Case and analysis of flip classroom based on micro-course video

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Abstract. The flipping classroom is a new type of teaching method developed with the development of information technology. It was explored and analyzed that the design and production of the micro-video of the junior high school chemistry, from the concept of teaching knowledge, experimental inquiry knowledge and computing class. The feasibility of flipping the classroom micro video was analyzed starting with the model one by one, and verified it with the case. The research results showed that flipped classroom can improve students' self-learning ability, but because students are not familiar with this new way of learning, participation is not very high. The research results can provide a basis for improving the teaching method of flipping classroom.

1. Introduction
In 2007, two high school teachers in the United States, Jonathan Bergmann and Aaron Sams, made a video of the class to help students who were absent due to illness or other objective factors. The video was passed to the Internet for students to learn. This is the prototype of the flip classroom micro-course [1]. Salman Khan set up the Khan Academy channel on YouTube and received a good response. At present, the Khan channel education subject has been expanded to more than a dozen subjects, and the number of views has reached hundreds of millions. [2] Jonathan Bergmann and Aaron. Sims’s "Flip Your Classroom: Talk to Every Student in Every Class Every Day" was published in the education sector. Arousing no small sensation, Jonathan Bergman and Aaron Sams have become the leaders of the flip classroom teaching.

In 2011, Hu Tiesheng took the lead in proposing a new form of teaching in China [2]. This new form is based on micro-video and named “micro-course”, which has injected new blood into Chinese traditional forms of education. In 2013, Huazhong University of Science and Technology proposed and led the establishment of the “C20 Mutual Union”, which provided a theoretical basis for the implementation of the flip classroom in China. Up to now, there have been more than a thousand schools in China that have conducted first-line teaching experiments on flipping classrooms. However, the implementation of China's flip classroom, although in the form of a "student-centered" teaching philosophy, fundamentally did not get rid of the "teacher-centered" traditional teaching philosophy. The reason is still the way of selecting talents in China. The focus of teacher teaching is on imparting knowledge. It has not paid enough attention to the ability of students to learn independently and
explore learning. Therefore, the implementation of the flipping classroom in China needs to change the cognition of teachers, so that we can truly achieve "student-centered".

2. Micro-course teaching implementation steps based on flipping classroom

Before the production of micro-classes video, teachers must first carry out teaching design, carefully analyze the teaching materials, thoroughly understand the teaching materials, and have a systematic overall mastery of the content of the teaching materials. Combining the teaching characteristics of the "flip classroom", the “flip classroom” is divided into four steps. Teaching design [3].

2.1 Shooting micro video

After a comprehensive and systematic analysis of the content of the textbook, the key points and difficulties of this lesson are clearly defined. The targeted production is for 3-10 hours of video. One video should be clear about a knowledge point, and the time should not be too long. Otherwise, it will lose its advantage as a micro-course, and it cannot be pursued in a short and rough way. Therefore, in the preparation period, it is crucial to correctly select the teaching content suitable for micro-course teaching. Although the knowledge of junior high school chemistry is not very advanced, the abstract concept consciousness is not very good for students who are new to this new subject. There are still some difficulties in accepting some conceptual knowledge of chemistry, so in the micro-curriculum production. Aspects need to add some visual and visual demonstrations, supplemented by language explanations, so that students have a clear understanding of the concept in their minds.

2.2 Making learning “task list”, designing self-exercise exercises

The “task list” is also called “autonomous learning task list”. It is produced under the situation of flipping the classroom micro-course. It is used by students and guides students to learn independently. The main content is “learning guide”, learning tasks, confusion and Suggest. Its main feature is that it no longer emphasizes teacher guidance and student learning, but puts students in an active position. The teacher's guiding position is reflected in the "learning guide," "learning task" and other means. The “task list” expresses the difficulty and other knowledge of the course through the form of the problem, and plays the role of task-driven and problem-oriented [1]. Let students naturally learn knowledge in the process of solving problems, help students to learn independently, and develop the ability to think independently.

At the end of the “task list”, after students complete self-learning, they should design an appropriate number of exercises that closely follow the self-study content to help students consolidate knowledge and identify difficult points.

