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Research on Open Education Practice Teaching of Engineering Majors Based on OBE Concept

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Abstract: ***Practice teaching is a weak link in training applied and skilled talents in the teaching process of open education. Because of the characteristics of learners' on-the-job learning, separation of time and space, and contradiction between work and study, the practice teaching model in traditional teaching environment cannot meet the needs of open education. Therefore, it is urgent to reconstruct the practice teaching system in open education. Based on the OBE education concept, cooperative education concept, whole-person education and other open education concepts, and according to the changes in social and economic conditions, teaching design is endowed with new connotations, a new practical teaching system suitable for open education is formed, and applied research is carried out in engineering specialties, so as to enhance the ability of open education to train applied and skilled talents.***

Keywords: Outcome-based Education, Open education, Practical teaching.

1. Preface

Open education focuses on the training of applied and skilled talents. Practice teaching has become the core teaching link of various specialties in open education. Practice teaching in open education is basically consistent with the teaching model of general higher education. It consists of curriculum practice teaching and comprehensive practice teaching. Due to the limited practical conditions and learners' extra-professional learning, the current teaching requirements of practical teaching cannot be effectively implemented, and the experimental items and hours are often simplified and compressed. Practical teaching in open education has become a bottleneck affecting the improvement of teaching quality in open education.

2. Analysis of the Current Situation of Open Education Practice

Taking open education learners as an example, learners generally engage in production frontline work. Although they have rich practical experience, they are often single and repetitive empirical skills, lacking professional and comprehensive application ability. In order to improve learners' practical ability, although the instructors also try to constantly adjust the teaching content, change the teaching methods and increase the hours of practical teaching, the teaching effect is still unsatisfactory. The main reasons are as follows:

2.1 Outdated Educational Philosophy and Insufficient Understanding of the Role And Status of Practical Teaching

The acquisition of professional knowledge, abilities, and the cultivation of qualities all stem from practical activities. However, the current open education is always constrained by the outdated educational philosophy of "emphasizing theory over practice, emphasizing knowledge over abilities". Teachers still prioritize theoretical teaching with practical teaching as a supplement, and adopt a teaching model where teachers take the lead and learners passively accept. Practical teaching is often seen only as a tool to deepen the understanding and mastery of theoretical courses, and the cultivation of learners' hands-on and analytical skills has not received sufficient attention.

2.2 The Practical Teaching System Lacks Progressiveness and Hierarchy

Due to the fact that learners come from various enterprises, institutions, and universities in society, there are significant differences in their age, work experience, job positions, learning goals, learning abilities, and learning conditions. Therefore, their needs for professional practice education are diverse. However, the current unified teaching content and requirements in open education overlook the diversity of individual needs. The practical teaching content is outdated, the teaching environment is single, and the teaching design, teaching methods, and teaching models are relatively rigid. All these factors will dampen the learners' enthusiasm for active learning. The design of practical teaching is not reasonable enough, and the implementation plan and methods lack innovation, which cannot meet the specialized, diversified, and personalized learning needs of learners.

2.3 The Design of Practical Teaching Projects is Divorced from Practical Application

The current practical teaching system often lacks a comprehensive plan for cultivating the ability to apply management theories and standardized knowledge to solve practical problems, which means that the practical teaching curriculum is not well-designed. Most practical teaching projects are verification of theoretical course content, lacking practicality related to professional positions, and are disconnected from social reality and the current situation of enterprises, unable to improve vocational skills and professional practical abilities. Moreover, current practical teaching generally provides the content, operation methods and steps, report formats, and even the experimental results of each step. This will lead to learners only mechanically following the steps without active thinking, which will make the practical teaching ineffective.

2.4 Practical Conditions Cannot Meet the Needs of Practical Teaching

At present, the construction of practical teaching faculty is not in place, and there is a serious shortage of "double-qualified" practical teaching instructors. Due to the lack of practical experience in teaching positions, teachers' practical abilities are greatly limited, and their practical teaching guidance is often "talking on paper", making it difficult to effectively guide learners to complete experimental and practical tasks. Furthermore, the construction of teaching practice bases lags behind, and due to constraints such as funding and space, the hardware conditions for practical teaching are relatively weak at present. Especially in grassroots teaching points, there is a serious lack of laboratory and on-campus practical teaching base construction; The collaboration between off-campus practical teaching bases is often difficult to operate effectively.

