

Cultivation of engineering innovation ability of engineering students based on interdisciplinary characteristics

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Abstract: Engineering specialty refers to a new engineering specialty produced by the intersection and combination of different engineering disciplines or the intersection and integration of engineering disciplines and other disciplines. The construction of freshman engineering specialty is a very complex core work in engineering construction, which plays an important reference and demonstration role in the construction of other types of disciplines and specialties in engineering and the construction of new specialties in other disciplines and specialties in higher education. The construction of New Engineering Major specialty mainly includes specialty setting, specialty training scheme formulation, curriculum system construction, teaching content formation, practical education and teaching system construction, innovation and entrepreneurship education system construction and so on. At the same time, in the construction of new engineering majors, we also need to pay attention to the supporting role of scientific research in the construction of engineering majors and talent training. According to the characteristics of engineering students. Infiltrate innovative education into a series of mechanical basic courses and practical links, and enrich the teaching content with new scientific and technological and social development achievements; Focus on the experimental course, optimize the content of the experimental course, and establish a new experimental course system integrating knowledge, ability and quality.

1. Introduction

In order to adapt to the new round of scientific and technological revolution, industrial reform, new economic development and the continuous improvement of the complexity of the problems faced by human society in the future, it is necessary to cross integrate multiple existing disciplines, or even unrelated disciplines in the past, generate new technologies, form new industries, and cultivate various types of high-quality talents with interdisciplinary ability, innovation and entrepreneurship ability, Promote and lead the development of technology, industry, economy and society in the future [1]. Interdisciplinary integration refers to a new comprehensive discipline system formed by the mutual penetration and integration of two or more disciplines. There is a very important problem in the cultivation of innovative talents, namely interest education [2]. In a negative sense, many excellent students have been trained hard because they are not interested in machinery [3]. In a positive sense, the cultivation of innovation ability needs not only a certain accumulation of knowledge and a solid theoretical foundation, but also a desire and motivation for innovation [5].

Disciplines are the important foundation of modern higher education. Universities are built around disciplines. Under the background of the new economy, interdisciplinary and integrated education has become the inevitable trend of the development of global higher education. The interdisciplinary and integrated integration of various forms and methods of engineering disciplines, which account for the main body of Higher Education, will become the guidance and demonstration of the development of higher education, among which the most representative is the engineering specialty in the construction of new engineering disciplines [6]. Interdisciplinary integration is the most important feature of new majors. This feature needs to run through the whole process of the construction of such majors and talent training. Continuous work needs to be carried out around this feature to ensure that the construction of majors and trained talents are interdisciplinary integration

[7]. The construction of New Engineering Major is a highly challenging, difficult and systematic work of the whole school. We should deeply study the correlation and interaction between different disciplines, find the meeting point, focus and support point of interdisciplinary integration, and form the amplification effect of interdisciplinary integration from the perspective of future development and the future needs of uncertainty and dynamic changes [8].

2. Engineering specialty setting

2.1. Determine the engineering major to be built

New Engineering Major mainly faces the needs of new technology, new industry and future technology and industrial development. Therefore, it is necessary to study and predict the development direction of national and regional future new technology and new industry and its demand for all kinds of engineering and scientific talents from two aspects. From the current development trend, a large number of industrial fields such as new generation information technology, network security, integrated circuit, intelligent manufacturing, high-end equipment, robot, artificial intelligence, virtual reality, biomedicine, modern transportation, efficient logistics, energy conservation and environmental protection, new energy, smart city, smart building and so on need the cross integration of multi-disciplinary disciplines. What is different from the traditional specialty setting is that determining the freshman specialty to be built needs to break the existing discipline and specialty boundaries at the university level, and comprehensively consider and analyze various education and teaching resources of the whole university and their cooperative relationship with the industry. The platform of engineering construction can be either the traditional department entity model, or a new organizational structure of interdisciplinary integration and non entity formed by the correlation of relevant departments and disciplines constituting New Engineering Majors. As shown in Figure 1:

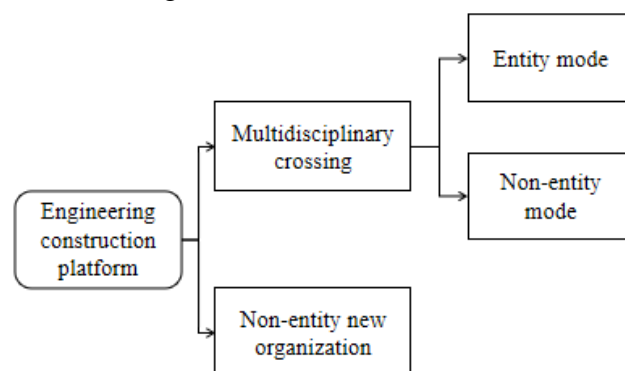


Figure 1 Engineering Construction Platform

The entity model and the non entity model have their own advantages and requirements. What kind of model to adopt requires colleges and universities to comprehensively analyze various factors, including the number of interdisciplinary disciplines, the atmosphere of cooperation between relevant colleges and departments, the complexity of freshman specialty construction and the two-level management model of colleges and universities. The direct connection between new industries or future technology and industrial development can not only substantially integrate relevant disciplines, but also ensure sustainable construction resources, but also have a stable cooperative relationship between government, industry, University and research.

