The Teaching Scheme Improvement of "Hydraulic and Pneumatic Transmission" Based on the Professional Certification Training Mode

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\textbf{Abstract.} With the promotion of Engineering Education Professional Certification, the traditional classroom teaching-oriented model has been unable to meet the requirements of the new period. The new training mode advocates the self-study of students after class, while strengthening the guiding role of the teachers. Combining with the professional certification training mode and the practical and engineering characteristics of the course of "hydraulic and pneumatic transmission", this paper puts forward a new improvement scheme in the aspects of the teaching skills; requirement of actual engineering; teaching in practical and time management after class, etc. This paper puts forward a reform plan aiming at the professional certification mode for the first time. The new teaching program is not only suitable for the new requirements of professional certification training mode, but also preparing for the higher level of professional personnel training.

1. Introduction

The project accreditation of engineering education has been started in China. Engineering Education Accreditation of Construction Engineering in higher education quality assurance system in China, which plays an important role in improving the quality of engineering education.

The propose of education professional certification make more requirements for colleges and universities. Its essence is to cut down the class hours and increase the self-study time after class. And pay more attention to the cultivation of students' learning ability.

In order to speed up the professional accreditation process. Major universities are trying to put forward a new type of teaching model for promoting the development of education[1].

2. The Analysis of the Teaching Characteristics of "Hydraulic and Pneumatic Transmission"

"Hydraulic and pneumatic transmission" as a mechanical professional course, It is a subject with practicality and engineering[2]. It has the characteristics of different from other mechanical course. Table 1 is the course of "hydraulic and pneumatic transmission" compared with other mechanical discipline of comparative analysis.

Table 1. The course of "hydraulic and pneumatic transmission" compared with the characteristics of other major courses.

<table>
<thead>
<tr>
<th>Course name</th>
<th>&quot;The mechanical design basis&quot;</th>
<th>&quot;Hydraulic and pneumatic transmission&quot;</th>
<th>&quot;Electrical control and PLC&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree of theoretical level</td>
<td>high</td>
<td>high</td>
<td>higher</td>
</tr>
<tr>
<td>Subject abstract degree</td>
<td>Lower</td>
<td>high</td>
<td>higher</td>
</tr>
<tr>
<td>The main way to study</td>
<td>Theory and entities</td>
<td>Theory, entities, and the simulation</td>
<td>Theory, entities, and the simulation</td>
</tr>
<tr>
<td>Main application fields</td>
<td>Mechanical field</td>
<td>Construction machinery field</td>
<td>Industrial control area</td>
</tr>
<tr>
<td>Degree of practicality and engineering</td>
<td>higher</td>
<td>high</td>
<td>high</td>
</tr>
</tbody>
</table>

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3. The Improvement Measures of Teaching Plan

Professional certification puts forward higher requirements for both educators and students. For the teachers, it changed their responsibilities of teaching in a large amount of time in the past into a small amount of classroom instruction and a large amount of after-school instruction now. For the students, it changed the main way of learning from the original class listening in the past to self-study after class now. In order to solve this problem, many teachers have summed up the following five improvement measures on the basis of their own years of teaching experience.

3.1 The Improvement of Teaching Skills

Classroom teaching is the first source of students’ cognition. It plays a vital role to develop students’ interest in the teaching. Therefore, they are the first consideration problems for teachers in the process of is how to improve the skills of teaching and let students can learn more knowledge in the limited classroom time.

In terms of the teaching of “hydraulic and pneumatic transmission”, for some complex hydraulic components such as axial piston pump, only through the explanation of theory, students often fail to understand the working principle structure and assembly relation deeply[3]. In order to achieve better teaching effect, we should adopt some new teaching mode to improve the skills of classroom teaching when the teacher explains in complex hydraulic structure elements. They can teach with the teaching mode of “material object and discussion”. On one hand, it can show students to the relationship between the hydraulic oil in the hydraulic flow more vivid through a 3D animation simulation and make the students understand the working principle of hydraulic components more profound. On the other hand, the students can understand each of the pump parts more intuitive through the process of removal of the swash plate axial piston pump installation.

In addition to the above methods, we can also improve the teaching level of teachers by using flipped classes.

3.2 Improving the Connection between Class Teaching Content and Engineering Practice

The purpose of teaching mainly includes above following two aspects: Theory and practice, they promote each other. In other word, "the theory can guide the engineering practice; the engineering practice can deepen the cognition of theory". They both play a vital role for the students to construct the knowledge system of hydraulic and pneumatic technology. They both are indispensable.

In recent years, the phenomenon of teaching detachment from reality is becoming more and more obvious. There are three main reasons for this phenomenon:

1. With the rapid development of hydraulic and pneumatic technology, it appears a lot of new hydraulic products and technology. While teachers often just to explain the traditional hydraulic and pneumatic knowledge in the classroom, which is not conducive to the students to understand the advanced hydraulic and pneumatic technology[4]. So teachers should introduce the development and application of new product in class.

