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# Construction Method of Ideological and Political Theories Teaching in the Course of Environmental Microbiology for Environmental and Ecological Engineering Major

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**Abstract** Environmental Microbiology is a professional basic course in the curriculum system of Environmental and Ecological Engineering major, which follows the requirements of ideological and political theories teaching in the course in higher education, and should be implemented in every course. Therefore, the construction of ideological and political theories teaching in the course should be an important task in the course construction of Environmental Microbiology. In view of the curriculum characteristics of Environmental Microbiology, such as multi-disciplinary feature, wide coverage and rapid development, it is an effective method for the construction of ideological and political theories teaching in the course of Environmental Microbiology by fully tapping the ideological and political elements of the curriculum, such as patriotism, scientific spirit and practical innovation, and integrating the ideological and political theories teaching in the course into the whole curriculum design and classroom teaching construction.

**Key words** Environmental Microbiology, Environmental and Ecological Engineering, Curriculum design, Ideological and political education

## 1 Introduction

On May 28, 2020, the Ministry of Education issued *Guiding Outline of Construction of Ideological and Political Theories Teaching in the Course in Colleges and Universities* [JiaoGao (2020) 3], which systematically explained the goals, requirements and contents of the construction of ideological and political theories teaching in the courses in the new era. Ideological and political education should run through the talent training system. It is necessary to promote the construction of ideological and political theories teaching in the courses in colleges and universities, give full play to the educational role of each course, implement the fundamental task of cultivating people by virtue, and improve the quality of talent training in colleges and universities[1].

Environmental and Ecological Engineering is a major added in *Catalogue of Undergraduate Majors in Colleges and Universities (2012)* revised by the Ministry of Education, which is under environmental science and engineering of Engineering. At present, there are about 74 colleges and universities in China offering undergraduate major of Environmental and Ecological Engineering, involving 19 first-class colleges and universities, and the major of Environmental and Ecological Engineering has occupied a certain position in the professional construction of colleges and universities in China. The types of Environmental and Ecological Engineering major construction are divided into the original major adjustment type and the newly built type, and the original major adjustment type is the majority. Some colleges and universities first adjust the original Ecology major to the ecological engineering direction and then directly replace it with the Environmental and Ecological Engineering major. In some colleges and universities, the majors of Environmental Science under Engineering and Environmental Science and Environmental Engineering under the engineering discipline are adjusted to the major of Environmental and Ecological Engineering. This major aims to train talents with solid environmental protection professional knowledge and high ideological and political literacy for the country. In the teaching of Environmental and Ecological Engineering course, we should pay attention to the training of scientific thinking methods, the education of science and engineering ethics, and cultivate students' sense of responsibility and mission to explore the unknown, pursue the truth and climb the scientific peak, make perfection more perfect, and strengthen the patriotism and mission of serving the country through science and technology[2-4]. Environmental Microbiology is often offered as a professional basic course, whether it is Ecology major under science or Environmental Science and Engineering major under engineering. In the curriculum system of Environmental and Ecological Engineering major, Environmental Microbiology plays an important professional basic role.

Taking Environmental Microbiology as the object, this paper discusses its curriculum characteristics, the combination of ideological and political elements, the curriculum design of integrating ideological and political elements into curriculum content, and the methods of integrating ideological and political elements into the whole process of classroom teaching construction, so as to promote

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the construction of Environmental and Ecological Engineering major and realize its educational mission.

## 2 Course characteristics of Environmental Microbiology

Microorganisms widely exist in various ecosystems, play the role of producers, consumers or decomposers, and play an irreplaceable role in material circulation and ecosystem balance in nature and human society, especially in environmental pollution and control. Environmental Microbiology covers a wide range of subjects, including the development of environmental microbiology, microbial types (viruses, bacteria, archaea, actinomycetes, cyanobacteria, protozoa, micro-metazoa, eukaryotic algae, fungi, *etc.*) and their characteristics, microbial growth and metabolism, microbial inheritance and variation, microbial distribution in soil, water and air, microbial relationships, microbial role in material cycle (carbon cycle, nitrogen cycle, sulfur cycle, phosphorus cycle, *etc.*), anaerobic and aerobic biological treatment of sewage, microbial groups and treatment technologies commonly used in waste residue and waste gas, indicator microbial types and detection methods of environmental pollution in microbial environmental monitoring, and applications of new microbial technologies in environmental science, such as immobilization technology, microbial flocculants, environment-friendly microbial preparation, waste resource utilization of microorganisms such as single cell protein and bacterial metallurgy, and morphological identification, counting and culture experiments of pathogenic microorganisms, microbial toxins and various types of environmental microorganisms in the environment. In the stage of industrial civilization in the process of human historical civilization, social economy develops rapidly, and environmental problems are also prominent. Sustainable development should not only achieve the purpose of economic development, but also protect the natural resources and environment such as atmosphere, water, land and forest on which human beings depend for survival, so that future generations can also develop sustainably. Therefore, environmental governance has become the basic way and important guarantee to realize sustainable development[5]. One of the main tasks of environmental governance is to use the life activities of microorganisms to continuously remove the "garbage" on the earth, improve the living environment of human beings and improve the quality of human life[6].

