

## Research and practice of online and offline blended teaching of instrument analysis course under the background of big data

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**Abstract:** 2021 is the first year of the "14th Five-Year Plan" for education, and China's higher education is moving towards Informatization 2.0. In the era of booming big data, higher education will also undergo a series of profound changes. This paper takes the higher education entering the era of big data as the research background. Taking the instrument analysis course as an example, analyzes the key problems that should be solved in the online and offline blended teaching. Summarizes the advantages of the student-centered online interactive teaching using the Changjiang Rain Classroom platform, and discusses the online and offline blended teaching integrating scientific research cases.

### 1. Introduction

With the rapid development of information technology, human society has entered the era of big data. At present, big data is gradually becoming a new generation of information technology and service formats for discovering new knowledge, creating new value and enhancing new capabilities from a collection of data in a general sense. Big data will cause a revolution. The huge data resources make various fields start the process of quantification, whether it is academia, business or government, all fields will start this process, and the same is true in the field of education. From a global perspective, a new round of scientific and technological revolution and industrial revolution is emerging, major technological innovations are leading social changes, and the development of new technologies such as big data, the Internet, and artificial intelligence is constantly reshaping the form of education, the methods of knowledge acquisition and teaching. The combination of big data and the development of higher education has gradually become an important means to solve current educational problems, an inexhaustible driving force for promoting deep-level educational reform, and a strategic measure to boost educational modernization. Socialism with Chinese characteristics has entered a new era. In order to support the modernization of the country, build a strong country in education, create a good ecology for education reform and development, and open up a new situation for the modernization of education in a new era, on April 13, 2018, the Ministry of Education issued "Education Informatization 2.0".<sup>[1-2]</sup>

"China's Education Modernization 2035" depicts the prospect of education development facing the future, and clarifies the basic, leading and overall status and role of education in the development of the country's modernization.<sup>[3-4]</sup> With the increasing influence of information technology on education, accelerating the reform of education to promote the reform and innovation of educational organizational forms and management models, and comprehensively promoting the modernization of education with educational informatization has become a strategic choice for the reform and development of my country's educational undertakings. In the era of big data, big data in education will have a profound impact on the reform of education and teaching. Under the fundamental task of cultivating people with morality, big data thinking is an important education and teaching concept to gain insight into new opportunities, meet new challenges, and continuously improve the quality of higher education teaching.

## **2. The Key Problems that should be Solved in Online and Offline Hybrid Teaching in the Era of Big Data**

The 12 graduation requirements of the Chemical Education Professional Accreditation Standards clearly point out the importance of developing students' "research skills, analytical problems, and complex engineering problems." The chemistry major has high requirements for practice. The "Supplementary Standards for the Certification of Chemistry Education Majors" proposes: "The rate of experimentation in professional courses should reach more than 90%, and the proportion of comprehensive, design and innovative experimental courses in the total experimental courses should be more than 60%."<sup>[5-6]</sup> It can be seen from this that the cultivation of innovative thinking and practical ability is particularly important in the training objectives of materials majors. Instrumental analysis is the professional foundation and main course of chemistry major, and the quality of the course is very important for cultivating innovative and applied talents. Therefore, based on the goal-oriented needs of chemical education professional certification, in the context of first-class curriculum construction, the construction and reform of instrumental analysis courses should mainly include the following aspects: (1) Based on the needs of economic and social development and the goal of talent training, optimize and reconstruct the teaching content and curriculum system, and strive to introduce scientific research practice cases into classroom teaching, infiltrate ideological and political information, and stimulate students' learning interest and motivation; (2) Strengthen classroom design, take students as the center, and enable students to deeply understand basic theoretical knowledge and improve their ability to analyze problems through seminar-style teaching; (3) Make full use of online course resources and online and offline mixed teaching to solve the contradiction between teaching and learning, and further improve students' learning effect.

