Construction of Curriculum System of Energy and Power Engineering Specialty under the Background of New Engineering and Technical Disciplines

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Abstract: Combined with the new standards for the construction of “New Engineering and Technical Disciplines”, According to the successful experience in energy and power engineering, higher requirements have been put on the training of energy and power engineering professionals, and a curriculum system must be formulated and improved to suit them.This paper systematically optimizes and integrates the professional curriculum system in the talent training program.Discussed the construction of the curriculum system for energy and power engineering majors from theoretical courses, practical courses to scientific research innovation training, etc.With the goal of cultivating innovation ability, highlighting the combination of theory and practice to achieve the training goal of applied innovative talents.

Introduction

Important national strategies such as "Made in China 2025", "Internet +" and "The Belt and Road"(B&R) have put forward new requirements for the reform and development of higher education in China, and engineering majors are facing new opportunities and challenges.In order to meet the national strategic needs for higher education and talent training, the Ministry of Education actively responded to and vigorously carried out new engineering construction, and successively formed the "Fudan Consensus", "Tianda Action" and "Beijing Guide" [1-2].At present, the construction of "New Engineering and Technical Disciplines" is moving from ideological mobilization to practical action.

Since February 2017, more and more colleges and universities have carried out "New Engineering and Technical Disciplines" professional construction, and the core positioning of new engineering construction is "talent quality".Applied undergraduate colleges are an important base for regional talent training.and the quality of their talent training is directly related to the construction and development of universities and localities.The construction and development of “New Engineering and Technical Disciplines” takes the new economy and new industry as the background, and requires the establishment of innovative, comprehensive and full-cycle engineering education "new concepts",Constructing a "new structure" of disciplines and specialties combining emerging engineering and traditional engineering,Explore and implement a "new model" of engineering education talent training, create a "new quality" of internationally competitive engineering education, and establish and improve a "new system" of engineering education with Chinese characteristics.

Energy and power engineering is a traditional engineering specialty that trains energy and power talents for the country. The energy and power industry is an important pillar industry to achieve the national development strategy. Professionals have broad development prospects.Therefore, in order to train qualified professionals in energy and power engineering, a corresponding curriculum system is required.This paper combines our successful experience in running energy and power engineering

majors, explores effective methods and approaches for realizing the construction of new engineering disciplines in energy and power engineering majors by optimizing and improving the professional curriculum system, updating course content, and reforming teaching methods.[3-6]

Innovate the Talent Training Model and Restructure the Curriculum Training System

In terms of energy and power engineering talent training model, we mainly explore and think about teaching in four aspects.

(1) Strengthen education in basic subjects such as mathematics and physics;

(2) Attention should be paid to the cross integration of disciplines such as mechanics, mechanics, and heat transfer;

(3) Pay attention to the cross integration of machinery, power and energy;

(4) Attention should be paid to the combination of teaching, research, and use, especially to jointly train talents with enterprises and research institutions in the energy industry and build a "teaching-research-use" system

Give full play to the advantages of multi-party cooperation in production, education and research, jointly analyze the development trend of the industry, and determine the clear talent training goals in combination with social talent needs and subject characteristics.Based on theoretical learning, scientific research training, and innovative practice, the strengths of all parties are integrated, the advantages of all parties are coordinated, the training plan is jointly formulated, the training target is explored, and the training plan is improved and optimized.Focus on cultivating the talents' innovative application ability in the field of energy and power, improve the support services for social development, and form a procedural energy and power engineering curriculum system and collaborative training mechanism that integrates theoretical teaching, scientific training, and innovative practice.In terms of basic knowledge, professional knowledge, practical ability, innovation ability, ethics, and scientific and professional quality, the talents have achieved comprehensive and balanced development.

According to the training goals of our university's professional talents, starting from the students' expected learning results, scientifically formulate the training requirements (graduation requirements) and must implement them one by one into specific courses.On the basis of clear training objectives and curriculum teaching objectives, curriculum reorganization, multidimensional integration and overall optimization are carried out.Explore the establishment of core curriculum groups to achieve curriculum optimization goals that are commensurate with the needs of the specialty and have the best overall functionality.Establish advanced concepts of innovation and entrepreneurship education, and integrate innovation and entrepreneurship education into the entire process of talent training.Promote the development of innovation and entrepreneurship education with engineering education reform, and incorporate the goals of innovation and entrepreneurship education into public education, professional education, and the second classroom system.By appropriately reducing the number of classroom hours, strengthening practical teaching, increasing elective courses, offering innovative and entrepreneurial courses, and carrying out extracurricular activities, the educational and teaching activities inside and outside the school and outside the school form an organic whole Ensure the smooth implementation of talent training programs and the complete realization of talent training goals.In summary, we set up a curriculum system from four aspects: general education, professional education, and practical education. The curriculum structure is shown in Fig. 1.

