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Research on the Reform of Practical Course Teaching System for Energy and Power Engineering Specialty

Ye Tian
Chongqing University of Science and Technology, Chongqing, 401331, China

Abstract: How to deal with the challenge of the new industrial revolution, how to train the talents in the field of new energy will deal with the impact of the new industrial revolution, and how to adapt to and support the development of the new energy industry, it is urgent to give a clear answer. Through the experience of creative research and reform in curriculum system, curriculum optimization and integration, teaching methods, etc., this paper will reorganize the curriculum content, enrich the economic management law and ethics education, strengthen the curriculum comprehensiveness, realize the curriculum conformity with the international, enhance the students' comprehensive ability, construct the complete knowledge view, in order to provide the feasible and effective reform theory for the practical course of energy and power engineering specialty.

Keywords: Energy and power engineering; Practical curriculum; Teaching system; Curriculum structure reorganization

1. Introduction

At present, the development of China's new energy industry is in the trend of being popular, but the supply of professionals in the field of new energy is insufficient. With relatively backward training mode and the insufficient foresight of knowledge structure, it cannot effectively adapt to the challenges of the new industrial revolution and the requirements of new energy development and utilization. Lack of high-quality professionals has become a key bottleneck restricting the sustainable development of new energy industry.

As the core part of talent training system, the construction of curriculum system plays a fundamental role [1]. On the one hand, it must meet the "technical requirements" of the development and utilization of new energy, and give students the knowledge and ability to meet their needs; on the other hand, it must meet the "all-round requirements" of the new industrial revolution for the quality of talents and lay the foundation for the comprehensive quality of students for future development. The comprehensive analysis of the undergraduate curriculum system in the field of new energy in more than ten universities and colleges in China shows that the existing curriculum system basically adheres to the top-down traditional knowledge framework and the "compartment" curriculum model, which is out of line with the training objectives, has a single curriculum structure, and lacks the sense of globalization. These all lead it to the obvious lack of foresight of the whole undergraduate curriculum system, fail to keep up with the pace of the new industrial revolution and be unable to suit for the requirements of rapid development of new energy industry.

Therefore, the construction of the undergraduate curriculum system in the new energy field in China should first clarify the value orientation of the undergraduate curriculum system in the new energy field facing the new industrial revolution, and highlight the connotation of the curriculum system facing the new industrial revolution [2]; secondly, we should reform the curriculum module, create and integrate the cutting-edge characteristic curriculum, build a vertical and horizontal collaborative "process" curriculum model, so as to make it more in line with the students' cognitive law and growth law; thirdly, we should reorganize the curriculum content, enrich the education of economic management and ethics, strengthen the comprehensiveness of the curriculum, realize the integration of the curriculum with the world, enhance the comprehensive ability of students and build a complete knowledge concept to enable the students to better grasp the relationship between the development and utilization of new energy and social development, and better look forward to and respond to the wave of new industrial revolution.

2. Challenges Faced by the Current Teaching System of Practical Courses of Energy and Power Engineering Specialty

2.1. Small number of talents is, and unconstructed talent reserve module

From the description of training objectives in the training plan of new energy science and engineering, it is not difficult to find that the training objectives are generally focused on mastering solid theoretical basis and professional knowledge, mastering technology in research, development, design, operation and other related fields, in which knowledge, skills (focusing on practical operation skills) and quality are the core requirements to achieve the training objectives [3]. However, the curriculum system of most colleges and universities does not design and implement the corresponding curriculum content according to the requirements of training objectives for knowledge, ability and quality. On the contrary, it pays more attention to the study of theoretical knowledge, and the cultivation of students' ideological and moral quality, operation technology and practical ability is far less than that of theoretical courses, resulting in students' excess knowledge and insufficient ability.

2.2. The original curriculum pattern hinders the integration, innovation and development of knowledge

The training system adopted by the undergraduate majors in the new energy field in China is still the traditional undergraduate course system of engineering majors. "Public basic course, discipline basic course, professional course practice and graduation design" are gradually increasing, and the development trend of "scientific mode" is emerging, which emphasizes vertical thinking, abstract learning from books, and pursuit of certainty, reanalysis and research. It is emphasized that the subject goal of engineering course is to solve the closed problems of certainty, linearity and static. At the same time, it can be seen from the analysis of Figure 1 that the proportion of theory and practice courses in energy science and engineering is seriously out of balance. Under the background of the new industrial revolution, this kind of "linear" training mode and highly "compartment oriented" curriculum arrangement inhibit the initiative of students, which is not conducive to the integration and innovation of knowledge. The talents cultivated are lack of creativity, and it is difficult to organically integrate with the rapid development and change of new energy technology.

