Innovative Model of Exercise Education in Environment Studies in University in China on the International View

Xiaoping Li[1], Linna Feng[2], Xu Zhang[1], Lijun Wang[1], Miao Ge[1]

[1]College of Tourism and Environment, Shaanxi Normal University, Xi'an, 710062, China
[2]Department of Law and Foreign language, Shaanxi Police Professional College, Xi'an, 710054, China
lixiaoping@snnu.edu.cn

Abstract - Aims to solve the current problems of exercitation and practice education in environment science major at universities in China; based on the investigation of the characteristic and practicum of exercitation in environment science education at universities in USA, England and Japan. The integrated innovative model of "TWO MODEL, THREE ARRANGEMENTS, DIVERSIFICATION" was proposal to the environment science education in China. After application of this model in Shaanxi Normal University, the results displayed that the new proposal model will significantly take positive effect on and benefit on the college student professional training and ES education in universities in China.

Index Terms - International view; environment science; exercitation education; innovation model; higher education

1. Introduction

Environment science (ES) discipline is an inter-disciplinary course program developed a multidimensional curriculum related with science, engineering and technologies as well as socio-economy and managerial aspects of environment. Founded in 1965, the Middlebury College Environmental Studies Program is the oldest undergraduate ES program in the United States. Up to 1990s, about 300 colleges and universities had provided the environmental studies and ES program. According to the statistic data, there are more than 400 universities offered ES program now.

The exercitation is very important links in the ES education. It is not only a crosslink between the theory and practice, but also a key step to evaluate the abilities of analysis and solving environmental problems. Most environmental educators [1-3] have studied the exercitation curriculum and environmental professional training base; they also have proposed some suggestions for exercitation. However, in China, ES majors are usually distributed in the different department or college; it is no same standard to the exercitation. Each ES major in different university has the different exercitation project. This paper would aim to establish the new innovative model of exercitation education in ES major in universities based on the international view, and propose the "TWO MODEL, THREE ARRANGEMENTS, DIVERSIFICATION" pattern to reference to the exercitation education for the ES major in universities in China.

2. Exercitation of ES major in university in the developed country

American, England and Japan are the oldest country to offer the ES program in the world. Table 1 list the chosen exercitation courses offered in the environment studies in the high reputation universities from the three countries. From the Tab.1, it shows that the laboratory analysis and field work, scientific training and independent study, seminar and inter-discipline research are the main contents among the course curriculum. It is obvious that Emphasis on the interdiscipline education and abilities orientation is their characteristic.

TABLE 1 The exercitation courses offered in the representative university

University	Exercitation courses
Middlebury College	Natural Science & Environment, Environment Science Practicum, Portrait of a Vermont Town, Vermont Waters, Research Methods in Vermont Environmental Science, Nature and Creativity, Environmental Studies Senior Seminar, Independent Study, ES Senior Honors Work
University of Reading	Laboratory methods, Independent research project, Field class (Environmental Science Field Class, Environmental Science and Management field Course, Soil Science Field Class, Earth Systems Field Class), Skills for Environmental Scientists
University of Tokyo	Environmental measurement, Simulation methods, Operations research, Earth system science, Industrial application of biological resources, Power and Generation Technologies, Food safety and risk analysis, Science, technology and society, Specialized Seminar, Fieldwork, International and Area Studies

(Source from the website: http://www.middlebury.edu/academics/es/courses; http://www.reading.ac.uk/Study/ug/EnvironmentalScienceBSc.aspx; http://peak.c.u-tokyo.ac.jp/our-courses/ESLibSen.html)

3. The review and problem of exercitation education in environment studies in university in China

ES is a new major in universities in China compared to others. However, the ES education has dramatically developed in the recent years. The ES education has formed its course system of lectures, laboratory, practice, field work and undergraduate thesis [1]. But the statistic data released from researchers [3] shows that 58.1% responders agree the ES courses rank ordinary level to meet the society demands comparing to other majors, while only 16.3 answers think the courses can fulfill society requirement. On the contrary, 23.3% responders consider they can not satisfy the society demands. The courses exists two main problems comparing to ES

curriculum in the developed country [4,5]. One is the course credits and percentages of field work are lower, anther is the shortage of independent studies in exercitation. The two problems result from none detail criteria and requirement as well as exercitation models in ES education in university. Nowadays, China has faced more serious environment problem, more qualified employee in ES would be needed. It is necessary to increase the course credits in field work and develop the basic exercitation model for ES education in university.

