Innovative Design and Implementation of the Flipped Classroom Teaching Mode Based on the Micro-courses

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Abstracts: Aiming at the common phenomenon in higher vocational colleges such as the sources of students are complex, a greater basic knowledge’s difference between students, their poor autonomous learning ability and lacking of learning interest and so on, this essay analyzes the main problems existing in the traditional teaching mode in Higher Vocational Education and the characteristics of Higher Vocational College students, shares the techniques of making high-quality micro course, designs innovatively the integration of the theory and practice of the Flip class teaching model, and designs teacher’s teaching activities in the circle of before and middle and after the course in details. Additionally, this essay introduces application of Flip class on internet.

Introduction

With the construction of educational overpass in our country, the source of students in higher vocational colleges becomes complicated. At present, the recruitment channels of higher vocational colleges are: ordinary high school graduate students, this part of the students are liberal arts and science, liberal arts students in science and engineering thinking and science and engineering foundation is relatively weak. In addition, there are students with independent enrollment students, whose overall knowledge of the students is relatively weak. There is a big difference between the students in different channels, and there are many problems, such as weak theoretical foundation, difficult to concentrate, lack of learning enthusiasm, learning initiative and poor study habits. At present, the biggest problem of higher vocational education is how to make the students who are not in the state actively invest in the classroom teaching, so as to improve the teaching quality?

Flip class is also called reversed classroom \cite{1-2}. The theory is to let students complete self-study before class by watching videos concerning the task of this lesson in the one hand. In the other hand, the use of classroom time is to carry out learning activities (project theme) to help students realize the internalization of knowledge, using brand new teaching ideas and methods, thus truly reflects the dominant subjectivity of students learning and teachers, completely changed the traditional classroom teaching mode. Sahlman Khan founded the Khan Academy, which is an example of a successful implementation of flipping classroom. Now teachers can freely get access to the platform of khan academy, constantly flipping the classroom teaching mode in practice, and achieved good teaching effect than expected.

The necessity of flipping classroom teaching reform

At present, most of the teaching methods in higher vocational colleges is "three stage" teaching mode: before class, the students learn the textbook, then the teachers explains the theoretical knowledge in the class, and at last the students do the exercises after class, as shown in Figure 1. For the students of vocational colleges, the teaching mode of the existing problem is: their theory foundation is relatively poor, so they cannot complete the preparation before class; when at class, they do not develop study habits well enough to understand teachers' explaining.
A survey on a large number of vocational students shows that they are particularly interested in information technology, and they have high practical ability, and their thinking is also very active! According to the characteristics of higher vocational students, it is necessary to make micro lesson video by using information technology, and let students watch the video repeatedly before class to have autonomous learning, hence knowledge differences among different recruitment channels of students would be remedied, in order to facilitate the integration of theory and practice teaching classroom activities, finally improve teaching quality.

How to make high-quality micro-course

Micro course is an important teaching resource to realize the reform of classroom teaching. An excellent micro course is able to attract students, and effectively interact with students, in order to make students grasp the basic knowledge of classroom teaching activities. The producing process of micro course includes: instructional design, video making and post processing. Instructional design is the key to a good quality of micro courses, which includes choosing topics, writing lesson plans and design of PPT. [3-4]

Choosing appropriate topics

The subject of the micro lesson is the key to the producing of micro course. Good topics can be twice the result with half the effort, while bad topics can make the micro course become commonplace and mediocre.

1. The key points or difficult points in teaching. Generally, one micro course explains one point of knowledge, which is intended for students to share teaching resources, resolving their puzzles. It is in line with the original intention of micro course to choose the most important point or the parts that are most difficult for students to understand,

2. Suitable for multimedia expression. Micro course, as a kind of media content, is designed to be suitable for the use of multimedia features, suitable for adding rich graphics, colorful interactive animation, and sound with video, so as to attract students to watch over and over again.

