

The Important Role of Comprehensive Professional Experiment in the Undergraduate Cultivation of Environmental Engineering

Shi Li ^a, Dongfeng Zhao ^b

Department of Environmental and Safety Engineering, China University of Petroleum,
Qingdao 266580, China

^alishi19785460@163.com, ^b36809475@qq.com

Abstract

Comprehensive professional experiment is an important content of course reformation, which has the important practical significance for student's practical ability, experimental skills and innovation ability. Based on the environmental monitoring experiment teaching reformation in China University of Petroleum, this paper discusses the new ideas and methods of comprehensive professional experiment of environmental engineering, and puts forward the comprehensive experimental skills training of environment monitoring's whole process in the process of experiment, inspires the enthusiasm of students to experiment and improves the quality of experimental teaching.

Keywords

Comprehensive professional experiment; practical ability; experimental skills; innovation ability; experimental teaching

1. Introduction

Recent years, many adverse environmental phenomena such as the haze, water pollution, living garbage and solid waste accumulation occupy land, ecological damage has captured widespread media attention, occupying newspaper headlines and sparking heated discussion. The majority of the public has become increasingly worried about the quality of the environment and environmental problems around today's society. The improvement of people's living standards does not mean only material needs and spiritual life satisfaction, but also the quality of living space environment.^[1] Meanwhile, the improvement of environmental quality requires countries continue to introduce more strict environmental protection laws and regulations and relevant policies as a guide, and also needs high-quality environmental engineering professional personnel engaged in environmental management and pollution control work. Various colleges and universities in China have established environmental engineering undergraduate specialty, which is responsible for the transportation of environmental management and pollution prevention professionals in all walks of life. There is no doubt that it matters to deepen professional environmental engineering curriculum teaching reform, to adapt to changing needs of society, to further improve the theoretical level and the practical ability of students, to cultivate professional ability is stronger, after graduation can quickly adapt to the job requirements of environmental engineering talents. It is not just the inevitable trend of ecological engineering professional development, but also an inherent requirement of China's environmental protection personnel enhancing the quality and ability and echelon construction.

Based on the environmental monitoring experiment teaching reformation in China University of Petroleum, this paper discusses the new ideas and methods of comprehensive professional experiment of environmental engineering, and puts forward the comprehensive experimental skills training of environment monitoring's whole process in the process of the experiment, highlights the significance

and necessity of comprehensive specialty experiment courses, so as to provide the reference for the other college of environmental engineering specialty course setting and teaching reform.

2. A Brief Analysis of the Undergraduate Teaching Mode of Environmental Engineering

China University of Petroleum (East China) environmental engineering specialty is one of the specialties of Shandong province. The current teaching model mainly includes four aspects: theory teaching, practice teaching, experimental teaching and graduation design: (1) Theoretical teaching usually refers to all kinds of basic theories and related subject knowledge related to environmental science, such as the principle of environmental engineering, environmental monitoring, environmental quality assessment, "three wastes" governance projects, oil industry and environmental protection; (2) Practice teaching usually refers to the students to go to the scene or production line, understanding environmental protection facilities and the actual application of environmental management, for example, go to a sewage treatment plant, environmental monitoring station, garbage landfill field visits; (3) Experimental teaching mainly includes the use of experimental instrument and determination methods of various indicators, such as the use of a variety of national standard method for the determination of atmospheric sulfur dioxide, nitrogen oxides, particulate matter, and index, water pH, COD, BOD and ammonia nitrogen index; (4) Graduation design refers to review and practice the knowledge learned in the previous studies and complete a small project under the guidance of graduation design teacher.

Department of environmental and safety engineering, China University of Petroleum, has established a comprehensive professional experimental course on the basis of summing up the past environmental engineering undergraduate teaching and research in other engineering colleges and universities, to meet the needs of the community to highlight the professional ability of graduates. In recent years, the effect of the implementation, has achieved good practical results, for other colleges environmental engineering undergraduate education also has certain reference significance.

Combined with the theory of teaching, practice and experimental teaching, the content of the comprehensive professional experiment course is the combination of the theory, practice and experiment, Through the practice and experiment of environmental engineering theory, the understanding of theoretical knowledge has been strengthened, and the comprehensive talents with solid theoretical foundation and practical application ability have been trained^[2].

The opening time of Comprehensive experiment curriculum is set in a senior last semester at present, the students, who more fully understand the content and character of environmental engineering, have already completed the training plan for the most part of environmental engineering, it will be good for a comprehensive professional experiment course and understanding or grasping the early theory of curriculum knowledge for students, the curriculum time for four weeks.

