The Application of Microlecture in Hydraulic and Pneumatic Transmission Lesson

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Abstract. Microlecture, as a new approach of teaching, was compact and vivid. The synergy between visual and audio effects was helpful to make student interest in learning it. Hydraulic and Pneumatic Transmission lesson is an important basic professional course for the 3rd grade students in mechanical engineering, but it is difficult to understand. Taking advantages of the microlecture and the features of Hydraulic and Pneumatic Transmission lesson, the application and effect of microlecture was introduced. The microlecture of hydraulic systems was provided, after practice, a good effect is gained.

Introduction

Microlecture, as a new approach of teaching, was compact and vivid. In 1993, American Professor LeRoy A. McGrew in University Northern Iowa developed "60 seconds course" in order to promote the public's perception of chemistry\textsuperscript{[1]}. In 2008, David Penrose puts forward five steps in microlecture design, list the key concepts to convey in the 60 seconds lecture\textsuperscript{[2]}. The combination of "microlecture" and "seconds" challenged the traditional pedagogical approach. Educause, an American educational informatization research institution which specifically studies the information technology in higher education, introduces its definition of microlecture, claiming that microlecture is a short recorded audio or video presentation on a single, tightly defined topic.

In China, microlecture is firstly put forward by Tiesheng Hu, a teacher in Educational Information Network Center of Foshan Educational Bureau in Guangdong Province. He concluded that microlecture was the short form of micro video network lecture and its carrier was micro instructional video. Microlecture refers to online video lecture resources which are designed and exploited to form a contextualization multimode learning style aiming at specific knowledge, such as key point, difficult point, question and something that will appear in test, or teaching link, such as study activity, subject, experiment and task\textsuperscript{[3]}. After that, microlecture was developed quickly in China\textsuperscript{[4-5]}. Hydraulic and Pneumatic Transmission is an important professional basic course for the 3rd Grade students majoring in mechanical engineering. Hydraulic systems have many advantages as power sources, but it is difficult to understand because of abstract. There are many papers on teaching reform on Hydraulic and Pneumatic\textsuperscript{[6-7]}, although these methods can be used to develop team spirit and improve the students' practical ability, but their understanding of the basic concepts and interest in the course is not remarkable improved. According to the advantages of the microlecture and the features of Hydraulic and Pneumatic Transmission, the microlecture of hydraulic systems will be introduced in this paper.

Microlectures's Design Principles

Although 1-minute lecture is effective, and perhaps the discipline of putting the key concepts into 1 minute presentations will focus the students and the assignments, but according to the features of Hydraulic and Pneumatic Transmission, microlecture should be short, effective, and conceptually
complete, so the application of microlecture in Hydraulic and Pneumatic Transmission should be 8-15 minutes long and it is better not to exceed 20 minutes.

The microlecture could be brief but also catch students’ eyes and inspire or motivate students’ further study regarding it would be worth to be watched again. Also, microlecture should be commenced with specific key points which are easy to learn and understand.

The complete microlecture design should include three steps, introduction, explanation and conclusion. Select tiny but independent integrated content as the teaching content, microlecture should be commenced with specific key points, the core concept and easy to learn and understand. This paper the microlecture of Hydraulic Systems will be as the example.

**Microlecture of Hydraulic Systems**

In this section, the microlecture of Hydraulic systems will be designed. The microlecture should be professional, brief and clear, and the special methods could be adopted to produce microlecture, such as animation, which can make the microlecture vividly.

The microlecture also should focus on training the abilities of the students to discover problems, analyze and solve problems. The engineering case will be used in animation demonstration, so the students can analyze the system composition intuitively.

The design process of microlecture as the following table:

<table>
<thead>
<tr>
<th>Content</th>
<th>Method</th>
<th>Design intent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Presenting new lesson</strong></td>
<td>Contrast; Animation Demonstrating</td>
<td>Find the system defects</td>
</tr>
<tr>
<td>1. The working principle of the hydraulic jack system;</td>
<td></td>
<td></td>
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<tr>
<td>2. Demo cars in the force deformation process of hydraulic pressure under the action of external force.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>A complete hydraulic system; The role of the various parts</strong></td>
<td>Animation Demonstrating; Video; Summary</td>
<td>Input visual concept; To strengthen the understanding through discussion</td>
</tr>
</tbody>
</table>

**Introduction**

Presentation: The working principle of the hydraulic jack system will be analyzed. Animation demonstration: System of division of jack. Let students understand the simple composition of the hydraulic system.

The composition of the hydraulic system: Demo cars in the force deformation process of hydraulic pressure under the action of external force, and inspire the student to find the system defects and understand the hydraulic jack is not a perfect hydraulic system, safety measures also need to prevent pressure too high and the speed adjustment of flow control element.
**Explanation**

With relatively simple perfect drive machine table of hydraulic transmission system as an example to students to explain in detail the working principle of hydraulic transmission system (Figure 1). The figure will input visual concept to the students.

![Figure 1. Basic hydraulic system.](image)

In Figure 1, regardless of its function and design, every hydraulic system has a minimum number of basic components in addition to a means through which the fluid is transmitted. A basic system consists of a pump, reservoir, directional valve, check valve, pressure relieve, selector valve, actuator, and filter.

Through the animation demonstrating in class, according to the functions, one whole hydraulic system conclude five components: pump, actuator, valve, auxiliary devices (Filter, tank, oil tube, Accumulator etc.) and working medium (oil, gas etc.). With the video of the hydraulic system, the visual concept was input.

The students will be told that there are six chapters in the curriculum, each component is explained in one chapter, and the combination of system is in the last chapter. So the students will have general knowledge of the whole book.

The comparison and animation demonstration case were used to deepen students understanding of each component of the role (Figure 2 and Figure 3).

![Figure 2. The movement of the hydraulic cylinder.](image)

![Figure 3. The unloading of the pump.](image)
In Figure 2 and Figure 3, the red color shows high pressure oil, that is the oil from the pump. The blue color shows low pressure oil, that is oil back to the tank. The animation and video as intuitive ways were used, which can make the student have intuitive understanding and grasp on the hydraulic transmission system and the function of each component. In order to explanation the role of each faction, change the valve core position of direction valve and the valve opening size of flow valve, let the student participate in discussing the effect of different hydraulic components which can deepen the understanding of the basic concepts.

**Conclusion:**

Using charts, summarizes the hydraulic drive system, with animation and video footage being input intuitive concept, the students will have class discussion on the question to strengthen their impression. Because of the study of the microlectures before class, the students have a preliminary understanding on the Hydraulic and Pneumatic Transmission, and have the great interest on the course.

The design and production of microlecture is basic, the assessment is required to test its effectiveness. Such approaches as subject choice, lecture content, lecture structuring, teaching norms and teaching effect etc. could be used to evaluate microlecture. After learning of microlecture, the students' understanding of abstract concepts were enhanced and the teaching effect was improved.

**Conclusion**

Microlecture, as a new approach of teaching, is very special and different from elementary education. This paper introduces the microlecture's characteristics and design principles, the microlecture is compact and vivid, one microlecture could only introduce one knowledge point, and the design should be professional, brief, clear and it could capture the students' eyes and aim to novelty. Hydraulic and Pneumatic Transmission lesson is an important professional basic course and it is difficult to learn for students, the synergy between visual effects and audio effects was helpful to raise student in learning. According to the advantages of the microlecture and the features of Hydraulic and Pneumatic Transmission lesson, the application and effect of microlectures were introduced. The microlecture of hydraulic systems was provided, and a good effect is gained.

**References**


