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Research and Construction of “Intelligence Plus” Air Re-Study Classroom--Take the “Higher Mathematics” Course as an Example

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ABSTRACT. *According to the draft of China's intelligent education development plan (2020-2035), the goal of intelligent education is to build a new talent training system in the intelligent era, which requires the classroom revolution of inquiry, collaboration and hybrid teaching methods. This revolution needs to deal with the classroom reform in the era of intelligence. It is not only based on diversified, open, flexible and appropriate digital education resources, but also requires teachers to become high-level digital teachers with “artificial intelligence +”. On April 1, 2016, Tsinghua University “Xuetang online” launched a smart teaching tool “Rain Classroom” based on WeChat and PPT. The tool can conveniently collect teaching data before, during and after class, and interact with teachers and students, so as to achieve real-time classroom data-driven teaching and learning. So far, more than 1.3 million classrooms in more than 90 countries and regions around the world, and more than 16 million users are using them in depth.*

KEYWORDS: *Intelligence plus, Higher mathematics, Air re-study*

1. Introduction

In recent years, China's colleges and universities have carried out the reform of credit system, taking students as the main body, implementing the course selection system, allowing students to choose courses across disciplines, departments, specialties and grades, so as to give students the opportunity to learn various professional courses and master more knowledge. However, students' learning energy is limited, and to complete their studies, they must take and obtain the module course credits specified by the major. Some students fail to pass the exam because of the basic deviation, learning attitude and learning methods. At this time, they need to study again to complete the requirements of graduation credits.

2. Problems in the Course of Revision

Taking “advanced mathematics” as an example, this course, as a public basic course for science and engineering majors, is opened in the first year of University. Because the course is abstract, difficult to calculate, and quite different from high school knowledge, some students do not pay enough attention to the course, resulting in a large number of students who take it again every year. Take the data of Shandong Jiaotong University in recent three years as an example (see Table 1).

Table 1 Statistics on The Number of Re-Engineered “Higher Mathematics” by Shandong Jiaotong University 2017-2020

Semester	2017-2018-1	2017-2018-2	2018-2019-1	2018-2019-2	2019-2020-1	2019-2020-2
Course	Advanced Mathematics(1)	Advanced Mathematics(2)	Advanced Mathematics(1)	Advanced Mathematics(2)	Advanced Mathematics(1)	Advanced Mathematics(2)
Number	188	276	315	517	215	514

At present, Shandong Jiaotong University mainly adopts three ways to study the re course: those who have a large number of retraining courses adopt the form of separate classes for those with large number of students, and those with a small number of students can insert the new class to follow the class and the students to study

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by themselves according to the situation of the students. Taking the course of advanced mathematics as an example, there are a large number of students who take part in the re course, involving many colleges and majors. If a separate re course is set up, it will be difficult to recruit courses and arrange courses. If students are selected to join the new class for revision, it will not only increase the teaching pressure of the normal class, but also the students can't attend class on time because of the conflict of class arrangement.

3. “Rain Classroom” and “Timely Rain”

Zhang Bingling in “Making “Mu Class” a “Main Battlefield” for Curriculum Re-Study [1].It is pointed out that a variety of online open courses can be used, the use of “mo class” and re-learning combined to achieve the purpose of mutual recognition of credits. However, “Mu class” has its own defects, the student's learning process can not achieve effective monitoring, offline discussion, meet the design of the class is not well controlled, the fairness of students' usual grades is open to discussion. Therefore, it is worth studying and discussing to find a more effective, intelligent and practical way to re-examine the classroom [2].

Professor Jinjun of Huazhong Normal University on the concept of abstraction, the number of students (more than 2500 people), the traditional large class teaching effect of the “linear algebra” course using the “1 plus 7” synchronous teaching method, specifically: the use of the same floor 8 smart classroom series live broadcast, more than 300 students divided into 8 small classrooms, the professor each selected a classroom to teach, the course has 30 minutes by the assistant to answer questions, not targeted students, Make up for the lack of the main classroom in the classroom and pay attention to every student, to achieve the premise of the scale of personalized teaching [3].

Combined with the development and application of various functions such as “Rain Classroom 4.0” video live, big data, random roll call in the classroom, classroom in-class testing, student classroom contribution (voice, picture), after-school assignment, online testing, video and courseware synchronization to WeChat client, we think we can consider the construction and use of the “smart plus” air classroom for re-learning students[4].