Writing lesson plans

Although a micro course lasts only a few minutes, it also needs a good teaching design. The teaching plan should list all the processes of the teaching, including the basic steps, the teaching methods used and the design of interactive teaching activities. A good lesson plan should include the following:

1. Reflect the characteristics of vocational education, combine theory and practice, and introduce the actual job scene.
2. Take the student as the main body, using heuristic teaching, and inspire students to think by questioning.
3. Produce the feeling of “one to one”, instead of merely recording lessons in the classroom.
4. Design interactive teaching activities, reflecting students' autonomous learning as the main body, stimulate students' interest in learning.
5. Refine the teaching process, and the appropriate period is 5-10 minutes.

**PPT production**

1. Background: The elegant the better. It should not be too messy or too bright. If the color of the background is too bright, it will make the content look empty. Meanwhile, totally no background or a solid color background is not recommended.
2. The lower right corner or the lower left corner should be blank, so the shadow of teacher will not block the contents.
3. Reasonable arrangements for the amount of information. There should be 50% words, 20% pictures, and 30% blank in the entire PPT.
4. The number of colors used in PPT should not more than 3 and 2 is the best.
5. There are several kinds of animation, but not too much, 2-5 kinds of pages’ effect is appropriate.
6. The combination of static and dynamic. Do not appear to be several consecutive pictures or all of PPT are in words.

**Innovative design of teaching method in Flip class**

**Self-study of basic knowledge before class**

Before class, using the platform to give reviewing materials and guidance information, and use mind map in the guidance information to explain the connections of relating knowledge points, thus to guide students to learn the basic concepts of the content before class. Whether students acquired the knowledge or not can be checked through the pre class tests in the platform. We can answer the questions raised by the students in the learning process at any time through the discussion and communication module of the network platform. According to the evaluation results in each of the questions for quantitative analysis, and refer to students in questions of exchange "analysis of the student learning network platform", it can be determined of the discussion emphasis and difficulty points of teaching. Then we can make teaching plan on focus, to realize the implementation of flipping the classroom.

**Interactive teaching activities in classroom**

At class, according to the design project, under the guidance of teachers, the actual engineering problem is decomposed into several steps, step by step to guide the students to discuss solutions, finally will upload the completed work to the teaching platform, to track and monitor the completion of students. Embody "students as the main body, the teacher as the leading" teaching modes, improve students' classroom participation, improve students' interest in learning, cultivate students' ability in practical work to analyze and solve problems.

**Process evaluation of network platform after class**

After class, make students do training of certificate exam by online evaluation module. Students can do homework online, also can adopt the traditional mode of homework, only to upload pictures of papers to the platform, using after-school practice module of student layout expansion after class. Each task has evaluation, and process evaluation accounted for 50% of the total score.

Innovative design of teaching method in Flip class is as shown in Figure 2.
Figure 2. Innovative design of teaching method in Flip class.

**Implementation of Flip class teaching mode**

According to the idea of the integration of theory and practice, each teaching unit is designed as a teaching task, as shown in Figure 3, with the help of network teaching platform, to realize flipped classroom teaching. In the network teaching platform, each teaching task contains 9 teaching section: “task situation”, “minding map”, “task order” and “micro-course videos”, "testing before class", "electronic courseware", "learning situation analysis", “interactive teaching activity at class”, “unit measurement”, “the expansion after class”. It is showed in the following the implementation of Flip class teaching mode, taking the diesel engine on the dead point as an example.
Self-study on line before class

In the "task situation" section, a 3D animation of the sewing machine and the diesel engine is given, and the dead point of the sewing machine is taken as an example, students are guided to think:

Why do we sometimes fail to start the sewing machine at the beginning? How did we get it to move?

The logic relationship between the knowledge points in this task is introduced in mind mapping which is shown in Figure 4.
Electronic courseware provides lectures with PPT, as a reference to online learning before class. In "Micro-course video" section, videos which were made in advance are shown there. The use of information technology into the interactive animation and actual work scene is recorded into a micro class for students, repeatedly watched. Students before class learning of basic knowledge needed in this class, make the implementation of flipping the classroom come true. The basic knowledge needed to explain dead point knowledge is the pressure angle and transmission angle, so the micro course video of pressure angle and transmission angle is placed in this part.

