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Original Research Article

Progress in the Teaching Mode Reform for Noise Control Engineering Under Collaborative Innovation

Jing Sun[1], Tingting Shen[1], Chen Wang[1], Nan Lu[2], Hui Liu[2], Xikui Wang[3], Xiuli Ge[1]

1. School of Environmental Science and Engineering, Qilu University of Technology (Shandong Academy of Sciences), Jinan, Shandong, 250353, PR China
2. Graduate Office, Qilu University of Technology (Shandong Academy of Sciences), Jinan, Shandong, 250353, PR China
3. College of Environmental Science and Engineering, Shandong Agriculture and Engineering University, Jinan, Shandong, 251100, PR China

Abstract: This work considers the characteristics of the Noise Control Engineering course of the Environmental Science and Engineering major. Specifically, the progress of the course reform in the context of collaborative innovation is discussed from the aspects of teaching mode improvement, interdisciplinary training, course teaching team construction, and updating of teaching materials and teaching content. Moreover, this work explores the construction of future courses and provides new ideas for the follow-up training of high-quality environmental engineering professionals.

Keywords: Noise control engineering; Collaborative innovation; Teaching mode; Interdisciplinary training

Introduction

Cultivating applied and compound technical talents that meet the needs of social development and industry calls for the reform of the training system and the construction of curriculum programs around collaborative innovation. The Noise Control Engineering course is one of the important professional courses under the Environmental Engineering and Environmental Science programs in colleges and universities [1]. The course mainly focuses on basic knowledge about noise and vibration pollution and effective treatment measures and programs. Its aim is to teach fundamental acoustic theories, experimental skills, and environmental noise control techniques to students so that they can master the design principles and methods of environmental noise testing and control engineering. Noise control engineering is the most important aspect of environmental physical pollution control engineering, and it maintains an important position in the teaching system of environmental disciplines.[2]

1 Teaching status and existing problems of noise pollution control engineering

Traditional classroom teaching ignores the diversity of talents in collaborative innovation training. With regard to the teaching methods for Noise Control Engineering, most colleges and universities still regard the teaching of existing knowledge as the main goal, and most of them adopt a single classroom teaching method. From the perspective of curriculum content, the center of the system is still the traditional theoretical subject knowledge. Universities' concept of building a "broad foundation" has not been thoroughly implemented, and the cross-linking of curriculum content and the extension of knowledge have been ignored. Such closed curriculum system and fixed mode lead to a single knowledge structure of trained talents; moreover, these talents lack adequate sensitivity and ability to grasp the new problems and new directions of the discipline, they exhibit weak social practice skills and are thus out of touch with the frontier of the discipline and the production line, and they are increasingly unable to meet the needs of collaborative development strategy [3,4].

The single-course teacher responsibility system deviates from the diversity of the collaborative innovation training of talents. At present, the dominant teaching mode in the Noise Control Engineering course is still a single "point-to-many" course teacher responsibility system. One or several teachers guide multiple students, and they cannot always grasp the level of knowledge of each student. At the same time, students' thinking can easily be led into a local and closed state, whereas holistic and open thinking that is required in innovation cannot be effectively trained[5]. Under current policies, an atmosphere that is conducive to collaborative innovation cannot be easily formed. Hence, students are hindered from absorbing new ideas on a large scale and achieving significant development on a higher platform.[5]

The course lacks practical teaching links. Noise Control Engineering is a practical course, and the teaching links, such as practical experiments, are important for students to deeply understand the course content and exercise their design skill for noise control technology. At present, few engineering examples are available for teachers. At the same time, few schools set up special internship and practice links in the curriculum. Therefore, arranging comprehensive and systematic practice for students to deepen their understanding of noise pollution control is difficult. The training of qualified pollution control engineers also presents challenges.

2 Progress in the reform of the teaching model of Noise Control Engineering under the

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background of collaborative innovation

The essential connotation of collaborative innovation is an innovative organization model constructed through the large-span integration for the realization of major technological innovation.

The reform of the curriculum teaching model opens up the line of communication with students.