2.5 The Process Management and Assessment Mechanism of Practical Teaching are Not Perfect Enough

At present, the organization and management methods of professional practice teaching are lagging behind; The quality control of practical teaching is not perfect; The assessment method of practical teaching is unreasonable. Therefore, in the implementation process of practical teaching, educators often go their own way, cutting down the content of practical teaching and compressing the hours of practical teaching, deviating from the teaching objectives and making it difficult to achieve the goal of cultivating applied and skilled talents.

Therefore, in order to cultivate applied and skilled talents in engineering based on open education, we must abandon traditional teaching practice models and uphold open educational concepts such as OBE, cooperative education, and whole-person education. We should form a new practical teaching system that is suitable for open education, and reverse the teaching design to give new connotations based on changes in the socio-economic situation.

3. New Connotation of Open Education Practice based on OBE

The OBE concept, also known as result-oriented education, is a kind of educational concept based on learning results or results-oriented [1]. It represents the mainstream direction of education reform in engineering specialty. It clearly focuses on and organizes every link of education so as to enable students to achieve the desired results in the learning process. In the 1980s and early 1990s, OBE education model was widely used in basic education in the United States, Australia and other countries. This education model pays attention to the analysis of students' learning output, reverse design of students' educational structure and related evaluation system, so as to rapidly improve the quality of teaching [2]. In the education system of OBE, educators need to have a clear idea of students' learning outcomes, that is, what students can do after finishing their studies, and to promote and ensure that students achieve these educational goals by designing appropriate educational structures. The output of learners is the motive force of this educational model. Obviously, it is different from the traditional model of teaching content-driven and educational input. In this sense, OBE is an innovation of the educational model. This operational concept and educational model are of great significance in the training of engineering and applied talents. It also meets the requirements of the training of applied and skilled talents in open education. It is especially suitable for guiding the teaching practice of open education such as engineering [3].

4. Design of Practical Teaching in Open Education based on OBE Model

OBE education model is a process model that aims at students' intended learning outcomes, designs educational system, implements educational programs, evaluates educational effects, and continuously improves the quality of education [4]. In the implementation of OBE engineering education in Colleges and universities, work is carried out from the professional education level and curriculum teaching level of engineering personnel training, and mutual coordination and real-time feedback are achieved. At the level of professional education, guided by students' intended professional training objectives and graduation requirements, we design the professional training program and curriculum system, train students' knowledge, ability and professional quality according to the engineering education program formulated by the specialty, evaluate and analyze the professional learning effect of graduates, and feedback the analysis results to the design of professional objectives. In order to achieve continuous improvement and improve the quality of professional engineering talents training. At the level of curriculum teaching, guided by students' intended learning outcomes, curriculum teaching design is carried out, advanced engineering education teaching methods are implemented, students' curriculum learning effectiveness is evaluated, analyzed and summarized, and teaching quality is continuously improved. Thus, in engineering education, curriculum design is the basis of engineering education, and curriculum design based on the concept of OBE engineering education is the key element to achieve OBE engineering education.

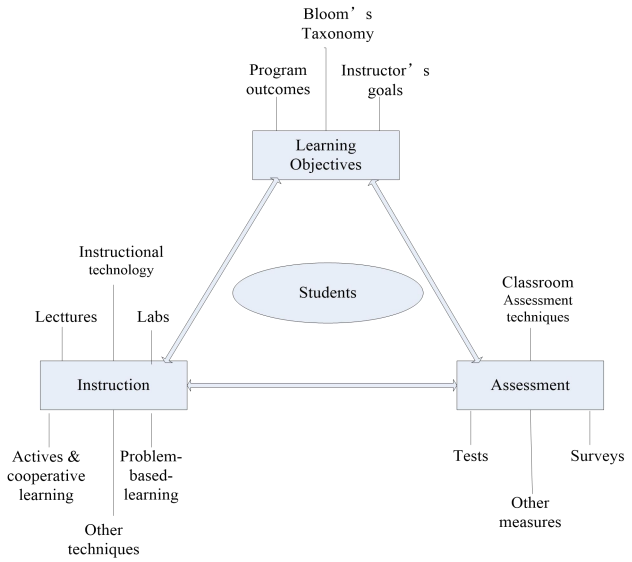

Figure 1: Teaching design of OBE model [5]

