

# RESEARCH AND PRACTICE OF HIGHER VOCATIONAL EDUCATION OF ENVIRONMENTAL ENGINEERING

Dr. Yalei Zhang

Institute of Technology, Tongji University

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**Abstract:** In China, the environmental protection industry is developing quickly, the environmental engineering education programmes have been forced to try to keep pace, it's necessary to develop the higher vocational education of environmental engineering to meet the demand for a great number correlative persons with comprehensive vocational capability. In this paper, the features of higher vocational education of environmental engineering are discussed. At the same time, the teaching programme establishment and practice of higher vocational education of environmental engineering are set forth also.

## INTRODUCTION

Environmental engineering is a rapidly developing field of engineering owing to undefined risks of environmental deterioration and the complex nature of the present environmental problems. Especially in China, with the quick development of environmental protection industry, the demand for correlative technology and administration persons is increasing. Scientific running of environmental protection and environmental health establishments need technological and practical people who have comprehensive vocational capability and can directly engage in production, service, technology, administration and operation of water supply, urban drainage, wastewater treatment, solid waste collection and handling systems on site. They differ from those academic and designing persons cultivated by usual discipline and teaching system, either differ from higher technology workers or technicians.

## FEATURES OF HIGHER VOCATIONAL EDUCATION OF ENVIRONMENTAL ENGINEERING

The American Academy of Environmental Engineering (AAEE,1998) defines environmental engineering as "...the application of engineering principles to the management of the environment for the protection of human health, for the protection of nature's beneficial ecosystems, and for environment related enhancement of the quality of human life". The practical interpretation of this definition is that Environmental Engineers design and oversee the operation of water and wastewater treatment plants and measure and monitor pollutants in the air, on the land, and in rivers and lakes (Alha, et al., 2000). In recent years, the environmental engineering has mushroomed to include all aspects of the human and terrestrial environment systems (Bishop,2000), with increased emphasis on waste minimization, recycling and reuse to minimize the amount of wastes to be managed. At the same time, the education of Environmental Engineers, must be committed to the concept of sustainable development, so that the present society will not endanger the survival of future generations. And the environmental engineering education programmes have been forced to try to keep pace.

Higher vocational education is a new type education mode of personnel training, in which people's capacity is primary (Xu, et al.,1999; Zhao,1999). And it's guided by the requirement of social and economical reality and future development tendency. Which is based on solid speciality knowledge, also needs skills acquired through strict discipline, in the whole process of education teaching and training, we should pay attention to theoretical knowledge while stressing on vocational technology cultivation, and think much of methodology of new knowledge and new skills and edification of social capacity to adapt to changing time and social requirement.

The features of higher vocational education of environmental engineering are accordance with the training goal also. As a main goal, the graduates are to be enabled to work on a technical environmental problem in its entirety. The level they work at is not meant to be highly advanced and scientific, but rather practical and applied. The graduates should have a number of skills such as:

- the ability to oversee the different environmental compartments (water, solid and air),
- capability to apply engineering principles in order to implement technical solutions,
- can directly engage in production, service, technology, administration and operation of water supply, urban drainage, wastewater treatment, solid waste collection and handling systems on site,
- the engineers responsible for the management and quality assurance of raw materials, products and waste streams in larger industrial enterprises, and
- the willingness for problem-oriented learning and continuing education as working engineers.

In general, high-tech information, high technology and high skills of environmental protection industry development, are basic features of higher vocational education of environmental engineering. Which should be run through the whole education process. The features of higher vocational education of environmental engineering include the following:

- Higher vocational education of environmental engineering is faced to the front line of environmental protection. It cultivates the advanced persons with perfect practical technology and skill needed by vocational post of environmental protection, and the persons with high technology, operation and management ability who can apply and operate environmental pollution treatment establishments, they can skilled work on site as soon as graduated from institute.
- The content of higher vocational education of environmental engineering are mainly mature fundamental theory, technology and administration criterion of environmental protection, its teaching programme and curriculum setting are determined by requirement for vocational capacity and vocational staff adapting to environmental protection post group.
- Higher vocational education of environmental engineering should promote formation of correlative skills, mastering of technology and cultivation of staff. Which is achieved through greatly setting and implementing of practice and cultivation curriculum needed by environmental protection vocation post. The setting and study of fundamental curriculum should supply more effective service for environmental protection practice and for achieving cultivation aim of our major.

## **TEACHING PROGRAMME ESTABLISHMENT OF HIGHER VOCATIONAL EDUCATION OF ENVIRONMENTAL ENGINEERING**

### **Pay attention on training vocational post capability of environmental protection**

Before establishing the teaching programme, it's necessary to go to the correlative environmental protection department, environmental health department and enterprises to realize the requirement for post capability. Based on the investigation as above, the staff room establishes the teaching

programme, then send to the units to emend and recognize. Finally, the speciality supervise committee discuss and confirm the effective teaching programme.

