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Curriculum Development of Modern Detection Technology Based on Cultivation of Scientific Research and Innovation Ability

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Abstract: Under the guidance of the Party's education policy, we set up advanced teaching concepts, introduce the concept of science and education integration into teaching construction, reform the teaching mode, and drive the modernisation of teaching. This paper is based on the course of Modern Detection Technology, strengthens the curriculum development from various aspects, designs the research and reform programme of the teaching ladder and system of the course, completes the innovation of the teaching methods and means of the course, achieves the purpose of teaching and educating students, and fosters the high-level talents with the ability of research and innovation.

Keywords: Curriculum development, Modern detection technology, Innovation ability, Postgraduate talent cultivation.

1. Introduction

Curriculum is the foundation of teaching construction in higher education, and curriculum construction is one of the important contents of the school's teaching capital construction, which is the key to improving the level of teaching and scientific research and ensuring the quality of talent cultivation[1]. Guided by Xi Jinping's thought of socialism with Chinese characteristics in the new era, implementing the spirit of the 20th Party Congress, executing the Party's education policy, promoting quality education in a comprehensive manner, further improving the work of curriculum construction and improving the level of curriculum construction. By strengthening the development of the curriculum, further deepening the teaching reform, adapting to the development trend of teaching in institutions of higher learning, advancing with the times, promoting educational innovation, changing the teaching and management methods, and improving the overall teaching level of the discipline of marine science.

In recent years, Harbin Institute of Technology has always been focusing on the fundamental task of cultivating moral integrity, taking the supply-side reform of talent cultivation as a hand[2], promoting the revolution of classroom teaching, enhancing the high order, innovation and challenge of the curriculum, and perfecting the construction of higher courses. The School of Chemical Engineering and Chemistry carries out curriculum construction and reform in accordance with the concept of international professional certification of engineering education: it effectively improves teaching quality and promotes the quality of innovative talents cultivation by perfecting the curriculum system and improving the practical teaching links[3]; The School of Transportation Science and Engineering actively explores the construction and practice of the curriculum ideology system for the curriculum group of road engineering disciplines, and builds the curriculum ideology system for the curriculum group of engineering disciplinary professional courses[4]; The College of Environment has formed a fruitful curriculum system after years of curriculum construction, with the design of practical teaching, case studies and other links as an aid to improve the teaching effect and students' ability to apply theoretical knowledge and solve practical problems[5]. Harbin Institute of Technology focuses on creating first-class majors, first-class courses, first-class teaching materials, first-class teachers, and firmly take the road of independent training of outstanding talents in the new era.

In the National Conference on Postgraduate Education held on 29 July 2020, President Xi Jinping stressed the importance of cultivating high-level talents with research and innovation capabilities. The cultivation of postgraduate innovation ability has high requirements for students to master the basic knowledge of their specialities as well as cross-disciplinary knowledge. Modern detection technology is a composite technology that integrates and synthesises multiple disciplines and technologies, and is widely used in various fields. The research and application of detection technology has important theoretical significance, in line with China's science and technology development strategy for a long period of time, and closely integrated with the national economy. The course of modern detection technology is a degree basic course for postgraduate students of marine science, and it has been found in many years of teaching that postgraduates are still deficient in the mastery and application of related knowledge. In order to cultivate postgraduates' innovative ability, comprehensively improve the level of postgraduates' dissertation, and encourage students to achieve original results, we intend to carry out curriculum construction and reform of the course, taking Xi Jinping's thought of socialism with Chinese characteristics in the new era as the guide, cultivating postgraduates' innovative spirit as the guiding principle, focusing on the cultivation of comprehensive quality, optimizing the teaching content of the course, reforming the teaching mode, and improving the inovative ability of the students.

