

Research on Organization and Implementation and Promoting Process for Excellent Engineer Cultivation

—Electrical Engineering and Its Automation Specialty, Lanzhou Jiaotong University

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Abstract—To deepen education reform and promote engineering education development, this paper systematically expounded organization, and implementation, and promotion process for excellence talents cultivation plan on Electrical Engineering and Its Automation Specialty at Lanzhou Jiaotong University, China, including organization, planning and operation, policy assurance, talents cultivation mechanism reform, teachers team construction, university-enterprise cooperation, internationalization, and graduates, and as well as future plans. This displays the cultivation characteristics and the acquired achievements of the specialty, comprehensively, such that some valued experience can be supplied for domestic similar specialty. The obtained practice expects to be able to promote engineering education development in China.

Keywords—engineering education; excellent talents; cultivation; organization; implementation; promotion

I. INTRODUCTION

To adapt to rail transit industry developing, Lanzhou Jiaotong University set Electric Engineering and Its Automation Specialty (EEAS) in 1999 in accordance with the new national undergraduate catalog, and at the same year began to recruit students[1]. Electric Engineering Laboratory Centre was evaluated as Experiment-Teaching Demonstration Centre on provincial level in 2009[2]. And then in 2010, the specialty was also selected as national characteristic specialty. Afterwards in 2011, it was approved for pilot training professional excellence engineers. At present, there are 824 registered students in the major in all, and around 200 students each grade including three nature classes and one excellent engineer class[3]. This major always stick to the characteristics of rail transit power supply, and constantly optimize the talent training mode and curriculum system, and construct the distinctive talent training plan to adapt railway leap-forward development, such that the students comprehensive quality and innovation consciousness are greatly improved, and good performance is achieved in various competitions[4]. Every year there are around six students recommended to the domestic colleges and universities for master degree. The graduate employment rate of the major is

more than 95% each year, and has attracted more and more high school students to enter oneself for an examination. Since the major establishment, in line with the principle of talents training of the service of railway and local power systems, there are more than 2000 professional technical personnel engaged in the field of electrified railway projects, and welcomed by employer, warmly. Many graduates have become managers, and business staff and technical director at railway bureau, and design institute, and railway enterprises and as well as institutions and local electric power enterprise.

II. OVERALL PROGRESS

A. Organization and Operation

To standardize and safeguard smooth implementation of the excellence plan of EEAS, further, under organization and leadership of the university, an expert group is established to supervise the implementation and revision of the excellence plan. Under the organization management of the expert group, through cooperation with Lanzhou Railway Administration and other enterprises, the engineering practice bases are established and expanded. At the same time, through the introduction of high-level personnel and arranging young teachers to learn abroad or access to other domestic universities, teachers team is further strengthen. The college actively invites experts to participate in the activities of all kinds of teaching practices, such that good teaching effect has been obtained. And the students also actively participate in various competitions, such that the ideal results are achieved. Currently, each teaching element completely follows excellence talents target demands in an orderly way to ensure the cultivation quality of graduates.

B. Policy Measure

Lanzhou Jiaotong University actively supplies financial support to pilot specialty, which is used to hire a tutor, teacher in charge and relevant management costs. In addition, all kinds of labs, libraries and reference rooms are also open to pilot class students. At any time, adequate classrooms are outfitted for pilot class. To be sure, at scholarship evaluation, and master graduate student recommending, and overseas exchange

learning, and other aspects, the university also formulates the corresponding policy priorities for the students. In school of Automation, the pilot class performs the open running-school mode: those students who drop out halfway are arranged to proper specialties to continue to learn since they can not adapt to pilot class teaching mode. Moreover, the school still specially equips the full-time counselors and teachers with the stronger organization and management ability. To cultivate the students engineering practice capability, the school deepens the cooperation with relevant enterprises, successively, and makes an effort to build national-level engineering practice base, such that a good foundation is laid for excellence talents. In the terms of training scheme internationalization, curriculum, textbooks, and teacher construction, the school cooperates with foreign high-level universities and international well-known enterprises to improve teaching quality as soon as possible. Dept. of Electrical Engineering still actively organizes teachers and students to learn engineering education concepts, such that everyone can understand the cultivation aim and teaching process, and consciously grasps it.

