

## Research on Cultivation Mode of Material Processing Talent for Industrial Plan in the Iron & Steel Industry

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**Abstract.** In order to construct the talent cultivation of material processing for industrial plan in Wuhan University of Science and Technology, this article analyzed the background and characteristics of industrial plan, and explored and constructed new talent cultivation mode of material processing for industrial plan from the construction of curriculum system, teaching methods, experiment platform and teaching team as well as enterprise-and-school joint cultivation.

### Introduction

In order to achieve rapid economic development in Hubei province, the provincial government issued "ten key industrial restructuring and revitalization plan of Hubei Province" in November 2009, which proposed ten big industry development ideas and policy measures, such as electronic information, automobile, iron & steel, non-ferrous metals, petrochemical, textile, equipment manufacturing, shipbuilding, light industry and logistics and so on [1,2]. The provincial government issued "opinions on accelerating the development of strategic emerging industries" in 2010, which decided to accelerate the development of energy-saving and environmental protection, new energy, new energy vehicles, electronic information, new materials, bio pharmaceutical, bio-breeding and other strategic emerging industries in Hubei province [3]. Development of ten big industries and strategic emerging industries proposes new and higher requirements for talent cultivation.

In order to well satisfy with talent requirements of enterprises and improve economic development of our province, the provincial department of education issued "notification about the implementation of the talent cultivation plan for strategic emerging(pillar) industry in colleges and universities of Hubei province" at August 31, 2010 [4,5]. Material forming and control engineering major (material processing) of Wuhan University of Science and Technology was listed as talent cultivation plan of pillar industry in 2012. How to construct innovative talent cultivation mode of material processing major to meet the demand of iron and steel industry becomes more and more urgent [6-8].

### Feature of industrial plan for the iron and steel industry

**Urgency.** In the past 15 years, with the rapid development of China's real estate industry, automotive industry, machinery manufacturing, electronics and shipbuilding industry, the demand for iron and steel was also increasing. China's steel production capacity had been explosive growth, and production capacity had reached the first in the world. In recent years, China's real estate and manufacturing industries have matured even shrink, and steel overcapacity and unreasonable product structure severely restricts the development of China's iron and steel industry. The low-end wire & rod and sheet are serious surplus, and high-end automotive sheet, aircraft carrier steel, military and specialty steel products needed to import are serious shortage. Some steel products abroad are restricted to China. The mainly causes are as following: ① the outdated production equipments; ② backward production technologies; ③ lack of practical engineering and technical personnel; ④ lack of creative talents; ⑤ lack of compound talents. To promote rapid and healthy development of the iron and steel enterprises,

we must improve the enterprise independent research and development ability and executive ability, and enhance the core competitiveness of iron and steel enterprises. Core competitiveness of iron and steel enterprise is the advanced technology, and talent is the key to the advanced technology to form. So cultivation of innovative talents for developing new technologies and practical and compound talents for production performance in the steel industry become more and more urgent[9].

Industrial plan is a breakthrough of higher engineering education in Hubei province, and focuses on innovative and practical education for the actual status of pillar industry in our province. Currently, there is not suitable training mode for the present situation of iron and steel industry in our province, and universities need bold and long-term exploration.

With the rapid development of globalization, domestic iron and steel enterprises participating in international trade and international competition are more and more frequently. Iron and steel enterprises lack of a few international talents who understand not only specialty and English and also management. At present, the Wuhan Iron and Steel Group and other iron and steel enterprises in Hubei province participate in international procurement of iron ore, overseas mergers and acquisitions business, investing and building factories in Brazil as well as a large number of international product sales and other overseas production activities.

**Innovative.** Industrial plan satisfies needs of enterprises for talents cultivated by colleges and universities, and eliminates gaps between talent cultivation in colleges and universities and talent requirements of enterprises. Colleges cultivate talents in the direction of demand of enterprises, and strengthen practical ability of talents, at the same time reduce cycle time and cost of personnel training of enterprises.

Industrial plan translates evaluation system of students from test scores to cultivate the ability, and attaches great importance to the learning and practice process instead of results through self-assessment, peer assessment of students, teachers comment and business mentors comment, etc.