4. The new innovative exercitation model in ES education in university

According to the ES education and ES curriculum in developed country, aimed to the main problems in ES courses in China, the integrated innovative model of "TWO MODEL, THREE ARRANGEMENTS, DIVERSIFICATION" was proposal and listed in the Table 2.

TABLE 2 The integrated innovative model of "TWO MODEL, THREE ARRANGEMENTS, DIVERSIFICATION"

Model	Arrangement	Special Courses
Junior exercitation (I:basic)	Laboratory and seminar	Laboratory work and analysis (Chemistry, biology, physics, mathematics, nature and resource, ecology, engineering and technology), Environmental Studies Seminar, Research methods, Laboratory methods and skills (soil, water, air, solid waste, ecology, microbiology et al.)
	Field work	Practicum and training (Waster water treatment plant, power generate plant, Environment monitor, Solid waste landfill plant, Base of biodiversity et al.)
Senior exercitation (II:integrated)	Independent studies	Specialized seminar, Independent research project, thesis project, research assistant, Senior honors research work

From the Table 2, two models are listed, one is junior exercitation including of laboratory and seminar, field work arrangements, and another is senior exercitation consist on the independent studies arrangement. Each arrangement should be composed by a series of special courses which will be chosen by college students from freshman to senior in ES major. The courses in model should be increased in the credits and percentages of exercitation education, and enhance on the interdiscipline skill and innovative abilities orientation.

5. Case study

Shaanxi Normal University (SNNU) is one of the key institutions of higher learning directly affiliated to Ministry of Education and it entered "211 Project University" in 2006. It is an important base of fostering teachers of higher education, middle school education and educational administrative cadres. It is regarded as "the cradle of teachers" in Northwest China. It offers Environmental Studies program for undergraduate and graduate in 2001. From then on, It has always continued on the research on the ES education and reform the course system in SNNU. Aims to enhance on the interdiscipline skill and innovative abilities orientation, and the application for the integrated innovative model of "TWO MODEL, THREE ARRANGEMENTS, DIVERSIFICATION" is summarized in the Table 3. In the Table 3, the credits of exercitation have increased to the 23.5 and the percentage improves to the 14.7%. The innovative model and its courses are successful to apply for the ES education. College students are pleased to choose the courses and their interdiscipline skill and innovative abilities have dramatically improved than before. The similar results are also found in the ES course reform research of Xu and Zhang [6,7].

6. Conclusion

ES education in American, England and Japan is prominent in the world. The courses offered in their ES program would give a very good example to reference to ES major in China. The integrated innovative model of "TWO MODEL, THREE ARRANGEMENTS, DIVERSIFICATION" was proposal and it will benefit for enhancing on the interdiscipline education and abilities of college students. After application of this model in Shaanxi Normal University, the results displayed that the new proposal model will significantly take positive effect on and benefit on the ES education in universities in China.

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TABLE 3 The courses offered in ES in SNNU in the integrated innovative model of "TWO MODEL, THREE ARRANGEMENTS, DIVERSIFICATION"

Model	**Arrangement**	**Special Courses**	Credits
Junior exercitation(Ⅰ:basic)	Laboratory and seminar	Organic chemistry experiment	1
		Inorganic and analytical chemistry experiment	2
		Microbiology environmental engineering experiment	1
		Environment chemistry experiment	1
		Environment monitoring experiment	2
		Waster water treatment engineering experiment	2
		Air pollution control engineering experiment	1
		Environmental measurement and simulation methods	1
		Environment engineering experiment	1
		Seminar in environment science and technology	1
		Environment analysis	1
		GIS application in ES	1
		Percentages in total credits	9.4%
	Field work	Integrated physical geography Practicum (National geology park of Cuihua mountain)	1.5
		Land desertification and integrated field work (Practicum in north of Shaanxi under the project of college student summer excercitation)	
		Integrated ecological field work of ecological engineering (Practicum in south of Shaanxi under the project of college student summer excercitation)	
		Field work of environment soil (Portrait of Luochan in loess Plateau)	
		Specialized field work and professional training (Xi'an waster water treatment plant, Baoji power generate plant, Xi'an agency of Environment monitor, Xi'an Solid waste landfill plant, Base of biodiversity in Qilin mountain)	2
		Percentages in total credits	2.2%
Senior exercitation(Ⅱ:integrated)	Independent studies	Specialized seminar	1
		Research training	1
		Independent research	1
		Thesis project	2
		Percentages in total credits	3.1%