According to the teaching design idea of OBE model (Figure 1), the practical teaching system of open education for engineering specialty is constructed. The overall system is divided into three sub-systems: target system, content system and management system.

4.1 Target System

Under the OBE concept, the confirmation of practical teaching objectives should not only be based on the requirements of university education, but also consider market demand and the ability requirements for students' future career development. By enhancing practical abilities and skills, students can better integrate subject knowledge with practical problems to cope with the complex environment of the engineering field. Different abilities should be layered and refined into different stages, forming an increasing line for practical ability cultivation. This further requires college teachers to have a deeper understanding of the professional employment scenarios and industry needs.

Engineering education categorizes students' abilities into four dimensions: basic engineering knowledge, individual skills, interpersonal and team competencies, and engineering system capabilities. From a cognitive standpoint, these abilities can be further divided into memory, application and comprehension, as well as analysis and creativity. Through practical teaching, students are cultivated in areas such as problem identification and analysis, theoretical synthesis and application, innovative thinking and improvement, interpersonal communication, and teamwork. Additionally, their comprehensive abilities are showcased throughout the conceptualization, design, implementation, and operation of project practices. Drawing on these principles and aligning with industry needs, the professional practical skills of talents are decomposed from individual aspects to encompass professional knowledge, comprehensive application, innovative thinking, and improvement capabilities. The practical teaching objective system encompasses overall, specialized, and innovative practical teaching goals. These are formulated based on the requirements of professional talent cultivation and are tailored to the unique characteristics of the profession.

4.2 Content System

Based on expected learning outcomes, and taking into account the interdisciplinary characteristics of engineering majors and industry demands, we reverse-engineer practical teaching content. This ensures that teaching objectives are hierarchical and align with progressively challenging teaching content, facilitating a traceable match between practical teaching goals and content. Guided by practical teaching objectives, we develop a multidisciplinary practical curriculum system tailored for engineering students. This approach enables students to better comprehend core concepts, seamlessly integrate data, information, and knowledge, enhance their comprehensive abilities, and better equip them to face future employment challenges. In designing practical teaching content, we map student ability levels to the practical teaching curriculum based on training objectives. The content system of practical teaching is structured into basic, comprehensive, and innovative practical sessions.

4.3 Evaluation System

In the OBE model, the evaluation of learners primarily focuses on assessing whether students have met the teaching objectives and practical skills requirements, while also providing them with corresponding feedback. Evaluating students' progress should not solely rely on their understanding of theoretical knowledge, but also consider whether they have developed the qualities necessary for success in their future work. Therefore, under the OBE model, the evaluation objectives of open education should be based on society's demands for vocational skills, and corresponding evaluation standards should be established according to societal needs. During the evaluation process, emphasis should be placed on assessing the abilities and qualities of adult learners. Assessment can provide feedback on the learning outcomes of adult learners through social media, Weibo, WeChat, QQ, and other platforms.

4.3.1 The principle of diversified evaluation with students as the central focus

The central focus of teaching is the student, with the aim of enabling them to acquire knowledge, abilities, and qualities. Therefore, teaching evaluation primarily begins with the needs of student development and the achievement of learning goals, promoting changes in teaching and learning methods. Evaluation results provide feedback on teaching quality and learning effectiveness, serving as a basis for reflecting on teaching activities, adjusting teaching methods, and carrying out teaching reforms. The practical teaching evaluation system should center around students and conduct diversified evaluations. Through multiple evaluations such as student self-evaluation, peer evaluation, teacher evaluation, and teaching management personnel, the evaluation results should be objective and practical. At the same time, it also encourages students to analyze themselves, understand their strengths and weaknesses, and set objective and practical learning goals, which is conducive to achieving learning goals.