2. Because the lack of communication between students, teachers and enterprises, which can make certain blindness in the process of teaching. Therefore, in the process of teaching, teachers, students and enterprises should be discussed and exchanged ideas regularly. What’s more, we should establish implementation of feedback mechanism between teachers and students, and enterprise.

3. Because the course of "hydraulic and pneumatic transmission" has the feature of practicality and engineering. In the process of teaching should reduce theoretical derivation formula in the classroom. Furthermore, it can reduce the students' burden and we can pay more attention to cultivating students' application ability.

3.3 Increasing the Link of Practice

“There is too much part of theory and too less practice part” is a widespread phenomenon in university education, especially for the course of "hydraulic and pneumatic transmission" with more practical. Practice is an important ways to train ‘students' practical ability and the ability to solve engineering practice.

The teaching practice of "hydraulic and pneumatic transmission" can be divided into two forms, basic experiment and comprehensive experiment. Basic experiment mainly exercises the students’
basic practical ability and strengthens their understanding of the basics of hydraulics through the operation of some basic hydraulic circuit. The comprehensive experiment is the field construction of the complex hydraulic circuit under the guidance of the teacher, and the teachers put forward the relevant experimental questions according to the experimental phenomenon. On the one hand, students can master some preliminary operation of hydraulic circuits through field experiments. On the other hand, it can encourage students to solve practical problems through experimental phenomenon[5].

3.4 The Revision and Improvement of Teaching Syllabus

The syllabus is the basis of all teaching activities. The definition of the syllabus should be combined with the current situation of students and the needs of enterprises, so that it will be more conducive to the establishment of student knowledge system.

The traditional syllabus "hydraulic and pneumatic transmission" has too much time of theory, which lead to the teaching process is too boring. It is not conducive to the construction of students' knowledge system and the cultivation of interest in curriculum learning. What’s more, it does not meet the requirements of quality education in the new period. The new syllabus should reform the following aspects:

1. The classroom teaching should reduce the theoretical formula and lighten the burden of students.
2. It increases the interpretation of hydraulic and pneumatic engineering examples, and pays more attention to cultivate students' ability to solve engineering practice.
3. It increases lecture section of the hydraulic and pneumatic front knowledge (It mainly introduces the new components of hydraulic pneumatic and the latest development of hydraulic pneumatic). It can make the students understand the front knowledge of hydraulic and lay a solid foundation for students to engage in the hydraulic and pneumatic industry.
4. We should arrange 2-3 after-school comprehensive homework in the teaching process.
   It can not only deepen the students' understanding of all parts of hydraulic and pneumatic knowledge, but also can promote the ability to solve practical problems, which can be more conducive to the construction of students' knowledge system.

The reform of the above three syllabus is based on the summary and reflection of many years' teaching experience. The revision and improvement of the syllabus is the reform from the source, which has important guiding significance to the teaching reform of the "Hydraulic and pneumatic transmission"[6].

3.5 Increasing Students' Self-study Time after Class

With the promotion of professional certification, college hours are constantly compressed. The classroom teaching alone has been unable to meet the needs of students' knowledge. Therefore, it is essential for the teachers to increase students' extracurricular learning part of time in an effective way.

It can provide more effective self-study platform for students through enrich network resources sharing environment open teaching. Through the network open teaching, multimedia course ware, loop animation and video recording, as well as domestic and foreign cutting-edge hydraulic knowledge lectures and other resource sharing can stimulate students' interest in learning. Students can get more learning materials from the online teaching platform after class. What’s more, students can study, consult and communicate with other students and teachers on the network platform according to their needs. They can also put forward their own views and opinions on it. Teachers can use the network platform to put hydraulic and pneumatic teaching syllabus, teaching arrangements and training programs online for students to query. So that students can understand the progress of the teacher's teaching so as to prepare in advance.

4. Conclusion

This paper aims at the training mode of professional certification. It combines with the characteristics of the course of "hydraulic and pneumatic transmission". An improved scheme is put forward in the aspects of the link of teaching skills; the link between class teaching content and
engineering practice; the link of practice teaching; the link of syllabus revision and the link of the guide of students’ self-study time. It can meet the requirements of the new training program and the reform of this teaching program can bring the following advantages.

1. It can help teachers and students to adapt to changes in their own responsibility better in the teaching process.
2. For teachers, the teaching content is optimized and the classroom efficiency is improved.
3. For students, self-study ability can be improved and they can adapt to the requirements of future enterprises more quickly.

This teaching improvement program also puts forward the theoretical basis for the teaching improvement of other related courses.

5. Acknowledgment

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6. References


