

# Construction of Practical Ability Training Mode for Excellent Environmental Engineers

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**Keywords:** Environmental engineer; Practical ability; Interdisciplinary integration; Practical teaching system; Sustainable development

**Abstract:** Starting from the introduction, this paper expounds the importance of environmental engineers in the current society and the urgency and significance of cultivating their practical ability. Subsequently, the culture framework was systematically constructed. Methodologically, this paper first emphasizes the importance of interdisciplinary knowledge integration, and proposes to broaden the vision and comprehensive ability of environmental engineers through the establishment of interdisciplinary course and joint teaching projects. Then, the paper designs a distinct practical teaching system, including basic experiment, professional training and comprehensive project practice, to ensure that students get comprehensive practical exercise. This paper also advocates social practice, community participation, lifelong learning and self-improvement, and the cultivation of leadership and teamwork to further enhance students' social adaptability and sustainable development potential. The implementation of this series of methods and strategies aims to cultivate environmental engineers with solid professional skills, extensive humanistic quality, strong ethical responsibility and excellent teamwork ability. They can not only deal with complex and changeable environmental problems flexibly, but also play a key role in international cooperation and promote the innovation and application of environmental technology.

## 1. Introduction

Under the background of global climate change, resource depletion and environmental pollution, the role of environmental engineers as a bridge between science and technology and nature is particularly critical [1]. They bear the heavy responsibility of designing, implementing and optimizing environmental protection technologies, and also need to find a balance between economic development and ecological protection to push the society towards sustainable development [2]. Environmental engineers solve urgent problems such as water pollution, air pollution and solid waste treatment by using professional knowledge, and contribute to the green future of the earth [3]. Therefore, cultivating environmental engineers with excellent practical ability is not only related to the progress of technology, but also the core element to achieve the goal of social sustainable development [4]. The construction of this training mode aims to ensure that future environmental engineers can flexibly respond to complex and changeable environmental challenges, innovatively propose solutions, and at the same time continue to learn and grow in practice [5].

Constructing the training mode of practical ability of outstanding environmental engineers needs a solid theoretical foundation [6]. Constructivist learning theory emphasizes student-centered, and promotes knowledge construction and skill improvement through problem solving in real situations [7]. This provides theoretical guidance for designing practical teaching activities. Environmental ethics originally provided moral guidance for engineers in decision-making and practice, ensuring that technological development serves human welfare and environmental protection [8]. The related theories together constitute the theoretical basis of constructing the practical ability training mode of outstanding environmental engineers, and provide the direction and basis for educational

practice.

At present, the related research on the cultivation of practical ability of environmental engineers has achieved certain results. In the international education system, such as the ABET certification system in the United States, the combination of engineering practice and international vision is emphasized; Europe promotes cross-border exchanges and cooperation through Erasmus+ and other projects to enhance students' international competitiveness [9]. In China, with the concept of "new engineering" put forward, the education of environmental engineering specialty began to pay attention to interdisciplinary integration and innovation ability training, and the practice teaching system was gradually improved. However, there is still much room for exploration in how to integrate humanistic quality education into engineer training, how to build a practical teaching system closer to the needs of the industry, and how to strengthen students' social practical ability and leadership training.

## **2. Humanistic quality and ethical responsibility of environmental engineers**

### **2.1. The value of humanistic quality in environmental engineering**

In the field of environmental engineering, the perfection of technology is important, but the nourishment of humanistic quality is also indispensable. Humanistic literacy covers literature, art, history, philosophy and other fields. It can broaden the vision of environmental engineers, so that when they face complex environmental problems, they can not only start from the technical point of view, but also integrate multi-dimensional thinking on human civilization, social structure and ecosystem [10]. This interdisciplinary knowledge background helps engineers to consider the social impact and cultural value of technology implementation more comprehensively when designing solutions, and avoid environmental damage or social injustice caused by "technology first". Therefore, this paper holds that improving the humanistic quality of environmental engineers is an important way to enhance their comprehensive ability and promote the sustainable development of environmental engineering.