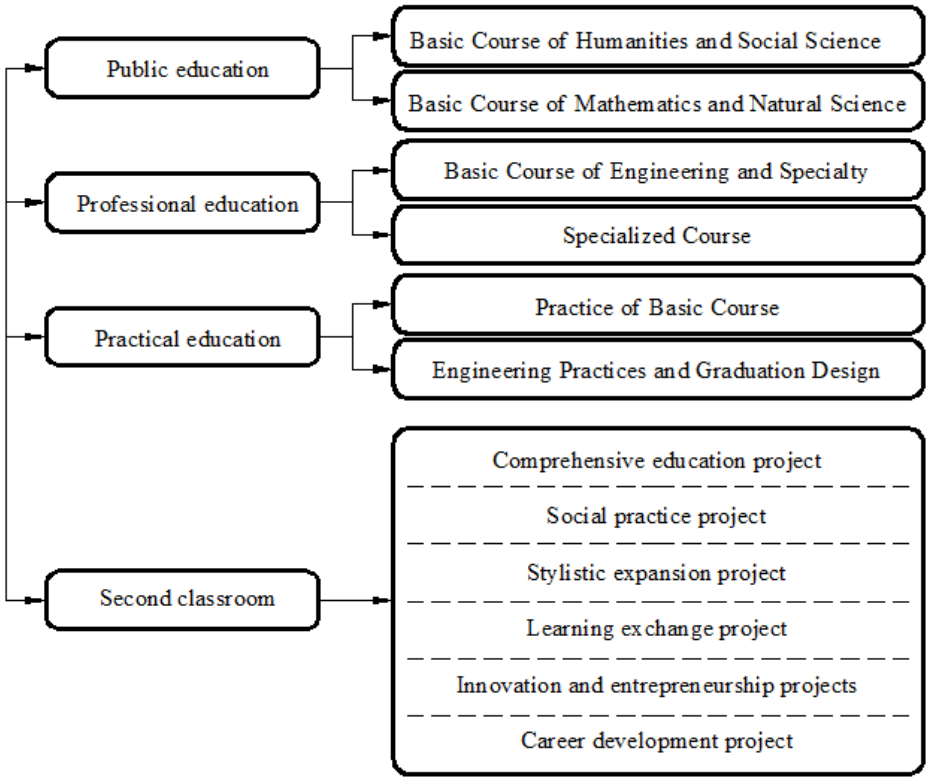

Figure 1. Course architecture diagram

Theoretical and Practical Courses.

According to the position of the curriculum in talent training, establish a modular curriculum system and optimize the combination of various courses. The course architecture is shown in Fig. 1.Engineering majors are required to control the total credits within 170 credits, of which humanities and social science courses account for at least 15%, mathematics and natural science courses account for at least 15%, engineering major courses and professional courses account for at least 30%, engineering practice Graduation design (thesis) accounts for at least 25% and the second class is at least 4 credits.

The curriculum is guided by the requirements of the “New Engineering and Technical Disciplines”, takes social needs as the goal, and improves the practical ability as the core. It emphasizes the organic combination of theory and application, highlighting case analysis and practical teaching.Continuous innovation and development can reflect the discipline's cutting-edge and practical energy and power engineering curriculum system.There are four main ways:

(1) The teaching content of general basic courses, professional basic courses, and professional courses shall be set up according to the principle of "necessary and general", and appropriate elective courses shall be appropriately added to continuously expand the international vision of students majoring in energy and power engineering.

(2)Constructing online courses and enriching learning resources: Multi-party industry-university-research joint construction of "Flipping Classroom" joint courses or supporting experimental projects, construction of "Massive Open Online Course" (MOOC), "video micro-class", development of theoretical or experimental courses Supporting courseware, experimental projects, experimental instructions, teaching materials or teaching demonstration software and hardware systems.

(3)Project-based practical courses and carefully constructed training cases: taking projects as carriers, integrating theoretical learning and ability training, so that students' learning styles can be transformed from individual learning to cooperative learning.Not only cultivate comprehensive

professional skills, but also enable students to understand the working environment in practice, integrate theory with practice, improve the ability to analyze, judge and solve problems, and teamwork.

(4)Launch innovation education. Focusing on the cultivation of talents that promote the spirit of innovation and innovation ability, the industry-university-research collaboration innovation mechanism is used as a platform to deeply dig teaching methods that conform to applied innovation, and form replicable promotion experiences. Therefore, it is necessary to create a gradual and step-by-step practical teaching system framework for energy and power engineering majors.

