



The Application of Wisdom Class Teaching Model in Physical Chemistry Experiment

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Abstract. This paper analyzes the problems existing in the traditional teaching model of physical chemistry course and raise the wisdom class teaching model. In the wisdom class teaching model, we introduced more teaching resources and platform in pre-class and after class. This teaching model can strengthen the interaction between teachers and students, improve students' learning enthusiasm, and it can monitor students' learning situation conveniently. Therefore, the wisdom class model can effectively improve the teaching quality of physical chemistry experiment.

Keywords: wisdom class · physical chemistry experiment · teaching model · rain class

1 Introduction

Physical chemistry experiment is an important compulsory basic course for chemistry, materials, environment and other related majors in colleges and universities. It is an independent course in chemistry teaching system, and it has the closest relationship with Physical Chemistry. The purpose of physical chemistry experiments is to enable students to preliminarily understand the research methods of chemistry, so as to lay a good foundation for the subsequent theoretical study and research [1].

The traditional teaching mode of physical chemistry is composed of pre-class preview, in-class explanation, experimental operation and after-class experimental report. In the traditional experimental teaching mode, most of the subject status of students is ignored, and students often passively accept the knowledge input by the teacher in the learning process. Therefore, traditional physical chemistry experiment teaching cannot mobilize students' initiative and enthusiasm, and it is difficult to cultivate students' comprehensive innovation ability [2].

The Education Informatization 2.0 action plan formulated by the Ministry of Education, it is planned to build a large platform of "Internet + education" by 2022 and develop a new model of Internet-based education services. Wisdom class is a new class teaching model based on the background of "Internet + education". It is based on cloud computing, big data, the Internet of Things and other information technologies. The appearance of wisdom class provides a new way to solve the deficiency of traditional teaching mode of physical chemistry experiment course.

2 Deficiencies in the Traditional Teaching Mode of Physical Chemistry Experiment

2.1 The Progress of Physical Chemistry Experiment Course Does not Match the Progress of Theoretical Course

The experimental courses of physical chemistry and the theoretical courses of physical chemistry in our school are offered in the same semester and the experimental teaching resources are relatively deficient. In order to meet the teaching arrangements of each class, it is difficult to ensure that the experimental courses are carried out after the corresponding theoretical knowledge. For example, the experiment “first-order reaction - sucrose transformation” is the content of chemical dynamics. The explanation of this knowledge in the theory course is in the second semester of sophomore year, but the experiment teaching is usually arranged in the first semester of sophomore year. As a result, students are unfamiliar with experimental theoretical knowledge in the experiment process, and it is difficult for them to understand the experimental principles. Physical chemistry experiments have also lost their role in consolidating and deepening theoretical knowledge [3].

2.2 The Teaching Mode is Single

The teaching process of physical chemistry experiment is generally previewing before class - explaining in class - operating by students - writing experiment report after class. In this traditional teaching mode, experimental teaching mainly relies on teachers' explanation and demonstration. Teachers are the main body of teaching, and students passively accept teachers' knowledge input, which is difficult to inspire students' thinking and stimulate their learning enthusiasm. Besides, it is difficult for students to absorb the complicated, long and informative content of the lecture. They do not have a deep grasp of experimental principles and operations, and do not have their own understanding of experimental phenomena and data rules. When errors occur in the experimental measurement results, students cannot find out it in time, which leads experiment to failure. These reasons cause students have poor enthusiasm for this course, some students reflect the course is boring and difficult to understand.

2.3 The Effect of Preview is Poor

In the traditional teaching mode, students are required to understand the experimental principle, experimental operation and the use of instruments and equipment through preview in advance [4]. The preview of physical chemistry experiment is generally completed by writing the preview report before class. In the process of the completion of the preview of experiment, some students do not pay enough attention to the experiment preview, in order to cope with the teacher's inspection, they mechanically copy the preview report without their own understanding and thinking. Experimental principles of physical chemistry are generally complex and involve a large number of formula derivation processes [5], which makes it difficult to understand. Therefore, the effect of preview is poor.

2.4 The Experiment and Data Processing Are Difficult

Compared with other basic chemical experiments, physical and chemical experiments have more instruments and equipment, and the equipment is also more complex, such as conductivity meter, potentiometer, Abbe refraction meter, polarimeter, etc. Before class, it is difficult for students to understand and imagine the operation of instrument through the document description of the textbook and the sketch of the instrument. Therefore, teachers need to spend more time to explain the principle and operation of the instrument in class, which makes it difficult for students to concentrate their attention and occupies too much experiment time.

After the completion of the experimental operation, students also need to process the acquired experimental data, some of the experimental data processing is complex. For example, in the “Measurement of solution surface adsorption - maximum bubble pressure method”, In order to obtain Γ_{∞} , we need six steps. Through the teacher’s oral description, students are often difficultly to understand and master, the data processing is often incorrect and the experimental report cannot be completed on time.