4.3.2 Emphasize formative evaluation, adhere to the principle of combining process-oriented and summative evaluations.

Purely summative theoretical and skill exams alone cannot provide timely feedback and guidance on teaching activities and students' learning outcomes, making it difficult to systematically evaluate students' practical abilities and problem-solving skills. Formative Evaluation, proposed by American evaluation expert Scriven, is a phased and feedback-oriented evaluation conducted to track the trajectory of teaching activities and identify problems in a timely manner, aiming to achieve better teaching effectiveness. [6] Formative Evaluation is a process evaluation that focuses on students' attitudes, beliefs, learning methods, thinking patterns, and logical abilities during the learning process. Introducing formative evaluation in practical teaching can provide timely and continuous feedback on teaching effectiveness, guide teachers and students to improve teaching and learning methods, and achieve teaching and learning goals.

5. Constructing Path of Open Education Practice Teaching System based on OBE Concept

Compared with the traditional practice teaching system, the construction path of OBE-based open education practice

teaching system includes five points.

5.1 Focus on Learning Process

Although the concept of OBE is called result-oriented education, it does not mean that it ignores the learning process. On the contrary, the OBE attaches great importance to the learning process. It emphasizes that students' learning process should be controlled to achieve the corresponding learning results, and the logical relationship between the learning process and the learning results should be clearly explained. This also conforms to the PDCA management concept in standardization [7].

5.2 Focus on Learning Outcomes

OBE is called result-oriented education. As its name implies, this concept attaches special importance to learning outcomes [8]. First, the learning outcomes are not limited to achievements. Secondly, the results include comprehensive indicators such as achievement, attendance rate, ability, employment rate and post-graduate salary, which together reflect the true meaning of the learning outcomes. Thirdly, the achievement and measurement of learning outcomes are not horizontal comparisons, but more vertical comparisons, reflecting the progress made after the completion of a certain process and step.

5.3 Reforming the Learning Model

OBE believes that learner-centered learning should be adopted and cooperative learning model should be advocated in the learning process. In the learner-centered learning model, professional practice teaching should be based on the corresponding platform to ensure the implementation of learner-centered learning model.

5.4 Innovative Evaluation Methods

The concept of OBE has a fundamental reform and innovation on the evaluation method, breaking the traditional evaluation system. In OBE, the evaluation is based on the results. The evaluation mechanism of industry mentors is introduced. The industry mentors evaluate the learners' on-the-job practice, the effectiveness of project practice and the performance of practice.

5.5 Emphasis on Continuous Improvement

The most important idea of applying OBE concept to practical teaching is to emphasize continuous improvement. In practice teaching, continuous improvement should be a procedural and institutionalized improvement system, which includes all aspects related to practice teaching, recognizes the current situation of practice teaching, the law of practice teaching, and the problems of practice teaching, and is good at and diligent in summing up experience and shortcomings, and puts forward suggestions for improvement and implementation.

6. Construction Measures

In order to guarantee the implementation of construction paths, such as paying attention to learning process, learning achievement, reforming learning model, innovating evaluation method and emphasizing continuous improvement, to construct a three-dimensional and multi-level open practical teaching system, the specific methods include:

Practice teaching content is hierarchical, practice forms and teaching methods are flexible and diversified.

Integrative design of theory teaching and practice teaching.

Combination of virtual and reality in practice model.

Diversified and multi-level design of practical teaching resources.

Practical teaching learning environment supports multi-path and personalized learning.

Through the construction of the practical teaching system of open education based on OBE concept, it adapts to the characteristics of time-space separation and great differences in learning ability of open education learners. According to the objectives of talent training, it takes learners as the center, takes "application and practice" as the main line, pays attention to the improvement of basic vocational quality, post vocational ability and vocational migration ability, and builds a three-dimensional and multi-level opening practical teaching system.

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