

# Construction of Practical Teaching Model of "Three Ladder Layer" and "Four Platform" for Environmental Science Specialty

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## Abstract

Strengthening the cultivation of practical and innovative ability of environmental science is the key link and important way to improve the quality of talents training in Environmental Science. We take advanced environmental science practice teaching idea as the instruction, take the environment experiment teaching and the scientific research, the production practice, the "Three Combinations" in second classroom as the starting point. In the specialty of environmental science, the multi environment practice system of "334" (three link, three ladder, four platform) environmental experiment innovation platform and "333" (three combination, three level, three base) are constructed. Thus, the comprehensive innovative practice education mode of cultivating environmental science talents is formed, and the students' innovative ability and entrepreneurial spirit are comprehensively improved.

**Keywords** Environmental science specialty, practical teaching model, Environment comprehensive innovation experiment system

## 1. The practice of advanced environmental practice teaching concept to promote the innovation ability training of environmental experiment

We are putting the environmental practice teaching idea for "the first innovation, ability for all-round development". The so-called "Three Emphasis" environmental practice teaching methods are as follows: emphasizing the teaching methods of strengthening the basic experimental knowledge of environment; emphasizing the teaching methods of improving the thinking quality of environmental science; emphasizing the teaching methods of training practical ability<sup>[1]</sup>. As well as, the so-called "three promote" environmental practice teaching mode are as follows: to promote the single knowledge teaching to apply comprehensive knowledge; to promote the single skill training to promote comprehensive experimental literacy training; to promote the simple learning knowledge to "double" spirit culture. The goal of environmental practice teaching of "three transformation" is the transformation from knowledge inculcation to independent thinking, from theoretical verification to analytical problem transformation, from imitation experiment to comprehensive innovation.

## 2. Constructing "334" experiment innovation platform in environment to improve the level of environmental experiment innovation ability training

Through the "three links" of the environmental experiment teaching between the experimental center, production enterprise, industry development, which are constructed the "334" environmental experiment innovation system in the "three ladder" (basic, comprehensive and innovative environment experiment) and "four platform (basic, professional, comprehensive and innovative experiment)"<sup>[2]</sup>. This can improve students' experimental ability and scientific thinking ability. By revising the training program and integration resources of environmental science talents, the environmental experiment class hours accounted for more than 40% of the total class hours, and the environmental comprehensive design experiment reached 60% of the total experimental number, Thus, the "four in one" of a multi environment experimental system for basic experiment, professional experiment, comprehensive experiment and innovative practice should be constructed. We set up innovative experimental programs for college students, and formed a four level innovative training program with the national, provincial and university levels. Nearly 50% of the students were funded and trained. Through improving the teaching module design of real environment experiment, the close link between environmental experiment teaching and experimental center, production enterprise and industry development is realized, and the training network of environmental experiment innovation with time is formed.

## 3. Create "333" multi practice system, improve the effectiveness of practice and innovation ability

The promotion of "Three Combinations" between environmental practice teaching and scientific research, production and the second classroom, which focuses on the reform and improvement the "three levels" comprehensive practice link of teaching practice, graduation practice and social practice. At the same time, which builds "three bases" environmental practice security system of the environmental practice teaching, scientific research training and production practice. Thus, it formed the multi environmental practice system of "333 (three combinations, three levels, three bases)"<sup>[3]</sup>. We invite the enterprise technical personnel to enter the classroom platform, innovation the field teaching method of "1 unit theory +1 unit practice". More than 90% of the production practice and graduation at the base with the enterprise were finished. 100% students have

participated in all kinds of social practice activities. The "three combination" is constructed the multiple environmental practice training system in "management practice innovation ability and comprehensive quality of talents. Through the "334" platform of experiment environment innovation and the "333" of environment comprehensive innovation of education practice mode inclining multi environment practice system and construction of cultivating the "double type" talents, the environmental science personnel quality and the "double" ability is improve significantly. Environmental science students published 50 papers, in all kinds of social competitions won 3 provincial awards, municipal 26 Item. The students have been enrolled as graduates in the Fudan University, Xiamen University, East China Institute of University of technology, Hohai University, Nanjing University of Technology University, Shanghai University, Nanjing Agricultural University, China University of mining and technology, Jiangnan University, Suzhou University and other famous universities. Every year, more than 40% of the graduates are employed in the environmental industry and go to the forefront of production and are welcomed by the society. The employment rate has been maintained at 100%.