2.2. Clarify the professional training objectives

The main goal of the construction of engineering disciplines and specialties can be expressed as the active layout, setting and construction of engineering disciplines and specialties that serve the national strategy, meet the industrial needs and face the future development, so as to cultivate a group of various cross compound excellent engineering science and technology talents with innovation and entrepreneurship ability, dynamic adaptability and high quality. We should not only

meet the needs of service oriented regional economic, social and industrial development, but also focus on the needs of new technologies, new industries and future technology and industrial development, so as to pay equal attention to service satisfaction, support and leading industrial development. The talent training standard system of freshmen specialty should be composed of national standards, industrial standards and school standards. School standards are not only the concretization of national standards and industrial standards at the school level, but also the specific implementation of freshmen specialty training objectives. They should be able to support the realization of freshmen specialty training objectives. The above five links in the whole process of freshman specialty setting should not only have the in-depth participation of industry and industry experts, but also have the active participation of experts from government industrial departments and research institutes. The purpose of multi-party participation is not only to accurately grasp the current demand for talents in new technologies and industries, but also to clearly grasp the development trend of future technologies and industries.

3. Engineering innovation ability

3.1. Design of engineering curriculum system

The basic curriculum group mainly provides freshmen with a wide range of courses such as humanities and Social Sciences, mathematics and computer foundation. It mainly includes two curriculum modules: Humanities Series and Mathematics Series. The basic curriculum group should focus on cultivating students' humanistic quality, sense of teamwork, sense of innovation, sense of social responsibility, feelings of home and country, global vision and digital thinking. The basic curriculum group of discipline and specialty needs to provide a broad discipline foundation and professional foundation for freshmen professionals from the perspective of future technology, industry and economic and social development. It mainly includes a series of curriculum modules of discipline foundation and a series of curriculum modules of specialty foundation. As shown in Figure 2, the curriculum system of engineering major for freshmen is as follows:

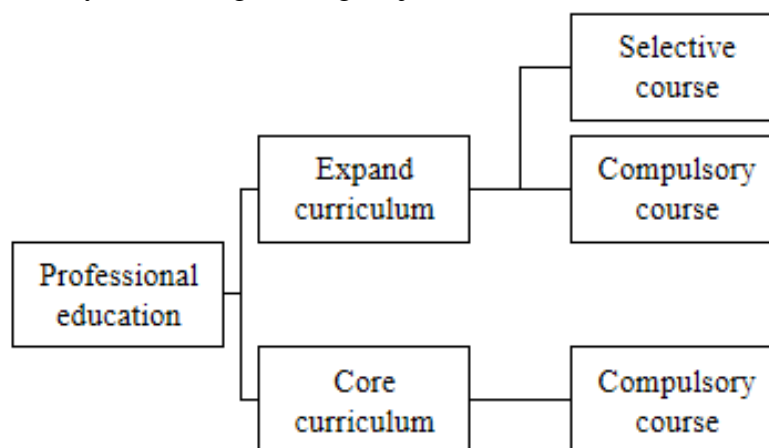


Figure 2 Curriculum system of engineering major for Freshmen

The basic curriculum group of discipline and specialty should pay attention to cultivating students' sense of teamwork, innovation, modern engineering, critical thinking, interdisciplinary and systematic thinking, digital ability, and pay attention to the education of engineering ethics and professional ethics. Professional core courses often need large investment for development, including certain research results in fields related to course content. We can't just integrate and restructure the existing relevant courses, but we must pay attention to highlighting the unique characteristics of Engineering Majors in the courses. Professional core courses should focus on cultivating students' complex engineering problem-solving ability, unstructured problem-solving ability, multidisciplinary team cooperation ability, research and development ability and innovation ability.

3.2. Multi-disciplinary integration of curriculum

The courses in the engineering specialty curriculum system basically need to be formed through the cross integration of the original discipline and specialty courses. According to the needs of realizing the curriculum objectives determined in the freshman professional training plan, or cross or integrate the relevant courses, or develop new courses. The integration of related courses refers to the intersection of the teaching contents of these courses, then mutual penetration, and finally substantive integration into new courses; The development of new courses is aimed at new professional directions or fields that are basically mature. It is necessary to have certain research accumulation and achievements in these directions or fields, which is enough to become the core content of the courses. At the same time, the renewal of the course content will become the norm of these courses. The formation of professional general basic courses needs to cross some existing courses; The formation of the basic courses of Freshmen's majors requires the intersection or integration of the basic courses of related disciplines and majors; The professional core courses of New Engineering Majors often need to integrate the original core courses of the relevant disciplines of New Engineering Majors, or develop new core courses; The professional development courses of New Engineering Majors are generally thematic and dynamic. These courses do not emphasize their own integrity, but pay attention to the innovation and cutting-edge of the content.

4. Conclusion

The construction of engineering specialty is a very complex core work in the construction of new engineering specialty. It has important reference value for the construction of new engineering specialty and emerging engineering specialty. It is typical and representative in the current and future development process of other disciplines and specialties in higher education. In order to cultivate engineering students' new consciousness and ability, we must infiltrate innovative education into the teaching content and curriculum system, and improve the teaching methods and means of the curriculum system of innovative education. Encouraging the combination of teaching and scientific research not only requires the school to adjust the assessment and evaluation indicators and standards for teachers, but also requires the school to introduce special and effective incentive and guarantee measures. Create conditions for more teachers to pay attention to cultivating students' innovative consciousness and ability, and integrate more contents about innovative skills and methods into curriculum teaching; Continue to advocate the combination of teaching and scientific research by teachers and the combination of learning and research by students, guide students to participate in Teachers' teaching and scientific research process, make full use of the equipment resources contained in teachers and laboratories, and form a benign interaction inside and outside classes and schools. Colleges and Universities Participating in the construction of new engineering disciplines attach great importance to it, produce rich and diverse implementation achievements of the construction of new engineering disciplines, and then cultivate a large number of high-quality and various cross compound engineering and scientific and technological talents required by the development of new economy.

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