2.3 Classroom intensive, collaborative completion of learning tasks

After the students' self-learning, the teacher has to solve two problems in the classroom. The first is to solve the problems and confusions that students have when they watch the micro-courses and do self-tests, and correct the deviations caused by students' self-study. The second is to do exercises related to the learning content of this lesson to consolidate the knowledge that students have learned. In the classroom, teachers can appropriately expand and extend knowledge according to the students' learning and mastery.

2.4 Student Self-reflection and Teacher Summary Evaluation

The micro-course is a new type of curriculum based on students' self-learning. Therefore, it has very high requirements for students. The students in the junior high school did not form a sense of reflection and summarization of the learned knowledge in time, and could not establish a complete Cognitive system, so many students think that chemical knowledge is difficult to understand and difficult to accept. Therefore, teachers should pay attention to cultivating students' ability of self-reflection and summarization, so that students can internalize the learned knowledge into their own
cognitive system in the process of reflection and summarization, so that knowledge can be connected in series and knowledge can be used. I feel very handy.

3. micro-course design and production based on flipping classroom

3.1 Junior high school chemical micro curriculum design principles
Student-centered is the most important principle of micro-course design and production [4]. It should be clear in the design and production of micro-courses: micro-courses are used for students, and micro-classes are used by students outside the classroom. The place of use can be anywhere. Therefore, teachers have no way to effectively monitor students' learning status and progress. Therefore, it is very important to implement the student-centered design principles and enhance the usefulness and interest of the micro-course [2].

Student-centered meaning includes the following three layers of meaning.

3.1.1 In the audio-visual design
mobilize the autonomy of students' learning, and look at the picture and ears to listen to the sound with the students' eyes. The content of the micro-course only needs to present the teaching content itself. It is not necessary to display the complete teaching activities. In the production of the pictures, it is necessary to make it clear and convenient for students to observe and learn. In the production of sound, students should understand clearly. The volume and sound should not make students feel uncomfortable.

3.1.2 In the design of ideas
The teachers must respect the characteristics of students, analyze the problems from the standpoint of students, and start teaching and organizing content. Combining the students' doubts and problems encountered in the study, the knowledge is broken down into small problems step by step, so that the students can learn in small steps, actively respond to the knowledge points, and adapt to the students' thinking mode so that they can gradually grasp what they want to learn.

3.1.3 In the student's feelings
Micro-course does not mean moving the traditional classroom from school to home, nor does it mean compressing the classroom time. The real attraction of micro-courses to students lies in the simple classroom environment. The teachers have a detailed and intimate explanation of the teaching content, and have the natural and intimate feelings of teachers one-on-one and the students' teaching.

3.2 junior high school chemistry micro-class design process

3.2.1 Pre-analysis
Before selecting the micro-choice questions, the teachers must analyze and select teaching materials, teaching objectives, teaching content and students' academic situation. First, it is necessary to analyze and analyze the knowledge points applicable to the teaching of micro-teaching. Secondly, it analyzes the students' physical and mental development, knowledge mastery and students' learning motivation, and conducts micro-course design in a targeted manner.

3.2.2 Determining the theme
The rational selection of the micro-course is a key step in the success of the micro-course, which is a direct reflection of the core value of the micro-course [3]. The topics of micro-courses can be divided into many types, including lectures, problem-solving, answering questions, and experimental types. The determination of the type of the micro-course has a guiding role in the production of micro-courses, and guides teachers in the selection of different teaching strategies in the teaching of micro-teaching.
3.2.3 Writing a lesson plan
The lesson plan is a concrete reflection of the subject of micro-teaching. It is based on the specific educational thoughts and the order of teaching content, and the teaching content and educational goals are specific to the curriculum implementation plan.

3.2.4 Micro-course recording
The teachers record the ppt and lecture process into video MP4 format using the camtasia studio6.0 screen recording software. Follow the general principles of micro-course recording when recording. The language is clear and concise, the key content is clear, and the rhythm is grasped accurately.

3.2.5 Implementation and reflection of micro-class
Micro-course production is completed in teacher practice teaching. Students learn independently according to the content of micro-course under the class. Teachers inspect and reflect on the content of micro-class learning, and constantly explore the micro-suitable students. Class teaching mode and content.

