	Teachers: 18 Students: 20	"Students post bullet screens more frequently, but when they really need to answer questions, no one responds, and classroom interaction fails to achieve the expected effect." (teacher 13) "We seldom take the initiative to answer questions. If no one answers the question, the teacher will answer it by himself or designate a classmate to answer it." (student 20)
Initiative in Learning	Teachers: 16 Students: 28	"Judging from the situation in class, students seldom preview in advance, and seldom review after class." (teacher 24) "I seldom study after class, except to finish the homework assigned by the teacher." (student 35)
Attention, Self-discipline	Students: 40	"I don't have enough concentration in class, and my self-discipline is a little bit poor. Without the supervision of a teacher, I can't help but click on the web page or chat with friends." (student 45)
Teaching Effect	Teachers: 30 Students: 56	"The teaching process is difficult to supervise, many students are perfunctory in class, and the effect of online teaching is not very good." (teacher 32) "There is no atmosphere for discussing and answering questions with everyone, and I don't want to review after class. I feel that online learning is far less effective than classroom teaching." (student 50)

III. Interview Results of Teachers and Students

Table III is the interview results of teachers and students.

TABLE III: THE INTERVIEW RESULTS

Themes	Percentage	Description
Online Teaching Platform and Teaching Mode	70% 30%	Platform: DingTalk Tencent Conference and QQ Live. Teaching Mode: Live online teaching.
Students' Feedback on Online Teaching	50%:	It is difficult to keep listening to the class for a long time.
	38%	Rarely reviewed the learning content after class.
	25%	Never or rarely participated in communication and interaction in class.
	35%	Teachers' online teaching skills were not proficient.
	25%	Teachers spoke too fast and assigned too much homework
	52.5%	Often change platforms.
Teachers' Feedback on Online Teaching	45%	Classroom supervision is difficult, students are not focused, classroom interaction is low.
	40%	Students' learning initiative is low.
	55%	Did not redesign the teaching design.

A. Online Teaching Platform and Teaching Mode

Through interviews, 70% of teachers mainly use the online live broadcast platform DingTalk. DingTalk supports after-class playback, screen sharing, and voice or video conversations between teachers and students. Teachers can post classroom test questions on DingTalk and count the results to record student data. In addition, DingTalk also has a series of advantages such as easy submission of homework and sign-in statistics, which is the first choice for teachers to live online teaching. Some teachers also use other platforms such as Tencent Conference and QQ Live. The teaching method adopted by teachers is mainly live online teaching. Teachers push teaching resources such as courseware and guided learning materials on the teaching platform, and carry out synchronous teaching activities such as online teaching and online discussion. In addition, teachers record the teaching process while carrying out live teaching and upload the recorded videos to relevant platforms for students to review and use after class. However, as a large number of students attend classes at the same time, problems such as slow platform login, voice delay and video lag often occur.

B. Students' Feedback on Online Teaching

In the interview, 50% of college students said that it is difficult to keep listening to the class for a long time during online teaching, and they often or sometimes do things unrelated to their studies; 38% of college students said they rarely reviewed the learning content after class; 25% of college students said they never or rarely participate in communication and interaction in class. 35% of students said the teachers' online teaching skills were not proficient, while 25% of the students said the teachers spoke too fast and assigned too much homework after class. In addition, 52.5% of the students said that different teachers choose different teaching platforms, sometimes the same course will use two or even three different platforms, students need to install multiple software and register.

