

# Teaching Model Integrating Online and Offline in Real Time ——An Exploration of New Teaching Mode for Regular Epidemic Prevention and Control

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**Abstract:** During epidemic, students in medium-risk or high-risk areas are unable to return to school on time. In response to this new challenge, there is an urgent need to create a new teaching mode to offer on-line courses to those absent from the offline classes, and we propose a model integrating online and offline teaching. It is based on “dual-camera” method, which allows off-campus students to virtually build up a physical classroom scenario on campus through computers and mobile phones. Using this model, students can participate in class remotely. In order to enhance the engagement of off-campus online students, emphasis is placed on interactive teaching. Teachers are required to design their teaching in advance and to work in collaboration with multiple departments, then using information technology and suitable teaching methods to enable students to participate in physical classroom teaching. This model has been tested in practice and has been successful in meeting the challenges. Finally, 4 areas for improvement and refinement are identified.

**Key words:** Epidemic prevention and control; New normal state; MOOC; Online and offline integrated teaching model

## 1 Introduction

While national epidemic prevention and control has remained stable in general since 2021, occasional multi-point occurrences and localized outbreaks have emerged. The prevention and control of epidemics in

China has stepped to a new normal state. Under these circumstances, students in medium and high risk areas are unable to return to campus normally for physical classroom learning before the spring or autumn terms start, posing new problems. In order to ensure that students in the infected areas have access to high quality classroom teaching without being affected by the epidemic when they are not able to return to school on time, there are requirements to develop a new teaching model which allows students in school to have classes in real while non-returning students have classes online, thus satisfying the needs of all students. This model would differ significantly from the teaching model used during the 2020 epidemic and would need to be designed in a practical way<sup>[1]</sup>.

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In order to adequately cater for students in school who have offline classes and non-returning students who have online classes, this paper innovatively proposes a new teaching model integrating online and offline in real time on the basis of previous theoretical research and practical summary<sup>[2-5]</sup>, which brings important inspiration and reference to solve the new problems under the new normal of regular epidemic prevention and control.

## 2 Problem Background and Solutions

Due to the epidemic in some areas, when a new school year starts, most students in the university will have returned to school, while a small number of students who are in medium or high risk areas will not be able to return to school in accordance with the epidemic prevention policy. As a result, the problem of students not all being able to concentrate on a uniform learning environment in a physical classroom offline occurs. Under the condition that the physical classroom is not equipped with a live teaching recording and broadcasting system, how to ensure that non returning students enjoy a basically consistent learning environment with returning students has become an urgent problem to be solved. The solution is for teachers to use technology methods to build a classroom environment that is largely restorative of the physical classroom, and then share it with the small number of students who are unable to return to school, and support them to participate in the physical classroom as well. To do this, it is necessary to synchronize offline physical classroom teaching with online classroom teaching in real time, which not only differs from pure online teaching or offline teaching, but also has difference with traditional hybrid online/offline (MOOC-based) teaching.

We must put the safety and health of students in the first place, adhere to the concept of “student-centeredness”, then actively change our thinking methods to innovate our teaching model practically. It is essential to give full play to the valuable experience

gained from the fight against epidemics in 2020 and make use of the advantages of online information technology to build the teaching environment integrating online and offline teaching, and carry out a new form of teaching that integrates offline face-to-face teaching and online learning. With this, we can guarantee that students who are unable to access the physical classroom can complete the learning content simultaneously through a suitable channel, bringing students a good learning environment, feeling and learning experience that they can “listen & watch & interact & discuss” to realize real-time integration between online and offline and sharing between on-campus and off-campus locations. And so the aim of substantial equivalence in teaching and learning for all students is achieved. In other words, we are able to create an integrated online and offline teaching environment for students who cannot attend physical classes due to the epidemic through the systematic and integrated innovation of concept, technology, form, mode, method, organization and service, thus achieving teaching and learning effectiveness.

## 3 Online and Offline Real-time Integrated Teaching

### 3.1 “Dual camera position” integrated teaching mode

“Dual camera position” integrated teaching refers to the use of 2 electronic devices (computer + pad/mobile phone/camera) at the classroom end to run video conference software to broadcast the PPT projection and blackboard-writing teaching of teachers in the classroom in real time through 2 channels, so as to realize that students outside the school can also use 2 electronic devices to study the teaching contents of projection and blackboard-writing at the same time, Comprehensively build a fusion and sharing learning environment, so as to achieve good learning results.

