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# Research and Application of Diversified Teaching Methods of Analytical Chemistry Experiment Course in Local Application-oriented Universities

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**Abstract:** In order to meet the needs of national economic transformation, local undergraduate universities make great efforts to transform into application-oriented universities, and provide application-oriented talents with innovative ability and practical ability for the economic and social development. Starting from the course "Analytical Chemistry Experiment", this paper puts forward diversified teaching methods to stimulate students' interest in learning, so as to cultivate the chemistry major students suitable for the needs of The Times, and serve for the economic and social development.

**Keywords:** Analytical chemistry experiment; Diversification; Teaching reform.

## 1. Introduction

Pu 'er University is located in "one city connects three countries, one river connects five neighbors". 14 ethnic groups live in Pu' er City, which is known as the "world tea source of coffee capital in China". College will be xi jinping, the thought of socialism with Chinese characteristics as guidance, in the party's 20 spirit, comprehensively strengthen the leadership of the party, earnestly implement the party's education policy, to carry out the khalid ents fundamental task, further defined local, regional, applied, international orientation, improve talent training, scientific research, service society, cultural heritage innovation and international exchanges and cooperation ability, strive to build a distinctive first-class high level applied university in the province.

Analytical chemistry is college chemistry, applied chemistry, material science, life science and other professional one of the important basic course, with the progress of The Times, discipline and the development of science and technology, analytical chemistry has become the eyes of science and technology, in the sustainable development of national economy, the growth of national defense forces and the development and utilization of natural resources and so on various aspects of the role is important. Analytical chemistry is a very practical subject. Therefore, the analytical chemistry experiment course of analytical chemistry is a separate course, which is divided into chemical analysis experiment and instrument analysis experiment, which is closely combined with the teaching of analytical chemistry theory course, and is one of the main professional courses of chemistry major.

With the rapid development and application of modern information technology, people's channels for receiving knowledge are more diversified. The traditional classroom teaching mode based on teacher teaching is difficult to meet students' increasingly diversified learning needs, and new teaching modes such as flipped classroom based on micro-video and mixed online and offline teaching are more likely to be accepted by college students. In order to keep up with the pace of higher education reform and social development, we have carried out active reform and exploration on the analytical chemistry experiment teaching based on the actual situation of our college, aiming to cultivate students' independent learning ability and innovative thinking, and improve the quality of talent training.

## 2. Analyze the Problems Existing in Chemistry Experiments in Traditional Teaching

### 2.1. Status quo of traditional teaching

Analytical chemistry experiment is a major major course for chemistry students in our school. The total score is 2 credits and starts in the third semester. Through the systematic training of analytical chemistry experiments, we can deepen their understanding of the basic principles and knowledge of analytical chemistry, and cultivate their ability to acquire new knowledge with experimental methods; master the basic operation skills of analytical chemistry experiments, cultivate the habit of careful preview, careful observation, truthfully recording and organizing instruments before experiments; cultivate the ability of independent thinking, correctly processing experimental data and concise and rigorous writing expression; pay attention to the ability of analyzing and solving problems and rigorous and realistic scientific style, so that students have the basic ability and accomplishment to engage in scientific research. Before the experiment, check the students' preview, and test the operation ability of the students. After the experiment, the students will sort out the experimental data and complete the experiment report, and the instructor will review the experiment report. The course content is completed by means of explanation, demonstration, operation demonstration and experimental operation.

### 2.2. Main existing problems

New analysis methods are emerging and teaching hours are shrinking, and students 'chemistry knowledge base is uneven; teachers are difficult to accurately grasp students' learning conditions. Cause in the traditional teaching mode of teachers of knowledge, for students 'individual differences and personalized needs, and students are busy mechanical copy,

"square medicine", thinking to explore, understand the design of the experimental scheme, cannot realize the students' innovative thinking ability, analysis ability and solve practical problems, difficult to meet the requirement of the new era of innovative talent training.

The assessment method of experimental results is single and lack of science. Previous experimental assessment and performance evaluation of analytical chemistry are as follows:

Performance evaluation: the final assessment accounts for 30% (including experimental operation and experimental data processing), and the usual performance account for 70% (including attendance, experimental preview, experimental operation and experimental report).

This assessment mechanism makes teachers can not get good after-school feedback, and students can not get the cultivation of practical ability and innovative consciousness, which is not conducive to the improvement of the teaching quality of experimental courses, and can not evaluate students objectively and comprehensively.

