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# A New Education Mode of Engineering Specialty Graduate Students

## Co-founding by college and enterprises, uniting of production, learning and researching

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**Abstract**

The current state and problems of the graduate students' education in China are set forth in the first. Then, the causes of problems are deeply analyzed. Some ideas and methods in engineering specialty graduate student's education are offered with co-founding by colleges and enterprises, uniting of production, learning and researching. Some problems that should be noted are pointed out, finally.

**Index Terms:** Engineering specialty graduate student; education mode; Co-founding by colleges and enterprises; uniting of production, learning ; researching

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### 1. Introduction

At present, the number of master station has reached nearly 20,000 and the number of postgraduate students has reached 120 million in China, which show an unprecedented scale and number, and the two values are also steadily rising. With the increasing of postgraduate number, graduate employment situation is not becoming optimistic and job prospect is worrying. We clearly feel that quite a portion of graduates are too choosy to take up an occupation.

It is cheerful that this situation has been realized by our country. So, full-time "Specialty Master" enrollment ration is increased and the percentage of admission for Academic Master is reduced. Compared with traditional academic degree, the full-time "Specialty Master" is newly established by Ministry of Education in 2009. It needs a unified entrance examination facing society. The academic degree and specialty degree are on the same level. However, there is distinct difference in their cultivating objective.

Academic degree is found in subject. It emphasizes on theory and research, aims at cultivating teachers of university and researchers of scientific research institution. Specialty degree is based on specialty practice and pays great attention to practice and application aiming at cultivating high-level personnel who have received formal high-level cultivating in specialty and expertise. The biggest difference between Academic Master and Specialty Master is that Academic Master will substantially increase application courses, lay particular emphasis

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on practice and lay graduation thesis on applying study. Specialty Master's outstanding feature is closely integrated with specialty, and those who get specialty degree are mainly engaged in jobs with significant specialty background, such as engineer, doctor, lawyer, accountant, and so on.

Engineering Master is familiar to the engineering colleges which are entitled to award a master's degree. Many master stations have cultivated postgraduate students for years, but students enrolled are general university graduates who work more than 3 years in enterprise. The students enrolled have some work and research experience. Their research topics are generally derived from engineering product design or projects development that they are engaged in. Therefore, they will meet the graduation requirements as long as they gain enough credits, wrote graduate papers and pass oral defense based on the project they engaged in or are engaging in.

Thus, full-time "Specialty Master" is different from "Engineering Master" in traditional sense. Specialty Master can recruit fresh graduates who have no work experience and research basis. It is a very prominent problem how to cultivate their engineering diathesis and improve their practical ability, paving the way for their future employment. So, it is worth of pondering and researching about what kinds of education methods should be used to cultivate Specialty Master.

## 2. ANALYSIS OF PROBLEMS IN CULTIVATING GRADUATE STUDENTS

Through the research and analysis of Graduate Education Plan, it can be found that there are several outstanding problems in current graduate students cultivating process.

*1. The dislocation between cultivating objectives and foster methods*

Through the research and analysis of graduate students' cultivating objectives of universities and scientific research institutes, it can be found that majority of Master cultivating units target at fostering PHD students, researchers, university teachers and scientific research backbone in enterprise, and few located in engineers and civil servants which lots of students obtain employment now.

The reason to establish such a cultivating target is that postgraduate students are generally regarded as research talents by the cultivating units. Through investigation, it can be found that there are two main destinations for the graduate to choose, one is further obtain a doctorate, another is directly find a job. And more and more graduate students choose to obtain employment in enterprise, engage in project design and product development. The proportion of graduate students who directly obtain employment accounted for roughly 80% of the total, and the proportion of graduate students who obtain doctorate at home or abroad accounted for roughly 20%.

It can be seen that the postgraduate cultivating objectives are more and more incompatible with the actual situation, and the dislocation is becoming more and more serious. It is cry for adjusting cultivating targets and changing cultivating methods, so that the work of cultivating graduate students can be on the right track.

*2. Paying more attention to academic and little to teaching*

From the national level, classified cultivating proposal for the undergraduate teaching has been proposed. At the same time, the quality project has been carried out by the Ministry of Education. Each specialty teaching guidance committee for undergraduate has been found. And guiding specialty cultivating plan has been given by them. From the school level, teaching is considered as the eternal work center, according to the documents and notices of the Ministry of Education. Universities' orientation is more clearly, they pay more attention to undergraduate education, increasing financial, material and human investment. The teaching quality is presented gratifying situation.

Compared with the undergraduate education, the postgraduate cultivating work is not only lack of government guidance, but also be put little emphasis on teaching. In raising educational quality, they generally focus on the thesis proposal, thesis assessment and oral defense, but neglect the research and management of teaching. The necessary checks, guidance, funds and equipment investment in teaching are lacked. The phenomenon that teacher absent and transfer class are serious. Teachers are obviously inadequate in energy investment.

*3. Research contents tend to science but not engineering*

Now, the master stations are all found in universities and research institutions. There is no master station in enterprise. Almost all the teachers are from universities or research institutes. Their research directions are almost located in the recent scientific frontier. Therefore, the research subjects of postgraduates are basically related to teachers' research projects, or the teachers' research contents. But the subjects integrate with engineering practice very few. Therefore, there is not enough engineering practice cultivating in the postgraduate cultivating process.

