

Preliminary Study on the Reform of Basic Courses of Electrical Engineering and Automation Based on Wireless Power Transmission

Lin Sha¹, Qifei Du²

¹School of Electrical Engineering and Automation, Tianjin Polytechnic University, Tianjin 300387, China;

²National Demonstration Center for Experimental Engineering Training Education, Tianjin Polytechnic University, Tianjin 300387, China.

Abstract

Based on the analysis of the characteristics of electrical engineering and its automation specialty and the status quo of basic engineering courses, based on the wireless energy transfer teaching cases, this paper puts forward the knowledge, ability and quality training mode of innovative applied electrical talents that fit OBE and the basic course system supporting the solution of complex engineering problems. Facing the needs of One Belt And One Road international talent training, this paper puts forward the implementation plan of engineering basic course reform based on OBE. The smart grid network topology and radio can transmit the new technology and other advanced academic frontiers is introduced into the basic course teaching process and engineering case analysis, build project, case import teaching content with, cooperate with micro lessons, classroom teaching, live interactive teaching in the form of the combination of knowledge model, research of feedback teaching engineering education concept in practice.

Keywords

OBE, complex engineering problems, smart grid, wireless energy transmission, case teaching, electrical engineering.

1. Introduction

Electrical engineering and its automation major are based on electrical engineering and integrate advanced technologies in the fields of automation, computer and electronic information; which is a national strategic emerging industry, as well as a wide-ranging major acting on international convention. There are characteristics of combining tradition with innovation in the curriculum system of this major, on the one hand, the traditional basic theories and basic methods in electrical engineering are relatively mature, which aim to provide solid support for engineering practice; on the other hand, electrical engineering theory has developed over the years, new technologies, new equipment, new materials, new standards, and new methods have been changing with each passing day, emerge in an endless stream. Facing engineering ability training and improvement needs of all students, exploring and carrying out the teaching reform of the basic course system of electrical engineering, integrating the knowledge of traditional disciplines and international frontier inter-discipline subject, enriching and expanding the students' deep foundation, strong ability and high quality training have realistic and long-term significance.

OBE (Outcomes-Based Education), namely students achieve specific learning outcomes as goal, emphasizes the learning outcomes of all students, regards the educational structure and

curriculum as a means to achieve learning outcome, and organizes the whole teaching activities and teaching methods by setting the student's learning goals.

This paper is oriented by stimulating students' learning interest and improving students' self-learning ability, and constructs the basic curriculum system setting and typical engineering case analysis of electrical engineering. Training students' innovative and engineering abilities from four aspects: curriculum system, training methods, teaching modes and teaching methods based on OBE, jointly promoting students' learning effect and serve the goal of professional talent training, as shown in Figure.1.

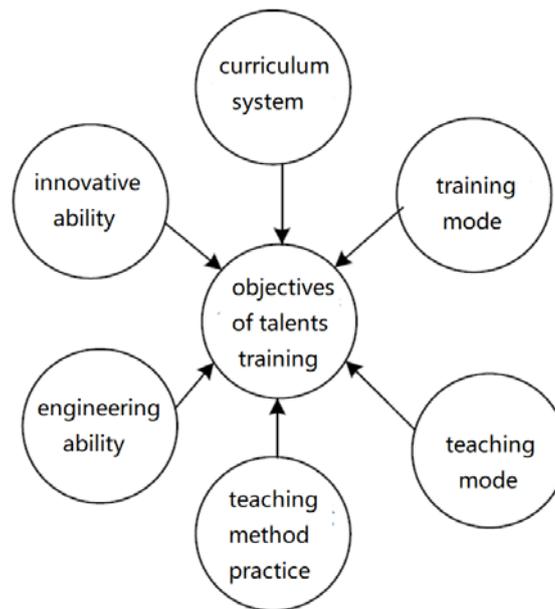


Figure 1. Talent training system based on OBE

2. Build the Engineering Basic Curriculum System Based on OBE

The OBE idea emphasizes learning outcomes and puts particular emphasis on the improvement of students' learning results and abilities, this paper aims to solve the long-standing problems, students don't know what to do when they study the basic course of engineering, they don't want to learn, their weak foundation in the study of professional courses affects the understanding and mastery of professional courses., when they comes to work or further study, find that the basic knowledge reserve does not support the problem of in-depth research. In the construction of the curriculum system, OBE attaches importance to learning results, the application ability of students and cultivation of innovative ability.