4. The Feasibility of “Rain Classroom Wisdom and” Air Rebuilding Classroom

(1) In order to facilitate the management and calculation of workload, it is recommended to carry out the re-work in the form of a separate shift, according to the number of students selected to the main teacher to calculate the workload. The teaching process uses the online live “intelligence plus” air classroom accounts for 80% of the teaching content, 10% of the teaching content in the smart classroom, 10% of the content in the form of meet class to give students counseling to answer questions and discussions. Online and offline combination, so that students make full use of time and place to complete credit courses.

(2) In order to better manage the students' usual performance, you can hire senior outstanding students as “rain class” class assistants, to help the main teacher to complete the classroom test, after-school homework and online test subjective questions review, to help the main teacher to complete the meeting and answer questions, and timely online answer students' questions, effectively complete the class, after-class tutoring work, the lecturer gives a certain amount of work according to the situation.

(3) According to the characteristics of re-study students, the teaching team construction is applicable to the characteristics of this level of students “ Rain Classroom” teaching courseware, supporting short preview video, pre-school pre-training exercise questions, after-school homework questions and knowledge modular problem library.

Since re-learning students have already studied the course more than once, the content setting can be different from the new teaching, according to the knowledge point modular teaching content, such as the Advanced Mathematics course can be designed as (see Table 2):

Thus to break the sequence of the content of teaching materials, the use of knowledge points to see the link, through the content learned, to achieve re-learning, deepen the foundation, clean the knowledge blind spot.

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Table 2 Modular Teaching Design of Advanced Mathematics Courses

Mathematics Module teaching	Function calculus of one variable	Limits and continuity of a conofunction function
		Function calculus of one variable
		Integration of functions of one variable
	Application of one variable function calculus	Applications of derivatives
		Application of definite integral
		First order differential equation and its application
	Calculus of multivariate function and its application	Images and properties of multivariate functions
		Differential calculus of multivariate functions
		Integral of multivariate function (multiple integral, line integral, area integral)〉
		Application of multivariate function calculus
	Infinite series	Number series
		Series of function terms
		Fourier series

5. The Teaching Design of the "Rain Classroom Wisdom and" Air Re-Engineering Classroom

5.1 Student Grouping

Taking the course of advanced mathematics as an example, we can set up a class for all the students who have taken the course again and divide them into several groups according to the number of students.

For example, 500 students can be set up as a large-scale independent class, and then the students will be divided into eight groups. Each group has set up the time of class and meeting time of smart classroom, and the students can choose groups according to their actual situation. During the whole teaching process, each group will attend the class in the smart classroom within the scheduled time, and other group students will choose the appropriate place to synchronously attend the live online course. In order to ensure 10% of the smart classroom teaching, each group should have at least 8 class hours in the smart classroom, and 8 class hours in group counseling and discussion class.

5.2 Smart Classroom with "Rain Classroom" to Create "Wisdom +" Air Classroom

(1) Using the live network video function of "rain class 4.0", the class sign in information is released to all students to ensure the attendance rate of students. In order to prevent students from not actively following the class after checking in, random roll call is used in class, and random roll call is conducted in class from time to time. Students in the classroom in the intelligent classroom are required to answer questions in class. Students in the air classroom use the "bullet screen" and "classroom contribution" functions to answer questions in real time.

(2) Using "Rain Classroom", the teaching content of "wisdom +" air classroom can be designed as: preview before class, lecture in class, homework after class and online test module.

Before class, use the video of knowledge points that have been built (it is best to record by teachers according to the characteristics of students) and some objective questions to preview the content 20 minutes

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before class. This design can ensure that students are prepared before class and “bring problems” in class. Meanwhile, the lecturer can analyze the preview data provided by “rain class” and focus on the knowledge points with high error rate.

In the stage of face-to-face teaching, modular teaching courseware is designed according to the characteristics of students, and classroom exercises are inserted into the courseware to strengthen the teaching difficulties and teaching emphasis. Among them, the design of objective questions such as single choice questions, filling in blanks and multiple-choice questions accounts for 5% of the teaching time, and the subjective questions account for 15% of the teaching time. According to the teacher's schedule, the students complete the classroom exercises in time. In order to ensure the participation of students, the lecturer will analyze the completion rate and accuracy of the objective questions on the screen, and randomly select the students' answers to the objective questions for screen analysis, and send the excellent students' homework to the whole class. Since the objective questions are automatically graded by the system, the subjective questions can be online graded by the teaching assistants of this course, so as to ensure that all the evaluation results are given before the end of the course. After the lecture, the “rain class” will give a list of “excellent students” and “early warning students” according to the students' classroom performance. At this time, it is necessary for the lecturer to praise the excellent students, conduct private chat with the early warning students, find problems and solve them in time.

