

## Discussion of Talents Training Mode of Environmental Protection Equipment Engineering Majors Based on OBE Concept

Xiangyang Wu<sup>1, a</sup>, Hong Liu<sup>1, b</sup>, Xiaohong Zhou<sup>1, c</sup> and Rujin Zhao<sup>1, d</sup>

<sup>1</sup>School of the environment and safety engineering, Jiangsu University, Zhenjiang 212013, China

<sup>a</sup>wuxy@ujs.edu.cn, <sup>b</sup>hliu@ujs.edu.cn, <sup>c</sup>xhzhou0214@163.com, <sup>d</sup>zhaorujin@ujs.edu.cn

**Keywords:** OBE concept; Environmental Protection Equipment Engineering; Talents Training; Engineering quality; Innovation ability

**Abstract.** Outcome-based Education (OBE) is an education mode taken teaching achievement as an oriented and is the central concept of engineering education certification. Environmental protection equipment engineering was opened in 2010 as for the new undergraduate professional. On the basis of "OBE" concept, the talents training target were scientifically confirmed and the talents training mode were reasonably constructed. The scientific, systematic and advanced teaching system was built thought thick foundation, wide caliber and strong ability principle and general education base. And the practice teaching system of "engineering ability and cultivating innovation ability" were also build in order to improving target training quality.

### 1. Introduction

Outcome-based Education (OBE) is an education mode taken teaching achievement as an oriented and it originated in the United States on the 1980 s. OBE concept can be interpreted as: what content of students need to learn? Why learn it? How to achieve learning goals? How to estimate and prove the outcomes of student learned. OBE concept had adapted to the requirements of society, especially enterprise requirements for talent those students' skills and abilities should be observed, measurable and can be applied in the mode of presentation [1]. Since then, this model has been widely used in Australia, Britain, Canada, South Africa, New Zealand and other countries. OBE concept promotes reformation of engineering education and improves engineering talent training quality, and has become the widespread focus in the domestic universities and colleges of engineering. At the same time, engineering education accreditation work depth promote on a national scale take "OBE" concept as the theory guidance.

OBE model firstly concern the learning results of students achieved when they graduated for a period of time (3-5 years), and also ensure students to achieve these results through the curriculum and teaching plan. OBE model emphasizes to establish a set of "easy observation and measurement of the quality standards, such as the training target, graduation requirements, etc., and insist the" Stakeholder Orientation ", in order that enterprises have the opportunity to take part in the standard establishment and evaluation activities of the talent training quality. Therefore, OBE concept meets the needs of enterprises for personnel training, therefore, are welcome by engineering field.

OBE model requires focus on the final results of educational achievement, also requires all of the course system, teaching process and evaluation are the final results to design and implementation. This allows students clear their goals and know what achievements he has received in the learning process. Therefore, educators clearly know students should have the ability and level when they graduated, in order to construct the structure of education and curriculum and ensure students could achieve the expected target [2-6]. OBE model is helpful to improve the quality of the engineering talents cultivation therefore, as new established environmental protection equipment engineering major, it is very necessary for strong engineering practice and innovation ability of senior engineering and technical personnel to construct the personnel training mode and curriculum content and practice teaching system based on the OBE concept.

## **2. OBE Model Framework**

OBE is the structure mode, which is expected learning outcomes for the center to organize implement and evaluate education structure. Chandrama Acharya pointed out that the OBE education pattern implementation mainly has four steps: defining the learning outcomes, realizing the learning outcomes, assessing learning outcomes and using the learning outcomes. This covers each factor of the PDCA cycle (plan, implementation, check, action).

It is the first key processes of definition the expected learning outcomes of graduates. This need described the knowledge, emotion and skills degree and level of student mastery, and also have the maneuverability. The teaching activities around the desired learning outcomes mainly expression in the curriculum plan of "reverse engineering", those mean that forthcoming graduates ability were organically led into the course plan, in order to clear the contribution of course, class to desired learning outcomes, ultimately, form a complete matching matrix.