2. Key Issues to Be Addressed in Curriculum Teaching and Student Development

2.1. Enabling students to gain a more systematic grasp of the body of knowledge of modern detection technology

Modern detection technology in automation, electronics, computers, control engineering, information processing, machinery and other disciplines, a variety of technologies fused into one and comprehensive use of conformity technology, widely used in biology, metallurgy, chemical industry, environment and other fields[6]. Including spectroscopy, chromatography and mass spectrometry and other technologies, the knowledge system is complex and diverse, and difficult to master, through the construction of the course system, so that the knowledge of this course systematic, master a variety of modern detection methods.

2.2. Improve students' ability to analyse and solve problems

The transformation of students from undergraduates to postgraduates is mainly the cultivation of scientific research ability and scientific research thinking, the implementation of the combination of science and education, on the basis of explaining the principles of basic methods, expanding the relevant content around the frontier areas of scientific research, focusing on the combination of frontier literature of scientific research, chapters of English textbooks and teaching, and integrating the latest research results of the teachers into the teaching of the course. In this way, we exercise graduate students' ability to review literature, improve their thinking ability and scientific research ideas, and expand their disciplinary vision. Focusing on students' learning, we cultivate students' independent learning ability, thinking ability and innovation ability.

2.3. Stimulate students' belief in the power of science and technology and to think ethically about scientific research

Explore the unique nurturing materials contained in the curriculum, such as the introduction of scientific research figures and the spirit of scientists, the international situation of scientific and technological innovation and the comparison of China's actual situation. By integrating them into the teaching, we can stimulate students' sentiment of strengthening the country through science and technology, scientific research ethics and the ability to link theory with practice. At the same time, students are guided to closely integrate what they have learnt with their own practical research work, and gradually internalise it into their own knowledge structure, so as to enhance their social adaptability and competitiveness.

3. Methods and Approaches to Be Adopted for Curriculum Development

3.1. Optimising the teaching ladder and content in keeping with the times

The development of the curriculum is firstly the construction of the echelons, and secondly to track the new progress of the discipline, organically combine the cutting-edge knowledge with the teaching of the curriculum, appropriately introduce the new results of the development of the discipline into the classroom teaching, deal with the relationship between the basic knowledge and the cutting-edge research content of the discipline, strengthen the establishment of the system of integration of science and education, and design and incorporate cases of course ideology and politics, so that the curriculum can achieve the unity of the modernity and fundamentals, the scientificity and systematicity.

3.1.1. Curriculum ladder building

Ladder construction is fundamental to the development of the curriculum. Teaching team construction is further strengthened in the course construction, and a teaching team with high academic level, good at innovation, high education, high title, reasonable age structure with high teaching level and strong scientific research ability is gradually built up. Teachers are encouraged to carry out scientific research activities, so as to improve the quality of teaching with a high-quality teaching team and new achievements in scientific research.

3.1.2. Systematisation and Chaining of Knowledge

In terms of course content, it mainly focuses on chromatography, spectroscopy and mass spectrometry, with emphasis on testing principles, sample preparation and contraindications, as well as practical operation of instruments. Isolated chapters are linked through comparison and synthesis, and on this basis, students are actively guided to summarise and find out the common law, so that the knowledge can be systematised.

3.1.3. Establishment of a system for integrating science and education

At present, the Modern Instrument Analysis Research Laboratory has undertaken a number of scientific research projects such as the National Key Research and Development Programme, the National Science and Technology Support Programme, the National Natural Science Foundation of China, the Natural Science Foundation of Shandong Province, and the Key Research and Development Programme of Shandong Province, etc. On the basis of this project, it increases the proportion of the content of the analysis of experimental results, data processing, and case study analysis, and guides the students to carry out the design of experiments, the operation of the instruments, and the analysis of data, and improves the students' The students will be guided to design experiments, operate instruments and analyse data, so as to improve their ability to analyse and solve problems. At the same time, on the basis of explaining the basic principles of methodology, the course focuses on expanding the content around the frontiers of scientific research, focusing on the combination of the frontiers of scientific research literature, chapters of the English textbook and teaching, and integrating the latest research results of the teachers into the teaching of the course.