*4. The singleness of teaching staff*

Whether in teaching or the subject guidance, universities and scientific research institutes are not short of teachers who have high educational background and high specialty ranks and titles. Though they have highly science level, their industry background and engineering practice experience are not enough. Just imagine, the teaching staff with this knowledge structure how to cultivate engineering postgraduate and how can cultivate them to preeminent engineers?

*5. The curriculum not driven by industry needs*

When arranging the curriculum plan and writing course syllabus, we usually pursue the completeness of knowledge in the guidance of subjects rather than industry demands. But in the age of knowledge explosion, it's impossible to impart all new knowledge and technology to graduates in 1~1.5 year. Therefore, it's only feasible that teaching them the most essential knowledge and most useful knowledge, in the guidance of employment, tightly combining with industry needs.

*6. Attaching importance to theory and showing contempt for practice*

Not only practical teaching such as course-design and specialty practice but also experiment in course don't contain in the curriculum plan. The major reason for doing like this is the lack of class hour and short time. Try to teach more theoretical knowledge in limited time. However, the teaching effect can be imagined due to the lack of cultivating and training for practical skills.

*7. The singleness of teaching methods*

In terms of teaching methods, it's almost teacher-centered and classroom-based for graduate teaching, and rarely adopts the teaching methods, such as heuristic teaching, interactive teaching, and project-driven teaching methods, which were adopted in undergraduate teaching. The diathesis of graduate students is indeed higher than undergraduates, and their comprehension is also better. So, it seems having no need to waste time. But in fact, the training chance of their thinking skills, teamwork ability, and project actualizing capacity is lost, which may affect their future rapid growth.

## 3. THE IDEAS AND METHODS FOR CULTIVATING ENGINEERING SPECIALTY MASTER

According to the planning of the Ministry of Education, the proportion of specialty master will gradually increase in the future. The specialty master will take all extra-enrollment quotas, and more than 5% of the enrollment quotas will be transferred from academic master to specialty master. The policy of national master enrollment will continue tilt to specialty master. This shows that the cultivating of specialty master has become an urgent problem need to be studied and solved.

The most effective solution to cultivate specialty master is taking the way of co-founding by college and enterprises, uniting of production, learning and researching. Firstly, let them learn and master specialty courses orienting to practical applications, and conduct necessary practice. Then go deeply into some excellent enterprises, learn the mainstream production craft and advanced equipment adopted by enterprises at present, master the main technology and key links of engineering design, and further discover the existent problem in current. From which, they can extract subject with high value and practical significance to study and design, write master thesis and carry out the final defense. Only in this way, it's possible to improve their working

ability and practical experience, better linked with enterprise. And we can pave the road for their future employment and work.

Our specific ideas and practices are as follows:

(1) Make scientific classification and filtration for enterprises, and positively communicate and negotiate with outstanding the enterprises tightly related, so as to reach the cooperation intention of master cultivating, obtain the desire and need of enterprises. On this basis, constitute cultivating objects and plans about the cultivating of specialty master, even the course syllabus with enterprise. Pay attention to combine theoretical system and academic frontier with engineering practice.

(2) Strengthen the development of teacher staff with dual identities (engineer and teacher), and establish a teaching team adapted to the cultivating of specialty master. At present, the policy that all doctors new recruited must exercise in enterprises for more than six months has come on by our school. Positively encourage and vigorously guide teachers to participate in productive practice, train their ability of engineering, make them obtaining working experience, even getting the certificate of engineer, so that they can carry on teaching orienting to specialty master.

(3) Adopt the way of project-driven or case teaching. Combine the study of students and practical projects. Teacher and students can carry out teaching activities by implement a complete "project" jointly. Develop the graduates' interest and build their confidence and cultivate their ability in way of exploring and solving questions. Create a real environment in the guidance of a proper project, and gradually go deep into teaching contents and deploy them thoroughly. Cultivate their team spirit and enhance their coordination and leadership ability by work with cooperation and due division of labor. So as to effectively improve the teaching effect. The good teaching effect of which has been proved through many courses in our teaching practice at present.

(4) In order to enable engineering graduates to gain the frontier knowledge in industry and grasp the development technologies and design methods of forefront line, we select some courses that engineering or application feathers are relatively strong, and full-time teachers are difficult to achieve good teaching effect, and engage some engineer with rich practice experience to give lessons, combining with realistic product design and project development. For example, we currently take half of class hour engage some excellent engineers from famous enterprises (including the network equipment manufacturer: Ruijie, network security and storage products provider: Huawei-symantec and Topsec, information system integration corporation: Jinshangqi) for teaching in course of "Higher Network Technology". It is very popular with students, and the teaching effect is evident.