Aim of the "testing before class" is to guide students to study by themselves by the use of micro course video and other reference materials before class. The main questions of this lesson before class test are:
1. Write out the definition of dead point and pole angle;
2. Analysis the causes of dead point by operating interactive animation of crank rocker mechanism.
3. Which mechanisms have dead point?

**At class Interactive teaching activity design of integration of theory and Practice**

In "learning situation analysis" section, based on results of before class test and questions discussed, we analyzes students' situation, then design teaching activities at lesson accordingly.

### Table 1. The learning situation analysis before class.

<table>
<thead>
<tr>
<th>Points of knowledge</th>
<th>learning situation Analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>The definition of dead points and the crank angle between extreme positions.</td>
<td>Have mastered</td>
</tr>
<tr>
<td>The reasons of the dead points existence and how to judge when a mechanism will appear dead points.</td>
<td>Difficult points</td>
</tr>
<tr>
<td>Which mechanisms have dead points in the common four-bar linkages? The methods of using and overcoming dead points.</td>
<td>Key points</td>
</tr>
</tbody>
</table>

"Interactive teaching activity at class" is carried out offline, according to the students before the completion of inspection, analysis of learning, we design the teaching activities, and make the task list at class to have a student-centered, teacher-led, collaborative way to guide students to step by step to complete the knowledge learning.

1. Interactive teaching activity 1: reveal the secret causes of dead point (difficult point)
   Use the interactive animation on the platform; complete the tasks in the following:
   **Step 1:** find out the two extreme positions of the pedals.
   **Step 2:** Analyze in these two moments, the pressure angle of the mechanism is______,
   The transmission angle is_______ the effective torque to drive the crank is _______
   **Step 3:** Observe the characteristics of the position of connecting rod and crank:
   Conclusion: Methods to determine whether a mechanism has dead point is to see whether the connecting rod and the follower are in the same straight line

2. Interactive teaching activity 2: Analyze situations when dead point existing in the four bar mechanism(key point)
   Operate the interactive animation in the network teaching platform; complete the following form as shown in Tab.2.

### Table 2. The task lists for students.

<table>
<thead>
<tr>
<th>mechanism names</th>
<th>Numbers of dead points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crank-rocker</td>
<td>number of dead points</td>
</tr>
<tr>
<td>Slider-crank</td>
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</tr>
</tbody>
</table>
3. Interactive teaching activity 3: Analyze the upper and lower stop point of diesel engine (practice lesson)

In the training room, students find out the upper and lower stop point of diesel engine using actual diesel in lab, by the way of manually turning, and observe the characteristics of the position of crank and connecting rod.

**Review online after class**

In "unit measurement" column, the online examination questions bank is placed here, which is mainly the key issues in the examination of the vocational students of skills. It can automatic score, display the answer, do paper analysis and other functions, eventually give the process evaluation.

In “expansion after class” section, students do exploration by themselves after class. The teaching platform has given the 3D animation of common mechanism. Examples of the situation that when the dead point is overcome: inertial flywheel, staggered arrangement (V type diesel engine) are given as well.

Application of dead points: Aircraft landing gear; Connecting rod type clamp; folding table; Folding chair.

**Conclusion**

This essay analyzes the main problems existing in the traditional teaching mode in Higher Vocational Education and the characteristics of Higher Vocational College students, shares the techniques of making high-quality micro course, designs innovatively the integration of the theory and practice of the Flip class teaching model, and designs teacher’s teaching activities in the circle of before and middle and after the course in details. Additionally, this essay introduces application of Flip class on internet.

Making good use of network platform, micro class, and Flip class teaching, effectively solutes the problems of the activities of classroom teaching of higher vocational college students, improves the students' learning enthusiasm and participation, and cultivate students' abilities of autonomous learning, analysis and solving problems. The innovative design of Flip class teaching mode coincident the training goal of cultivating high-level application-oriented talents in higher vocational colleges, can effectively improve the quality of teaching.

**Reference**

[1] Wang Xiaodong. The application research of "Flip class" teaching at the university, for example education technology professional English courses, [J]. Modern education technology,2013(8).