It is an important part of OBE education model to assessment of learning outcomes the OBE education model, is also just the relatively weak link of domestic colleges and universities. According to the theory and experience of American College Students' learning evaluation practice, the expected learning outcomes evaluation can be divided into the following aspects: According to teaching level, learning outcomes assessment can be divided into class level, professional level and school level. According to the assessment content, learning outcomes assessment can be divided into direct evaluation and indirect assessment. According to the teaching subjects, learning outcomes assessment can be divided into teachers, students, alumni, employers and managers. Those could form a perfect evaluation system, therefore, provides effective evidence and effective feedback for dynamic tracking of the quality of higher education and students' learning proliferation".

## **3. Design of the Environmental Protection Equipment Engineering Professional Personnel Training Target**

On the basis of OBE concept, the talents training target were scientifically confirmed according to the Chinese engineering education accreditation standard. The target is that this professional training meet the needs of the science, technology, economy, society development and advanced engineering and technical personnel with international vision, those talents have humanities and social science literacy, social responsibility, good occupation ethics and the spirit of innovation, and have basic knowledge of mathematics, physical, chemical and biological and engineering subject, and have basic theory and professional knowledge of environmental protection equipment and engineering aspects, have basic knowledge of environmental science and engineering, mechanical design and manufacture, automatic control, and environmental protection, and have the ability of design, manufacturing, installation, operation and management, environment analysis and detection. Five years after graduation, the environmental protection equipment design capacity, operation and analysis capacity, and pollution control facilities design capacity and construction and operation management capacity will be further enhanced. And the talents could rational use of the environmental protection equipment and engineering expertise, analysis solve the engineering technical problems encountered in the actual production, and become a unit of engineering technology and management backbone.

On this basis, further clarify the following graduation requirements:

(1) To be able to use mathematics, natural science, engineering foundation and professional knowledge to solve complex environmental protection equipment engineering problems.

(2) Be able to apply the basic principles of mathematics, natural science and engineering science, identify, express, and analysis of complex environmental protection equipment engineering problems through literature research, to obtain effective conclusions.

(3) Be able to design solutions to solve the complex environmental protection equipment engineering problem, designed to meet the specific needs of the system, unit (components) or

process, and can embody the sense of innovation in the aspects of environmental protection equipment design, considering society, health, and safety, law, culture and environment factors.

(4) Be able to study complex environmental equipment engineering problems based on scientific theory and method, including the design of experiments, analysis and interpretation of data, and through the comprehensive information to get a reasonable and effective conclusion.

(5) Be able to develop, select and use the of appropriate technology, resources, modern engineering tools and information technology tools based on the problem of complex environmental protection equipment engineering, including the prediction and simulation of complex environmental protection equipment engineering problems and can understand its limitations.

(6) Be able to reasonable analysis and evaluation the influence of engineering practice and complicated engineering problem solving scheme to society, health, and safety, law and culture based on engineering related background knowledge.

(7) Be able to understand and evaluate the impact of professional engineering practices on the environmental and social sustainability of complex environmental engineering problems.

(8) Be able to understand and comply with engineering practice in engineering ethics and norms, fulfill their responsibilities with the humanities and social science literacy, social responsibility.

(9) Be able to take the role of individuals, team members and director in a multi disciplinary context.

(10) Be able to effective communicate with peer and society citizen for complex environmental protection equipment engineering problems, including report writing and presentation, design statement and clear expression or respond to instructions. And able to communicate and exchange in the cross-cultural background with a certain international vision.

(11) Be able to understand and master the principles of engineering management and method of economic decision, and can applied it in multidisciplinary.

(12) Have the awareness of autonomous learning and lifelong learning, and have the ability to continuously learn and adapt to the development.

#### 4. Construction of Curriculum Content System Based on OBE

Based on the graduation requirements of the expected learning output, the course systems were reversed design. Furthermore, according to the students' talents training requirements of the environmental protection equipment engineering, the curriculum teaching system and practice teaching system were design as shown in Table1 and Table 2 [4].