### **Insist on the motive consistency of education and environmental protection work**

In the aspect of teaching material exploitation and curriculum setting, breaking away from the tie of systematic and integrality of subject education, spanning the frame of curriculum setting in general college. According to the necessary knowledge and capability structure for environmental engineering post, exploiting the curriculum with strong pertinency and synthesis in reason, such as “Running and management of waterworks and wastewater treatment plant”, and so on.

### **Standing out practice teaching**

An important aspect of the course is its practical orientation. Which is in according with the recommendations of the German Federal Ministry of Education, Science, Research and Technology (BMBF,1999). When establishment the teaching programme, taking into account the practical training, professional practical placement, and thesis outside the institute, and pay attention to increase the proportion of practice tache, reform the traditional teaching mode that theory and practice was carried out at different time and site, advocate theory teaching combined with experimentalizing. Emphasize the training nature of the teaching method, establish the skill training system for environmental engineering post when establishing the theory system for applying.

### **Take examination for the target to bring up synthetic qualified personnel**

Test paper proposition should fully materialize the feature of higher vocational education that the speciality foundation knowledge is solid and the practice skill is perfect. The test grades can reflect the students’ capability level as they really are.

## **PRACTICE OF HIGHER VOCATIONAL EDUCATION OF ENVIRONMENTAL ENGINEERING**

### **Educational content**

In addition to the theory and practice teaching content as above, it’s important to carry out vocational moral teaching, which should carry through the whole learning process in order to bring up the persons that love the environmental protection career, with strong responsibility, at the same time, who are good at study and willing to innovate during working process.

### **Tutors procession**

Tutors are the key to realize the teaching programme of higher vocational education. One side, we retain the even-tutors who are accomplished in theory and practice, in addition, we retain the careerman with abundance practice experience and high culture stuff as part-time tutors, in order to make teaching process press close to environmental working practice.

### **Teaching materials, media and simulation tool**

Textbooks and other written text materials and exercises differ from those usual textbooks, which are revised according to the requirements of the higher vocational education of enhancing practical elements. In addition, these basics can be accompanied by supplementary material such as:

a) multi-media, organised such that it can be down-loaded from the Internet; b) slides, photos, videos; c) discussion forum/bulletin board etc.; d) real world project descriptions (cases); e) commercial program links/applications.

### **Practice site**

The practice site at Tongji including:

- Relative production units having assigning co-operation agreement, which can supply practice and discipline site for students;
- Our institute has constituted “Shanghai city construction and administration practice center” (Xie, et al., 1999), the environmental pollution treatment practice room is being built now, which comprehensively embodies combination of mature technology, new technique and new research outcome, is a teaching and practice base having several functions of testing, practice and site simulation.

### **Professional practical training**

The professional practical training of 4 months undertaken during the last semester is compulsory. Public and private institutions, engineering companies, administration, plant operation, consulting firms or authorities, i.e., in the same working areas as the professionals the students are going to join, are expected to employ the students for a nominal salary for practical training (Gujer,2000). We expect that the students will gain insight into the constraints of professional surroundings, will gain motivation for their studies and will improve their ability to get involved in experimental and field work in view of their final diploma thesis. Which is one possibility to make contact with potential employers and to make them aware of potential future human resources.

This period is supervised by a senior engineer, and it is individually followed up by a faculty member. Our tutors will maintain quality control and will assist the students to find reasonable training opportunities. At the end, the students have to prepare oral and written presentations about their work.

### **The enterprises participating who will employ higher vocational educational graduates**

Be sure for cultivating the persons adapting to the front line of environmental protection, we should strive for the employment enterprises participating in and providing support during the whole process of education, such as specialty setting, teaching programme, curriculum content and teaching methods, including supplying teaching instruments, school running money and so on. The board and speciality supervise committee were organized in the Wuxi institute of Tongji University, in order to widely absorb the join of employ units, which achieves good effect.

### **SUMMARY**

The goals of higher vocational education of environmental engineering at Tongji, are cultivating the technological and practical persons who have comprehensive vocational capability and can directly engage in production, service, technology, administration and operation of water supply, urban drainage, wastewater treatment, solid waste collection and handling systems on site. They differ from those academic and designing persons cultivated by usual discipline and teaching system, either differ from higher technology workers or technicians. The level the graduates work at is not meant to be highly advanced and scientific, but rather practical and applied.

The features of higher vocational education of environmental engineering are accordance with the educational goal. The graduates should have a number of skills which are not found in that combination in other engineering disciplines.

The teaching programme establishment and practice of higher vocational education of environmental engineering are determined by its features as above.

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## CORRESPONDENCE

Dr. Yalei Zhang  
Institute of Technology, Tongji University  
71 Chifeng Road, Shanghai, 200092  
P.R.China  
Tel: +86-21-65980942, 65981365  
Fax: +86-21-65982769,  
E-mail: [yhzktzk@online.sh.cn](mailto:yhzktzk@online.sh.cn)