With the progress and development of society, there are more and more interdisciplinary subjects such as Environmental Microbiology and Ecology, Environmental Science and Engineering, which are more and more widely related to actual environmental problems, develop rapidly, cover a wide range, and integrate multiple disciplines. The course studies the physiological, biochemical and morphological distribution of microorganisms from different levels such as molecules, cells, individuals, populations, communities and ecosystems. The combination of theory and practice, basic microbiology knowledge and advanced biotechnology in the course of Environmental Microbiology will receive more and more attention in the professional education of students in environmental science and engineering in the future[7].

## 3 The construction method of ideological and political theories teaching in the course of Environmental Microbiology

**3.1 Method of combining curriculum content with ideological and political elements** The teaching objectives of knowledge and ability of Environmental Microbiology are as follows: through the course study, students can comprehensively apply the basic knowledge of microbiology, including individual, group characteristics, physiological and biochemical characteristics, genetic variation laws, cultivation characteristics and other basic knowledge, and use it to identify and express microbial problems in complex environmental ecology; students can apply the microbial principle in microbial ecology, microbial monitoring and environmental and ecological engineering, select suitable microorganisms for prevention, monitoring and transformation according to various ecosystems and pollutant types, and correctly identify and judge the key links and parameters in the problems in the operation of biological treatment; students can choose the appropriate training scheme, build an experimental system, carry out experiments safely, collect experimental data correctly, summarize and analyze, and obtain reasonable and effective conclusions according to the microbial species of the research object. The construction of ideological and political theories teaching in the course of Environmental Microbiology should adhere to the unity of professional education and quality education, integrate the ideological and political theories teaching into the teaching concept with "cultivating people by virtue" as the core, and take *Guiding Outline of Construction of Ideological and Political Theories Teaching in the Course in Colleges and Universities* [JiaoGao (2020) 3] as the main guiding ideology, deeply sort out the teaching content of courses, explore the ideological and political elements in professional courses, and fully integrate and present professional knowledge and ideological and political elements through effective teaching methods. See Table 1 for specific combination and presentation methods.

**3.2 Example of curriculum design of integrating ideological and political elements into curriculum content of Environmental Microbiology** The chapter of microorganism and environmental pollution control and treatment in the course of Environmental Microbiology is designed, and the teaching objectives are divided into knowledge objectives and ideological and political education objectives.

The knowledge objectives are as follows: through learning, students can understand the treatment difficulties of domestic garbage and the classification of treatment methods, such as sanitary landfill method and high temperature composting method; students can master the principle and technological process of specific sanitary landfill method and high temperature composting method, as well as the main microbial species and microbiological process in each stage of domestic garbage treatment; students can master how to convert waste gas into wastewater and then carry out biological treatment.