2.1 The Design of a Comprehensive Professional Experiment Content

Before the comprehensive experimental courses, the students have already completed the study of environmental monitoring course. But the experiment scheme is simpler, which is mainly based on the syllabus, Experiment purpose, principle, steps and matters needing attention, which is directed by the guidance teacher, and then by the students, most of them are repetitive verification experiment^[3]. Not only it promotes the students' basic experiment skills in the process of experiment, but also the students, relying on steps, complete experiment mechanically. The students did not participate in the preparation of the experimental apparatus, the preparation of the solution, such as a large number of preparations are prepared by the experimental guidance teacher in advance of the preparation. The students do experiment passively during the course of experiment operation, without the process of dependent thought, lack of initiative, creativity and the ability of explorations^[4]. The design of a comprehensive, on the basis of repetitive experiments, which is integrated into a whole subject, according to students' interest, they can choose the corresponding subject on the ground of giving several topics as a reference by the experiment guidance teacher, then determine the feasible experiment scheme under the common

discussion of the guidance teacher and students, the final experiment is dependently completed by themselves.

The content of Comprehensive experiment curriculum mainly includes: plan making, sample collection, data monitoring and the evaluation of results.

2.2 The Implementation of a Comprehensive Professional Experiment

(1) First of all, in accordance with environmental elements, all students were divided into three groups: atmosphere water, soil. They can choose one of groups on the basis of their own interests or hobbies, each group will be further divided into three small groups. According to the requirements of project, the member of all groups makes experiment scheme under the guidance of instructors, combined with professional knowledge and related national standards, it will require students to do a good job on preparation, which consolidates the theoretical basis of the environmental monitoring course. When the preliminary experiment plan is completed, the rationality of the experiment scheme discussed by group members and instructors, in order to fully mobilize the enthusiasm of the students, some effective measures were taken into consideration, the specific steps as follows: problems were put forward by the instructor on the basis of detailed experiment, students are prepared to answer this questions, simultaneously, recommendations were given by the instructor and the feasible solution was determined eventually.

During the course of the experiment scheme, we found some problems: (i) the blindness of consulting literature. The learning of undergraduate students are “nanny” teaching basically^[5], students passively were accepted knowledge by teachers all the time, due to lacking this aspect of the exercise, so that many students can't carry out after getting the subject, in the undergraduate study, teachers should provide the students with more independence-minded problem solving skills. (ii) the copying of scheme. The vast majority of students copy the reference materials merely, lacking environment monitoring and the flexible use of theoretical knowledge, for the specific monitoring object, the detailed implement scheme can be made by discussing with teachers.

(2) Campus area are treated as atmospheric and soil sample collection site, in accordance with the local gas phrase conditions, the sampling points are set by the atmosphere group, we should put the basic factor of the environmental air quality standards as a monitoring factor in the process of gas sample collection, soil samples collected on the basis of the relevant specific regulations^[6], several rivers near school are treated as water sample site, according to the actual circumstance of rivers, samples collected in accordance with the principle of surface water collection points.

All sampling sites are outdoors working, it will fully arouse the enthusiasm of the students' experiment and the ability of practice, students can be familiar with the layout of sampling points, sampling time, sampling frequency and the actual monitoring work, the knowledge of textbook will be applied to the practice work skillfully^[7].

(3) After collected, samples were analyzed by the data analysis group in the laboratory according to the national standard or other methods to analyze the samples.

In the past, the experiment was a confirmatory experiment with insufficient novelty, and the students always complete the experimental process under the guidance of teachers so that their initiative is not strong. And the purpose of establishing the comprehensive experimental courses is that it not only can greatly enhance the student's subjective initiative, but make students understand various national standard monitoring methods standards in the field of environmental engineering and master basic experimental skills of various common pollutant indicators to train the ability of finding and solving the problem. Thus they can quickly adapt to the working environment after graduating, which effectively reduce the transition time of students to a workers to improve work efficiency^[8].

3. The Significance Of Reform and Innovation Of Comprehensive Professional Experiment

Comprehensive professional experiment can be thought is a form of open experimental teaching, and can also be considered to be a form of experimental teaching to achieve "flipped classroom", also represent the development direction of the experiment teaching in the future, which could greatly exert the subjective initiative of the undergraduate education that is more efficiently served by school resources^[10,11]. Environmental and Safety Engineering Department, China University of Petroleum (East China), in the implementation process of comprehensive specialty experiment, found that, in the process of experiment, students surge in interest with a clear division of labor. When encountering problems, they more positively consult in the aspect of literature of science and technology or national standards. Guidance teachers who only play the role of guiding can enable students to successfully complete all work and students' subjective initiative and experimental skills significantly improve^[12]. Through the study of the actual work of graduates followed that, environmental engineering graduates can quickly integrate into jobs, and employers found that graduates of our school are very understanding and familiar with all aspects of environmental monitoring process, such as formulating monitoring program, sample collection, transport of samples, sample records and handover, sample analysis and the monitoring report writing. In the actual work, they show the maturity that does not conform to the age and has been widely affirmed by the employing unit.

