Exploration and Research on Education Management for Multidisciplinary Graduates—The Training Practice at School of Aerospace, Xi’an Jiaotong University

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Keywords: Management of graduate education, Discipline.

Abstract: This paper aims at some problems that the management of graduate education is facing. Combining with the discipline construction, we carried out some attempts and researches on improving the quality of graduate students’ recruitment and training practice for different disciplines, and generalizations, which based on the educational practice of graduate students at School of Aerospace, Xi’an Jiaotong University. The present work is a try for combining with the discipline features to improve the quality of graduate education.

Graduate Education in China and the Discipline

Present Situation and Existing Problems of Graduate Education

Since the setting up of degree system in 1981, there were 4.26 million master graduate students and 490,000 doctor graduate students which were trained in China [1]. By the end of 2014, the number of graduate students in China is 1.85 million, of which the master graduate student 1.54 million people, a doctoral candidate at 310,000 [2]. It has become a great nation of graduate education in China. However, with the rapid expansion of scale of graduate students, the problems existing in the recruitment, training, etc. became progressively. Firstly, the increase of graduate student recruitment lacks on the investigation of the depth of the society and the market demand, and brings excess caused part of the professional talents, employment difficulty [3]. Secondly, to supervise and guarantee the process of graduate student training mechanism is not sound, and the quality of master graduate student training is not high. The figures show that the elimination rate of master graduate student is less than 5% in China, which is as high as 30% ~ 50% in developed countries. This situation of easy enrollment and easy graduation lowers the level of master degree [1]. Finally, the training talents are lack of international competitiveness, because of the slow internationalization of graduate education in China [3].

The Relationship between Graduate Education and Discipline

The meaning of university discipline has become more than a pure academic concept, that has a certain administrative function and bears three functions which are the talents cultivation, scientific research and social service, based on academic or research area classification. The meaning of university discipline construction includes the tutor team construction, scientific research and technological innovation, personnel training and construction of foundation platform [4]. Graduate education is to train high-level talents to adapt to the social needs, which is measured by the quality of training talents [5]. Therefore, discipline is the basic unit of graduate education, and graduate education is the important connotation of discipline construction. The level and the feature of discipline determine the cultivation model of graduate students and professional quality, and graduate students grow in characteristic of discipline [6].
The Graduate Education at School of Aerospace Engineering

The Basic Situation

The School of Aerospace of Xi'an Jiaotong University was established in April, 2005. At present, it has doctor’s and master’s degree authorization centers both in Mechanics and Aeronautical and Astronautical Science and Technology. There are 33 professors and 44 doctoral supervisors. Among them, there are about 20 high-level talents who won the Recruitment Program of Global Experts, the Cheung Kong Scholars Program of China, the National Science Fund for Distinguished Young Scholars, the New Century National Hundred, Thousand and Ten Thousand Talent Project, etc., and 4 persons are the Ministry of Education (New) cross century talents. It has 2 Innovation research groups of National Natural Science Foundation of China, one Innovation research team of Ministry of Education of China, one ‘111’ Projects. There are principal investigators of five Ministry of Science and Technology of China and more than 100 national science research programs of National Key Basic Research Programs, National Science and Technology Major Project of the Ministry of Science and Technology of China, Key Program of NSFC and so on. It got the Second Prize of National Natural Science Award yearly in recent 4 years, and had won 6 national awards for science and technology progress and national awards for technological invention, and more than 50 awards of provincial and ministerial level scientific research, and 15 teaching achievement prizes both on national and provincial level. There are 3 sponsors of international academic journals such as International Journal of Aerospace and Lightweight Structures, International Journal of Applied Mechanics, International Journal of Computational Materials Science and Engineering, and one sponsor of national academic journal.

The Present Situation of Graduate Students’ Recruitment and Training

With the development of the discipline, the scale of graduate students’ recruitment of our school has been increasing year by year. There are about 140 doctor and master graduate students, including the international students, recruited in both disciplines of Mechanics and Aeronautical and Astronautical Science and Technology every year in recent 5 years, compared to only 30 at the very beginning.

However, relative to the expansion of students’ recruitment, how to improve the quality of students and their training has become one of the key problems for graduate education. At first, because of the strong teacher resources and facilities and high-level scientific research programs, we need more and more high quality students. Except the undergraduate students in our majors, we recruit some transfers from Machinery, Energy and Power Engineering, etc., who are lack of mechanics and aeronautic and astronautic majors. Therefore, it has some specificity in training program making, courses setting, courses teaching, and the topics of thesis selecting, etc. Secondly, with the reforms of policy of Ministry of Education and our university, there are more and more different types of graduate students, who are different in discipline backgrounds, specialized knowledge, and ability of research, etc., who are also different in objectives of training, Research characteristics, and dissertation evaluation. How to improve the quality of recruitment and training under different disciplines, and how to give the best development conditions for different types of students, have become the most important problem of our graduate education in recent years.

Multi-Disciplinary Try and Practice in Management

Classification of Recruitment, Improving the Quality of Students’ Recruitment in Ways, and Strict Control of Supervisor Qualification

Master students’ recruitment contains two types. One type is the recommend exemption, which recruits excellent recommended exemption students graduated from universities in the nation, and keeps the discipline correspondence between undergraduate and postgraduate. The other type is the uniform national examination admission, which choose excellent examinees to recruit, who apply for Energy and Power Engineering, etc. Besides, cooperating with the International Education College of
our university, we recruited overseas graduate students for the first time. Doctoral students’ recruitment also contains two types. One type is the qualification exam, which chooses some excellent master students to recruit. The other type is application assessment changed from the uniform examination, which cancels the written test and gives high spot reviews on comprehensive scientific research ability and quality by supervisors.