3.1.4. Design and integration of ideological and political cases in the curriculum

We will explore the unique nurturing materials contained in the curriculum and incorporate them into our teaching. For example, the introduction of scientific research figures and the spirit of scientists, the comparison between the international situation of science and technology innovation

and the actual situation in China, the application of modern analytical technology in food safety, environmental monitoring, medical diagnosis and other fields, etc., to stimulate students' feelings of strengthening the country through science and technology, scientific research ethics and the ability to link theory with practice.

3.2. Pioneering innovation and improving teaching methods and tools

Further increase the efforts of teaching reform and teaching research, further explore the organic combination of modern educational technology and heuristic teaching in terms of teaching methods and means, formulate clear course objectives and scientific teaching planning, deepen the teaching reform, and constantly explore new methods, approaches and measures for teaching to improve the teaching effect [7].

3.2.1. Multimedia-assisted instruction

Through pictures and videos and other forms of demonstration of the working principle of the instrument, the use of flash animation or the operation of the instrument simulation software, simulation of the experimental operation of the instrument analysis steps and software operation steps, so that the students learn for fun, to increase the perceptual understanding of the instrument, and to improve the success rate of the actual experimental operation.

3.2.2. Case-based approach

Typical examples containing the essence of science and full of inspiration are selected from daily life, scientific history and scientific research examples, so that students can better grasp and understand the relevant knowledge points. In case teaching, modern teaching methods and inspirational teaching are fully applied to cultivate students' ability to connect theory with practice. Combined with the teacher's own scientific research work and the current development of cutting-edge technologies and topics, the teaching process focuses on the introduction of problem-solving ideas and methods to consolidate students' understanding of theoretical knowledge and enhance their interest in learning.

3.2.3. Flipped classroom and seminar pedagogy

Focusing on the modern detection technology taught in class, students voluntarily form a study group, choose a topic, conduct a literature review, summarise the research progress in the field, and produce courseware for classroom reporting. At the end of the lecture, the teacher and students ask questions and discuss the content of the report, so as to exercise the graduate students' ability to review the literature, promote their thinking ability and scientific research ideas, and expand their disciplinary horizons.

3.2.4. Project-oriented extracurricular experiments

Based on the theoretical learning in the classroom, students choose the experimental projects related to their own subject groups, or choose the projects they are interested in, and through consulting the literature, they formulate a feasible plan, including the pre-treatment of the samples, the conditions of sample testing, as well as the problems and solutions they may encounter, etc., and then complete the process of testing and analysis, and form the experimental report with the assistance of the laboratory teacher or their elder brothers and sisters. This will enable students to truly understand and master the principles and applications of the technology and lay a good foundation for future scientific research.

3.2.5. Network Teaching and Learning

To build the webpage content of the course, which mainly includes the objectives, contents, syllabus, courseware, test questions, course tutorials, etc., to improve the scientific, academic, practical and ornamental nature of the network construction, to increase the access rate and utilisation rate of students, and to improve the effectiveness of networked teaching and learning.

4. Conclusion

This paper proposes a programme for curriculum development and reform of the Modern Detection Technology course based on the cultivation of scientific research and innovation ability. The research and reform of the course teaching ladder and system mainly includes the construction of the course ladder, systematisation and veinisation of knowledge, the establishment of the system of science and education integration, the design and integration of the course's ideological and political cases, the optimisation of the teaching content, the strengthening of the knowledge system, and the injection of frontier advances in the discipline. The innovation of course teaching methods and means mainly refers to the adoption of diversified teaching modes, matching and positioning appropriate teaching methods to specific teaching contents, such as multimedia-assisted teaching, case teaching method, flipped classroom and seminar teaching method, project-oriented extracurricular experiments, as well as the construction of network teaching, etc., to stimulate students' interest in learning and to improve students' comprehensive ability of scientific research. By strengthening the construction of the curriculum, advancing with the times and educational innovation, the overall teaching level of the discipline of marine science will be improved.

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