4. Junior high school chemical micro-curriculum implementation case
According to the general design principles of the micro-course and the characteristics of the junior high school chemistry, the chemical knowledge is divided into several types. In this paper, we mainly present conceptual lecture classes, experimental operation classes, and calculation classes. Analyze the micro-course design forms of different types of knowledge points.

4.1 Concept Teaching Class - Structure of the Atom
（1）Pre-analysis: This section is selected from the third section of the second unit of the 9th grade chemistry book of Shandong Education Publishing House. Before studying this lesson, students have already learned the movement of water molecules and the changes of water molecules, for microscopic particles. The numerator has a certain understanding, the learning of the structure of the atom can be analogous to the molecular structure, and the knowledge of the students can be used to understand the new knowledge.

（2）micro-class self-learning task list

| Study guide |  |
|-------------|---|
| Name of the project: | the composition of the atom |
| Achieve the goal: | Master the composition of the atom by watching the instructional videos and completing the tasks specified in the Autonomous Learning Task List |
| Classroom learning form notice | Classroom Testing - Group Collaboration Discussion - Feedback - Summary Review |
| The learning task | |
| Complete the following tasks by watching the micro-course video | 1. Review the structure and molecular motion of molecules 2. Understand people’s understanding of the atomic structure 3. Know the structure of the atom |
| Confusion and suggestions | (Students fill in their own) |
4.2 Experimental Exploration Class - Laboratory Preparation of Oxygen

4.2.1. Analysis of the situation
Experiments are a very important part of the chemistry discipline, and it is one of the very important goals of this section to enable students to master the normative experimental skills. This lesson is selected from the third section of the "Current Air" section of the ninth grade of "Chemistry" of Shandong Education Publishing House. This section is the first complete operation of the students in the junior high school stage, which lays a very important foundation for future experimental operations.

Students are not familiar with the steps, precautions, etc. of the experimental operation, so pay attention to the standardization and accuracy of the words in the course of the course. Through the study of the micro-course video, the success rate of the students' actual operation can be greatly improved.

4.2.2 micro-class self-learning task list
Table 2 Self-learning task list- "Exploring the Water World" - the Preparation of Oxygen

| Study guide | "Exploring the Water World" - the Preparation of Oxygen |
|-------------|----------------------------------------------------------|
| Name of the project | Master the method of making oxygen by watching the instructional videos and completing the tasks specified in the Autonomous Learning Task List. |
| Achieve the goal | Classroom Testing - Group Collaboration Discussion - Practical Operations - Summary Review |
| Classroom learning form notice | The learning task |
| Complete the following tasks by watching the micro-course video | 1. Know the oxygen preparation device |
| | 2. know the oxygen collection device |
| | 3. Can say the method of verification and completion of oxygen. |
| | 4. Know what the properties of the catalyst and catalyst are. |
| Confusion and suggestions | (Students fill in their own) |

5. Summary and reflection
Under the guidance of the new curriculum, for the analysis of junior high school chemistry, the flipping classroom and three different types of knowledge points are carefully practiced and analyzed. Practice shows that these three types of knowledge points are suitable for combination with the flipping classroom. In the process of learning, the students’ interest is greatly stimulated, and the subject status of the class is returned to the students, so that the students’ self-learning ability, cooperative learning ability and inquiry learning ability are greatly improved.

For this research on the flipping classroom micro-course, we also found some limitations:
(1) the time to flip the classroom into our country is very short, the actual application and classroom teaching time is shorter, and the flipping classroom has not spread to most schools. In teaching activities, so the existing research results are not enough to get a definitive conclusion.
(2) After three years of compulsory education, and the traditional teaching methods adapted to “teacher teaching and student learning”, the students in the third grade did not adapt well to the flipping classroom that focused on independent learning.
(3) Given that junior high school students are facing the pressure of entering a higher school, most of the concerns of schools and teachers are on how to improve students' performance. The flipping
classroom that focuses on cultivating students' self-learning ability and inquiry ability obviously cannot fully adapt to the "fast pace."

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