Exploration and Practice in Innovative Training of Part-Time Engineering Master in Instrument and Meter Engineering

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Abstract—The contradiction between work and study, lack of re-innovation capacity and academic tendency in cultivation are the main problems in training of part-time engineering master. In the context of the current information, it is necessary to strengthen the reform and innovation of the training of part-time engineering master's degree, to promote the cultivation and tempering of highquality technical talents, to train the capability of reinnovation and to establish a more scientific and rational training system for part-time engineering master's degree. In this paper, from the training system of the part-time engineering masters in Instrument and Meter Engineering, it's explored that the part-time engineering masters' innovative education system construction strategy and measures.

Index Terms—part-time postgraduate student, contradiction between work and study, academic tendency, re-innovation

I. INTRODUCTION

With the development of science and technology in the whole scientific and engineering field, the demand of higher-level professional talents in various industries has been increasing, thus the part-time postgraduate education has developed rapidly. But there are some outstanding problems such as low educational level, academic tendency and poor quality assurance. Especially in the part-time postgraduate training of pioneer engineers, there are some vital problems that need to handle, which restricts the use efficiency and redevelopment of the equipment. The re-education of technicians has the characteristics of hierarchy of demands, field specified application, and the demands to keep up with the technological frontier. Therefore, how to explore and practice the mode of part-time postgraduate students' education in the new situation has become a key issue in the current theory and practice research of the part-time engineering master education [1]. Based on the practice of the training of part-time engineering master in the field of Instrument and Meter Engineering, this paper explores and test the innovative training mode of parttime engineering master.

A. Contradiction between Work and Study

The contradiction between work and study is common in study of part-time engineering master. As a pioneer engineers, the demand from work is the full period of technical support. Full-time or even part-time learning modes are likely to reduce the technical support. Therefore, we need to consider a more powerful and comprehensive technical guarantee when we develop the training program, and adopt a variety of teaching methods flexibly to satisfy the demand for pioneer engineers in technical support.

B. Re-innovation and Re-development Ability

In the context of informatization, the re-innovation and re-development ability of high-tech equipment is insufficient. When facing of increasingly informationbased level of equipment, the technicians are lack of the systematic knowledge structure of equipment allocation and innovation. With the gradual development of information technology, some of the technician, because of the lack of related science, knowledge and technical capabilities in equipment development, thereby restrict the use of equipment, resulting in the idle equipment resources.

C. Academic Tendency

Academic tendency is common cultivation of part-time postgraduate. In the training of part-time postgraduate, the training program and training process attach too much importance to the imparting of theoretical knowledge, so as to neglect the key technical or engineering problems that need to be solved in the students' actual daily work. Copying the training program of academic master, the cooperation mechanism of double tutor formed into an illusion, the dissertation thesis divorced from the actual work, result in academic tendency in training process and eventually restrict the benign development and high-level talents' training [2].

III. STRATEGIES OF INNOVATION TRAINING SYSTEM FOR PART-TIME ENGINEERING MASTER

Aiming to solve the major problems in the process of the training of part-time engineering master, the

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innovation training system mainly starts from the following aspects, which focus on solving the difficult problems in the process of the training of part-time engineering master.

A. Teaching Arrangement

For the actual situation of the students heavy task, we should make a flexible study schedule, arrange the curricula, arrange the teaching, compile the teaching materials and case database, and select the professors who have rich research project experience to mainly teach.

The study curricula includes the basic courses and the specialized course, in which the basic course is used to enhance the students' basic research ability, and provide the foundation for the specialized course teaching. The basic courses adopt the traditional school centralized teaching way. Specialized courses are implemented in the form of "research class" and " case discussion". Teaching team members are often in charge of latest researches, therefore they have a better understanding of the current situation of the students' technical ability and the engineering problems that need to be solved, and can arrange the course content according to the difference of the students.

The teaching arrangement is based on the intelligibility of knowledge and the difficulty in theory practice. The feedback mechanism is introduced at each stage of teaching, which adopts various organizational forms, such as teacher consultation, questionnaire survey, experts' consultation and so on. To realize the process quality and target quality management of teaching process, the effectiveness check of small closed loop and big closed loop is adopted. Especially in the selection of specialized course textbooks, it is necessary to fully embody the reason for teaching, to fully consider the differences between the students' basic knowledge and the half-thinking pattern formed by specific technical job.