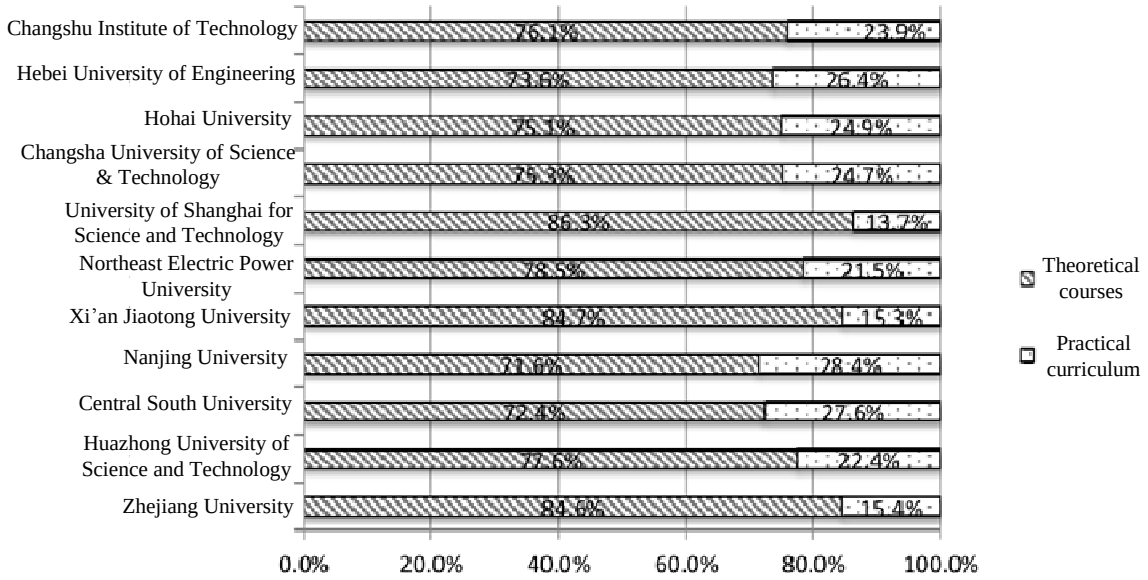

Figure 1. Credit proportion of theoretical and practical courses of energy science and engineering specialty in some universities and colleges

(Note: the above data are from the literature "Current Situation of Undergraduate Curriculum System in the Field of New Energy in China" [4].)

2.3. Single structure of professional courses and lack of openness and practicality

As the framework of curriculum system, curriculum structure is an important link between curriculum objectives and educational achievements. [3, 4] The design of curriculum structure should not only reflect the logical relationship between subject knowledge, reflect the closely connected social production demand relationship, but also fully consider the emotional cognitive relationship of students' development [5]. Therefore, the modern university curriculum structure should not only en-

sure the academic, but also highlight the cutting-edge and humanistic characteristics of university curriculum. However, taking the current curriculum system of new energy specialty as an example, its curriculum structure mode is still basically in the traditional organization mode stage. The curriculum module is composed of three traditional modules: general knowledge, discipline and practice. It mainly focuses on the new energy professional knowledge and organizes and implements in the form of theoretical courses and a small number of practical courses. It is not sensitive to the development trend of new energy market or new energy industry. The openness and comprehensiveness of curriculum structure are not enough.

3. Reorganization of Practical Courses in Energy and Power Engineering Specialty

In order to improve the above problems, it is urgent to reform the practical teaching system of energy and power engineering. This paper will reorganize the practical teaching and implement the practice mode of "Four Combinations". The practical teaching links are affected by various factors, which makes our reform process extremely difficult. Therefore, we will not only change the theoretical teaching system, but also try to improve the practical teaching to achieve a qualitative leap.

3.1. Reorganization of practical teaching links

In order to enhance the effect of students' practice, cultivate their interest and improve their practical operation ability, we reorganized the practical teaching links, put forward a new mode of professional practice teaching, which is "theory combined with practice, physical operation based on virtual simulation, sectional implementation of reference to the overall arrangement, off campus base combined with on campus base", and combined the new mode with reorganization. The fundamental of this reorganization and reform is the combination of theory and practice [6]. We alternate the theory teaching and practice-based field teaching in the classroom and closely link the theory and practice. From the aspect of perceptual cognition, students are guided with professional theoretical knowledge. From the aspect of rational cognition, students can have a real sense of experience in operating the physical system through the demonstration and teaching of on-site disassembly and assembly of physical devices, and deepen the understanding of perceptual cognition. In terms of management, the overall planning management has played a long-term role, and the specific indicators and requirements of subsection management have been implemented into practice. In the further reform and development in the future, we should actively strengthen the construction of the practice base inside the school, improving the hardware and software conditions. At the same time, we should vigorously promote the construction of the practice base outside the school. As the main basis of practice, practice base inside school should be enriched with professional basic practice. Due to its limitation, practice base outside school should maximize the using time and carry out compact practice project teaching. The new internship mode, through on-the-spot instruction for students, enables students to experience the operation personally and offers them with more opportunities to operate, thus comprehensively improving students' learning ability. At the same time, it makes instructors obtain a sense of achievement and improve their enthusiasm.

3.2. Reorganization of design practice teaching

The graduation design, mechanical parts design and curriculum design are planned as a whole. Carry out planning and reorganization with purpose. In these practical teaching links, combined with the integration of design theoretical basis and comprehensive training of modern design methods, the basic computer training for students should be strengthened in a planned and phased way, such as calculation method and numerical calculation CAD, commercial software application, database, and object-oriented program design [7]. Combine theory with practice to elaborate and make graduation project. Complete general basic training in about one month, such as translation of foreign papers, search and arrangement of materials, elaboration of literature review, etc. In the last semester, it will take about one month to make carry out training of the professional direction elective courses, so that the students who are making the graduation design can also hear the professional course explanation. After the completion of the elective course, they can continue to complete the graduation design of the selected professional direction. As a result, students' adaptability to employment can be enhanced

4. Conclusion

Based on the challenge of the new industrial revolution to the cultivation of undergraduate talents in the field of new energy in China, this study combs the main problems existing in the current undergraduate curriculum system in the field of new energy in China; then, through the problem analysis, it puts forward the construction idea of the practical curriculum of energy and power engineering for the new industrial revolution, and hopes to provide feasible theory for the research in this field through the content of this paper.

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