C. Talent Training Mechanism Reform

Dept. of Electrical Engineering develops and perfects the excellence talents training scheme by learning from other units and investigating from social demands, which includes training mode, cultivation standards, matrices, enterprise solutions, and teachers construction plan, and etc, such that the training targets and graduation requirements are more biased towards engineering education standard. Compared with natural classes, the main characteristics of excellence class lie in higher target, and more emphasis on the engineering practice. Of course, the most core ability is to solve complicated engineering project. The gross trend is that although the total score of cultivation plan becomes more and more small, the proportion of engineering practice is being enlarged, i.e., the course system is becoming more compact and reasonable[5]. The talent training scheme highlights the enterprise engineering education link, which can be divided into five links, namely, enterprise cognition practice, course practice, enterprise engineering practice, project design, graduation design of the enterprise, and enterprise engineering education, which promotes the close combination between the theory and the reality, and reinforces the understanding of the students to enterprises culture. In the design links, the student ability to analyze and resolve problems is improved by large-type comprehensive exercises, and simultaneously, the ability with Chinese writing and language expression are also improved, dramatically. To meet the personalized demands of the students, and diversified innovation will, and the cultivation of inter-disciplinary talent, all the students in pilot class are required to attend the science and technology innovation activities, and encouraged to form a cross innovation team with diverse grades, and interdisciplinary, and majors. In addition, the students may be occupied in teacher science researches, and also arranged to other innovation activities in holiday.

To promote the implementation of the excellence talents education plans towards engineering practice, the school actively organizes the students to Lanzhou Railway Administration, and Chai-gorge hydropower station, and north-Lanzhou marshalling yard, and North-Lanzhou traction

substation, and as well as 10kV gross step-down substation of Lanzhou Jiaotong University to visit learning, and invites director engineer Li at Lanzhou Hydropower Design Institute, and senior lecturer Xue at Lanzhou Railway Bureau, and vice gross-engineer Zhang at Gansu Building Materials Design and Research Institute to give the students good reports. By the visits and practices, the students deepen the understanding of curriculum contents related, and as well as cognitive sense and the attribution to their specialty learned. In addition, by these practice activities, the students still acquire other related specialties knowledge, such as architecture, structure, plumbing, and etc, which broaden the knowledge vision field, and explore the practice abilities, and improve engineering quality, and achieve the expected aim. At the same time, by cooperation with enterprises in-depth, the thesis quality of graduation design is improved, dramatically, and social values of the college students are also embodied, perfectly, such that they are full of confidence and hope for their future.

To aim at each teaching and practice module, the school still actively develops scientific researches, and applies multiple educational reform projects, and publishes many research papers, and successfully achieves multiple teaching achievements, whose contents include talents training mode reform, and innovative teaching methods and means and reform, and the new examination method research and reform, and as well as the practice ability cultivating and expanding, and etc. On another hand, the school still strengthens the construction of excellent courses and network curriculum resources, including electrical testing technology, and traction power supply system, an introduction to electrical engineering, and power and electronics technology, and high voltage technology and so on many online courses, wherein traction power supply system is selected as Gansu province high quality network resources course, which lay a solid foundation for excellence engineers talents cultivation[3].

To ensure the smooth implementation of excellent talents cultivation plan, the school still arranges mentor to every student for pilot class with high title, and formulates corresponding tutor working conditions to provide students with specific guidance and help. In the aspect of teaching mode management, the school still develops suitable test examination and evaluation system, and section leadership listening class regulation, and course test form and proposition demands, and other rules and regulations, and etc. The school teaching supervision and counseling office participates and monitors the whole teaching process to ensure teaching quality.

