Curriculum Group Design and Application for Control Engineering Discipline Based on Outcome-Based Education

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Abstract. With the direction of the study outcomes and job requirements for postgraduate students, outcome-based education is implemented in the curriculum group design and application for control engineering discipline in Wuhan University of Science and Technology, which is based on the demand analysis of master of full-time professional degree. Combined with the demand of society and enterprises, the system structure of the curriculum group pays more emphasis on the practical ability of student, and it is driven by the students’ final study outcome. The curriculum group for control engineering discipline has three blocks: basic curriculums, core curriculums and expanding curriculums and the educational quality is evaluated by the variety of student outcomes.

Introduction

Education is the basis of personnel training, science and technology development. The high engineering education has an important role for the transformation of Chinese engineering and science personnel from the quantitative growth to the qualitative enhancement. Professional degree education is an important branch of the high engineering education and from 2009 the Chinese full-time postgraduate education is divided into two different types: academic degree and professional degree, the former pays more attention on theoretical research and the latter mainly on practical application. Compared to the full-time academic degree, full-time professional postgraduate education is still in initial period and its training objective is shown obviously that the existing training system of the academic postgraduate education can’t be used directly in that of the professional postgraduate education. So it is important and necessary to establish a special training system for the full-time professional postgraduate education according to the demand of times and the training objective.

Curriculum group is the tendency of curriculum reform for colleges and universities, and it changes the single structure of courses and focuses on the optimization and integration of courses to construct a curriculum system with reasonable structure, clear hierarchy and interactive relationship. It is necessary for colleges and universities to establish curriculum group since the variety of major courses and the teaching period are cut down gradually. With the demand analysis of the full-time professional degree students’ ability, the curriculum group for the control engineering major driven by the outcomes in author’s university is introduced in the paper, and it is realized by the use of practical outcomes to evaluate and manifest the coherence between the educational process and objective. The outcomes stimulate the study motivation, develop practical ability and obtain comprehensively professional skill eventually. The practical teaching effects show that the curriculum group system realizes the educational objective.

Quality Demand Analysis of Full-Time Professional Degree

Curriculum group is not only the development of the current curriculum reform but also the requirement of the Chinese society and economic. Generally, the market needs and development is
the direction for any kind of professional education, that is to say, the personnel cultivation for the full-time profession degree should be related with the social environment and enterprise demand, including academic and professional knowledge. Nowadays, “Made in China 2025” is an important developing strategy for the next 10 years, and its core target is to push the national creative ability. As to the high engineering education, practical teaching mode is the cultivating core. So it is important to optimize the teaching process and establish scientific system for the profession teaching evaluation and regulation. Meanwhile, the cross-disciplinary is necessary for the entrepreneurial spirit in the times of “Made in China 2025”. With the observation of the industry development in America and western countries, the creative educational system driven by the professional demand is more practical and stable to push the social economic toward the sound development. The advantage of the education system is that the students have had professional and practical ability after their graduation[1-3]. The reform direction in developed countries is same to emphasize on the cultivation of engineering practical training and comprehensive ability[4,5]. Comparatively speaking, there is a certain difference in the quality of the higher engineering education between China and the developed countries. Additionally, the graduated education of the full-time professional degree, as an emerging type, needs a sustainably, developmental and proprietary training system[6,7]. Practical and professional ability is the obvious character for the student with the professional degree, on the basis of the special investigation of the training modes of the full-time professional degree in the national fourteen key universities[8]. As a conclusion, practice is the obvious character and profession is the inner demand for the full-time professional degree.

**Curriculum Group for the Control Engineering Discipline Based on Outcome-Based Education**

The integration and regulation of curriculum group should be with a certain target and solve some adequate problems. In order to manifest the reasonable and effective structure of curriculum group, the professional skills and knowledge required by the current professional fields should be known in advance to judge whether the designed curriculum schedule meet the students’ employment demand. So called “Outcome-Based Education” is a learning mechanism that is interacted with the students’ ability, hobby, future success and employment after graduation. The emphasis of the Outcome-Based Education is not the scores but the competence owned by the students after finishing the courses. So the Outcome-Based Education is satisfied with the design of curriculum group for the full-time professional degree.

