

Exploration and Practice of Organic Chemistry Online Teaching Based on the Zhihuishu and Tencent Classroom

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Abstract: Two online education platforms, Zhihuishu and Tencent classroom, were applied to the online teaching of organic chemistry. The Zhihuishu was mainly used for pre-class preview and after-class homework assignment, while Tencent classroom was used for live teaching, which complemented each other's advantages to ensure the smooth progress of online teaching and achieved good teaching effects.

Keywords: Organic chemistry, online teaching, Zhihuishu education platform, Tencent classroom

1. Introduction

Online teaching refers to the teaching mode in which teachers teach courses online in the form of video, audio, PPT or live broadcast, and students use mobile phones, IPAD or computers to learn. Online teaching breaks the limitations of time and space, and students can learn anytime and anywhere. The COVID-19 epidemic has made online teaching the dominant form of teaching all over the world. Jiao Jianli et al. summarized several typical online teaching forms, including online courses, webcast courses, self-directed learning, and TV air classes etc. [1]. Massive Open Online Courses (MOOC) and webcast courses are the main ways of online teaching in colleges and universities [2]. How to make full use of the existing online open course platform resources, choose the appropriate online tools, build a teaching model suitable for their own courses, and achieve the equivalence between online teaching and classroom teaching quality is a challenge for university teachers.

Organic Chemistry is an important and basic course for chemical engineering, pharmacy, biology, materials and other related majors. The main purpose and task of this course is to require students to master the structure, nomenclature, properties and mutual transformation of various organic compounds. And enable students to receive good training in scientific thinking in the process of organic chemistry learning, have the ability to use organic chemistry knowledge to analyze and solve complex problems in their professional fields, and cultivate innovative thinking and rigorous scientific spirit. According to the curriculum characteristics of organic chemistry and the previous curriculum construction, we adopted the mixed online teaching mode of Zhihuishu education platform and Tencent classroom. We implemented the three-stage teaching method of "pre-class + in-class + after-class" [3], that is, pre-class preview, after-class homework, tutoring and answering questions were carried out on the Zhihuishu education platform, while the live teaching was completed in Tencent classroom. In teaching design and practice, we adhered to the student-centered, and had achieved good teaching results.

2. Pre-class preview on Zhihuishu education platform

Zhihuishu is a credit course operation service platform, which provides curriculum reform, cross-school shared courses, credit mutual recognition, degree support and other services. In the early stage, we have established a shared course of organic chemistry on the Zhihuishu platform, and used it as a medium to explore and practice the reversal classroom teaching model, and accumulated some

experience in online teaching [4].

2.1. Uploading learning resources

Teachers first set up their own flip courses on the Zhihuishu online platform, and notify students through the WeChat group, students scan the code or click the link to join the course. The platform includes nine columns, such as learning tasks, learning resources, question-and-answer discussion, homework and examination, learning situation data, grade management and so on. Teachers upload electronic textbooks, PPT, animation and other materials in the learning resources, and urge students to preview and complete the learning tasks combined with the videos of the shared courses. Through learning situation data, teachers can check the students' learning progress and learning time at any time, and timely remind the students who have not finished.

2.2. Post learning tasks

In the design of learning tasks, the problem-driven method is used to guide students' autonomous learning and stimulate students' internal motivation. For example, when learning the localization law of electrophilic substituent of benzene, students are required to complete two preparatory tasks: one is to analyze the effects of substituents on the electrophilic substituent reactivity and reaction orientation; the other is to find out the structural characteristics of different locational groups.

2.3. Design self-test questions to test the effect of preview

Teachers design relatively simple preview self-test questions for learning tasks, which are usually multiple choice questions or fill-in-the-blank questions, such as writing the products of chlorination reaction of toluene and nitrobenzene, and pointing out which type of localization group -NHCOCH₃ is, etc. In this way, students can not only have clear learning goals, but also independently test the learning effect, and really become the main body of learning. The platform can count and analyze the scores of the preview self-test questions, which is convenient for teachers to grasp the weak links of students' knowledge and arrange the live teaching content reasonably.

3. Live teaching in Tencent classroom

Tencent classroom APP is a professional online education tool launched by Tencent. Teachers need to install Tencent Classroom Extreme Edition on their computers, and students can install Tencent Classroom on their computers or mobile phones, or click on the link sent by the teacher to listen to the lecture directly. Tencent classroom online live broadcast function is very powerful, with check-in, raise hands, ask questions, text discussion, 1 + 5 people voice interaction, test answer and other functions. At the same time, it supports PPT presentation, screen sharing, whiteboard and other diversified teaching modes, and can generate playback within 24 hours after class.

The teaching content of live broadcast mainly includes three parts: review of preview tasks, explanation of key and difficult points and summary. The teacher first guides the students to discuss the preview task. The students can publish their words in the discussion area or "raise their hands" to make speech by using the Lianmai function. The teacher comments and summarizes the key points and difficulties. For example, when learning the localization law of electrophilic substitution of benzene, teachers guide students to summarize the following two aspects: first, the localization groups on the benzene ring can be divided into ortho-para localization group and meso-para localization group. In addition to the halogenated group, the ortho-para localization group is the activation group, and the meso-para localization group is the passivation group; Secondly, the structure characteristics of the two types of locators are that most of the ortho-para locators are connected to the benzene ring by saturated atoms, while most of the meso-para locators are connected to the benzene ring by unsaturated atoms. The teacher further explains the electronic effect between the two kinds of localization groups and benzene rings, and guides the students to find out the essence of the localization law.