Table1 Construction of curriculum content system based on OBE

General education platform	Mechanical and electrical professional foundation platform	Environmental science and engineering foundation platform	Environmental protection equipment engineering professional platform	Diathesis developing platform
Philosophy and Political Theory	Engineering Graphics			
College English (Foundation)	Theoretical mechanics			
Higher mathematics	Mechanics of materials	Basis of Environmental Chemistry	Water Pollution Control Engineering	Military theory
Linear algebra	Fluid mechanics and fluid mechanics	Environmental Microbiology	Air Pollution Control Engineering	Situation and policy
Probability statistics	Electrical Engineering and Electronics	Principles of Environmental Engineering	Engineering	Introduction to academic planning
College physics	Theory and Design of Mechanism	Environmental Engineering analysis and detection	Solid waste treatment and disposal	College English (improvement or expansion)
Computer program design	Tolerance and detection technology		Environmental Protection Equipment	
	Fundamentals of engineering materials and manufacturing technology			
Humanities and	Mechanical Cad	Foundation of	Physical Pollution	Freshman

Science Economic management Art appreciation Comprehensive education	Mechanical optimal design Electro-mechanical Drive Control Sensor technology Advanced manufacturing technology Principle and Application of Single-chip Processor Mechanical fault diagnosis technology	Environmental Science environmental biotechnology Environmental engineering materials Environmental engineering program design Reaction kinetics and reactor design	Control Engineering Pipeline engineering Industrial wastewater Treatment technology Environmental Engineering construction and management Operation and management of environmental protection facilities Embodiment of environmental management Environmental impact assessment	Seminar Online self-study course Online self-study course Social investigation and Practice
--	--	--	---	--

Based on OBE model, curriculum teaching and practice teaching system could well meet the professional training objectives and graduation requirements, and also effectively improve students ability of solve complex problems in environmental protection equipment and engineering problems field and also have international vision and the ability to continue learn and adapt and developing.

Table2 Practice teaching system of environmental protection equipment engineering specialty based on OBE

Fourth grade	Environmental protection equipment design innovation	Innovative experiment course (Comprehensive, Designing experiment)	Graduation design	
Third Grade	Application foundation of Environmental Engineering	Professional basic course experiment (Comprehensive, Designing experiment)	Scientific research training Design of professional production practice course	Innovation training
Second Grade			Specialty Cognitive Practice	
First grade	Fundamentals of environmental science and Engineering	Basic course experiment	Industrial systems Cognitive Practice Metalworking practice Military skill training	

## 5. Summary

China has become the twenty-first member of the "Washington Accord". Signatory countries of the "Washington Agreement" have implemented the engineering education model based on the output. Construction philosophy of environmental protection equipment and engineering education mode based on OBE have very important significance to improve the professional quality of personnel training, establish with provisions of the Washington Agreement "with" quality of effectiveness system of engineering education.

## 6. References

- [1]. Shanks, Joyce. Unintended Outcomes: Curriculum and Outcome-Based Education [C]. //the Annual Meeting of the American Educational Research Association, Atlanta,1993: 12-16.
- [2]. P.H. Gu, W. L. Hu, P. Lin, N. S. Bao, X. H. Lu. The engineering education model the practice and exploration of Shantou University based on the "learning output" (OBE)[J]. Higher engineering education research, 2014, Vol.1, pp: 27-37. (In Chinese)
- [3]. Chandrama Acharya. Outcome-based education (OBE): A New Paradigm for Learning [J]. CDTLink. 2003, Vol. 7, No. 3.
- [4]. H. Liu, X. Y. Wu, C. W. Yi. Practice and Exploration on the construction of Environmental Engineering Specialty in Jiangsu University [J]. Education and Vocation, 2010, Vol. 35, 125-127. (In Chinese)
- [5]. D.J. Zhang. Focus on Learning Output Emphasis on Student Development [J]. Exploring Education Development, 2011, 8:76-79. (In Chinese)
- [6]. C. Sun. Reflection of research on learning outcomes of American college students [J]. Higher Education Development and Evaluation. 2009, 25(6): 81-84. (In Chinese).