

# Analysis on the Reform Strategy and Effect of Applied Talents Training in Energy and Power Engineering

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**Abstract.** In order to achieve the goal of training applied talents in energy and power engineering. This paper studies the reform strategies of professional development concept, professional orientation, overall optimization of curriculum system, and teaching methods and means, adapt to the needs of industry development and local economic and social application-oriented technical talents, and analyze and summarize the reform results and positive effects of the applied talent training model. The results show that the teaching strategy can achieve the "five parts form a system" application-oriented talent training goals. The reform strategies and methods for the application reform of applied talents in energy and power engineering are validated in this paper.

## Introduction

With the urgent demand for applied technology talents, it is required that applied technology talents must be able to closely relate to the social environment, integrate and innovate multidisciplinary expertise, and be able to creatively solve practical engineering problems and system engineering problems. The traditional undergraduate education is based on the principle of "thick foundation, broad professionalism, strong ability and high quality". In addition to the general training objectives of ordinary undergraduate education, applied undergraduate education should emphasize the application of talents. The characteristics of construction and management are mainly embodied in the combination of academic, technical and professional, and the improvement of students' social adaptability and vocational skills. [1]

## Problems in the Traditional Talent Training Mode

**Talent Training and Social Needs are out of Touch.** With the rapid development of the economy and society, China's higher engineering professional education has exposed many outstanding problems. Facing the demand market of a large number of engineering professional and technical talents in the society. On the one hand, it is difficult for employers to recruit their needs and their qualifications. On the other hand, there are a large number of technical talents. But there are a large number of graduates of engineering majors who are unemployed or unable to find a satisfactory situation. The main reason for this situation is the various drawbacks of traditional education. The most prominent problem is that the technology and social needs taught by the existing higher education are different from the skills that the enterprises actually need. The students only learn the theory and lack practice. Knowledge but lack of innovation, lack of applied practice and poor overall quality.

**The Course System is Unreasonable.** The curriculum system plays an important role in the process of talent cultivation and is the main carrier for the realization of talent training objectives. In the training of traditional engineering professionals, due to the unreasonable setting of curriculum system and course content, the content of engineering practice is insufficient, the practical knowledge is not enough, the theory teaching is emphasized, the practical teaching is weak, the course content is old, the teaching is boring, lack of systematic curriculum optimization and content integration. Content

integration seriously affects the cultivation of students' comprehensive application practice ability. [2,3]

**Teaching Methods and Means.** Although the traditional teaching methods and methods are conducive to the play of the leading role of teachers, which is conducive to the regulation of teaching process and the management of teaching organization, the teaching environment is lower and the teaching efficiency is high. However, its defects are also obvious. As the subject of cognition, students can only passively accept knowledge in the whole teaching process, ignoring the students' initiative, which can not afford to cultivate high-quality application. Innovative talents are important, so we must change the traditional teaching model. [3,4]

## Reform Strategy of Applied Talents Training Mode

**Professional Development Concept and Positioning Strategy.** After years of professional education, our energy and power engineering profession has always been guided by industry development and social needs, adhere to the application of OBE school philosophy, and cultivate applied engineering and technical personnel to meet social needs. According to the experience and research of the professional education in the past ten years, combined with the actual and social talent needs of our school and the long-term development strategy, we have determined the reasonable professional talent training goal and development orientation by long-term adherence to the full participation of professional teachers in teaching research and reform practice. Gradually optimize and form a professional school-running idea of “five parts form a system” applied talents who are more suitable for social needs and have strong humanities, scientific, professional, practical and innovative abilities. As shown in Fig.1.