In this integrated teaching environment, video conference software (such as Tencent conference, Tencent classroom, etc.) is usually run online on the

classroom computer as a channel of audio and video signal live source (recording function can be turned on at the same time); at the same time, in the classroom, special personnel or arrangers (which can be acted by students) also run the same video conference software through mobile electronic devices (pads/mobile phones), focusing on collecting teachers' blackboard writing, classroom environment and other information as the live video source of the second channel. Students who have not yet returned to school use "Dual camera position" equipment (laptop + laptop/pad/mobile phone) to receive 2 channels live broadcast information at the same time, and restore the "live information" of classroom teaching locally. Fig. 1 shows this online and offline integrated teaching mode based on "Dual camera position".

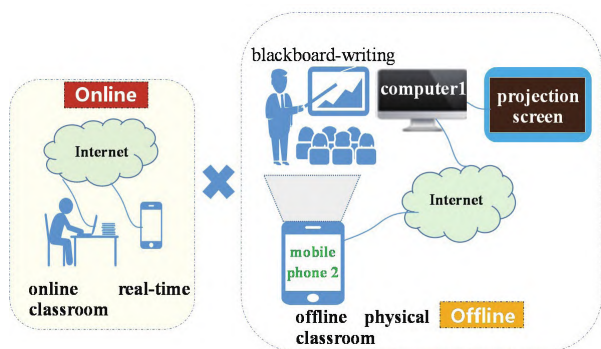


Fig. 1 Online and offline integrated teaching mode based on "Dual camera position".

### 3.2 Carry out online and offline integrated teaching

Considering the sense of space distance and the lack of reality of face-to-face communication in distance online learning, it is very important to carry out interactive classroom teaching to increase the participation of students who have not yet returned to school in online learning.

With the help of "Rain Classroom" and other information-based teaching aids, through roll call, questions, classroom tests, problem solving, problem discussion and other forms, we can mobilize online students' enthusiasm to participate in classroom learning, so that exchange and discussion, teacher-

student interaction, student interaction and flipped classroom can be carried out more in-depth online offline classes, promote students to deeply integrate into the classroom teaching environment to increase the sense of integration and intimacy, reduce the sense of distance and alienation.

In essence, the above integrated teaching is a real-time "synchronous live broadcast" teaching, which needs to be carried out on the premise that the network connection and speed meet the requirements. As an alternative and minimum guarantee scheme, it is required to use the "asynchronous recording and broadcasting" method to record audio and video throughout the teaching process of teachers, and share them with students who have not yet returned to school for learning and use through appropriate ways and channels after class.

In particular, teachers should try to use MOOC to carry out teaching, give full play to the basic functions of MOOC online autonomous learning before class, classroom discussion and flipped classroom teaching, and consolidation and improvement after class, and combine it with the depth of this integrated teaching to give full play to the maximum effect.

### 3.3 Strengthen interactive teaching in class

Fully carrying out interactive teaching in the classroom and bringing a good sense of integration to online students is the basic requirement of online and offline integrated teaching mode, which can be implemented from 2 aspects.

1) Carry out interactive teaching by using the "Rain Classroom" (Yangtze River version).

We should pay special attention to the use of the "Yangtze River version Rain Classroom" information-based teaching aids installed in the classroom computer of the teaching building, and increase the interaction between all students and teachers online and offline by using the built-in functions such as random roll call, exercise test, live communication, discussion and interaction, and the sharing of learning materials before and after class.

2) Innovating and optimizing interactive teaching methods to enhance classroom vitality.

Through the innovative use of interactive teaching methods such as homework submission, case analysis, problem exploration, group discussion and flipped classroom, online and non-local students are guided to participate in classroom teaching, forming an integrated teaching mode of online and offline interaction, teacher-student interaction and student interaction, and various forms of integrated interaction.

### 3.4 Teaching organization and implementation process

The online and offline integrated teaching mode has brought some challenges to the teaching organization, including the need to accurately grasp the situation of students returning to school in advance, find out the students who have not returned to school, and master their schedule information, which requires the coordination and linkage between the teaching department and the Student Work Department to complete effectively. The key point is that teachers should comprehensively design the curriculum, effectively connect the pre class, in class and after class teaching stages, and meet the needs of the new form of teaching. Fig. 2 shows the basic process from preparation to implementation.

