

Construction and Practice of the Innovative Engineering Education System under the Multidisciplinary Integration

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ABSTRACT

At present, the intersection and integration of disciplines have received unprecedented attention, which is of great significance for promoting national development and implementing the technological powerhouse strategy. It can help college students break professional barriers and develop interdisciplinary thinking and innovation ability. It can enrich education and teaching content, and improve teaching quality. It also can meet the specific needs of students and promote social development. On the basis of studying the significance of constructing and implementing the innovative engineering education system under multidisciplinary integration, this paper puts forward concrete measures to promote the construction and practice of innovative engineering education system under the multidisciplinary integration.

KEYWORDS

multidisciplinary integration; engineering education system; interdisciplinary thinking; teacher professionalism; teaching evaluation

In the era of rapid development of science and technology, in order to become an engineering powerhouse, training high-quality engineering and technical personnel is the top priority. Under the multidisciplinary integration, the innovative construction and practice of the engineering education system can not only meet the needs of the development of the times, but also help China to achieve the goal of education and engineering powerhouse, which is of great significance.

1 The Significance of Construction and Practice of Innovative Engineering Education System under the Multidisciplinary Integration

1.1 Break Professional Barriers and Form Interdisciplinary Thinking and Innovation Ability

In the past, the engineering education system of colleges and universities did not carry out construction and practice under the integration of multiple disciplines, which resulted in some fields being ignored or even abandoned due to the perspective of a single discipline. In the professional learning, college students usually only learned a single subject knowledge, resulting in their narrow vision and single knowledge structure. Therefore, they are unable to effectively and flexibly respond to the increasingly complex development of modern society. However, the construction and practice of the innovative engineering education system under the multidisciplinary integration has brought attention to the neglected fields in the past, so that the course can effectively break the barriers between traditional engineering disciplines, and students are no longer limited to a single professional perspective, and can have access to professional knowledge of more disciplines in the classroom, widely absorb the knowledge of multiple disciplines and broaden their horizons. In addition, it can stimulate students' own inspiration and cultivate their innovation ability. Meanwhile, under the influence of the construction and practice of innovative engineering education system under the multidisciplinary integration, students can gradually discover the potential links between various disciplines, then make best use of the advantages and bypass the disadvantages in the process of solving practical problems, and develop the habit of looking at problems from a multi-dimensional perspective. At the same time, students can internalize and integrate multidisciplinary knowledge in their mind, and finally form interdisciplinary thinking and innovation ability^[1]. In a word, the construction and practice of innovative engineering education system under the multidisciplinary integration can effectively break the specialty monopoly, provide students with a broader vision, and cultivate the interdisciplinary thinking and innovation ability of students, which is of important practical significance.

1.2 Enrich the Teaching Content and Improve the Teaching Quality

The construction and practice of innovative engineering education system under the multidisciplinary integration requires teachers to organically penetrate and combine the knowledge of different disciplines, expand the teaching content, and transform the traditional teaching content of a single discipline into an interdisciplinary comprehensive knowledge system. In other words, teachers can integrate professional knowledge in multiple fields into classroom

teaching to further enrich the teaching content, and make the teaching more layered and attractive. For example, when teaching professional knowledge of bridge design, teachers integrate the knowledge of mechanical calculation, computer programming and other fields into the classroom, and add some practical cases in the teaching process, so that the combination of theoretical teaching and practical application can enrich the classroom content, make the classroom content richer and more three-dimensional, then help students to understand the internal links between knowledge points to a certain extent, and further improve the quality of innovative engineering education system construction and practical teaching implemented by teachers under the multidisciplinary integration. Second, colleges and universities innovate the construction and practice of engineering education system under the multidisciplinary integration, and teachers further expand teaching content in class and refer to relevant knowledge of multiple disciplines, which can gradually create a learning atmosphere of multidisciplinary integration in class, stimulate students' interest in learning to a extent, improve their participation in class, and then unconsciously improve students' knowledge reserve and skill levels. Therefore, the teaching effectiveness of teachers can be significantly improved. In addition, in the context of interdisciplinary integration, teachers in colleges and universities will comprehensively consider their own teaching design from an interdisciplinary perspective when designing teaching plans. Specifically, teachers will have the awareness of using new teaching methods and means when designing teaching plans, which can significantly improve their teaching quality and help students internalize knowledge in their hearts, and externalize it in their actions.