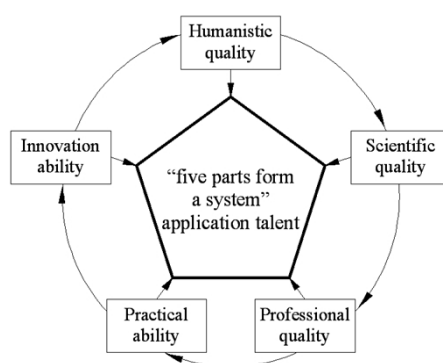


Figure. 1 “ five parts form a system” application talent training goal

The “ five parts form a system” application-oriented talent training enables post-graduate students to independently undertake more comprehensive engineering tasks, meet the needs of industry-oriented talents, and have a strong sense of professionalism and responsibility to better serve society. Compared with ordinary applied talents, the “ five parts form a system” application talents have stronger sustainability, plasticity and social adaptability. In the past few years, through the gradual adjustment, optimization and improvement, the development concept of the profession is in line with the concept of result-oriented education. The school-running orientation is clear, the quality of teaching is obviously improved, the quality of personnel training is continuously improved, and the effect of running a school is remarkable. [4]

**The Overall Optimization Strategy of the Curriculum System.** (1) Course system construction based on top-level design. The construction of the curriculum system and the setting of course content are important breakthroughs in the realization of the training objectives of applied talents. The construction of the curriculum system is an important part of the talent training model. In the process of formulating the talent training program, our school requires to fully absorb the advanced educational concepts and methods of domestic and foreign universities, especially in accordance with the concept

of outcome-oriented education (OBE). The successful experience of the National Engineering Education Accreditation Program of the Washington Accord combines the long-term development strategy of talents with the social needs of applied talents, reasonably determines professional talent training objectives, develops specifications, and scientifically designs and constructs curriculum systems for applied talents. The school's process and training model, the school carried out a reasonable top-level design. Through a variety of means and teaching reform practices, improve the quality of education and teaching, and effectively achieve the ability to enhance students' innovation, entrepreneurship and employment. [4]

According to the status of the course in the cultivation of talents, a modular curriculum system is established to optimize the combination of courses. Our school requires that the total credits of engineering majors should not exceed 170 credits. As shown in Table 1, the curriculum system and the post-reform credit ratios meet the requirements of the engineering education professional certification standards, which can ensure the requirements of professional applied talent training.

Table 1 Proportion of credits after the reform of the professional curriculum system

	<b>Engineering education professional certification standard requirements</b>	<b>The proportion of credits after the reform of the curriculum system</b>
Humanities and Social Sciences	$\geq 15\%$	18.87%
Mathematics and Natural Sciences	$\geq 15\%$	17.75%
Professional Foundation and Professional Courses	$\geq 30\%$	33.55%
Engineering Practice and Graduation Design (Thesis)	$\geq 20\%$	27.42%
Second Classroom	--	2.35%

(2) Optimization and Practice Based on Professional Curriculum System. ① Optimize the integration of professional theory curriculum system. During the undergraduate course, the content of each course should be connected to each other, and the connection and matching between the courses must be considered. Combined with the energy and power engineering practice of our school, the student's teaching plan process is divided into three parts: the first part is the public basic course, which mainly includes college English, advanced mathematics, university physics, computer and other courses; the second part is Engineering and professional foundation courses, including engineering mechanics, engineering fluid mechanics, thermodynamics and electrical and electronics courses; the third part is the professional direction courses, mainly related to thermal engineering, refrigeration technology and internal combustion engine three professional courses. The curriculum system can be divided into three main lines: the first main line is fluid and thermal courses, such as engineering fluid mechanics, engineering thermodynamics, heat transfer, combustion and other courses; the second main line is engineering mechanics courses, including theoretical mechanics, material mechanics, etc.; the third main line is computer courses. In the course of the teaching plan, you must consider the semester of the course you are studying to determine a more reasonable professional teaching plan. [5]

Combining the characteristics of our school's energy and power engineering professional experience, we have rationally optimized and integrated the professional courses in the process of talent revision, and optimized the integration based on the common courses of thermal testing technology and heat exchanger principle. There are four professional courses for four, which reduces the repetition of teaching content. In order to meet the needs of the society and the development of students' individuality, three professional courses are offered in each of the three professional courses, which fully guarantees the professionalism of the students' professional knowledge. At the same time, through the establishment of professional elective courses, students' knowledge will be further expanded, and students' scientific and professional qualities will be further improved. Through the

establishment of professional courses, we will cultivate and improve students' sense of innovation and international vision. For example, professional leaders, academic frontier lectures, and professional safety introductions, such as academic leaders and external enterprise engineering and technical personnel, enhance students' humanistic quality and engineering awareness, professional quality and innovative entrepreneurial awareness.