On the other hand, the information feedback to students who entered the stage of postgraduate study found that, after a comprehensive experimental exercise, they show the strong ability of practice and innovation in the postgraduate scientific research work, which is more beneficial to scientific research.

4. Conclusion

The stage effect has been achieved by the implementation of comprehensive professional experiment, which has the aim of cultivating students' practical ability, experimental ability and creative ability and plays an important promoting role in further strengthening the experimental teaching reform of our department, establishing the scientific and perfect system of experiment teaching, strengthening students' practical ability and experimental skills and improving the level of hospital teaching^[13].

Meanwhile, in the reform of deepening experimental teaching, it is the premise and guarantee to strengthen laboratory management and construction. It is the basis that good experimental condition can improve the level of experimental teaching. If comprehensive professional experiments are conducted, it will need a large number of people, longer completion time and much experimental equipment. Therefore, it is necessary to strengthen the laboratory overall planning and control, to optimize the laboratory resource allocation and to increase investment in software and hardware facilities so that students are provided with a good experimental environment^[14, 15].

In summary, the establishment and implementation of the comprehensive professional experimental courses, which is the need of training environmental protection related personnel, will improve the practical application ability of environmental engineering students in the aspect of environmental monitoring. With the propulsion of teaching reform, In order to enable the students to get better comprehensive ability training, it is essential to continuously improve the experimental environment and reform the experimental content.

References

- [1] Yongzuo Diao. On the quality of life. *Economist*, 2003(6): 4-10.
- [2] Caoming Luo, Yangwei Tao, Wen Liu. Research on the construction of signal and information processing course group based on applied talents training. *China Electric Power Education*, 2013(32): 115-117.
- [3] Kun Li, Yonghong Shi. Research and exploration on the exploration and practice of the open system of innovative talents training laboratory. *Laboratory*, 2015(1): 258-261.

-
- [4] Zhenhan Fang, Huanhu Yu. The exploration of the reform of experimental teaching to promote students' innovation power. *China Electric Power Education*, 2012(29): 104-105.
- [5] Ruiqin Kang, Lin Zhao, Shuang Yang. Problems and countermeasures of environmental monitoring experiment teaching. *Guangzhou Chemical Industry*, 2012(21): 176-177.
- [6] Haiyan Li, Lingbo Li. Petrochemical site environmental evaluation. *Journal of Safety, Health and Environment*, 2006(7): 31-33.
- [7] Yanfang Dong. Introduction to quality control on water quality sampling. *A View of Labor Unions*, 2013(23): 46-47.
- [8] Quanshou Zhou. The advantages and disadvantages of centralized experiment and open experiment. *Course Education Research (New Teachers Teaching)*, 2012(18): 81.
- [9] Huanying Wang. The reform research of instrument analysis experiment teaching. *Journal of Hengshui University*, 2011(1): 79-80.
- [10] Jingjing Yang, Zhengmao Zhu. The problems and countermeasures of research university undergraduate education. *China Higher Education Research*, 2007(11): 80-81.
- [11] Fengyun Wang, Xianwen Wei, Hongtao Zhang. The exploration and practice of undergraduate and graduate student interaction experiment pattern. *Journal of College Chemistry*, 2010(1): 16-19.
- [12] Shouping Lu, Guo Qiang, Ming Diao. Establish correct technology "innovation" philosophy of cultivating students' comprehensive ability. *Laboratory research and exploration*. 2015(2): 145-147.
- [13] Jiayue Chen, Jian Chen. The exploration about promoting the innovative consciousness and practical ability of the students in the experimental class. *Transportation Vocational Education*, 2012(6): 19-21.
- [14] Wuchuan Wei, Jinquan Pan, Huaxu Chen. Laboratory research and exploration on strengthening laboratory open management and training high quality applied talents. *Laboratory Research and Exploration*, 2015(3): 259-261.
- [15] Junxia Liu, Qiongyu Liu. The practice of comprehensive experimental teaching reform of environmental monitoring. *Laboratory Science*, 2009(6): 18-19.