1.3 Meet the Specific Needs of Students and Promote Social Development

The construction and practice of innovative engineering education system under the integration of multiple disciplines can meet the individual learning needs of students to the maximum extent, and then lay a talent foundation for the further development of society. In the teaching classroom with the integration of multiple disciplines, teachers can teach students according to their aptitude. In other words, teachers can provide students with diversified learning resources and guidance according to their specific needs, so as to meet their personalized learning needs. Therefore, in the case of the construction and practice of innovative engineering education system under the multidisciplinary integration, students can learn relevant knowledge according to their own interests and development directions, then systematically improve their own comprehensive ability, form a diversified knowledge system, better adapt to the needs of society, and become interdisciplinary talents. In the reaching mode of the construction and practice of innovative engineering education system under multi-disciplinary integration, the knowledge reserve and comprehensive quality of students will be improved, and then they can effectively participate in social production and economic activities. In other words, when students enter the society, they can be directly transformed into the driving force to promote the social development and improve the social production efficiency, thus injecting vitality into social and economic development, and promoting further social development^[2].

2 The Measures for the Construction and Practice of Innovative Engineering Education System under the Multidisciplinary Integration

2.1 Construct the Engineering Education System under the Multidisciplinary Integration

In the past, when colleges and universities developed talent training plans for the engineering education system, the boundaries between disciplines were clear, and each major independently developed the curriculum system, which lacked the interdisciplinary research and exchanges, and was not conducive to the improvement of students' comprehensive quality. In other words, to a certain extent, the diversity of course content was severely limited, and there were overlapping courses in many disciplines, which made students learn similar content repeatedly and wasted educational resources. Moreover, due to the lack of higher-level knowledge, students were difficult to access knowledge in other fields, which hindered the expansion of students' knowledge and the formation of cross-disciplinary thinking. Teachers adhered to the traditional cognitive mode, and subjected to the closed teaching and education mode to fail to fully realize the importance of interdisciplinary cooperation, so that it was difficult to form a multi-party linkage in curriculum design^[3].

The construction and practice of innovative engineering education system in colleges and universities under the integration of multiple disciplines can promote the improvement of education quality and talent training. The core of the construction of innovative engineering education system under the multidisciplinary integration is to design and construct the curriculum structure scientifically and reasonably, so as to provide prerequisites for the cross fusion of knowledge of different disciplines. When designing the curriculum of the engineering education system with the integration of multiple disciplines, the characteristics and application value of the subject content are fully considered, and the theoretical knowledge is explained and divided into general knowledge to form a systematic and hierarchical

teaching framework to help students identify the key points and learning difficulties of different disciplines, thus improving students' learning efficiency. Taking the School of Chemistry and Chemical Engineering as an example, in order to build a multi-disciplinary engineering education system, the teaching content needs to be divided into four main directions: organic materials, inorganic materials, composite materials and metal materials, so as to build a more diversified teaching system and help students deeply grasp basic theories. Second, it is necessary to build a practice teaching system to help students transform theoretical knowledge into ability. Practice teaching is an important part of the innovative engineering education system. Therefore, colleges and universities should build a multi-level, open and three-dimensional practice teaching system to enhance students' practice ability and cultivate their interdisciplinary comprehensive application ability. In order to determine the goal of the innovative engineering education system with the multidisciplinary integration and ensure that the educational practice does not deviate from the direction, it is not only necessary to cultivate students' professional skills and knowledge, but also pay attention to the all-round development of students' morality, intelligence, physical fitness and aesthetic sense. Third, it should optimize the curriculum structure and rationally layout the curriculum system. In the curriculum, the interdisciplinary knowledge modules should be reasonably arranged, so that students can master the basic knowledge of their own specialty, and integrate the knowledge of other disciplines^[4]. The module of professional curriculum system should highlight the specialty characteristics of the subject, pay attention to the mastery of basic theories and the cultivation of professional ability, and increase the number of edge subject courses that intersect with professional subjects to broaden students' knowledge and help students solve problems more flexibly in interdisciplinary projects.