# 3. Application of Diversified Teaching Mode in Analytical Chemistry Experiments

## 3.1. Mixed online and offline teaching mode

The network teaching platform of Pu'er University (Super Star learning platform) is combined with the traditional laboratory teaching. The basic path of mixed teaching of analytical chemistry experimental course can be set as follows: online preview, offline exploration and online consolidation. In classroom teaching, teachers sort out the students' preview and the feedback problems according by the platform.

Before class (online preview): One week before the experiment starts, the teacher will set up clear preview tasks according to the teaching objectives, and publish the learning materials and task points to the Superstar Learning Pass platform. Students can complete the preview task by watching the operation video, learning the experimental teaching materials, and completing the preview test questions. Through online preview before class, students are allowed to complete the "what is" stage of learning before class, deepen the understanding of the relevant principles and foundations of the experiment, master the relevant experimental knowledge, improve the learning efficiency, and develop the habit of independent learning. In addition, teachers use the online teaching platform to explain the potential safety risks of pre-class experiments, leaving students more abundant time for scientific research, so that students can participate more in the experiment process, have a stronger desire to discuss and answer questions more actively, so as to ensure the teaching quality of experimental courses.

Class (offline field): problem oriented and classroom discussion teaching mode, the teacher will experiment principle, experiment possible phenomenon, the choice of indicators, the influence of interference ion, error source design into thinking, problem oriented to guide the teaching, enable the students to complete the "why" stage of learning. In class, the teacher randomly selects students to answer the thinking questions, and other students will supplement or put forward different opinions and discuss them. After the discussion, the teacher will comment and summarize; finally, the teacher will comb and emphasize the important knowledge points, and design questions to guide the students to think during the experiment. The whole teaching link takes students as the main body to answer and discuss, and teachers play a guiding role. Students will conduct experiments independently according to the pre-class preview and the class discussion content. The teacher will observe whether the students 'experiment operation and whether the record data are standardized and correct them in time, and score according to the students' operation.

After class (combination of online and offline): make students complete the "how to use" stage of learning. After the experiment class, the students first gave the corresponding answers to the expansion content released by the teacher and the questions raised during the online preview, and only a little time to realize the relevant experimental theoretical knowledge and experimental skills, consolidate and expand; secondly, review the problems by watching the offline experimental operation repeatedly, constantly correct their mistakes in the experimental operation, consolidate the operation skills and theoretical knowledge; Finally, upload the completed experiment report. The teacher corrects the students' experiment report in time, and uses the online teaching platform to check the irregular operation behavior of each student in the experiment process, and urges and guides the students to correct through wechat, QQ and other software, so as to make an objective and reasonable evaluation of the students.

In the past three years, diversified teaching practices have been carried out in chemistry 20 (undergraduate), 21 (undergraduate) and 22 (undergraduate). The number of students is 44,40 and 66 respectively. In the teaching of analytical chemistry experiment, 103 learning task points were published, the chapter learning times were 17,202 times, and 197 chapter tests were completed。

## 3.2. Discussion-type teaching mode

Increase the proportion of designed experiments, and adopt the way of class grouping. The basic path is: write plans and report to teachers and students' questions for experiment reflection and summary. In addition, in the process of the experiment, and students are encouraged to think hard, improve experimental methods, and develop students' potential. (Figure 1)

**Figure 1.** Seminar-type teaching mode

## 3.3. Experimental assessment and result evaluation

This course adopts a diversified learning evaluation system that integrates online and offline to stimulate students' enthusiasm and autonomy in learning. The comprehensive score of the course consists of process assessment results and final assessment results, among which the process assessment results include attendance, online learning (including

experimental preview), experimental operation, experimental report, mid-term test, etc., accounting for 70%; the final assessment results are the final experimental operation skills test results, accounting for 30%.

# 4. Conclusion

The preview mode combining online and offline, the diversified teaching mode of problem oriented and classroom discussion, and the establishment of the whole process diversified experimental assessment system truly reflect the student-centered and teacher-guided teaching concept. This teaching mode not only emphasizes the cultivation of students 'experimental operation skills, but also stimulates students' learning initiative, effectively improves students' independent learning ability and innovative thinking ability, and improves the quality of experimental teaching. In the future teaching practice, we still need to continuously reform the analytical chemistry experiment teaching in combination with the reality, and innovate the teaching mode suitable for the development of The Times, so as to improve the quality of talent training.

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