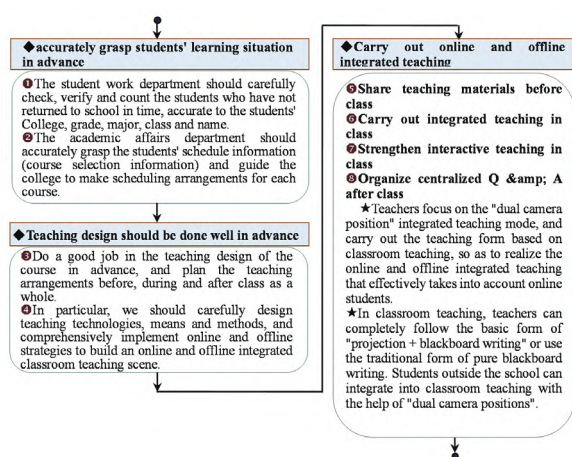


Fig. 2 Organization and implementation process to ensure the smooth implementation of online and offline real-time integrated teaching.

### 3.5 Differences with traditional online and offline hybrid teaching mode

This online and offline integrated teaching based on Dual camera position has the following 2 characteristics in essence.

1) Partial Online and Partial Offline.

Online and offline real-time integrated classroom teaching solves the problem that a small number of students who have not yet returned to school cannot enter the campus to participate in physical classroom teaching, but learn the teaching carried out by teachers in offline physical classroom online. Therefore, some students are online and some students are offline at the same time in real time, that is, the "Partial Online and Partial Offline" mode.

2) On campus and off campus integrated classroom teaching.

Some students outside the school use online learning, while some students inside the school use offline learning in a physical classroom. The 2 can be called "On campus and off campus integrated classroom teaching". In essence, they are cross space teaching, which extends the offline teaching space to online by using computer network technology, that is, online and offline have the same class.

Based on the above 2 characteristics, Table 1 compares the online and offline real-time integrated teaching mode with the traditional online and offline hybrid teaching mode.

## 4 Case Practice

At the beginning of the fall semester of 2021, the epidemic situation continued in some parts of the country, and dozens of students on the author's campus could not return to school on time, encountering the problems mentioned above. The campus has already made a plan for this and proposed an online and offline integrated teaching response plan.

Under the leadership of the academic affairs department, the student work department cooperated closely with the teaching unit and made various

**Table 1 Comparison between online and offline real-time integrated teaching mode and traditional online and offline hybrid teaching mode.**

Teaching model	Real time / synchronization	Regional / physical	Relevance to MOOC platform
Traditional online and offline hybrid teaching mode	Online teaching and offline teaching are carried out in different periods. Usually, online teaching is arranged before class and offline teaching is in class	Students are usually located on campus, log in to MOOC platform before class to carry out self-study and group learning, and participate in teacher teaching in class	The combination of online and offline teaching based on MOOC is the mainstream of hybrid teaching
Online and offline real-time integrated teaching mode	Online teaching and offline teaching are carried out simultaneously	Students who have not returned to school learn the teacher's teaching content in the classroom on campus in real time through the network outside the campus	In principle, there is no need to rely on the MOOC platform, but students in medium and high-risk areas can log in to the MOOC platform for self-study and group learning like students on campus before and after class

preparations according to the process in Fig. 2. The academic affairs department refined the work process, carried out online and offline integrated teaching training for classroom teachers involved in the corresponding courses, helped teachers master the necessary technology, organizational management and teaching methods, and re-engineered the multimedia equipment in the classroom to support the new teaching model. Under the organization of the administrative department and with the innovative support of teachers and students, the online and offline integrated teaching after the opening of the school was carried out smoothly<sup>[6]</sup>, ensuring the synchronous learning of offline physical classroom teaching and online network classroom teaching, and opening up a new channel for students who have not returned to school to integrate into the offline physical classroom, which not only allows them to achieve uninterrupted academics, but also brings the real-time presentation of the physical classroom teaching scene, and can ensure their participation.

This model and programme are equally applicable to the learning of returning students who are in quarantine due to the impact of the pandemic. In early September 2021, the campus reported students who had close contact, and the students were randomly picked up in multiple batches for isolation, and the relevant sub-close contacts were also required to use intramural isolation. In the face of this sudden situation, online and

offline integrated teaching has been put in use again. Teachers continue to come to the classroom for classes, using a combination of PPT and board book to carry out teaching, and students in isolation learn through online classrooms. Even in some classes, because all students are isolated, there is only one teacher in the classroom teaching, and all students are learning online, but students can still see the warm picture of the teacher in the classroom where the teacher's PPT and board book are the same as usual. Teaching and learning take place simultaneously in separate spaces. This model is different from the online teaching of all teachers and students in the first half of 2020 when the epidemic was severe, and there are new changes in the teaching mode and teaching method.