After teaching each knowledge point, the teacher will send students online exercises in class to train students to use the basic knowledge of organic chemistry to analyze and solve problems. As mentioned earlier location law of electrophilic substitution, the students are asked to complete two aspects of exercises, first, students practice comparing the electrophilic substitution activities of various benzene derivatives, such as the bromination reaction sequence of toluene, chlorobenzene, nitrobenzene, phenol,

etc. Second, students practice using the location law to choose a reasonable synthetic route to synthesize benzene derivatives, such as whether to synthesize m-nitrochlorobenzene by chlorination or nitrification and chlorination. Teachers can test the students' classroom learning effect and adjust the teaching design in time by issuing options and setting answer time through the answer card function. Students can "raise their hands" at any time or have class discussions if they have questions or do not understand. Students who actively participate and perform well will be evaluated, encouraged and included in their grades in time. Students who cannot actively participate in the discussion will be asked random questions, so that more students can participate in the discussion, enhance the interactivity and communication of the live broadcast, and then improve the efficiency of classroom teaching.

Tencent Classroom has the function of playback. Students who do not fully understand the part in the live class can learn it again by watching it. Students who fail to attend class on time for some reasons can watch the class video and make up the lesson anytime and anywhere, which is incomparable to the offline class.

4. After-class learning based on Zhihuishu education platform

After the live broadcast, the teacher publishes the homework or online test questions in the "homework examination" column of Zhihuishu platform according to the live teaching progress, the students complete and submit them within a specified time, and the teachers review the homework and view the homework analysis data in time. The Zhihuishu platform can provide the performance of the distribution and the accuracy analysis of each subject. According to these data, the teacher understands the students' mastery of knowledge, focuses on explaining the topics with an error rate of more than 40% in the homework and carries out appropriate expansion training during the live broadcast, and carries out personalized analysis and individual tutoring for the students with poor grades.

Omni-directional online testing can effectively test the effect of live teaching, play a good role in supervising students' learning, and provide a reliable basis for teachers' objective evaluation of students, which is conducive to the construction of omni-directional and process evaluation system.

The implementation of after-class learning through the Zhihuishu course platform is a continuation of the live class, which can test the learning effect of the live class and provide a sufficient basis for the improvement of online teaching activities.

5. Effect of Online Teaching

We have published 32 learning tasks and 62 learning resources on the online platform of Zhihuishu, including PPT, micro videos of important knowledge points, Flash animations of three-dimensional structure and reaction mechanism, solution analysis of exercises, etc. Issued 27 assignments, 11 chapter tests, a total of 585 exercises. Through the performance management of the platform, students' check-in, homework, test and Q&A are quantified, which can be checked at any time by students. The usual score accounts for 40% of the final exam, which also greatly motivates students' learning enthusiasm, and the completion rate of both check-in and homework is above 96%.

We have broadcast 54 times in Tencent classroom, a total of 108 class hours. The live course content mainly includes three parts: key review, new lesson teaching and summary discussion. In the key review, we review the knowledge points of the previous section, check the preview tasks, and focus on the topics with an error rate of more than 40% in the Zhihuishu platform. In the new class, the answer card will be released more than 2 times each time, and all the staff will be urged to participate, so that we can know the students' knowledge mastery and class participation at any time. Students who cannot actively participate in the discussion will be randomly asked questions. During the whole live broadcast, 316 students were asked questions, and more than 90% of the students could answer the questions timely and accurately. In the process of teaching, heuristic teaching is mainly adopted, and students are guided to think through carefully designed questions. Students interact actively in the discussion area and the effect is good.

In the final exam, 321 students from two majors took part in the exam, among which 43 were excellent, accounting for 13.4%, 130 were good, accounting for 40.5%, 106 were medium, accounting for 33.0%, 32 were passing, accounting for 10%, and 10 were failing, accounting for 3.1%, which was in line with the normal distribution (Figure 1).

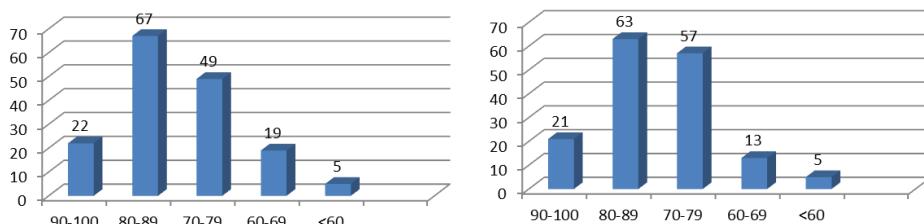


Figure 1: Bar chart of final exam score distribution

6. Conclusion

We use two online teaching platforms, Zhihuishu and Tencent classroom, to carry out online teaching. The Zhihuishu platform is mainly used for pre-class preview and homework assignment, and Tencent classroom carries out live teaching. Both of them complement each other and ensure the smooth progress of online teaching and good teaching effect. It is a beneficial practice of the transformation from traditional higher teaching mode to innovative higher teaching mode [5].

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