#### **4 Integrating environmental experimental teaching resources, setting up the "three ladder" environmental experimental teaching system of basic, comprehensive, innovative**

The environmental practice teaching idea is gave well dinner for "the first innovation, ability for all-round development "." the combination of three (the combination of teaching and research, teaching and production of the combination of the first and second class combined) "as a means to construct the environment of basic type, integrated type and innovation of" three Echelon "experiment. The experiments of "three ladder layer" of environment basic type, comprehensive type and innovation type constructed with "three combinations"(combination of teaching and research, combination of teaching and production, combination of the first and the second class) as the means. A "four platform" of the environment experimental innovative training system was constitute diversified by the basic experiments, professional experiments, comprehensive experiments and innovative training practice. Improving the "three ladder" open platform in experimental practice, it was the built "three bases" practice security system Including environmental practice teaching, scientific research training, production practice, and so on. This paper explores the practice and innovation ability of undergraduate talents in Environmental Science, and constructs a comprehensive innovative practice education mode to train environmental science talents<sup>[4]</sup>.

#### **5. Constructing environmental experimental teaching platform, forming a "four platform" of comprehensive innovative experimental system of basic experiment, professional experiment, comprehensive experiment and innovative experiment**

Through the implementation of innovative ability training to the whole process of environmental science talents training, the practice system from basic and professional training to comprehensive experiment and then to innovative experiment has been formed. The comprehensive innovative experiment system of each layer is designed, the every undergraduate is trained in different forms of innovative experimental practice<sup>[5]</sup>.

##### **(1) Basic experiment platform**

Base on the platform of school experimental teaching demonstration center, the function of basic experiment platform is brought into full play. Through the strengthening of basic experimental skills operation, a solid and good operating skills for students to enter the professional experimental platform operation is enhanced, and a good scientific thinking habits is developed.

##### **(2) Professional experimental platform**

According to the training requirements of innovative talents, the talent training program of environmental science specialty was revised, the number of experimental courses of environmental core specialty was increased, and the proportion of class hour between environmental experiment course and theoretical course was improved. By reforming the curriculum system of environmental experiment teaching, the environmental experiment course is separated from the theoretical course, and the experimental course of environmental core specialty is set up independently.

##### **(3) Comprehensive experimental platform**

On the basis of mastering the basic theoretical knowledge of environmental science specialty and under the guidance of teachers, students can solve scientific problems through the literature review, independent topic selection and comprehensive use of knowledge. In the process of conducting comprehensive experimental training, the advanced nature of the topic selection should be emphasized.

The students' innovative thinking ability is trained and broaden the academic horizon through the selection of topics to train. According to the source of the selected topic, comprehensive experiments are divided into two categories. One kind of "research based learning" comprehensive experiment based on curriculum theory learning is facing the academic front; while the other is the "technology upgrading" comprehensive experiment taking professional / industrial problems as the breakthrough point, and pays attention to the production practice.

#### **(4) Innovation training practice platform**

On the basis of environmental comprehensive experimental platform training, around the environmental science professional and industry issues, in-depth exploration, depth and breadth of research have been strengthened. Innovation training program of college students through "four in one" of the national and provincial level, school level and college level, students are encouraged to participate in the practice of independent innovation, encouraged to undertake the scientific research project activities of teacher, so that students can further standardize scientific research training, stimulate scientific research interest and innovation spirit. Through the choice of professional / industry issues, we organize students to carry out social investigation and research, so as to promote students to understand the current situation of the industry, deepen the understanding of Environmental Science. By encouraging students to participate in various social contests, such as career planning competition and Entrepreneurship Program competition, students' competitive ability and innovative ability can be improved. Students participated in the 2016 "Youth" AVIC university students' entrepreneurship competition, the fourth "Challenge Cup" College Students' Entrepreneurship Program competition, won the national gold medal 1 items. The students in the Education Department of Jiangsu Province, the second China "Internet plus" innovation and entrepreneurship competition, won the third-prize in Jiangsu Province. Students participated in the "water cup" cup water treatment experiment invitational tournament of college students in Jiangsu Province, and won the provincial prize, the provincial prize and the provincial two prizes. Students participated in the second session of the "Puxi Cup" environmental monitoring skills contest, won the top award 1, first prize, two prizes and three prizes.