Characteristics of talent cultivation for industrial plan are as below: ① enterprises deeply involve in the training process; ② strengthening the cultivation of engineering practice and innovation ability of students; ③ eliminating gaps among various specialized courses or majors of universities, and coupling various courses in horizontal and vertical directions for demand-oriented of enterprises for expanding areas of expertise and cultivating high-quality multi-field compound talents.

Industrial plan changes talent cultivation mode from the traditional school cultivation alone or shallowly joint cultivation of school-enterprise to the deeply joint training mode of school-enterprise, carries out major talent training and major construction work, jointly develops talent training program, major teaching plan and course system, and jointly builds practice bases and double structure teachers with the iron and steel enterprises in our province.

### **Optimization of curriculum system**

Material forming and control engineering major has obvious interdisciplinary characteristics, i.e., the characteristics of mechanical discipline, material discipline and metallurgy discipline in our university. Original curriculum system of material forming and control engineering major can not meet the materials processing experimental class's requirements for industrial plan in Wuhan University of Science and Technology, also can't meet the practical needs of personnel training and market. Thus material processing major as a strategic pillar industry must innovate original curriculum system, and train students' profound humanistic literacy, broad theoretical foundation and stronger vocational ability based on the status and development needs of the metallurgical industry. With the improvement of automation degree, extension of enterprise production chain and improvement of internationalization degree, Demand for compound talents in iron and steel enterprises increases. Experimental class for Industrial plan must carry on the omni-directional reform of curriculum system. Curriculum system of experimental class can be set according to the module orientation, and divided

into four basic modules: basic course module (public basic courses, subject basic courses and specialized basic courses), specialized course module, quality development module and practical courses module (Table 1). New curriculum system fully embodies characteristics of the scientificity, rationality, avant-garde and integrity. Public basic course teaching strengthens the oral English and computer programming teaching. Subject basic course reinforces teaching of mechanics, materials science and metallurgical principles. Quality development course module intensifies the teaching of materials research methods, the finite element method and rolling automation control. In order to maximize the teaching effect and overcome the disadvantages of original curriculum system, such as sui generis courses and weak comprehensive application, curriculum system was constructed with the main line of knowledge, ability and quality integration, and optimized all kinds of courses teaching resources. Focusing on the integration of the related courses around project implement, it expands professional field, and condenses basic theory content for cultivating students' multidisciplinary comprehensive knowledge and ability to analyze the problem.

Table 1 Academic credit requirements for graduating.

Type of course	Academic credit	Type of course	Academic credit
1、Basic course module	104	2、Specialized course module	35
Public basic courses	38	3、Quality development module	10
Subject basic courses	40	4、Practical Course module	25
Specialized basic courses	26		

### Construction of item teaching method for theoretical teaching

The item teaching method is introduced into teaching to overcome the disadvantages of the traditional teaching mode. The teachers and students carry out teaching activities through the implementation of a complete project together, which changes follower status of students of the traditional teaching method. The item teaching method advocates "learning by doing" or "learning in doing", emphasizes the students as the main body, teachers as guidance and item as the medium, and improve the students' comprehensive ability through item implementation and target finish. Students are assigned suitable difficulty and real projects or assumption projects based on actual engineering projects. The teachers teach theoretical knowledge related projects and guide students to develop project plan and implement project plan [10].

The teaching mode of school-enterprises cooperation is introduced into teaching. Teaching contents involved in practical aspects are passed on by virtual platform model aids, laboratory equipment and production enterprises. specialized teachers have tried "in-kind" teaching methods. For example, rolling process, material forming equipment and other courses are teach in university laboratories or steel virtual platform site. Dissertations selected are closely related to practice and topic of scientific research work of teachers. Students train the engineering quality and scientific research ability in learning.

A variety of performance evaluation system are combined. Student achievement evaluation are carry out by student peer assessment combining evaluation of full-time teachers and business mentors. Focusing on the process of project implementation instead of the project results.