### **2.2. Environmental ethics and professional conduct**

Environmental engineers are practitioners of environmental protection. Its professional ethics and ethics are directly related to the success or failure of environmental engineering and the long-term well-being of society. Environmental ethics requires engineers to follow the principles of respecting nature, fairness and justice, and putting prevention first in decision-making and practice, so as to ensure that the application of technology will not cause irreversible damage to the environment and will not aggravate social inequality. Professional ethics is reflected in strict compliance with professional standards, responsible attitude towards public health and true reporting of environmental data. Environmental engineers should always maintain a high professional ethics, dare to expose and resist any violation of environmental laws and regulations, and become a solid guardian of environmental protection. By strengthening environmental ethics education and professional ethics training, a group of environmental engineers with both technical strength and noble morality can be trained. This can contribute to the construction of a green and harmonious social environment.

### **2.3. Cross-cultural communication and cooperation ability**

In today's globalization, environmental problems are transnational. Its solution needs the joint efforts of the international community. Therefore, it is particularly important for environmental engineers to have the ability of cross-cultural communication and cooperation. Cross-cultural communication ability not only means barrier-free communication in language, but also lies in understanding and respecting values and ways of thinking in different cultural backgrounds. This ability helps engineers communicate effectively with team members from different countries and regions in international projects to find global solutions to environmental problems. Through international cooperation, environmental engineers can be exposed to more advanced technology

and management experience, promote the international flow of knowledge and skills, and improve the professional level of individuals and teams. Cross-cultural communication can also enhance the global vision of environmental issues and encourage engineers to integrate multicultural elements into their designs. In this way, the achievements of environmental engineering can be closer to the needs of local society, and the harmonious coexistence of technology and culture can be realized.

### 3. Interdisciplinary integration and the construction of practical teaching system

#### 3.1. Interdisciplinary knowledge integration

In the highly complex field of environmental engineering, it is often difficult for the knowledge of a single subject to comprehensively deal with complex and changeable environmental problems. Therefore, interdisciplinary knowledge integration has become the key to cultivate outstanding environmental engineers. This means that the education of environmental engineering specialty should not be limited to traditional engineering science and technology, but should widely absorb the knowledge and theories of ecology, economics, sociology, law and even psychology. Through the establishment of interdisciplinary course, the implementation of joint teaching projects and the formation of interdisciplinary research teams, the cross-infiltration and integration of different knowledge systems can be promoted, and environmental engineers with broad vision and comprehensive ability can be trained. These engineers can find more comprehensive and feasible solutions in complex environments.

#### 3.2. Practice teaching system design

Practice teaching is an important way to cultivate the practical ability of environmental engineers. A perfect practical teaching system should cover many levels, such as basic experiment, professional training and comprehensive project practice. See Figure 1 for details:

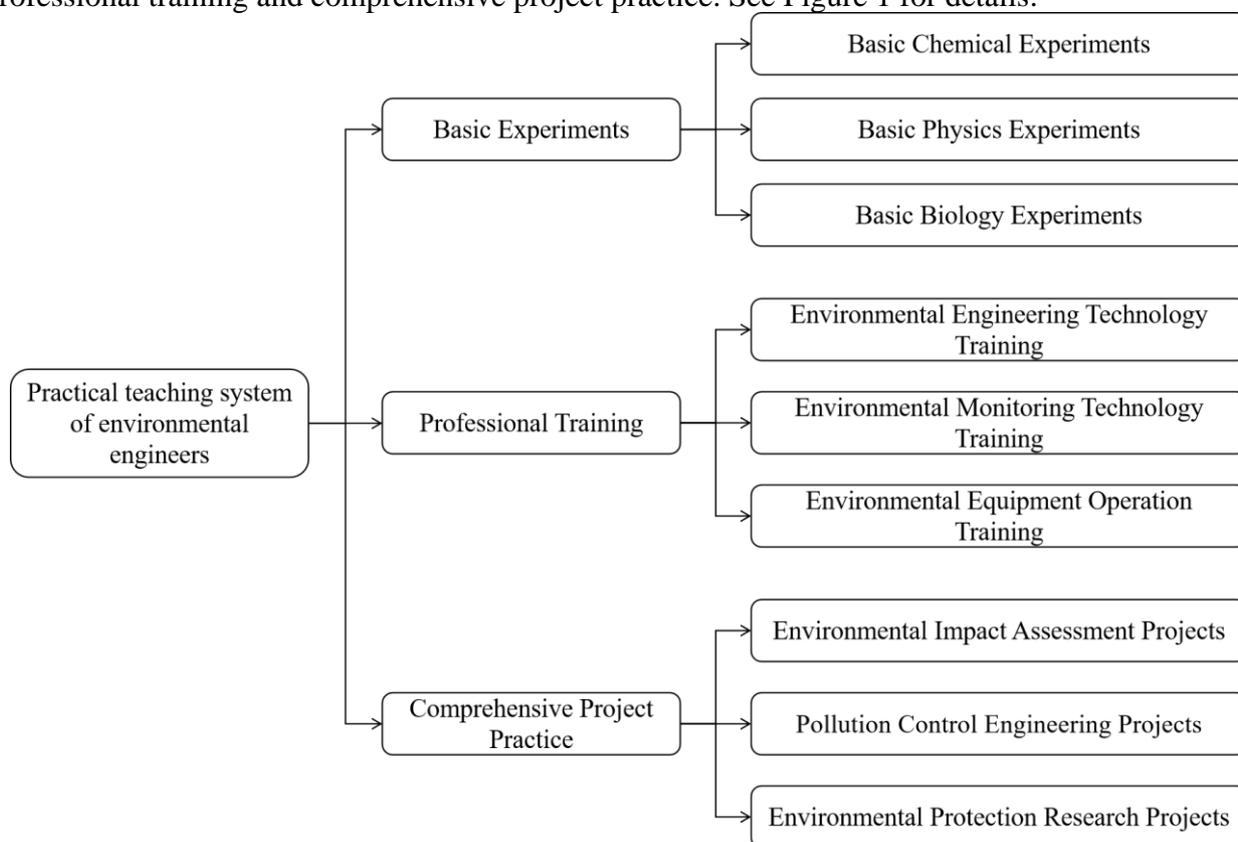


Figure 1 Practical teaching system of environmental engineers

The practical teaching system should also pay attention to feedback and evaluation, and find out students' shortcomings in practice in time through regular practice reports, project presentations and expert reviews. Based on this, targeted guidance and improvement suggestions are provided to

ensure the maximum effect of practical teaching.

### 3.3. Innovative ability and problem-solving ability training

In the field of environmental engineering, innovation ability and problem solving ability are particularly important in the face of endless new challenges. Innovation ability is not only reflected in technological innovation, but also includes management innovation, service innovation and many other aspects. By introducing innovative methods such as design thinking and reverse thinking, students are encouraged to jump out of the traditional framework and dare to try new ideas and technologies. Problem-solving ability requires students to accurately identify the essence of problems, quickly collect and analyze relevant information, and propose and implement effective solutions.

In order to cultivate these abilities, the teaching environment should encourage openness and tolerance, and set up various teaching activities such as problem situation simulation, case analysis and role playing. In this way, students can learn how to find, analyze and solve problems in practice. Schools should also establish innovation laboratories, business incubators and other platforms to provide students with opportunities to turn innovative ideas into practical results and stimulate their creative potential. Based on this, environmental engineering talents who understand technology and are good at innovation are cultivated.

## 4. Social participation and the cultivation of sustainable development ability

### 4.1. Social practice and community participation

The training of environmental engineers should not be confined to the campus, but should go deep into social practice. By organizing students to participate in social practices such as community service, environmental public welfare activities and environmental policy propaganda, their sense of social responsibility can be enhanced; It can deepen their understanding of environmental problems in practice and apply what they have learned to the solution of practical problems. Community participation provides a platform for environmental engineers to communicate directly with the public. Through holding environmental protection lectures, carrying out environmental education and other activities, the public's awareness of environmental protection will be improved and engineers' communication, organization and coordination skills will be exercised. Social practice and community participation are the bridge between theory and practice, which is helpful to cultivate environmental engineers who know both technology and society and can actively participate in environmental governance.