In addition, regional differences in online teaching were found in the interviews. 8 students from cities said that they attended classes and studied according to the school schedule, and there was little difference between online learning and school learning. Another 7 students from cities said they are more efficient at home where they have a separate bedroom and study room and are not disturbed in class. They can also take care of pets or study cooking, which is much more comfortable than at school. 11 students from rural areas said that there was more interference from the living environment when attending classes at home. The network signal at home was not very good and there were often visits from neighbors. After attending classes, they often had to engage in certain daily labor. The study time was not sufficient so it was difficult for them to carry out in-depth and dedicated study. Through a questionnaire survey and interviews with students of Liaocheng University, Yan [7] also found that during the online teaching period, students living in rural areas were subjected to more interference factors in class, they were engaged in more labor than urban students, and their study time was more easily affected by various things. During the online learning period, the completion of academic tasks and self-study plans of rural students is worse than that of urban students. Zhao *et al.* [8] mentioned that network conditions are the basic factor causing the difference between urban and rural areas in online learning. Low network coverage and unstable network signals are important factors that affect the online learning effect and learning experience of rural students. Therefore, a stable and smooth network and a quiet and undisturbed learning environment are the primary needs of rural students. For urban students, they are more concerned about their class status and learning experience.

C. Teachers' Feedback on Online Teaching

In the interview, 45% of teachers reflect that in the process of online teaching, classroom supervision is difficult, students are not focused, classroom interaction is low, students seldom actively answer questions, and the teaching effect is not good. 40% of the teachers reflect that students' learning initiative is low, and they seldom preview in advance or review actively after class; Almost all teachers agree that compared with traditional classroom teaching, online teaching needs to make substantial adjustments in teaching design, teaching strategies and teaching methods, especially in pre-class lesson preparation, classroom interaction, student evaluation and other links, teachers must pay more efforts to achieve certain effect. 55% of the teachers said that they did not redesign the teaching design when they carried out online teaching, but copied the traditional curriculum content to online courses. They said that because they had never had online live teaching before, they needed to learn the use of various software, familiarize themselves with the teaching platform, debug hardware and software, which consumed a lot of their time, so they did not have enough time to redesign the teaching design and adjust the teaching strategy.

Through a survey on students' and teachers' online teaching adaptation, it is found that 75% of students and 70% of teachers can adapt to the online teaching environment and are relatively satisfied with online teaching, but they also said

that online teaching is not as effective as traditional classrooms. In the survey on whether online teaching can replace classroom teaching, 67.5% of teachers and 65% of students clearly stated that online teaching cannot replace classroom teaching in the future. There are also 20% of teachers and 22.5% of students who have a neutral attitude towards online teaching replacing classroom teaching, and another 12.5% of teachers and students are optimistic about online teaching replacing classroom teaching.

IV. Discussion

A. The Reasons that Affect Online Teaching

Through interviews with teachers and students and reviewing the literature, it is found that the main reasons that affect the effect of online teaching in colleges and universities are as follows. The discussion and analysis of these factors will help to find corresponding countermeasures to improve the effect of online teaching.

1) Lack of a stable and unified teaching platform that meets the requirements of online teaching

1) Colleges and universities have never considered designing a teaching platform that can accommodate the online teaching needs of the whole school, although they have made efforts to expand the capacity to meet the needs of teachers' online teaching under the epidemic situation, it is neither realistic nor possible to build a unified teaching platform in the short term. Therefore, in this case, teachers can only choose the course teaching platform independently. Since different teachers choose different online teaching platforms, students need to download a variety of teaching software and tools, and they need to switch between different teaching platforms and tools for different courses. Students must first be familiar with the operation of various online teaching platforms and tools in class, otherwise it will affect the normal class. This virtually increases the cumbersomeness of the class procedures and brings inconvenience to students' learning.
2) Network speed and platform stability are also one of the important factors affecting the effect of online teaching. The smooth progress of online teaching can not be separated from network support and hardware guarantee. In the actual teaching process, when large-scale real-time live video teaching is carried out at the same time, there are often some situations such as carton, disconnection and flashbacks caused by the network. In addition, whether the hardware equipment of the participants is easy to use and whether the network environment is smooth are also important factors that affect the effect of online teaching.

