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Construction and Teaching Reform of "Research foundation of Computer Science" Course based on OBE Concept

Jiajing Li, Yan Yan, Guoying Zhang

School of Artificial Intelligence, China University of Mining and Technology (Beijing), China

Abstract: The research foundation of computer science is a compulsory professional foundation course for master's students of computer science and technology and related disciplines and majors. Due to the extensive content of this course, covering four topics: advanced computer architecture, Internet of Things technology, network and information security, and algorithm design and analysis, students feel that it is difficult to master scientific learning methods and lack the goal and initiative of learning. This article is guided by the OBE concept and explores and practices the teaching reform of computer graduate courses in the context of the construction of new engineering disciplines, starting from five key links: setting teaching objectives, designing teaching content, reforming teaching modes, establishing teaching evaluation mechanisms.

Keywords: OBE; New Engineering Construction; Teaching Objectives; Teaching Content; Teaching Methods; Teaching Evaluation Mechanisms.

1. Introduction

The research foundation of computer science is a compulsory professional basic course for postgraduates of computer science and technology and related disciplines and specialties, which mainly covers four parts: advanced computer architecture, Internet of Things technology, network and information security, and algorithm design and analysis, involving the theoretical and technical basis of the main specialties and research directions of computer science. It is a necessary knowledge to master advanced theories and technologies such as artificial intelligence, big data, industrial Internet, cloud computing and so on.

The research foundation of computer science course has been offered for three years, and the teaching objects are all postgraduates majoring in computer science and technology, with a total of 168 lecturers. Due to the large content of this course, covering four topics including advanced computer architecture, Internet of things technology, network and information security, and algorithm design and analysis, students feel that it is difficult to master scientific learning methods and lack of learning objectives and initiative. The traditional indoctrination teaching mode cannot cultivate students' abilities of discovering problems, analyzing problems, solving problems, teamwork, communication and expression, so it is difficult to meet the requirements of "cultivating innovative and outstanding engineering and technological talents and providing talent support for China's industrial development" put forward by the new engineering course.

Innovation and practical ability are an important training goal for computer graduate students, and it is also a basic requirement for the talent cultivation of computer graduate students in the construction of new engineering disciplines. Since 2017, the Ministry of Education has been fully promoting the construction of new engineering disciplines to actively respond to the implementation of major national strategies such as intelligent manufacturing and digital transformation. The national innovation driven development and the construction of new engineering disciplines urgently need to improve the education quality of computer related graduate students, and deepening curriculum and teaching reform is one of the key measures to improve the quality of graduate education.

OBE is an advanced teaching philosophy that emphasizes the output of results and emphasizes the achievement of abilities rather than imparting knowledge [1]. It has been widely recognized and applied in multiple countries such as the United States, the United Kingdom, Canada, and Singapore. At present, many university teachers in China have conducted extensive research and achieved good results in curriculum teaching reform based on the OBE concept. However, how to use the OBE concept as a guide, starting from the four key links of teaching goal formulation, teaching content design, teaching mode reform, and teaching evaluation mechanism establishment, to carry out teaching reform on computer graduate courses under the background of new engineering construction still needs further exploration and practice.

2. Related Research at Home and Abroad

As an advanced teaching concept, OBE has been widely recognized and applied in many countries, such as the United States, Britain, Canada and Singapore. In recent years, more and more university teachers in China have applied the concept of OBE to the reform of curriculum teaching. Liu Aiqin et al. conducted an exploration of ideological and political education in computer science courses based on the OBE concept [2]. Yan Xiaofei et al. studied the construction of a computer related professional quality monitoring system based on OBE [3]. Shang Huibin et al. proposed a blended learning practice for computer fundamentals based on OBE [4]. Zheng Jianxing et al. proposed research on personalized teaching of courses based on the OBE education concept in the context of new engineering disciplines [5]. Wang Fei et al. proposed a three-dimensional integrated teaching model of "guidance, practice, and evaluation" for computer science and

technology majors based on the OBE concept [6]. Wang Zhenduo et al. proposed the exploration and practice of innovative application capabilities in computer related majors driven by subject competitions under the OBE concept [7].

3. Research Methods and Initiatives

The main approach to research and reform is to develop teaching objectives based on results, design modular teaching content, improve teaching methods, and establish a multi-dimensional teaching evaluation mechanism.

3.1. Results-oriented Teaching Objectives

The formulation of curriculum teaching objectives should follow the basic principle of "positioning application and keeping up with industry" under the background of new engineering construction, and the expected learning results should also be combined with big data, cloud computing, Internet of Things and artificial intelligence as far as possible, closely focusing on the national digital transformation strategy and the development needs of local industries. And firmly grasp the development direction of 5G, industrial Internet, artificial intelligence, digital economy and other emerging industries. In the formulation of teaching objectives, we should pay attention to the learning results as the orientation, and take into account the basic theoretical knowledge, scientific research innovation and engineering practice ability, team cooperation ability and communication ability.

3.2. Results-oriented Teaching Content

The concept of OBE advocates student-centered and results-oriented design of course teaching content, combined with the basic requirements of computer graduate personnel training and the characteristics of computer graduate courses, the teaching content can be divided into theoretical teaching module, academic discussion module and project training module. The theoretical teaching module aims to enable students to understand and master the basic theoretical knowledge and application of computer-related postgraduate courses, the academic discussion module focuses on cultivating students' scientific research and innovation ability, and the project training module focuses on cultivating students' engineering practice ability.

3.3. Results-oriented Seminar Teaching Mode

In order to improve the research and innovation ability of computer science graduate students, following the core requirements of "student-centered, results-oriented" advocated by OBE concept, this paper puts forward a hierarchical discussion-based teaching method suitable for computer science graduate courses. On the basis of fully considering the characteristics of computer graduate courses in local universities and the characteristics of graduate students, the seminar teaching is divided into two levels: "course-related knowledge learning" and "course-related academic discussion".

3.4. Reforming of Results-oriented Evaluation System

In order to better promote the cultivation of research and innovation ability of graduate students majoring in computer science, it is necessary to construct a method that can reasonably evaluate students' learning output. In view of the three teaching modules of "theoretical teaching, academic discussion and project training", a multi-dimensional teaching evaluation mechanism is established by combining process evaluation with achievement evaluation. Through the course teaching evaluation, teachers can grasp the students' learning status and find the problems in teaching, which provides the basis for the continuous improvement of course teaching, so as to continuously improve the teaching effect of the course.

3.5. Optimization of Course Ideological and Political Content

In the past, the ideological and political objectives of teaching are summarized as four aspects: cultivating national feelings, cultivating professional self-confidence, cultivating craftsman spirit and cultivating professional spirit. We further fully tap the contents related to academic norms, integrate formal normative education, content normative education and moral normative education into curriculum teaching, and integrate academic normative content into assessment and evaluation through case teaching such as moral cases, technical cases and legal cases, standardize academic activities and enhance academic ethics. To shape and improve the spirit of independent innovation and practical ability of graduate students for the spirit of "cultivating integrity and virtue, preserving essence and self-generation".

4. Conclusion

Guided by the OBE concept, this paper aims to reform the teaching of computer related graduate courses in the context of the construction of new engineering disciplines, starting from four key links: developing teaching objectives guided by results, reverse designing modular teaching content, improving teaching methods, and establishing a multi-dimensional teaching evaluation mechanism. Integrate formal, content, and moral education into curriculum teaching in ideological and political education.

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