Fundamentally changing the current teaching defects of the Noise Control Engineering curriculum system calls for the reform of its teaching methods and models. Among the many teaching modes, CDIO, that is, conceive, design, implement, and operate, is an education mode that is highly suitable for engineering courses. CDIO mainly cultivates technical knowledge and reasoning ability, professional skills and ethics, interpersonal communication and collaborative capabilities, and the entire CDIO domain [6,7]. The CDIO mode has been developing in China for over 10 years, and it has gradually become one of the important and influential reform actions in the field of higher engineering education in the country. Some colleges and universities have extended the concept of CDIO to various fields of teaching reform, but most of them are still limited to mechanical, electrical, chemical, and civil majors [8]. Chengdu University of Information Technology proposed the KSR-CDIO talent training model, with a focus on the key words "demand," "students," "practice," "curriculum," and "environment," to reform the engineering teaching model and train students' ability in the context of actual engineering by increasing comprehensive group projects. Shantou University combined CDIO and KIP to gradually form an engineering education mode with project-driven activities as the essential feature and three-level projects as the formal feature; the proposed model also exhibits clear levels, a reasonable structure, and integrated curriculum design [9]. Tang Xiaomin et al. constructed a noise control engineering teaching link, teaching mode, practical content, and assessment and evaluation systems on the basis of CDIO; improved students' knowledge of actual engineering time and innovation; and cultivated their overall skill through connections with actual engineering cases and projects [10]. The reform of the above education model has greatly mobilized students' interest in learning.

Considering the engineering characteristics of noise pollution in a physical pollution control project, Zhang Jialei et al. used the results-oriented "outcome-based education" teaching model to implement teaching reforms from the three aspects of course content, course teaching methods, and assessment system; the model improves the teaching effects in the classroom [11].

It breaks through the barriers between disciplines and promotes interdisciplinary collaborative innovation.

Although Noise Control Engineering is a professional course for environmental disciplines, the nature of the course determines the need for support from many disciplines. For example, the knowledge of university-level physics, physical chemistry, and advanced mathematics is a bridge that connects university-level physics and environmental pollution control disciplines. Knowledge production, knowledge dissemination, and knowledge transfer can be carried out through the integration of resources, formation of multidisciplinary teams, and practice in the management system and operation mechanism of collaborative innovation to cultivate engineering practice talents. The Collaborative Innovation Center of Yangtze River Delta Region Green Pharmaceuticals collaborated with Zhejiang University of Technology as the lead unit and with Zhejiang University and Shanghai Institute of Pharmaceutical Industry as the collaborative units to build an interdisciplinary education platform, open interdisciplinary courses, and form interdisciplinary research and teaching groups; the developed platform involves mutually hired teachers and sharing of courses and laboratory resources [12]. This model builds benign interaction mechanisms between "teaching" and "learning," "in class" and "out of class," "theory" and "practice," and "online and offline"; the model is conducive to improving the results of practical education. It also realizes the intersection and cooperation between disciplines in the form of innovative practice to help students participate in actual environmental protection engineering projects. Through actual combat training, students can master the skills of engineering implementation and process innovation. Such an approach is conducive to the cultivation of practical talents.

It breaks through the single-teacher responsibility system and builds a multidisciplinary teaching team for collaborative training.

Research shows that the team operation model can maximize the intelligence of organization members and the advantages of different disciplines and then ultimately produce the wisdom value-added effect of $1 + 1 > 2$. The construction of a team structure system for the noise pollution control engineering courses helps realize micro-flat guidance methods[13]. On the basis of the intersectional characteristics of environmental science and engineering, instructors are grouped according to professional expertise, level of professional title, sources of teachers, and age range. At the same time, multiple combinations are equipped with curriculum guidance teams according to the training needs of students. Through a multi-teacher curriculum team structure system, students can receive mutual guidance from multiple teachers in the teacher team. This mode thus eliminates the stereotypes of the single-teacher responsibility system among curriculum teachers. Students' horizons of knowledge can be broadened to promote technological innovation. According to the personalities and training needs of different students, multiple combinations of instructor teams are formed.

3 Conclusions

Therefore, the needs of environment-related industries and enterprises for high-quality applied talents in the field of environmental protection industry can be satisfied by improving the teaching mode, promoting interdisciplinary collaborative innovation, building a course team jointly, improving the use of teaching materials, updating teaching content, and conducting research on collaborative innovation training modes for engineering talents on the basis of noise control engineering course construction. The results should provide support for the diversified training of environmental talents.

Fund topics:

1. Qilu University of Technology (Shandong Academy of Sciences) Key Project of School-level Teaching and Research Project in 2019-Research on the Teaching Reform of Noise Control Engineering Course Based on CDIO and OBE under the Background of New Engineering 2019zd13

2. 2020 Shandong Province Graduate Education Quality Course Construction Project- Technology of Pollutant Separation and

Analysis SDYKC20171

3. 2016 Special Project of Shandong Graduate Education Innovation Plan-The innovation and practice of the model innovation and practice of the joint training of postgraduates by the deep integration of science and education under the background of supply-side reforms-Taking Qilu University of Technology and Shandong Academy of Sciences as the research object SDYZ1601

4. General Teaching and Research Project of Qilu University of Technology of 2020-Teaching Reform and Exploration of Integration of Science and Education Based on the Background of "Double First-class" Construction-Take the cross-advantaged characteristic course "Environmental Chemistry" as an example 2020kjzx07

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