② Strengthen the practice teaching link. In the process of revising the talent training program, our school's energy and power engineering program focuses on strengthening the cultivation of students' practical ability, engineering quality and innovation ability, continuously optimizing and integrating professional practice links, and appropriately increasing the proportion of professional practice teaching links. The modularized and practical teaching curriculum system forms a thick and orderly practical teaching link, which provides a strong guarantee for the cultivation of students' innovative practical ability. As shown in Table 2, the proportion of credits for the practice teaching links of the new training program is increased 8 times. Credits, nearly 5 percentage points, ensure that all aspects of practical teaching are gradual, achieving an organic combination of in-class and out-of-class and social practice in the process of talent cultivation, focusing on further strengthening students' practical ability, innovation ability, engineering awareness and vocational skills.

Table 2 Proportion of credits for practical teaching links in energy and power engineering			
	<b>Total credits</b>	<b>Practical credits</b>	<b>Practice as a percentage of total credits</b>
2012	170	38.5	22.6%
2016	170	46.5	27.4%

Through the modules of computer, experiment, internship, course design, training, graduation design, etc., increase the training effect on students' engineering quality education. It further narrows the distance between the professional knowledge of students and the actual production of engineering, and strives to make students truly improve their engineering quality and comprehensive innovation and practical ability.

③ Strengthening the ability to innovate through the second classroom. Through the colorful second class, guide and encourage students to participate in the course surgical technology activities and social practice, actively participate in the discipline competition, participate in the teacher's scientific research, let the students learn to think deeply, connect the theory with the reality, and independently explore problems and improve the problem. The sense of teamwork further strengthens the students' theoretical connection with practical and hands-on ability, develops the professional vision of students, and effectively improves students' ability to solve practical problems in engineering. Through the mutual promotion and close integration of the first classroom and the second classroom in the talent training system, we will further create strong conditions for students' personality development and characteristics, and effectively achieve the students' ability of innovation, practice, communication and teamwork, and truly improve their practical ability. And the quality of engineering, to achieve the goal of training the ability to innovate, and enhance the competitiveness of comprehensive employment [4,5,6].

④ Course construction. Pay attention to the importance of curriculum construction in the process of talent cultivation, adhere to the standards and requirements of quality courses and excellent courses, improve relevant teaching resources, and actively create professional excellent courses and quality courses. By effectively strengthening teaching standards, standards and improving teaching quality, the construction and development of the entire profession has been improved. Through the gradual improvement and standardization of compulsory courses and professional elective courses, formulate reasonable and practical syllabus and curriculum standards, improve and select a series of high-quality teaching materials, reference books and multimedia courseware materials to strengthen the construction of the curriculum. Combine the different characteristics of professional basic courses and professional courses, actively improve the assessment methods, strengthen the construction and improvement of test questions, gradually implement the separation of teaching and test, unified

propositions, standardize the mechanism of examination and assessment, and then ensure and improve the quality of curriculum construction.

**Strategies for Reforming Teaching Methods and Means.** Teaching methods and teaching methods are the key to carrying out teaching activities and achieving teaching goals. Through the continuous reform and practice of the teaching methods and means of the curriculum, vigorously promote the modern teaching methods and applications, reform the deficiencies of the traditional teaching model, and carry out innovations in multimedia teaching, MOOC online, virtual simulation and other teaching methods, focusing on the active atmosphere of the classroom, so that students Actively cooperate with the participation of teaching, thus mobilizing students' initiative and innovation ability, strengthening classroom interaction, improving teaching quality and effectiveness, and continuously improving the quality of personnel training through continuous efforts to explore diverse teaching methods.