(5) We positively introduce foreign excellent engineering educational resources to carry out cooperative teaching, in order to make our engineering graduates adapt and achieve the international standards for talents cultivating. We make efforts to take our master station not only to the cradle of Chinese engineers, but also to the cradle of international engineers. To this end, we engaged two professors from Northwestern University of American to teach the two courses of "Artificial Intelligence" and "Formalization Language and Automatic Machine" for our graduates, which obtain a good response. Currently, we are positively promoting our graduate students to foreign universities and enterprises to exchange learning and practical cultivating.

(6) Employ some advanced engineers and enterprise managers with a certain level of theory and extensive practical experience to serve our instructor of specialty graduates. Arrange their writing stage of degree thesis to enterprises, so that they can choose subject according to the actual needs of product research and design, project development. The experts in enterprise may jointly guide specialty graduate students with us, and compose a thesis oral defense group. At present, the file is issued by our school and we begin to implement.

## 4. SEVERAL PROBLEMS SHOULE BE NOTED

During the course of cultivating engineering specialty graduates in a way of co-founding by college and enterprises, uniting of production, learning and researching, there are several problems should be noted as follows:

(1) It can be taken into account that establishing instruction and management agency for cultivating specialty graduates in the way of "co-founding by college and enterprise, uniting of production, learning and researching", harmonizing and solving possible problems in cooperation. And should establish corresponding teaching management system, inspiriting and assessment system, project evaluation and feedback system, and resources sharing mechanisms.

(2) Adhering to the rule of mutual benefit and development together. It is the prerequisite and the guarantee to promote the cultivating of specialty master in the way of "co-founding by college and enterprises, uniting of production, learning and researching". The fundamental purpose of which is to achieve "win-win" among cultivating institution, enterprises, specialty masters and society. It must not be at a cost of sacrificing interest of any part. Therefore, for different entities, there are different values. For the cultivating institution, the core of the cultivating way is to improve the quality of engineering master, shorten the distance between enterprises and cultivating institution, enhance the opportunity and ability of which cultivating institution serve society. For enterprises, the value of this cultivating way is to gain talents adapting to enterprises development, upgrade the level of human resource, and obtain the technical support of cultivating institution for enterprise development. For specialty masters, in this way, they can get the engineering and technology knowledge and working experience from first line, enhance the ability of analysis and solve practical engineering problems, directly enhance the employability and competitiveness, and even realize "zero-distance employment". For society, it can achieve direct docking between cultivating units and talents demanding units, solves the conflict between supply of talents and demand of talents effectively, and increases the employment rate of the whole society, contribute to the establishment of harmonious society.

(3) In the process of "co-founding by college and enterprises, uniting of production, learning and researching", cultivating institution can achieve the three functions, talents cultivating, scientific research and social services. It's beyond doubt that we take this cultivating way as a basic point and main line. But on this basis, we should insist on comprehensive and multifaceted college-enterprise cooperation, and strive to serve enterprises and society. Therefore, we must start from the needs of enterprises, make efforts to find an entry point for college-enterprise cooperation, and take the way of cooperation that can best meet enterprise needs and bring into play the advantages of cultivating institution. We should change the state of "spontaneous, shallow and loose" in college-enterprise cooperation, promote positive interaction and depth integration among college, vocation and enterprises.

In the process of cooperation between college and enterprise, should give full play to the advantages including excellent faculty, a solid basis knowledge, abundant teaching experience, extensive academic exchanges at home and abroad, and rich information resources. We should bring to play the advantages including complete teaching equipment, a wealth of books and information, comprehensive information systems and retrieval means, good science and research equipments, advanced experiment instruments. So that teachers in college and researchers in enterprise can solve technical problems, develop new products, cultivate staffs collectively. A compact and osmotic relationship should be established by college and enterprise.

(4) In terms of the constructing of teachers' team, we should carry out diversity, and persist in three combinations, that is, the combination of full-time and half-time, the combination of internality and externality, the combination of production, learning and researching. On the base of full-time teachers' team, engage a certain percentage of outstanding enterprise managers and engineering technicians as instructors and teachers, and provide the most frontier engineering practical technology for specialty masters. As a result, try our best to fulfill the "seamless convergence" between personnel cultivating and enterprise needs, and foster talents with a notion of market. Moreover, break up the traditional academic educational system with backward teaching contents, outdated teaching methods, and the disjoint between theory and practice.

## SUMMARY

Through long-term research and practice, we draw following conclusions:

(1) "Co-founding by college and enterprises, uniting of production, learning and researching" is an important way to promote the combination of colleges and enterprises, and also to culture advanced applying talents that meet the needs of society. In the background of world economic integration, it's not only the need for development of both schools and enterprises, but also a development trend for world education facing modernization and socialization.

(2) "Co-founding by college and enterprises, uniting of production, learning and researching" can effectively improve college cultivating model and teaching method, and combine the needs of enterprises and cultivating goals. So as to clearly define the direction of personnel cultivating and increase the employment rate of graduates. It also can improve the actual work ability and employment adaptability through introduce and use the talents, fund, and equipments in enterprises.

(3) "Co-founding by college and enterprises, uniting of production, learning and researching" can provide effective technical support and talents storage for enterprises, make the enterprises full of vigor and vitality. It can also effectively improve the scientific and technological content in production and economic benefits, through timely transferring science and research results of universities into practical productive forces.

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