2.5 The Course Assessment Method is Single

The result of physical chemistry experiment course mainly includes three parts: experiment preview report, experiment report and classroom performance. The students basically copy the preview report according to the book and copy the report from other students, and there is little difference in the completion of each student. Therefore, according to the traditional way of assessment, students’ learning cannot be differentiated.

3 Application of the Teaching Model of Wisdom Class

In order to solve the above problems in teaching, the wisdom class teaching model is introduced into the physical chemistry experimental teaching reform of our school. The design of wisdom class teaching process is shown in Fig. 1. The wisdom class teaching mode makes full use of the teaching resources on the Internet.

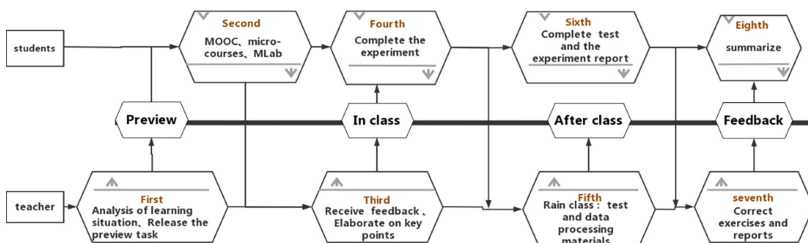


Fig. 1. Flow chart of wisdom class teaching

3.1 Introduce Online Micro-class, MOOCs and Other Courses in the Pre-class Preview

According to the experimental content, teachers make teaching plans, use the rain class combined with various online platforms, and release preview requirements. Students preview the experimental principles and watch the experimental operation by watching the micro video. They can also master the experimental principles easily without learning the theoretical knowledge. It is more intuitive to learn by video and easier for students to understand the principle and experimental operation. In this teaching mode, preview requirements are issued through the rain class, and the intelligent education platform “School Online” is associated with the rain class. Relevant video courseware can be directly watched in the rain class, and the platform does not limit the learning time, which can fit the learning arrangement of this course. At the same time, students can consult and discuss with teachers online at any time if they have questions, and teachers can also effectively monitor students’ learning progress in the background.

3.2 Introduce the MLab Simulation Teaching Platform

MLab is an experimental simulation teaching APP. The platform has rich teaching resources, covering most part of the content of physical chemistry experiment, and can fit the basic teaching needs. Through this teaching platform, students can understand the structure, operation method and experimental steps of the instrument before class, so as to better complete the preview before the experiment. MLab has practice mode and assessment mode. Students can be familiar with the operation steps of the experiment through the practice mode, and then test their mastery of the experimental steps through the assessment mode. Teachers can also check the weak links of students through data analysis, so as to better arrange classroom teaching.

3.3 Classroom Teaching

After receiving feedback of rain class and MLab preview, teachers conduct targeted classroom teaching according to the problems in preview. First of all, the teacher explains the important and difficult points in the experiment, so that the students can better grasp the experiment principle and operation. Secondly, students are organized to have group discussions, which mainly discuss the common problems feedbacks from the learning platform, and teachers provide guidance in the discussion process. Through discussion, we can stimulate students’ enthusiasm for learning and improve their problem-solving ability.

3.4 Test and Data Push After the Class

After the completion of classroom experiment teaching, teachers will push data processing methods and test questions to the rain class. Through the learning materials pushed by the Rain class, students can better learn the data processing software and complete the experimental data processing. Teachers can judge students’ mastery of the experiment content through the completion of the test questions and reports, give feedback, and students can summarize through the teacher’s feedback.

Table 1. Evaluation standards of physical chemistry experiment results

Assessment content	Evaluation basis	score	ratio
Experiment preview	The learning situation of micro class and MOOCs Rain classroom interaction	100	10%
Experimental operation	Standardization of operation. Accuracy of the results	100	20%
Exercises	Accuracy	100	10%
Experiment report	Normalization Degree of completion	100	20%
Final examination	Close testing Comprehensive survey	100	50%

3.5 Comprehensive Evaluation

Compared with the assessment methods in the traditional teaching methods, the assessment methods of wisdom class teaching are more diversified, including the scores of rain class preview and rain class test. The comprehensive assessment standards are shown in the Table 1. The comprehensive score is composed of these five parts. This assessment method can comprehensively reflect students' course learning.

4 Conclusion

In the wisdom class teaching mode, more learning resources and learning platforms are introduced, teaching resources and methods are more diversified, which can stimulate students' learning enthusiasm and autonomy, improve the efficiency of experiment preview, and make the evaluation more comprehensive. This teaching mode is more conducive to reflect the principal position of students, so that students have an interest in physical chemistry experiment courses, actively participate in classroom teaching, and finally realize the teaching objectives of physical chemistry.

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