The Teaching Reform and Practice of Photoelectric Advanced Mathematics Course of Science and Technology Integration

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Abstract. Based on the uniqueness of the training process of optoelectronic professionals under the background of "new engineering", and closely focusing on the goal of "integration of science and engineering" to cultivate innovative and outstanding engineering talents, explore the teaching reform and practice of science and engineering integration of optoelectronic higher mathematics courses in local universities. In order to solve the problem of single and rigid talent training caused by imperfect curriculum system, insufficient application of curriculum practice due to single teaching methods, and insufficient integration of innovative education into the curriculum due to lack of practice part, through the research and practice of optimizing curriculum design, reforming teaching methods, strengthening the construction of teachers, practical teaching and assessment and evaluation, the cross-integration of curriculum science and engineering is an important direction of teaching reform in colleges and universities, and its implementation effect is related to whether the goal of compound innovative talent training can be achieved. Therefore, when necessary, it is necessary to implement from multiple dimensions such as "online and offline, inside and outside the classroom, and inside and outside the school" to effectively promote the reform of engineering education in colleges and universities and achieve the goal of innovative talent training. Realize the deep integration of advanced mathematics and optoelectronic new engineering majors, and cultivate high-quality talents for the development of China's optoelectronic new engineering field.

Keywords: New engineering; Optoelectronic; Science and technology integration; Reform and practice

1. Introduction

In 2017, the Ministry of Education issued the Notice of the Department of Higher Education of the Ministry of Education on Carrying out Research and Practice of New engineering, which put forward the educational concept of "new engineering" [1]. The Department of Higher Education of the Ministry of Education clearly proposed to promote the construction and development of "new engineering" in the subsequent key work deployment. The connotation of "new engineering" is to take moral education as the guidance, cope with changes and shape the future as the construction concept, and take inheritance and innovation, cross and integration, coordination and sharing as the main way to cultivate diversified and innovative outstanding engineering talents in the future. Among them, "crossover and integration of disciplines" is an important way to develop new engineering. The most common fusion of disciplines in engineering colleges is the fusion of science and technology [2-5]. With the development of society and the progress of science and technology, the world has entered the era of digital technology, and new trends and problems have appeared in all walks of life. At present, big data analysis and application, information field, intelligence and other industries cross integration, produce a large number of digital, automation, intelligent scientific and technological achievements, and will be intelligent, integrated, personalized and networked development, and widely integrated into various fields [6-8]. Scientific and technological progress requires high-tech talents with innovative ability to achieve it. Not only the mathematical theory knowledge is very important, but also the engineering application skills are very important. These industries require a solid foundation in mathematical theory and applied skills in engineering [3,4]. How to enable students to master the basic theories and methods, but also to apply the theoretical knowledge to various majors, is an important topic. The integration of

science and technology is an important way to solve the above problems, and it is also a new exploration to implement higher engineering education reform, which is of great significance [9,10].

2. The Main Problems Existing in College Engineering Mathematics Teaching Based on the Concept of Integration of Science and Technology

(1) The imperfection of the curriculum system leads to the problem of uniformity and rigidity of personnel training;

(2) The single teaching method leads to the problem of insufficient curriculum practice;

(3) The lack of practical application leads to the problem that innovative education is not fully integrated into the curriculum.

3. The Main Contents of the Reform of University Engineering Mathematics Teaching Based on the Concept of Integration of Science and Technology

Under the background of "new engineering" and in combination with the reality of schools, students and teachers, how to achieve the cross-integration of science and technology well in all links of the course, so as to improve students' ability of comprehensive applied mathematics and interdisciplinary knowledge, so that students have the ability of continuous learning and adaptation to development.

(1) Continuously improve the "theory + application + practice" higher mathematics curriculum system that adapts to the development of new engineering: According to the needs of new engineering majors, adjust and optimize the structure of higher mathematics curriculum, combine mathematical theory and application, and build a set of public mathematics curriculum system "guided by mathematical and optoelectronic professional problems, assisted by inquiry-based practice", which can not only pay attention to the foundation of mathematics, but also strengthen the intersection and integration of majors, so that it can better serve different professional fields.

(2) Explore effective teaching methods: Through research and practice, summarize and promote higher mathematics teaching methods that adapt to the new engineering background, including case teaching, discussion teaching, project learning, etc., by searching materials, fully researching, selecting cases according to knowledge points and professional knowledge, and establishing a case base for the cross-integration of knowledge points in hierarchical and hierarchical course chapters. To provide enough materials for the specific development of the integration of science and technology courses, so as to improve the teaching effect and students' learning experience.

(3) Build a "high-quality, strong application" teacher team: through training, communication, research and other ways, improve teachers' knowledge and understanding of the application of higher mathematics in various professional fields, enhance teachers' practical teaching ability, so that they can better guide students to learn and apply mathematical knowledge.

(4) Build a capability-oriented professional practical training system: set up experimental courses related to optoelectronics majors to cultivate students' hands-on ability and innovative spirit. Encourage students to apply mathematical knowledge to practical problems and scientific and technological innovation through activities such as mathematical contest in modeling, numerical calculation competition and off-campus enterprise visits and internships.