D. TeachersTeam Construction

In recent two years, the school strengthens the construction of the curriculum echelon, such as curriculum group construction, and course director rules, and inspection expert panel listening to teacher, and continues to strengthen and carry out the relevant system and regulations, such that school of automation ranked first in process of teaching comprehensive evaluation organized by university in 2015. Moreover, department of electrical engineering actively introduces high-level talents, which supplies fresh blood for the teachers troop construction. In 2016, there are two Doctors introduced respectively from North China electric power university and

Southwest Jiaotong University, which contributes to the diversity of the subject construction and teaching sources. Simultaneously, Department of electrical engineering also actively arranges backbone teachers to go abroad to learn foreign advanced engineering teaching idea and teaching experience, such that the level of pilot specialty internationalized teaching is dramatically enhanced. The school also strengthens the cultivation of young teachers, and requires them to attend lecture contest, actively, and the winner will be given a priority on promotion title. On the other hand, the school still improves teacher scientific research level, such that the aim of scientific research to promote teaching is better realized. In addition, the school also actively organizes the teachers to participate in all kinds of teaching meetings and engineering conferences, which enhances the understanding on excellent engineer education plan of young teachers. In the end, the school still cooperates with the enterprises, and establishes the enterprise tutors team jointly, which enriches the teacher team further, such that the largest advantages are achieved for the students, such as Lanzhou Railway Administration, Lanzhou Hydropower Design Institute, and Xuji Electric Group Co., LTD, and etc. In 2015 and 2016, under the help of the experts above, the students grasp the related technical contents of the two courses with An Introduction to Electrical Engineering and An Introduction to Rail Transit.

E. University-Enterprise Cooperation

In 2016, the college implements respectively cooperation with Qinghai Electric Power Company and Lanzhou Railway Administration to jointly guide to graduation design of the pilot class. And simultaneously, the school still invites the experts from these units such as direct engineer Li at Lanzhou Hydropower Design Institute, and vice gross engineer Xu at Survey and Design Institute, Lanzhou Jiaotong University to attend graduation design reply, which makes the pilot class students possess deep feeling on their innovations. In March, 2017, the school still organizes some of the teachers to visit learning to Xuji Group Co., LTD, and jointly cooperates to promote the teaching quality of pilot class. The school also

arranges some teachers to other similar Universities to survey their cultivation plans and laboratory constructions to guide own working such as Chongqing University, Xihua University, and Zhongyuan Technology University. Through cooperation with the companies related, the engineering practice and innovation ability of the students are dramatically, and their unity cooperation spirit is excited, such that they possess better fusion into environment and understanding on their future career.

F. Internationalization

To promote engineering education development and learn the theory to run a school of engineering education in the world, the school performs twice revision of the cultivation program respectively in 2015 and 2016, and in line with international standards of training plan through introducing English reference books and expanding the bilingual teaching courses scale and so on means. The school actively organizes and attends the relevant international conference to promote the engineering education development.

G. Graduates

The first 36-people graduates of the major have formally graduated in June 2016, and whose employment situation can be shown in Table I, and the overall employment situation of the major is also shown in Table II[6].

Seen from Table I and Table II, the overall employment rate of the pilot class is 91.67% higher than the grade average 91.16%, and lower than the level of another two classes, however, which reflects the social cognitive deficiencies for excellence plan, and also exposes the outstanding students of poor ability in integrating into the environment, on the other hand.

Table III shows employment unit classification of the pilot class students, and the overall situation is shown in Table4.