Based on the OBE concept, the typical topology and the new technology of wireless energy transmission of the smart grid are introduced into the teaching process of the basic course of electrical engineering, and the boundaries among the courses are opened, the basic curriculum system of electrical engineering and automation major engineering is organized oriented by project and case. Make the engineering basic course strongly support the training goal of talents in this major, help the construction of "new engineering".

As shown in Figure.2, the electromagnetic coupling resonant wireless power transfer system as the curriculum system of the engineering basic course of complex engineering problems, in the past, the basic course was based on electric supply, the source-end introduces wind power, photovoltaic, wind and solar complementation, wind and photovoltaic complementation and other smart grid concept. The load end can supply power for AC motor or DC load. The intermediate link involves the content of circuit, analog electronic technology, digital electronic technology, power electronics technology, engineering electromagnetic field and other

engineering basic courses. Based on engineering basic curriculum system of OBE, the engineering basic course knowledge required for electrical engineering is integrated from the power supply to the load; the frontier of advanced disciplines is introduced into the teaching system of engineering basic courses, and break through the path of students from theoretical learning to practical practice to innovative application. Based on typical case teaching and student feedback, this paper analyzes the corresponding relation of complex engineering problems on electrical engineering, its automation major training goals, and basic engineering courses and ability cultivation of complex engineering problems, and finds directions for continuous improvement.

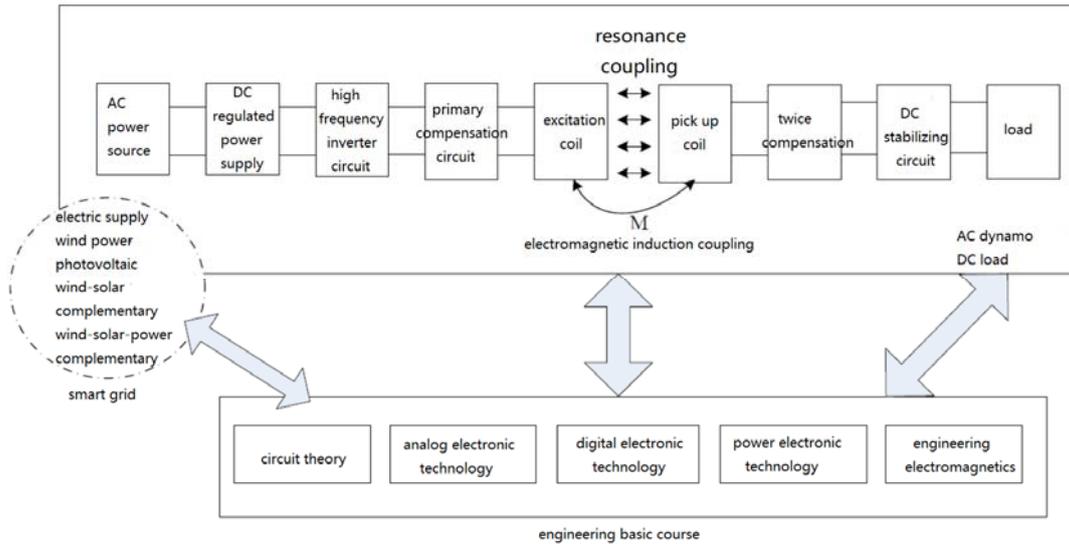


Figure 2. The engineering basic course system block diagram of complex engineering problems of wireless energy transfer system

3. Build the Student-centered Training Mode

All students as core, the design of teaching plan are guided by the cultivation of knowledge, ability and quality. In the talent training mode, the "school-enterprise double participation" and "three unions" were introduced, and the "evaluation-feedback-improvement" closed-loop was established, the continuous improvement training mechanism in which schools and enterprises participate together is formed, as shown in Figure.3.