2) Students are easily distracted in class, self-discipline and learning autonomy is low

Online teaching connects teachers and students in different spaces through the network, breaking through the limitations of geographical conditions, which is an important advantage compared with traditional classroom teaching. However, online teaching has brought great changes to the teaching environment. Teachers and students are separated in space, the leading role of teachers is weakened, and students have greater autonomy, which requires students to have good motivation and strong self-discipline to complete the study [9]. College students have weak awareness of autonomous learning, vague goals of autonomous learning, and lack of good autonomous learning habits and effective self-monitoring [10]. In the digital learning environment, the attention keeping time of digital resources presented in the form of text is generally less than 10 minutes, and the attention keeping time of digital resources presented in the form of video is generally less than 20 minutes [11]. Traditional classroom teaching has a strong learning atmosphere and teacher supervision, while online learning has many uncontrollable factors that affect attention, such as the activities of family members and the environment around the family. Entertainment games and social information on computers and mobile phones will also attract students greatly, while students' non-learning behaviors are rarely constrained, which puts forward high requirements for students' learning autonomy and self-discipline [12]. Nearly half of the students in the interview indicated that they need to strengthen their learning self-discipline and learning autonomy. They said that they browsed the web, chatted with friends online, and some even played games during class, which seriously affected the effect of online teaching.

3) The online teaching ability of college teachers is not high

1) Online teaching requires teachers to master network information technology and have online teaching ability. Before the epidemic, most teachers used traditional classroom teaching. Before the epidemic, teachers mostly used traditional classroom teaching, except for a small number of teachers who had contacted MOOC and tried mixed teaching before, most university teachers were still unfamiliar with online teaching. Young and middle-aged teachers can generally adapt to online teaching quickly, but some older teachers have difficulty in learning and using online teaching tools. Han and Ge's survey and research on 1147 teachers in 28 undergraduate and vocational colleges across the country also showed that domestic college teachers' ability to innovate teaching models with the help of information technology and the ability of information-based teaching research need to be improved [13].
2) Compared with traditional classroom teaching, the teaching environment, teaching time and space, and teaching platform that online teaching relies on have undergone a new transformation. Therefore, online teaching is by no means a simple copy of classroom teaching content, but a new teaching design according to the situation of students and the characteristics of online teaching. The survey shows that teachers are not making the necessary changes when they move from classroom to online teaching. Among the teachers interviewed, 28 teachers said that they just moved the content of their usual classroom teaching to online

teaching, and did not redesign the online teaching. The online teaching quality report of Peking University also shows that the current teaching methods of many courses are basically similar to the original classroom teaching. Teachers need to reconstruct the curriculum system from teaching concepts to teaching methods according to the characteristics of online teaching [14]. Tianjin University pointed out in the quality report that teachers have not fully realized the difference between online teaching and traditional classroom teaching; students are still more adapted to the role of passive listening to lectures rather than active participants, and are accustomed to classroom teaching without pressure [15].

B. Countermeasures to Improve the Effect of Online Teaching

1) To strengthen the support of universities for platforms and course resources, and accelerate the construction of a stable and efficient unified online teaching platform.

Colleges and universities should vigorously promote the construction of online teaching platforms and course resources, further optimize course resources and platforms, and continue to monitor online teaching to ensure the quality of online teaching.

1) First of all, colleges and universities should improve on-campus curriculum resources and further centralize and unify the teaching platform. Schools can introduce stable live video and recording services and connect with the on-campus teaching platform, so that students' learning behavior can be carried out on the on-campus teaching platform as soon as possible. In this way, colleges and universities can more effectively supervise students' learning behaviors and incorporate relevant learning behaviors into the assessment system.
2) Secondly, colleges and universities should increase bandwidth and server investment, and increase the expansion of the course platform to ensure the stability of online teaching. At the same time, it is necessary to continuously improve the functions of the platform and improve the operating performance of the system to avoid the negative impact of network congestion and platform collapse to the greatest extent.
3) Finally, colleges and universities should play an active role in quality monitoring and evaluation of platform big data. In view of the actual situation of online teaching, schools can formulate relevant evaluation system and incorporate it into the evaluation system of students and teachers, so as to enhance the application level and auxiliary decision-making ability of the platform in process guarantee and evaluation analysis, and improve the intelligence and humanization of the platform.