**Factor Analysis of Student’ Learning Outcome**

Control engineering, based on cybernetics, information theory and system theory, is a important engineering field that the control theory and technology is applied to meet and realize the automatic requirements in all kinds of engineering fields. For control engineering, control system is as its object, and the main tools are mathematic method and computer technology. The research of control engineering includes all kinds of control strategy, theory, technology and method to realize the modeling, analysis, synthesis and realization of control system. According the requires of control engineering discipline, the student should have such following factors,

1. an ability to apply knowledge of mathematics, science and engineering to deal with practical engineering problems,
2. an ability to analyze engineering problems and design control systems to meet desired aim,
3. an ability to read professional documents,
4. an ability to use computer and cyber technology,
5. an ability to work in a group,
6. an ability of creativity
7. an ability of self-learning and thinking
Factor Analysis of Professional Requires

The obvious difference between academic degree and professional degree is career directionality and professional education is built on the systemic knowledge with academic basis, that is to say, students graduated from professional degree should also have an ability to use theory obtained from class to solve practical problems. As to control engineering, it involves many fields, such as computer technology, instrument and meter engineering, electric engineering, electronics engineering and mechanical engineering, etc. Graduates of control engineering should become professional engineers who can be engaged in design, research, manufacture, construction and management on control system. So professional requires from control engineering are discipline knowledge, interdisciplinary knowledge, practical knowledge and methodical application, etc.

Structure of Curriculum Group Based on Outcome-Education

With times development, people-oriented professional education is the nature of the education system. As to a professional degree student, he/she wants to obtain abilities, specially, practical ability which can be applied into his/her job immediately after graduation. So both academic courses and practical courses are set in the curriculum group and the method of modular design is considered for professional courses, divided into three blocks: professional basis curriculum, professional curriculum and practical curriculum. The curriculum group is driven by not scores but abilities obtained by student after study. That is to say, the structure of curriculum group of full-time professional degree, shown in Fig. 1, is designed according to student’ learning requires and professional requires discussed above.

![Curriculum Group](image)

Figure 1. Structure of curriculum group of full-time professional degree based on outcome-education.

Application of Curriculum Group Based on Outcome-Based Education

Multi-disciplinary and multi-domain are considered in the construction of the curriculum group for the control engineering discipline. Depending on the discipline platforms of the college and school, some relative disciplines are considered in the curriculum group, including computer science and engineering, electrical engineering, information technology, and mechanical engineering, etc.

Curriculum group for the control engineering discipline is divided into four blocks and professional basis curriculum, professional curriculum and practical curriculum are introduced in detail. According to the above analysis based on outcome-education, the principle of curriculum group is to develop students’ creative and practical ability. With the consideration of study outcome, a wide platform is supplied by the construction of curriculum system for control engineering discipline. As to professional basis curriculum, add the curriculum “Innovation and Practice of IT Industry” to develop graduate’s innovative idea and scientific research method to satisfy the demand of nowadays society, and eventually to improve engineering quality and innovative ability for students in IT field. The knowledge and ability of theory and practice of intellectual property benefits
the industrialization of enterprise or personal outcome and the trade of intellectual property, which can improve the national technology competition, so “Theory and Practice of Intellectual Property” is added in the curriculum group to make student grasp basic theory and practice of intellectual property and familiar with basic principles about how to protect the corresponding property. As to professional curriculum, add “Theory and Practice of Network” and “control Technology and Application of the Internet of things” to expand major scope and develop student’s IT knowledge. As to practical curriculum, some practical elements are add to the corresponding curriculums, and the practical modes are different including experiments in lab, group discussion, oral presentation and lectures etc. As a result, the studying process becomes bidirectional communication and student’s personal practice which satisfies the nature spirit of Outcome-Based Education. In order to let student know the dynamic development of the control engineering discipline, “Lectures on Industry Frontier” is arranged as a practical curriculum.

Evaluation of curriculum group is the other important aspect for the construction of curriculum system. On the basis of Outcome-Based Education, various testing modes are taken to improve student’s self-learning ability and practical experience, including paper, patents, research reports, engineering designs, software copyrights and so on.

Conclusion

Professional degree education is an important branch of the high engineering education, and the full-time professional postgraduate education is a new type compared to the full-time academic postgraduate education. Due to its specially educational character, the curriculum system of the full-time professional postgraduate education is variable. Additionally, Curriculum group is the tendency of curriculum reform for colleges and universities, and it changes the former single structure of courses and focuses on the optimization and integration of courses to construct a curriculum system with reasonable development. With the factor analysis of student’ learning outcome and professional requires, a structure of curriculum group of full-time professional degree based on based on outcome-education is designed and its content is discussed in detail. The curriculum group for the control engineering discipline reflects the demand of society development. Specially, consider the practical demand of student to improve educational quality and realize the educational target.

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Reference