TABLE I. EMPLOYMENT SITUATION OF THE PILOT CLASS

Graduate		Employed			Unemployed	
<i>Total</i>	<i>Female</i>	<i>Total</i>	<i>graduate student</i>	<i>Employment rate</i>	<i>Total</i>	<i>female</i>
36	9	29	4	91.67%	3	1

TABLE II. THE OVERALL EMPLOYMENT SITUATION OF THE MAJOR

	Graduate		Employed			Unemployed	
	<i>Total</i>	<i>Female</i>	<i>Total</i>	<i>Female</i>	<i>Employment rate</i>	<i>Total</i>	<i>Female</i>
Pilot Class	36	9	29	4	91.67%	3	1
1202-Class	61	16	51	5	91.80%	5	0
1203-Class	60	18	56	3	98.33%	1	0
1204-Class	58	12	44	4	82.76%	10	2
Overall	215	55	180	16	91.16%	19	3

TABLE III. EMPLOYMENT CLASSIFICATION OF THE PILOT CLASS

Engineering Bureau	Railway Bureau	Production Manufacturer	Survey Design	Urban Rail	Private Enterprises	National Enterprises	School	Business Unit	Troops	Graduate Student	Others
4	12	0	0	2	4	6	1	0	0	4	3

TABLE IV. THE OVERALL EMPLOYMENT CLASSIFICATION OF THE MAJOR

Major	Employment Unit Distribution																	
	Engineering Bureau		Railway Bureau		Production Manufacturer		Survey Design		Urban Rail		Private Enterprises		National Enterprises		School	Troop	Graduate Student	
Pilot Class	4	11.11%	12	33.33%	0	0.00%	0	0.00%	2	5.56%	4	11.11%	6	16.67%	1		4	11.11%
Class 1202	6	9.84%	16	26.23%	2	3.28%	0	0.00%	6	9.84%	1	1.64%	16	26.23%		4	5	8.20%
Class 1203	9	15.00%	21	35.00%	0	0.00%	0	0.00%	2	3.33%	3	5.00%	15	25.00%	1	5	3	5.00%
Class 1204	8	13.79%	15	25.86%	2	3.45%	0	0.00%	2	3.45%	4	6.90%	8	13.79%		5	4	6.90%
Overall	27	12.56%	64	29.77%	4	1.86%	0	0.00%	12	5.58%	12	5.58%	45	20.93%	2	14	16	7.44%

Known from Table III and Table IV, there are employment units, Railway Bureau, and Private Enterprises, and Graduate students, the employment unit distribution of the pilot class is higher than average value, especially, twice than average value in Private Enterprises, which shows stronger competitiveness of pilot class than other classes. In Engineering Bureau, Railway Bureau, and Urban Rail, and etc, the one of the two are almost same, which indicates that some students possess almost same with natural class. But in troop, the employment size is zero of talent class far lower than other classes, which reflects that the military quality is in decline of the pilot.

H. Future Plan

To further carry out and implement engineering education spirit, and closely focus on excellence engineers education training objectives and teaching plan guidelines, the key to do is the following several aspects.

- To revise the cultivation continuously once again, and strength the construction of curriculum systems. For this reason, new more scientific training plan is expected.
- To strengthen the construction of engineering practice education center or base, such that the channel is widen of the outstanding engineers training.
- To improve teaching evaluation system, and perfect the evaluation criteria.
- To strengthen the construction of the teacher team, and promote the teaching reform development in-depth.
- To strength the mental health education, and more rapidly adapt to environment.
- To strengthen internationalization, and cultivate cross-cultural communication and cooperation ability.
- To cultivate engineering thinking capability such that the students can apply it to solve complicated engineering problems.

- To further know talents demands from the society, and continuously improve the training process.

III. CONCLUSION

This paper presents the organization and implementation and promoting process of excellent engineer cultivation plan in School of Automation, Lanzhou Jiaotong University, including organization and operation, policy measure, talent training mechanism reform, teacher team construction, university-enterprise cooperation, and graduates, and as well as future plan, and exhibits some teaching features and the acquired achievements all around, and points out some issue existed and ways to overcome. It not only can supply other similar specialties with some valued experience, but also still possesses popularization and application value, such that large contributions are conducted for China engineering education reform.

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