### 4.2. Lifelong learning and self-improvement

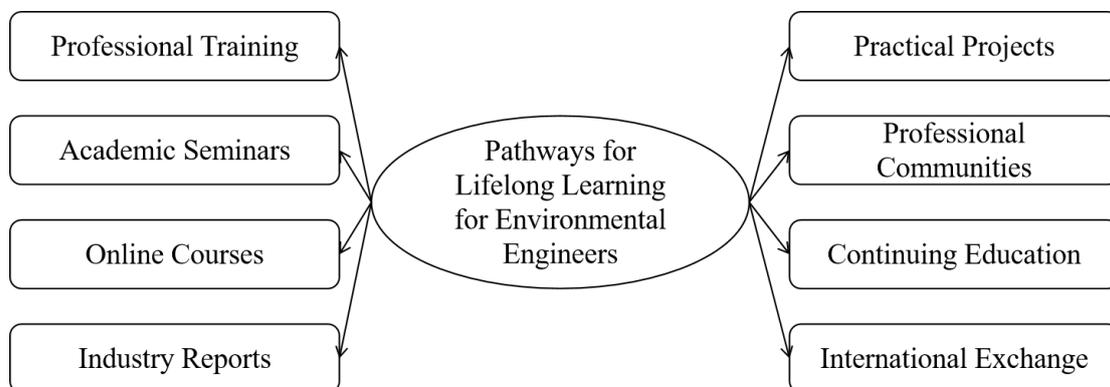


Figure 2 Approaches to lifelong learning of environmental engineers

In the field of environmental science and engineering, new technologies and new ideas emerge one after another, which requires environmental engineers to have the ability of lifelong learning. Lifelong learning means constantly updating professional knowledge, including keen insight and learning on emerging technologies, policies and regulations and international trends. By

participating in professional training, academic seminars, online courses and other ways (as shown in Figure 2), environmental engineers can constantly update their knowledge structure and maintain their professional competitiveness.

Self-improvement requires engineers to have self-reflection and critical thinking, to actively identify their own shortcomings, set learning goals, and take actions to improve them.

### **4.3. Leadership and teamwork**

The solution of environmental problems requires interdisciplinary and cross-disciplinary cooperation. This requires environmental engineers to have excellent professional skills and good leadership and teamwork skills. Leadership is reflected in being able to lead the team to define goals, make plans and implement them effectively, and to motivate the team and find solutions when encountering difficulties. Teamwork ability requires engineers to communicate effectively with people from different backgrounds and professions, and work together to realize the optimal allocation of resources and the smooth completion of tasks. By participating in team projects, leadership training, simulation drills and other activities, environmental engineers can exercise their leadership and teamwork skills, learn how to give full play to their personal advantages in a diverse environment, and promote the overall effectiveness of the team. These abilities are very important for environmental engineers in their future career, whether they are project leaders or team members, and they are an important guarantee to promote the success of environmental projects and achieve environmental goals.

## **5. Conclusions**

Through discussion, it is found that it is a systematic project to cultivate the practical ability of outstanding environmental engineers. It needs the integration of interdisciplinary knowledge and solid professional skills training, and emphasizes the nourishment of humanistic quality, the responsibility of ethical responsibility and the cultivation of sustainable development ability. By constructing a perfect practical teaching system, strengthening social practice and community participation, encouraging lifelong learning and self-improvement, and cultivating leadership and teamwork ability, we can lay a solid foundation for future environmental engineers. In this way, they can become compound talents who know both technology and management, have an international vision and understand the local reality, and are brave in innovation and good at cooperation. Such an environmental engineer will be able to play a key role in global environmental governance and promote the development of society in a greener and sustainable direction.

The training of environmental engineers should not only focus on the current technical needs, but also focus on the future development trend and social responsibility. It is the mission entrusted to us by the times to continuously optimize the training system of environmental engineers and continuously improve their practical ability and comprehensive quality, and it is also the performance of being responsible for the future.

## **Acknowledgements**

The authors acknowledge that the article is funded by Research and Practice on the Construction Path of "Outstanding Engineers" in Environmental Engineering Specialty, a research program approved by Sichuan Province Higher Education Environmental Science and Engineering Teaching & Steering Committee (CHJZW202108).

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