#### **6. Based on the "three levels and four platforms", the "three combinations" as the means to create a diversified experimental innovation training system**

The "three combinations" refers to the combination of teaching and research, the combination of teaching and production and the combination of the first and second class, which were combined with various teaching resources<sup>[6]</sup>. The talent environment culture science teaching and research activities and production practice, meet the actual need to improve students' quality and ability, to achieve training objectives double type "talents, eventually adapt to the development of society and industry demand for talent.

##### **(1)Combination of teaching and scientific research**

Relying on the Jiangsu province key discipline advantage and research resources, we actively explore, reform and innovation in the practical teaching system, experimental teaching platform and teaching methods, it is enable students to master the basic theory of environmental science and basic skills, emphasizes the cultivation of the learning motivation, mode of thinking, practical ability, innovation spirit.

##### **(2) Combination of teaching and production**

On the basis of making full use of the talent advantages and technological advantages of colleges and universities, we should create various forms of environmental science talents and cultivate cooperative education mode. this paper explores the effective way of combining learning with production, and comprehensively improves the students' ability of combining theory with practice, production practice ability and employment and Entrepreneurship.

##### **(3)The combination of the first and the second class**

The first classroom teaching mainly refers to the professional knowledge, and the second class is opposed to the first class, has the connotation of quality education of all kinds of learning activities, is the extension and supplement to the first class, but also the derivation and sublimation. Through the first classroom learning, students can store a wealth of theoretical knowledge, lay a solid academic foundation, while the second class will learn knowledge and theory of three-dimensional, and integrated into all kinds of practical activities. To this end, we participate in Nanjing University Yancheng environmental protection technology and Engineering Research Institute jointly run, carry out environmental practitioners systematic, normal, professional sex training, the implementation of the strengthening of environmental awareness and the quality of employees as the connotation of the project". Lianyungang and Binhai chemical industry park wastewater treatment plant (station, workshop) personnel training courses were held several times, the purpose is for Binhai and Lianyungang chemical industrial park environmental governance strong foundation. Training is carried out from four aspects: the training of Industrial Park leaders, industrial wastewater treatment technology, analysis and testing post skills and waste gas treatment backbone, the purpose is to enhance the awareness of environmental protection and control the level of development, enhance the professional skills of the backbone of employees, promote the healthy development of the park, and train applied talents for environmental protection industry.

#### **7. Construction of the "three combination" of environment of experiment and practice of open platform, providing guarantee for cultivating the "double type" environmental science talent innovation ability**

Through the experiment created by environmental science teaching center, the practice base outside the school (more than 20 out of school teaching and research base) composed of open, three-dimensional experiment

platform, it provides the environment and atmosphere for students, such as the theory and practice of close contact, the first and the second class, a new combination of comprehensive training consciousness and innovation ability. A cooperative relationship training is established with the Yancheng City environmental monitoring center station, Jianhu County East sewage treatment plant, Yancheng City solid waste disposal center Co. Ltd., Dongtai environmental monitoring station, Yancheng City city sewage treatment plant, Yancheng City Institute for food and drug control, Yancheng City Longgang Longhu salt and other enterprises. As an outside practice and training base for environmental science specialty, it expands the teaching space, enables teachers and students to master the application technology of environmental science, and improves the adaptability of students when they enter society. The advantages of combining production, teaching and research are highlighted.

Through several years of efforts, we have advanced teaching philosophy as a guide, it is constructed the environment experiment innovation platform of the "334" (three link, three ladder, four platform) and the multi environment practice system of the "333" (three combination, three level, three base). The comprehensive innovation education practice mode of the "double type" talents cultivation in environment science is formatted. Remarkable results have been achieved in the practice of cultivating and improving the innovative ability of environmental science talents. The proportion and quality of students' further study are improved, and the graduates are fully affirmed by the employers and the society in terms of social popularity and the performance in their work.

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