2.2 Enhance teachers' Professional Quality, Strengthen Teachers' Cooperation, and Build a Win-win Situation

Teachers are the core driving force for the construction and practice of innovative engineering education system in colleges and universities under the multidisciplinary integration. Improving the professional quality of teachers in colleges and universities and strengthening the communication and cooperation among teachers will help to achieve this goal. Based on this, colleges and universities need to pay attention to improving the professional quality of teachers, so that teachers will have a broader knowledge reserve. First, colleges and universities introduce well-known academic experts and scholars at home and abroad to organize lectures and academic exchange activities for teachers to help them grasp the cutting-edge trends and technology applications of various disciplines in a timely manner, so as to break the barriers between disciplines, broaden the teaching horizon of teachers, and improve teachers' interdisciplinary teaching ability. Colleges and universities strengthen cooperation with well-known universities or scientific research institutions at home and abroad, and carry out interdisciplinary research projects to enhance teachers' interdisciplinary comprehensive ability in practice. Meanwhile, colleges and universities organize teachers to participate in interdisciplinary training and academic exchange activities at home and abroad on a regular basis to provide teachers with opportunities to learn teaching concepts and methods from other schools, and increase teachers' understanding and identity of multidisciplinary integration. Besides, colleges and universities strengthen the cooperation with enterprises, and select teachers to work in school-enterprise cooperation units for temporary training, so that teachers can accumulate experience in actual engineering projects, and have a deeper and accurate understanding of market demand and technological frontier in the practice process, thus promoting teachers to implement the concept of multidisciplinary integration in teaching more effectively. Second, college and universities regularly organize teaching experience exchange meetings to strengthen cooperation among teachers, in order to achieve the teaching goal of win-win. Colleges and universities organize teachers to hold teaching experience exchange meetings to share teaching experience and innovative practices of multidisciplinary integration, and form the complement knowledge and experience through the communication among teachers, so as to make the curriculum content more rich and targeted.

2.3 Improve the Teaching Evaluation of Innovative Engineering Education System under the Multidisciplinary Integration

In the innovative engineering education system of multidisciplinary integration, the improvement of teaching evaluation methods is very important. Traditional teaching evaluation methods usually focus on the classroom performance and final examination, which mainly focus on students' mastery of a single subject knowledge. However, in the process of construction and practice of the innovative engineering education system under the multidisciplinary integration, only the innovation and improvement of teaching evaluation can better adapt to the teaching mode of multidisciplinary integration. First, it is necessary to adjust the structure of teaching evaluation and set up an evaluation system of "professional courses and interdisciplinary courses", which not only focuses on the evaluation of students' mastery of basic theories and professional skills in their own professional field, but also focuses on students' integration

and innovative application of knowledge from multiple disciplines. Second, it is necessary to introduce the process evaluation method. Teachers continuously monitor the learning process of students to have a more accurate grasp of students' ability to learn multiple disciplines.

3 Conclusion

In the context of the current social development, it is self-evident to cultivate students' interdisciplinary thinking and innovative ability. However, the education reform is still a long way to go. In order to help college students better adapt to the society, colleges and universities should actively take measures to build an engineering education system under the multidisciplinary integration, enhance the professional quality of teachers, strengthen the cooperation among teachers, build a win-win situation, and improve the teaching evaluation of innovative engineering education system under the multidisciplinary integration.

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