## Reform Results And Positive Effects

**Reform Practice Results.** With the continuous deepening of subject research and teaching reform and practice, the overall school-running thinking of energy and power engineering in our school is clear, the positioning is correct, the quality of professional personnel training is steadily improved, and the professional development trend is good. By constructing a diversified talent training platform, students have created a good platform to participate in academic competitions or scientific and technological innovation training, and students' innovative practice ability has been significantly improved. In recent years, professional students can actively participate in academic competitions, teacher research and other work. The proportion of students who have applied for academic competitions such as college students' innovation and entrepreneurship training programs, mathematical modeling competitions, and mechanical innovation design competitions has increased year by year, and has won many national, provincial, and school-level awards. The pass rate of the Computer Rank Examination and the College English Test Band 4 and 6 has also increased year by year, and the students' engineering innovation practice ability has been greatly improved. The employment rate of graduates has been maintained at over 95%. The comprehensive ability and quality of graduates have also been demonstrated in the workplace. The employment units have fully recognized and the social reputation of professional schools has been continuously improved.

**Achieve the Goal of Applying Innovative Talents.** Our school's energy and power engineering majors have been based on the OBE concept for engineering quality education reform for many years. The “five parts form a system” application-oriented professionals have been trained to position themselves, and have achieved better through the gradual adjustment, optimization and improvement of the curriculum system. The goal of talent training has improved the quality of talent training and the quality of running schools has continuously improved. The specific achievement of the target situation is shown in Table 3.

Table 3 The goal of the professional curriculum system reform to achieve talent training

Sorting Classes	Course characteristics	Mainly achieve the goal				
		Humanistic quality	Scientific quality	Professional quality	Practical ability	Innovation ability
Public foundation course	Solidity	✓	✓			
Engineering Foundation and Professional Foundation Course	Generosity	✓	✓	✓		
Professional course	Fine specificity	✓	✓	✓	✓	
Practice teaching	Strengthening	✓	✓	✓	✓	✓
second classroom	Richness	✓	✓	✓	✓	✓

**Improve the Quality of Teaching and Subject Professional Construction.** (1) A reasonable talent training model has improved the quality of professional talents. (2) Reasonably revised the talent training program and strengthened the construction of the professional curriculum system. (3) Improve the quality of professional teaching and research activities and improve the overall teaching level of the

profession. (4) Reasonably constructing the echelon of teachers and strengthening the construction of professional faculty.(5) Strengthened the communication and communication of teaching, and promoted the development of subject professionalism. (6) The research results tested in practice provide reference for the development and reform of related majors.

## **Conclusion**

The field of energy and power is the first-class major scientific and social problems facing the world. The energy and power engineering majors are more representative engineering majors. Combining the teaching reform and strategy analysis of our school's energy and power engineering majors for several years, through analysis and reference Advanced talent training mode and concept, relying on the reform of professional curriculum system and curriculum construction, exploring effective ways to train applied talents in energy and power engineering, so as to achieve the " five parts form a system " application-oriented talent training goal for social and economic development construction services.

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## **References**

- [1] S. Lin:Journal of Jilin Agricultural Science and TechnologyCollege, (2016) No.2,p.111-113.(In Chinese)
- [2] Z.G. Chen, X.H. Yang, J.R. Wu, B.C. Fu, Z.N. Xu and X.W. Zhang, Higher Engineering Education Research, (2012)No.01,p.75-80. (In Chinese)
- [3] Z. Li, Chinese University Teaching, (2012)No.03,p.12-14+56. (In Chinese)
- [4] X.F. Lv, Journal of Jilin Institute of Chemical Technology,( 2016)No.12,p.54-57. (In Chinese)
- [5] Y.W. Yan, J.Z. Li, X.M. He and J.H. Li, Science and Technology Innovation Herald, (2015)No.24,p.194-196. (In Chinese)
- [6] Y. Xie, Z.W. Shi, X. Wang and Y.C. Gu, Today Science Park,(2009)No.18,p.209-210. (In Chinese)