### Establishment of multidimensional experimental platform

Experimental class of materials processing for industrial plan has a number of practical teaching hours. Practical teaching is divided into three stages of basic ability, engineering practice ability and independent innovation ability. Basic ability and innovation ability training are completed in the school, while the engineering practice ability training is completed in metallurgical enterprises. From improving students' comprehensive ability and innovation ability in engineering design, the campus practical teaching content divided into four levels (basic, comprehensive, design and innovative) based

on mastering degree to knowledge in different stages are carried out on the two experimental platforms (basic comprehensive experiment platform and design innovation experiment platform). Basic comprehensive experiment platform comprised of software and hardware environment of provincial material science experimental teaching centre and departmental opening laboratory mainly go on the first three level practical teaching to cultivate the students' practical ability. Design innovation experimental platform comprised of software and hardware environment of the State Key Laboratory of Refractories and Metallurgy and Key Laboratory for Ferrous Metallurgy and Resources Utilization of Ministry of Education and other labs focuses on the cultivation of students' innovative ability. Off-campus practical teaching carries out "231" mode where "2" refers to two kinds of abilities of the practice and industry service, "3" means the combination of the three aspects, i.e. "teaching, production and scientific research", "plant, place and school" or "classroom teaching, extracurricular study and practice", and "1" refers to apply teaching method of functional element method into practical teaching. "231" practical teaching relies on WUST-WISCO joint practice base, xinyegang and echeng iron and steel corporation practice base, and so on to develop material processing practical teaching with the characteristics of iron and steel metallurgy. Enterprise experts and teachers guide students' off-campus practical teaching together to cultivate the students' engineering consciousness.

### **Construction of teaching team**

Basic premise of high-quality teaching is reasonable teaching team configuration. Faculty construction system is undoubtedly foundation and direct guarantee for high quality personnel training. Teaching staff construction must be flexible in mechanism and rational in configuration and implement ideas of "going out and inviting in". On the one hand, Encouraging existing full-time teachers to further education, visiting and academic exchanges at other colleges and universities with professional advantages at home and abroad, which improve teachers' theoretical level and scientific research ability. Promoting teachers to short-term work and lead the students to practice in the iron and steel enterprise for expanding experience in engineering practice of the full-time teachers. On the other hand, actively engaging metallurgical experts and academic leaders from colleges and institutes at the home and abroad and engineering and technical personnel with rich experience from the iron and steel enterprises to participate in the school's teaching and scientific research work. Breaking major limitation, and constructing a innovative and multidisciplinary teaching team comprised of various major teachers from the material processing, materials science, metallurgy and automation, and so on and experts and engineering technicians from research institutes and iron & steel enterprises. Forming multi-directional and multidisciplinary teacher team with basic theory, engineering practice experience, the latest scientific and practical management. Students can study all kinds of knowledge related to future work position. More importantly, multi-source teacher team make demand of iron and steel enterprises agree with students' abilities cultivated by teaching team with rich multidisciplinary knowledge and experience.

### **School-enterprise joint cultivation**

**Selection of student.** Experimental class students for Industrial plan are enrolled from separate entrance examination and the first-year engineering undergraduates by written test and interview on a voluntary basis. The experimental class candidates must have high foreign language level, solid chemical foundation, strong autonomous learning ability, high comprehensive quality and keen interest in the material processing major in iron & steel industry. Experimental class scale must be controlled in 30 people. Experimental class adopts small classes teaching in all courses. Students of experimental class are arranged tutors from a freshman to instruct learning and research work.

**Cultivation of academic credit system.** For operational convenience, the traditional cultivation mode of material processing major adopted academic year system. Experimental class for industrial plan adopts a flexible full-credit system cultivation mode and a four-year undergraduate school system in general. Students of experimental class can complete their studies in three to six years. When finished total credits, students can graduate or pursue graduate study in advance.

**Joint cultivation of school-enterprise.** Experimental class of material processing for industrial plan adopts school-enterprise joint and order (directional) cultivation mode. Students of experimental class are cultivated commonly by school and the related enterprises in Hubei province. School and enterprises commonly draft talent training program and professional teaching plan, develop courses, build the internship practice base, and construct dual-teacher team. Experimental class adopts talent cultivation mode of 3.5 + 0.5, where 3.5 years are basic theory and engineering practical teaching period, and 0.5 years are the enterprise real role practice stage. Engineering practice quality cultivation is always the main line in the process of student cultivation of experimental class.

## Conclusion

Research on cultivation mode of material processing talent for industrial plan in the iron & steel industry contributed to the higher education closely combined with social and economic development, and guided colleges actively adapt to the transition of economic development pattern and economic restructuring, optimized the curriculum system, teacher team, teaching methods and talent cultivation mode, deepened reform of talent cultivation model, and explored cultivation mode of applied, innovative and compound talents urgently needed in the iron and steel enterprises of our province.

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