Combined with the successful experience of energy and power engineering majors, the professional courses were reasonably optimized and integrated during the talent revision process, and five 168-hour professional theory courses were optimized and integrated into four 120-hour courses.At the same time, by opening professional characteristic courses, students' consciousness of innovation and entrepreneurship and internationalization ability are cultivated.For example, professional introductions,subject-leading lectures, and introduction to professional safety by the subject leaders and external engineering and technical personnel.Promote students 'humanistic quality, engineering consciousness, professional quality and innovation and entrepreneurship consciousness. Interdisciplinary courses or professional elective modules can meet and promote students' personalized learning and development.Cultivate application-oriented innovative talents that are more suitable for social needs through practical teaching [7].During the revision of the talent training program of our university, the emphasis on strengthening the cultivation of students' practical skills, engineering quality and innovation ability, the continuous optimization and integration of professional practice links, and appropriate increase of the proportion of professional practice teaching links.in order to cultivate Students' innovative and practical ability provides a strong guarantee.In the new version of the talent training program, the credits in the practice teaching account for about 27.4% of the total credits, an increase of 8 credits compared to the previous, accounting for about 5%.The heavy and orderly practice teaching links run through the entire process of talent training, forming a layered and modular practice teaching curriculum system, ensuring that each link of practice teaching is progressive.The organic combination of social practice inside and outside the classroom during the training of talents has been realized. During the implementation process, the cultivation of students' practical skills, engineering consciousness, innovation ability and professional skills was emphasized.[8,9]

Research Innovation Training.

In order to better achieve the goal of cultivating new engineering professionals, by creating a multi-faceted scientific research and practice training platform, students' innovation ability and comprehensive practical quality are improved.By establishing an innovation platform, students are encouraged to actively participate in extracurricular scientific research activities, subject lectures, etc., so that students learn to think deeply, integrate theory with practice, solve problems autonomously and exploratoryly, and improve teamwork awareness [10].In the process of talent training, add courses such as engineering software training, adhere to the combination of engineering software design and analysis tools and practical applications, so that students learn how to choose appropriate methods to analyze and solve different problems and different methods of the same problem, and emphasize the cohesion of students' coordinated training with divergent thinking, focusing on training students' knowledge transfer ability.Encourage students to extensively study relevant domestic and foreign literature, and improve their ability to discover scientific research problems in shared academic resources; regularly participate in academic exchanges and project discussions, learn methods, methods and techniques used by others in analyzing and solving problems; participate in subject competitions To apply what you have learned, try to bridge the gap from learning to use, and exercise your ability to analyze and solve problems.Focus on training students 'ability to find, analyze, and solve problems, especially students' knowledge transfer skills between different analysis methods for the

same problem and similar analysis methods for different problems.To this end, a research and innovation training program for energy and power engineering is proposed, as shown in Table 1.

Table 1 Research and innovation training programs for energy and power engineering majors

No.	research innovation training goals	scientific research innovation training platform
1	cultivation of interest and vision, scientific spirit and values	a series of professional lectures, expert academic reports, academic forums
2	practical skills and experimental skills, discovery analysis and problem solving skills	curriculum design, project training, energy discipline competition, national college student mechanical innovation design competition, national college student mathematical modeling competition
3	Literature review, study and sharing capabilities	Document translation, academic reports and seminars, seminars
4	Comprehensive quality such as scientific method and creative thinking	Experimental and scientific research projects, dissertations

In Terms of Practical Innovation.

In terms of practical innovation, it is mainly achieved through comprehensive curriculum design, project research and development, joint research and dissertation.This requires continuously deepening the participation of multi-party collaborative education, expanding the breadth of collaborative education, strengthening the construction of practice bases and the construction of collaborative innovation laboratories in schools.Through perfecting the "industry-industry-research" cooperation model, establishing a mutually beneficial win-win mechanism, the joint innovation laboratory established with enterprises and institutions guides and trains students from three aspects: application project development, applied academic competitions, and innovation project research.Let students participate in the development of projects with practical application significance. Through academic competitions, they can quickly improve their scientific research capabilities, strengthen academic exchanges, and fully tap their own innovation capabilities.Effectively improve the innovative application ability and professional ability of energy and power engineering professionals.

Through the second classroom to complete the courses and other education and teaching links in the training plan, students are encouraged to actively participate in subject competitions, participate in social activities of community activities, and participate in teaching and research projects of professional teachers.Actively encourage students to participate in professional training and study to obtain relevant professional training certificates, and effectively improve students' ability to solve practical engineering problems.Establish a talent training system that closely integrates the first classroom and the second classroom, and guides students to participate in a variety of colorful second classroom activities.Create conditions for students' personality development and unique talents in various ways.Cultivate students' creative thinking, practical ability, communication ability and teamwork spirit,Promote the development of students' personality, make the students really improve their practical ability and engineering quality, achieve the cultivation of innovative ability, enhance employment competitiveness, and then be recognized by employers.

Conclusion

Starting from the new requirements for the construction of new engineering disciplines, the construction of the curriculum system for the specialty of energy and power engineering was discussed

from three aspects: the setting of theoretical and practical courses, scientific research innovation training, and practical innovation.Focusing on improving students' innovation ability as the core, emphasizing the organic combination of the theory and application of the curriculum system, highlighting the status of curriculum case analysis, project training and practical exercise, and constantly optimizing and improving the disciplines and innovation Energy and Power Engineering Course System.In order to meet the social needs of energy and power engineering professionals to achieve the goal of talent training.

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