## **3. Using the Changjiang Rain Classroom Teaching Platform for Online Auxiliary Teaching**

In recent years, through the review and summary of a large number of relevant literature, as well as through the research and practice of instrument analysis course construction and online and offline hybrid teaching mode, class teachers have made great progress in the construction and reform of online and offline hybrid teaching mode. Practice shows that using the online course platform of Changjiang Rain Classroom to assist teaching is more conducive to solving the contradiction between teaching and learning. For example, the Yangtze River Rain Classroom is used to assist students in the three stages of pre-class, in-class and after-class respectively. By publishing learning objectives, teaching courseware and recorded short videos explaining important knowledge points before class, it can help students achieve. In traditional teaching, teachers have to teach the same course knowledge to most students in the classroom, which often leads to the situation that top students "can't eat enough" and students with poor foundation "can't eat it". Using the Changjiang Rain Classroom online course platform for online auxiliary teaching can not only provide richer online course resources for top students to expand their professional horizons, but also make online course resources a booster and a gas station for students with weak foundations. The recorded courses, short videos and courseware in the online courses can help students with poor learning ability to truly understand and master the basic theory and related knowledge of the course through repeated viewing and learning, so as to achieve the best students learn better and the poor students. Moreover, students' autonomous learning ability and comprehension ability can be effectively improved through students' autonomous learning of online course resources. Therefore, using the online course platform of Changjiang Rain Classroom for auxiliary teaching can benefit all students. It is not only an effective way to solve the problem of different students and other problems, but also to comprehensively improve the learning ability of all students and expand their professional field of vision.

## **4. Online Interactive Teaching with Students as the Center**

During the epidemic, online teaching has become the main teaching mode. In order to allow students to receive good learning effects, the teachers of the class group have further improved the

teaching resources of online courses, updated the teaching courseware, and re-recorded and uploaded new course recordings. Through recent online teaching practice, it is found that student-centered online interactive teaching is more conducive to mobilizing students' learning enthusiasm and participation, and has played an important role in cultivating students' learning interest and thinking ability. During the online teaching period in September 2022, the average number of daily visits by more than 30 students reached more than 300 times, indicating that online teaching can greatly promote students' learning initiative and help cultivate students' autonomous learning ability. In addition, through online interaction, teachers can timely grasp the learning effect of students and the mastery of knowledge points, so as to strengthen the explanation and practice of a knowledge point in a more targeted manner. Teachers can grasp the results of students' answers and learning effects in time through the results of each in-class test.

Provide guidance and answers to students who answered incorrectly in time, so as to ensure that each student can accurately grasp the knowledge points of the course and keep up with the teaching progress of the course. During the online teaching period, teachers will go to Changjiang Rain Classroom almost every day to supplement course teaching resources, publish online teaching notices, and publish or review assignments and tests.

## **5. Fully Integrate Scientific Research Cases for Online and Offline Blended Teaching**

In the era of big data, online and offline hybrid teaching will surely become the mainstream mode of school curriculum implementation in the future. The online and offline hybrid teaching mode is not a simple superposition of "online" and "offline", but through pre-class learning, online self-learning, classroom key and difficult explanations, online and offline in-depth discussions and procedural assessments, etc. The seminar-style teaching integrating scientific research cases is student-centered, combined with appropriate scientific research cases, and focuses on core knowledge points, and conducts teaching in the form of seminars. Case study teaching will be more conducive to mobilizing students' enthusiasm for learning, and is conducive to cultivating students' self-learning ability and problem analysis ability. For example, during the course teaching, teachers can set up different topics and require students to review relevant literature in groups and summarize them into PPT for classroom reporting. Practice shows that learning activities such as literature review, PPT production, classroom reports and online defense can stimulate students' learning motivation and expand the learning depth of the course. Online and offline blended teaching based on the cultivation of innovative ability has been paid more and more attention. At present, the online and offline hybrid teaching mode of instrument analysis courses mainly reflects the following characteristics: (1) Continuously updated teaching courseware and recorded course videos can ensure that students have a good self-learning effect; (2) Rich online course resources lay a foundation for the top students to further expand their professional knowledge fields and the frontier development of disciplines; (3) Sufficient interaction and communication before, during and after class stimulates students' enthusiasm for learning and helps students to master solid theoretical knowledge of courses; (4) Online open discussion topics and heuristic and case-based teaching further mobilize students' learning motivation, and help to cultivate their analytical problem-solving, research, communication, and ability to solve complex engineering practice problems. At present, the online and offline blended teaching of the instrument analysis course has gone through multiple teaching cycles. During the online and offline blended teaching process, the teachers of the class group insist on in-depth study and research, and constantly improve and improve the teaching mode.

## **6. Conclusion**

In the context of first-class curriculum construction, based on the "Chemistry Education Professional Certification Standards" and graduation requirements, the continuous construction and reform of the instrumental analysis curriculum is of great significance for cultivating high-quality professionals.

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