After class, according to the teaching content of each class, 10 homework assignments with a score of 100 points are set, which basically include 7 objective questions such as selection and filling in the blank, and 3 subjective questions. After class, the main lecturer sends them to the class, and sets the end time for submitting assignments and the time for publishing answers. Students' subjective questions are annotated and evaluated by the teaching assistants on the computer using the “rain class” webpage. Students with poor quality can choose to push back to answer again. For the students who participate in the “Rain Classroom wisdom +” air refreshment class, there will be no paper homework left, and only focus on the after-school homework when answering questions in the meeting class.

According to the teaching progress of the course, after each teaching module is completed, according to the teaching knowledge points, teaching key points and teaching difficulties, the module knowledge test questions with 100 points of moderate difficulty and wide coverage are set, of which the objective questions account for 60% and the subjective questions account for 40%. In order to ensure that students can complete the test independently within the specified time, the lecturer pushes the students' online test questions within the predetermined time through “rain class”, sets the test duration, test completion time and test answer announcement time, and students choose the place to complete the test, so as to ensure the fairness and fairness of the “wisdom +” air classroom, and achieve the goal of evaluating students' learning effect.

Because the teaching content setting of re learning students has broken the normal teaching progress, the mid-term examination will not be set up under the premise of online testing of module knowledge.

(3)After all the teaching is completed, all teaching data can be exported through the webpage, including: class attendance, classroom evaluation scores (including roll call plus points, in class test results, classroom reaction speed, etc.), pre class preview results, after-school homework scores and module knowledge test scores. These scores can objectively evaluate students' usual scores. According to the weight of various grades, the usual scores can be set as (see Table 3)

Table 3 Peacetime Score Weight Settings

Class check-in	Classroom evaluation Results	Pre-class previews Results	After-school homework Results	Module Knowledge Point Test scores
15%	25%	10%	25%	25%

The evaluation of re learning students is not only positive evaluation, but also formative evaluation. In this regard, according to the students' knowledge, the final closed book examination is adopted, with a full score of 100. According to the setting of “wisdom plus” air classroom, face-to-face teaching and Q & a face-to-face teaching, the final evaluation of students is set as: 50% of the usual score and 50% of the final examination paper.

6. “Rain Classroom Wisdom and Solutions” Air Rebuilding Classroom Problems and Solutions

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6.1 Problems with the Calculation of Teaching Workload

Different from the traditional classroom teaching, there are a large number of students in the “wisdom +” air classroom. It is suggested to set up special funds and corresponding workload for the “wisdom +” air classroom. The class fee and workload are set by the whole teaching team, and the lecturer and the teaching assistant are assigned according to the course participation.

6.2 Student Management Issues

Re learning students come from different colleges, majors and grades, with a large number of students, and there are many time conflicts in class, which can not guarantee the attendance rate of students. Therefore, it is suggested that the group preset should be carried out according to the college and grade of the students. According to the time of the students, the group of students in the smart classroom can be adjusted flexibly, which not only ensures that the students can attend lectures in the smart classroom, but also takes into account the learning effect of other students in the synchronous “wisdom +” air classroom.

6.3 Fairness in Student Performance Evaluation

Because the “rain class” is different from the traditional classroom, the students' learning data can be recorded more comprehensive and complete. According to the practical effect, we can improve the proportion of ordinary grades, try our best to be consistent with the assessment results of ordinary classroom teaching, and try to make the score normal distribution and tend to be reasonable.

6.4 Knowledge Point “Modularity” Issue

Re-learning students have studied the course more than once, have a certain understanding of the knowledge system of the whole course, and can find the difficulties and key points of the course from their own perspective. Therefore, from the modular design of the course content and knowledge points before and after, comparative explanation, to achieve the “knowledge points” from the shallow to the deep, from the easy to the difficult, to sort out the internal relationship of all knowledge points and the order before and after.

7. Conclusion

As a smart learning tool based on WeChat and PPT, “Rain Classroom” can make use of limited high-quality teaching resources, expand the teaching mode by adopting the mode of live online class, and complete the teaching process of students' re learning. And ensure the real-time monitoring and positive evaluation of students' learning before, during and after class. Therefore, it is urgent and necessary to construct the “Rain Classroom wisdom +” air repair classroom for the credit system reform in Colleges and universities. However, there are also some problems in the “wisdom +” air classroom, such as insufficient monitoring of students' learning process, poor fairness of students' homework evaluation, and how to adapt to the new hybrid teaching mode, which makes the teaching management more complex and challenging. In addition, some practical courses are not suitable for “wisdom +” aerial classroom, or face-to-face courses are better. Therefore, how to reasonably and appropriately apply “Rain Classroom wisdom +” air re class and improve its weight in the re course is only worth our further thinking and exploration.

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