Based on the superiority of discipline, teacher recourses, scientific research projects, the research platforms such as national key laboratory in strength and vibration and ICAM, we establish actively stable relationship on recommended exemption students to each other with high levels of colleges and universities. Every year we hold the Discipline Open day, the School Open Day, and the Summer School, and send teams going out to different universities for publicity. In addition, we specially build website for publicity of recruitment and supervisors’ information, make brochures and boards for publicity. All of these efforts have expanded the influence of discipline.

Besides, we make strict and dynamic scrutiny for supervisor recruiting students’ qualification. Planning development of discipline as a whole, we optimize recruitment catalogs, assess scientific research projects and achievements of supervisors strictly, and determine supervisor recruiting students’ qualification and quota finally, which based on examinees’ quality and the number of recruitment.

Building Graduate Student Training Mode with Different Discipline Characteristics

Learning from graduate student training modes of top universities abroad, under different disciplines and different types of graduate students, we firstly seriously analyze individual difference and mutual feature on graduate students’ training objectives, research areas, training modes, courses setting, professional practice, subjects and mid-term examinations and defense of theses, etc. Then we design different training programs for master’s degree and doctor’s degree in different disciplines and engineering fields, which present discipline differences and diversified characteristics of graduate students training. For example, degree courses are different in different disciplines, and the degree courses for the Master of Engineering are set characteristically. To reflect discipline characteristics, we construct outside-school Practice Base with enterprises, and build the Air and Space Display Field. The types of degree theses in different disciplines may be different, and the requirements of the theses’ review and defense might be different.

Establishing Effective Assessment and Monitoring Mechanism for Graduate Student Training

Based on analyzing the quality of students in different disciplines, the evaluation index systems of subjects selection and mid-term examinations of theses are built, and the ‘focus tracking on the back of the 20%’ mechanism is implemented, that will be continuously focused on training and monitoring the back of the 20% students in the subsequent training link. We establish curriculum evaluation feedback mechanism, which means to organize senior experts to a certain lecture and to investigate graduate students randomly for the final evaluation results that will be used for adjusting graduate student course system. Meanwhile, we introduce the comprehensive evaluation mechanism composed by discovering the re-contributed and re-published theses, post evaluation of theses, outstanding doctoral dissertation output, academic awards of graduate students, and finally its result will influence directly the supervisor recruiting students’ qualification and quota next year.

Promoting the Discipline Development by the Internationalization of Graduate Education

Accelerating the internationalization of graduate education is one of the key of improving the quality of graduate student training [3]. The internationalization of graduate training has become the trends in graduate education in China. We have close cooperation relations on talent development and scientific research with the first-class universities and research institutes of the United States, Britain, Japan, Germany, France, Canada and other countries, and establish actively relationship on recommendation and exchange to each other with international high level subjects. So far, we have
signed cooperation agreements with Iowa State University, University of Liverpool, and so on. Every year there are Ph.D. students to attend international academic conferences at least once per person, about 20 master graduate student to go abroad for academic conference, about 10 graduate students funded by CSC or other cooperation projects abroad, and at least 1 outside experts visiting lecture per week. The International Center of Applied Mechanics (ICAM) was established in 2012. It has become a high-end special academic zone with the core of overseas famous scholars, and has conducted the cutting-edge research and innovative personnel training. At the same time, by statistical analyzing the ratio of graduate students in different disciplines of the forms and the effects of overseas exchanges, CSC projects, key construction projects, scholarships of foreign universities, attendance of high-level international conference, we provide basic data and support for the reinforce of discipline foreign exchanges and international training, and the promotion of establishing talent cultivating collaboration with international high level of discipline.

Summary

Through the above measures implementation and improvement, the quality of graduate students’ recruitment has been steadily improving in recent 5 years, and the ratios of master graduate students and doctoral students who come from ‘211 Project’ colleges have gone up to 80% and 85%. By tracking and monitoring the links of theses’ subject selection, mid-term examinations and intensive inspection, all of the theses have passed the Academic Degrees Committee’s review, and the random checks of the State Academic Degrees Committee and the Ministry of Education, without any academic misconduct. Master's graduates publish one paper as the first author on core journals or above per person, and PhD graduates publish 3 papers as the first author on SCI per person. There are 4 persons won the award for university-level outstanding doctoral dissertation, 4 persons won the award for provincial outstanding doctoral dissertation, and 2 persons won the award for national excellent doctoral dissertation nomination. Two doctoral students won the award for academic new talents, and one doctoral student gained support of the Ministry of education for outstanding doctoral students, and two teams won the first prize for the first graduate student future aircraft innovation competition. Over the years, the scale of graduate students’ recruitment keeps stable, and the quality of graduate education improves significantly at the same time. The pattern of clear hierarchy of the graduate student training has been made by a high level platform support, the national major projects traction, and high quality teacher’s guide.

These results obtained show that the graduate student education and discipline construction is inseparable. On the one hand, the establishment of the national key laboratory in strength and vibration, the ministry of education portending sub-center of new aircraft joint research center for serving environment and multiple institute, the experimental teaching demonstration center for mechanical and other provincial key laboratories, provide a more broader platform for the innovative talent training and high level scientific research. On the other hand, the promotion of the quality of graduate education supports and accelerates the development of discipline. Mechanics ranked seventh in the national assessment of discipline in 2012, two forward than last time. After the review and field survey by discipline appraisal group of the State Council, the doctor's degree authorization centers of Aeronautical and Astronautical Science and Technology successfully passed the special assessment of the Ministry of Education in 2015.

Nevertheless, there are still some problems in practical management, such as how to reasonably and safely carry out elimination system among the process of graduate student training, how to promote more efficient communication between Chinese students and overseas students, and these problems will be solved continually in later research and practice.
References