## 5 Areas Worth Improving

### 5.1 Do a good job of multi-departmental coordination and linkage

As a new teaching form and model, online and offline integrated teaching involves multiple departments in the school, and it is necessary for multiple parties to strengthen coordination and cooperation while doing their own work, do a good job in teaching organization and management, and ensure that they are implemented in a consistent manner.

Carrying out online and offline integrated teaching is the basic teaching arrangement to deal with the

situation that students in some areas cannot return to school on time due to the epidemic. This is not only a new exploration of new situations and new problems encountered under the normalization of epidemic prevention and control combined with practical innovation, but also a practical test of the comprehensive ability of teaching and talent training.

### **5.2 Increase the intensity of participatory and interactive teaching exploration**

Online and offline integrated teaching is the integration of multiple scenarios, means and methods, which requires teachers to comprehensively design curriculum teaching to better meet the needs of the new normal and new forms of teaching. The focus and difficulty of this is to carry out the design and implementation of participatory interactive teaching, and how to effectively integrate online students into physical classroom teaching to form an integrated classroom that effectively integrates online and offline through the optimization of teaching processes and the creation of teaching methods.

### **5.3 Flipped classroom teaching with effective online and offline collaboration**

Because there are students who cannot return to school, it is impossible to achieve the flipped classroom teaching of the conventional offline physical classroom, which is the problem that online and offline integrated teaching will face in the development of flipped classroom teaching. This is quite challenging. In order to realize this new teaching model, it is not only necessary to unify the grouping of online and offline students, but also to design the flipped classroom process and do a good job in the coordinated and orderly participation of online and offline students.

### **5.4 Do a good job of psychological and humanistic care**

How online students integrate into physical classroom teaching should achieve a multi-faceted integration of environment, learning and psychology. This is because students who fail to return to school in time may be anxious, worried about academic backwardness and low class participation. Therefore, teachers should pay

special attention and care to online students. In terms of classes, seminars, quizzes (online and offline real-time tests), homework (online submission of assignments), etc., teachers should let students who learn online have a good sense of integration, do not feel apathy and edge, but feel warmth and integration. Teachers should carry out good online and offline real-time synchronous teaching, organize online students to participate in classroom discussions, exchange opinions, consciously do a good job of care, alleviate anxiety and low emotions, eliminate the sense of distance and alienation. This is education with temperature.

## **6 Summary**

Online and offline real-time integrated teaching is a new teaching model triggered by the new normal of epidemic prevention and control, which basically realizes the simultaneous online learning of some students and the offline learning of some students, and initially solves the problem that the coverage of teaching activities is limited to the physical classroom space. It has a certain innovative and progressive significance. In addition, due to the fact that teachers need to pay attention to the effect of classroom teaching in real time, and it is difficult to monitor the response and effect of students' learning status, there are also many new challenges in this teaching mode, which need to be continuously explored and improved. In order to achieve the equivalent purpose of online and offline teaching and learning effects, it is necessary to combine the actual situation and do a comprehensive reform of teaching mode, teaching methods, teaching organization, teaching management and other aspects in a targeted manner, bringing more immersive, realistic and experiential online teaching space, and even creating a ubiquitous learning space.

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#### References

- [1] Wu Y. Realize the “track change and overtaking” of China’s higher education[J]. China Education Network, 2020(5): 12-13. (in Chinese)
- [2] Zhang C, Xu X F, Zhang L, et al. Take advantage of MOOC to reshape teaching and realize the new mode of online and offline hybrid teaching[J]. China University Teaching, 2018(5): 79-83. (in Chinese)
- [3] Zhang C, Lv W G, Li J X. Exploration and practice of multi integration network teaching form[J]. Computer Education, 2021(4): 98-101. (in Chinese)
- [4] Zhang C, Lv W G, Li J X. Online participatory discussion teaching of computer architecture courses[J]. Computer Education, 2021(1): 8-12. (in Chinese)
- [5] Xu X F, Zhang C, Jiang J W. On the model innovation and experience sharing of online teaching in China from the perspective of coping with the epidemic crisis[J]. China University Teaching, 2020(7): 42-46. (in Chinese)
- [6] Harbin Institute Technology, Weihai. Online and offline integrated teaching opens the first lesson of the new semester[EB/OL]. (2021-09-06)[2022-06-01]. <https://www.hitwh.edu.cn/2021/0906/c1307a142461/page.htm>. (in Chinese)



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