(5) Continue to improve the evaluation system of "emphasizing process and diversification" : In order to match the new teaching content, it is necessary to adopt a new assessment method. The integration of science and technology research into the process assessment, try to set open questions in part of the content, open book examination. At the same time, the corresponding process assessment standards are set, so that students can experience the fun of integrated teaching of science and technology and actively participate in it. Through the research and practice of the above content, it can promote the deep integration of higher mathematics and new engineering majors of optoelectronics, improve students' ability of comprehensive applied mathematics and

interdisciplinary knowledge, and enable students to have the ability of continuous learning and adaptation to development.

4. The Main Way of the Reform of University Engineering Mathematics Teaching Based on the Concept of Integration of Science and Technology

Centering on the requirement of "innovative compound talents" under the background of "new engineering", the teaching concept of combining theory with practice is implemented, and the cross-integration of science and technology courses is done well from the aspects of teaching content, teaching methods, teaching resources, assessment methods, teaching team, curriculum ideology and politics.

(1) Optimize the teaching content although the course is an applied tool subject, not all knowledge points are suitable for the integration of science and technology, so suitable knowledge points should be selected for integration. It is necessary to explain clearly the application background and prospect of the theory, and pay attention to cultivating students' understanding of the connotation of concepts and theorems, improving students' logical thinking ability and students' application of mathematical knowledge and methods. To optimize the teaching content, we should pay attention to training students' understanding of the connotation of concepts and theorems, pay attention to improving students' logical thinking ability and students' practical application of mathematical knowledge and methods. Mind mapping can be used to establish the network format or chain relationship between knowledge, and it should be embodied in the multimedia courseware content.

(2) Reform the teaching method the traditional teaching mainly focuses on the pure curriculum theory for offline teaching. The requirement of integration of science and technology increases the content of courses, which involves comprehensive knowledge points and complex content. Therefore, it is necessary to straighten out the correlation between various chapters and knowledge points and make a good arrangement of courses: which are face-to-face learning, which need online self-study, which need group discussion after class, and which are experimental operations. It is necessary to pay more attention to problem-driven and application background, appropriately reduce the content of repetitive calculation, and increase exercise classes, discussion classes and open thematic classes. We should use a variety of teaching methods comprehensively, make full use of online and offline links, and do a good job of curriculum integration before and after class.

(3) Enrich teaching resources the information age has provided various convenient conditions for resource sharing. Academic website database, university MOOCs, the construction of fine courses and forums of various universities have provided many valuable electronic resources for curriculum reform. Various teaching reform conferences and experience sharing meetings can provide new offline resources for teaching reform. Make use of Learning Pass to do a good job in the construction of the course platform, and build the integrated part of science and technology according to the knowledge point background, knowledge point analysis, knowledge point application (case analysis, etc.) model. And in the introduction part, we add the integrated resources such as the professional lectures of the course, the analysis of the perception of the subsequent application of the course for senior students, and the introduction of the application of the course for enterprise technical personnel, so that everyone can grasp the whole course by outlining the main points and make use of all resources to help the integration of the course.

(4) Adjust the assessment method

(i) Evaluation of the teacher's teaching effect. At present, the evaluation of teachers mainly relies on peer evaluation and student evaluation, and there is no more objective evaluation mechanism. This project will provide a quantitative algorithm for teacher evaluation of mathematics teachers' teaching situation and their contribution to engineering education.

(ii) Evaluation of the effectiveness of student learning. Break the traditional way of examination, pay attention to the evaluation of the combination of examination and assessment. Such as the use of mathematical modeling, the students will be grouped, through solving practical problems to

assess the students; Another example is to carry out practical activities in enterprises, and assess students through their ability to solve practical problems in enterprises.

(5) Build a teaching team a good teaching team is the premise of good teaching, and the integration of curriculum and science requires teachers to be familiar with the engineering application of the curriculum as much as possible. However, most of the team teachers are engaged in basic theory teaching and lack of engineering background. Therefore, in order to improve this situation, we need to build a good teaching team from many aspects: encouraging teachers to carry on professional learning; Regularly send teachers to participate in some related teaching reform meetings; The team regularly holds curriculum building seminars; Maintain active contact with relevant department course leaders; Appointing senior students as "course follow-up application consultants"; And make clear the division of work in the team -- different teachers connect with different departments. Maintain the healthy development of the team from multiple angles, and ensure that the integration of science and technology is implemented in the deep.

5. Conclusions

Through a series of university mathematics teaching reform research and practice in recent years, a new teaching path of "from mathematical theory, to professional application, and then to innovative development" has been formed, the teaching quality of mathematics courses in our school has been greatly improved, and the strong support of mathematics teaching for our school's advantageous engineering majors has been realized, and outstanding students of all majors in the school have achieved excellent results in international and domestic mathematical modeling competitions and college mathematics competitions, and students' innovation ability and practical ability have been significantly improved. Produce outstanding talent training effect. In the future, we will further carry out the construction of off-campus enterprise training bases and organize visits for outstanding students.

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