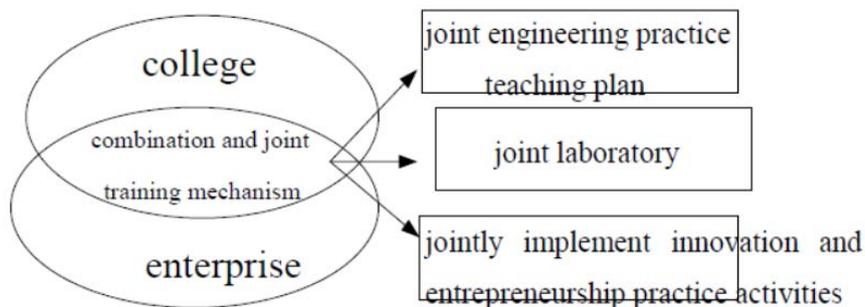


Figure 3. Diagram of the training mode of the double participation and three unions

The joint training system and training mechanism are formed through colleges and high-tech enterprises, jointly work out engineering practice teaching programs, and jointly carry out innovation and entrepreneurial practice activities, and unite laboratories to improve the students' foundation and practice quality. Regularly tease out major and enterprise's

requirements for engineering basic courses with professional teachers, enterprise leaders and student representatives, and improve teaching content and teaching methods in real time.

Carrying out teaching students in accordance with their aptitude; work out order training program for students' knowledge, quality, ability and career development, train innovative applied technical talents needed for the construction and development of electrical related majors suitable for regional economic development. Planning different innovative development directions for students to cultivate and deliver the professional and technical talents needed for the construction and development of the energy and power industry suitable for regional economic development.

4. Teaching Model Reform Based on OBE

At present, the basic courses in colleges and universities generally have insufficient teaching hours. In order to protect the knowledge that students can truly master, under the trend of "popularization" globalization of education information, the current learning model is undergoing rapid changes and development, in addition to classroom learning, open courses, professional counseling, MOOC, micro-courses, and flipped classes based on online platforms are gradually accepted by learners.

This paper combines the characteristics of electrical engineering, its automation major and engineering basic courses, integrates various teaching methods and means to construct a new teaching model based on OBE. The engineering basic course is changed from a single classroom lecture to a combination of classroom lectures, online teaching, on-the-spot teaching, group discussion, and self-learning etc.

Relying on the Tianjin Key Laboratory of New Technology for Electronic Energy, the on-the-spot teaching is carried out, which makes students close contact the frontiers of the discipline, and vividly understand the supporting role of the learned engineering basic courses. Using the teaching advantages of "Circuit Theory" and "Electrical Engineering and Electron Technology" two Tianjin quality courses to carry out online teaching, students can use the leisure time to learn flexibly, and also alleviate the general problems of less class hour. Classroom teaching puts particular emphasis on the relationship among knowledge points, the relationship between knowledge points and practical applications, and use group discussion to enhance student participation. The learning outcomes as goal, improve the learning effects of students. Exploring and carrying out the combination of teaching methods, online teaching, on-the-spot teaching, group discussion and other teaching methods.

At the same time, exploring the use of online learning APP to organize the student curriculum in the classroom teaching, the mobile APP is used to check in efficiently and accurately before class, the answer in the class, and randomly selecting students to answer questions to increase the participation of student, test is made when complete the teaching content, after class, students can join a group topic discussion related to the course content. Make the phone change from a ducked tool to a head-up weapon.

5. Students' Ability Training Mode Based on OBE Idea

The traditional verification experiment as basis in students' engineering ability training of engineering basic courses, virtual simulation experiments are added to the experimental design that is difficult to carry out in the laboratory, based on the introduction of new electrical engineering courses, relevant experiments are designed, such as wireless charger production, magnetic suspension car production and so on, which enhance students' active learning interests and engineering practice ability.

In the comprehensive quality training, based on OBE, the wireless energy transfer technology is integrated into the teaching process of engineering basic courses of electrical engineering and automation major, the teaching content is closely related to engineering application, and the students' learning effect and learning results are emphasized. Various teaching methods are flexibly used, complement each other and support each other, fully mobilize students' learning initiative and interest, and improve students' overall quality.

6. Conclusion

Facing the needs of the national development of the Belt and Road, the transformation of industry-school-research collaborative innovative achievements and the construction and development of electrical engineering talents, the basic curriculum system and case teaching implementation plan of electrical engineering were constructed based on improving students' ability to solve complex engineering problems, improve the training quality of electrical undergraduate talent from the aspects of knowledge, ability and comprehensive quality, serve the talent training needed for industry enterprises and social and economic development.

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