2) To strengthen the guidance to students and enhance their autonomy and self-discipline in learning

1) Teachers should pay attention to cultivate students' sense of self-efficacy, guide them to identify the root of problems from the internal attribution, and establish the concept of independent learning. Teachers should also guide students to deeply understand the significance of learning, and make students interested in learning through wonderful curriculum content and various teaching methods, so as to form a positive and stable learning emotional experience and improve the possibility of their autonomous learning. College students themselves should also change their passive learning habits, actively adapt to online learning requirements, listen carefully in class and actively participate in classroom interaction, review and preview in time after class, enter online classroom with questions, and cultivate the spirit of diligent thinking and daring to question.
2) Teachers can also use the data collected by the online teaching platform to judge the learning effect of students, make timely teaching adjustments according to the actual situation of students. In class, teachers motivate students through scientific and effective process evaluation, so that they can actively participate in learning. In addition, colleges and universities can also set up relevant courses to guide students to make life direction and study plan, help students strengthen self-discipline and self-motivation, so as to improve students' independent learning ability.

3) To improve teachers' online teaching level and information technology literacy to ensure the quality of online teaching

1) To optimize online teaching design. Teachers should change the traditional teaching concept, practice the "student-centered" concept, and continuously optimize online teaching content and teaching methods. In the teaching design, more practical and exploratory teaching activities are integrated, and the individualized education and individualized development of students are highlighted to improve students' classroom participation. In addition, the interaction and communication between teachers and students should be strengthened in the teaching design. For example, Q & A discussion, group mutual evaluation, group debate and other activities can be carried out in class, which can enhance students' sense of participation in online teaching. Finally, teachers should make full use of the convenience and timeliness of the internet to evaluate and give feedback on students' learning, so as to stimulate students' interest in learning and improve teaching effects.
2) Teachers should actively improve their information technology literacy and proficiency in the use of online teaching equipment, and actively integrate into the general trend of online teaching reform. Colleges and universities should also continue to conduct online teaching skills training for teachers to help them improve their information technology level. The school can organize some teachers with strong information technology ability and rich experience in online teaching to share their experience. In addition, policy support for online teaching should be increased, and teachers should be encouraged to actively participate in the teaching reform and practice of online teaching.

V. Conclusion

Online teaching is the product of the development of the times, which can make up for the shortcomings of traditional face-to-face classroom, but the teaching effect of online teaching is not very good during the epidemic. Through literature research and interviews with some teachers and students in the author's university, it is found that the poor effect of online teaching is mainly due to the disunity of teaching platform, the instability of network, the poor learning autonomy and self-discipline of students, and the low online teaching ability of teachers. Colleges and universities should seize this large-scale online teaching opportunity, accelerate the construction of a stable and efficient unified online teaching platform, continuously improve the platform functions, and strengthen the technical support for online learning. Teachers should strive to improve their information technology literacy, change their teaching concepts, optimize teaching design, and continuously improve their online teaching capabilities. Students should actively participate in teaching interaction, and continuously strengthen their autonomy and self-discipline in learning under the guidance of schools and teachers. Through the joint efforts of the school, teachers and students, the quality of online teaching is continuously promoted, enhanced and improved to improve the effect of online teaching.

With the continuous development of network information technology, online teaching is becoming more and more popular. The online teaching mode reflects the advantages of convenience, speed, anytime, anywhere and personalization. Online teaching has its advanced side, but it also has its insurmountable limitations. The author believes that the combination of online and offline teaching will become the "new normal" of education in the future. After the epidemic, we should not only retain the advantages of online teaching, but also restore the traditional classroom teaching and promote its advantages, so as to give full play to the greatest advantages of online and offline hybrid teaching. This study is based on the actual situation of the author's university, the author hopes to provide a useful reference for the sustainable and healthy development of online teaching. The author will continue to improve the problems found in the future work and study, hoping to put forward more meaningful improvement countermeasures for online teaching.

Conflict of Interest

The authors declare no conflict of interest.

Author Contributions

Changyu Liu conducted the research and wrote the paper; James L. Patnao, Jr formulated the overarching research goals and aims; all authors had approved the final version.

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