**Table 1 Main ideological and political elements in each chapter of Environmental Microbiology**

| No. | Chapter | Professional knowledge points | Ideological and political elements | Methods | Introduction |
|---|---|---|---|---|---|
| 1 | Introduction | The formation and development of environmental microbiology | International understanding: world developments | Scientific figures | Global carbon dioxide increase, global climate change and sustainable development are universally recognized |
| 2 | Virus | Emerging virus | International understanding: A global challenge facing mankind | News report | Harm and prevention methods of avian influenza and novel coronavirus |
| 3 | Prokaryotic microorganism | Mycoplasma | Patriotism: consciousness of public welfare and volunteer service | Popular science video | Classification of SARS: infectious and non-infectious |
| 4 | Eukaryotic microorganism | Algae and environmental protection | Scientific spirit: rational thinking, able to use scientific thinking mode to understand things, solve problems, guide behavior, *etc.* | Case analysis | Water eutrophication: Cyanobacteria outbreak in Taihu Lake and treatment of water eutrophication in Dianchi Lake of Kunming |
| 5 | Physiology of microorganisms | Luminescence phenomenon | Deep learning: information awareness, conscious and effective acquisition, evaluation, identification and use of information | Popular science video | Application of luminescent bacteria in environmental monitoring |
| 6 | Growth of microorganisms and influence of environmental factors | Antibiotics | Scientific spirit: criticizing, questioning, question consciousness | Literature interpretation | Abuse of antibiotics, emergence of superbugs |
| 7 | Inheritance and variation of microorganisms | Variation of microorganisms | Practical innovation: technology application, improvement and optimization of existing technology, *etc.* | Case analysis | Directional cultivation of strains, utilization of genetically engineered strains, avoidance of gene pollution, *etc.* |
| 8 | Microbial ecology | The relationship between microorganisms and other organisms | Scientific spirit: brave in exploring, trying boldly and actively seeking effective problem solutions | Case analysis | Existence form and utilization mode of interbiotic, symbiotic or parasitic relationship between microorganisms and other organisms |
| 9 | The role of microorganisms in the circulation of environmental substances | The role of microorganisms in carbon cycle | Patriotism: social responsibility, fear of nature, the relationship between man and nature, green lifestyle and sustainable development concept | Literature interpretation | Realization method of energy saving, emission reduction and carbon neutralization |
| 10 | Control and treatment of microbial and environmental pollution | Microorganism in organic solid waste treatment | Practice and innovation: technology application, the organic connection between technology and human civilization | Case analysis | Circular economy, ways and means of turning waste into wealth |
| 11 | Application of new microbiological technology in environmental science | Diversity of microorganisms in the environment | Scientific spirit: the spirit of exploring bravely, defying difficulties and persisting in exploration | Literature reading | Further research and utilization of uncultured microorganisms |
| 12 | Environmental microbiology experiment | Isolation and culture of bacteria from activated sludge | Practical innovation: technology application, interest and willingness to learn and master technology | Case analysis | Technical application of pure strain isolation and culture of bacteria |

The ideological and political education objectives are as follows: through the study of garbage classification and other knowledge, students can enhance their sense of responsibility, mission and urgency in ecological civilization construction, and better understand the national environmental protection policy. Through the analysis of sanitary landfill and composting cases, students can establish the development concept of innovation, coordination, green, openness and sharing, clarify the needs of nature balance and the integrity and sustainability of human social development, and internalize the green development concept into the basic component of the world outlook; students can understand the significance of energy conservation and emission reduction, circular economy and waste resource utilization, cultivate the excellent quality of diligence, thrift and nature protection through the supporting practical education and the second course activities, realize practical innovation, and organically link technology with human civilization through the application of technology. Ideological and political education runs through all links before, during and after class, and it can strengthen major cognition, set models, cultivate patriotism, and clarify value orientation by playing videos of relevant contents before class and discussing after class. During the specific implementation, the documentary *Garbage Besieged City or Under the Dome* will be broadcast before class to guide students to pay attention to the problems of waste gas and waste residue. In class, teachers explain garbage classification, biological treatment methods of garbage, *etc.*, let students watch *Great Craftsman 4*, and stimulate students' thinking on waste resource utilization methods through the case of "kitchen waste dyer" Zhang Junlin making kitchen waste into dye to realize turning waste into treasure. After-class practical activities can be arranged

to visit landfills to make students feel the significance of garbage classification. Environmental protection knowledge contests are arranged in the second classroom activities, mainly competitions of some policies and regulations and some measures advocated by local governments, such as *Implementation Plan of Domestic Waste Classification System issued by the General Office of the State Council* [GuoBanFa (2017) 26], and "clean vegetables entering the city" advocated by many cities, so as to guide students to trace the source and explore the realization of garbage reduction and recycling from the source.

Through the design of each link, the ideological and political elements and professional knowledge are fully integrated, and the combination of professional education and ideological and political education is realized.

## 4 Conclusion

Environmental Microbiology is a professional course of science or engineering, and promoting the construction of ideological and political theories teaching in the course of Environmental Microbiology is related to the development of environmental science and engineering. It is necessary to combine ideological and political education with the cultivation of scientific spirit in course teaching, cultivate students' sense of responsibility and sense of mission of daring to explore the unknown, daring to pursue truth, and climbing the scientific peak, and improve students' ability to correctly understand, analyze and solve problems, cultivate students' craftsmanship spirit of dedication, rigorous work style, excellence, trustworthiness and innovation, and stimulate students to serve the country with patriotism, science and technology and mission. The major of Environmental and Ecological Engineering was set up late in the disciplines of the Ministry of Education, and the development process of professional construction is short. Environmental Microbiology is the basic course of Environmental and Ecological Engineering major, and the construction of ideological and political theories teaching in the course of Environmental Microbiology will help promote the speed and effectiveness of professional construction. The full exploration of ideological and political elements in curriculum, the organic combination of ideological and political theories teaching and professional knowledge, and the integration of ideological and political elements into the whole teaching process before, during and after class will make Environmental Microbiology a bioreactor for professional education and ideological and political education.

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