B. First-Class Curriculum Construction

The main focus of the curriculum design is to construct the exemplary teaching case, to highlight the practical teaching phases. The curriculum should highlight the characteristics of innovation and effectively reflect the development trend and characteristics of engineering technology in modern instrumentation field.

By means of theory teaching, lectures, research, network teaching and experiment teaching, the courses provides students with new knowledge, new techniques and methods, expands their thinking and also enhances their abilities to solve the practical problems in the engineering[3]. The reform optimizes the relationship between classical theory and modern science and technology development, and introduces the newest achievements of discipline development and teaching and research achievements into the course of education.

The teaching content pays attention to the combination of theory and practice, on the one hand it pays attention to the basic concept and basic principle of the course, and on the other hand it emphatically introduces its application achievement. Excellent textbooks and original textbooks from abroad should be actively introduced and used, and bilingual teaching should be carried out, so as to ensure the quality of teaching courses.

C. MOOC

For some courses, MOOC is adopted as a supplement to short-term teaching. Students are able to arrange their daily self-study through it. Combined with research teaching and case teaching, we should focus on developing a typical case base, combine cases in teaching, and promote technological research imperceptibly.



Figure 1. MOOC course system in instrumentation field.

MOOC teaching is on base of students' independent study and teachers' guidance. It is an open teaching mode of resource sharing, which can make full use of its time dispersion, interest and professionalism to compensate for the impact of "knowledge bombing" on the students caused by short-term concentrated teaching.

It integrates the resources of related courses, cases, large assignments, references and so on to the network teaching platform, and provides strong support for students' inquiry learning and self-regulated learning. Teachers should take advantage of students' interest and make teaching for learning services. Learning is to guide the improvement and deepening of teaching. As shown in Fig. 1, the specialized course MOOC system adopted by master of engineering education in the field of instrumentation engineering, which involves the main phases of information lifecycle, and provides a complete knowledge structure for cultivating students' innovation ability. As a supplement, we adopt the teaching examination separation in the examination process of the network course such as the MOOC course. The examination is organized in the classroom, to avoid the malpractice complete network teaching may bring.

D. Strict Double Tutor System

Strictly implementing the double tutor system to ensure the quality of the whole cycle of training. The education mode of cooperation between schools and enterprises is neither a simple classroom teaching nor a mere field teaching of an enterprise, but an organic combination of classroom teaching and field teaching. If the management of the two-tutor system is loose, the tutor in enterprises only pays attention to the practical engineering problems faced by the students, and the tutor of school only pays attention to the students' curriculum and knowledge system, and pays attention to the problems and key technical methods.

A close interaction channel between the students and two tutors should be established. The school tutor guides the students to deepen their independent innovation ability from the theoretical and technical level, and the enterprise tutor instructs the students to use new theory to solve the engineering problems and ensure the whole cycle of training quality. At the same time, the school should establish a sound tutor evaluation system, through the management layer to implement the system. The evaluation of school tutor mainly focuses on new technology, new theory, practical application and so on, meanwhile evaluation of enterprise tutor focuses on process management, academic standardization, training goals.

E. Proposal and Dissertation

The school should combine with the actual techniques to filter the topics of research, and reform the evaluation system of the dissertation, proposal mechanism and dissertation review mechanism, to guarantee the quality of specialized degree dissertation.

According to the characteristics of part-time postgraduate students, the school should make suitable papers standard and evaluation standards, and make a difference of the full-time postgraduate education from the topics, the disposal, and dissertation [4].

When selecting the topics, we should take into account the project and technical problems that the company of graduate students need to solve, and adopt the approach of enterprise-tutor-led and school-tutor-assisted for the students to design the topic. The form of dissertations written by part-time postgraduates should take fully into account the types of engineering papers, such as product development, engineering design, applied research and research reports, so as to make the dissertations of parttime postgraduates outstanding. We should guide and encourage part-time students to take part in the selection of professional degree dissertations and the award of outstanding professional degree theses.

F. Interaction Mechanism

All through the phases as selecting talents to take part in entrance examination, starting classes, teaching implementation, disposal, mid-term evaluation, dissertation writing and review, etc., the leadership of both sides should give strong support. Through the establishment of interactive communication mechanism between management of two sides, it would promote the cognition of the management decision-making, enlarge the popularization and application of the teaching achievement in the whole instrument field, strengthen the organization execution and effectiveness of the above scientific methods, and eventually promote the development of the part-time engineering master education better.

IV. PRACTICE AND VALIDATION

The proposed training system aims to solve the major contradictions such as "contradiction between work and

study", the lower innovation ability of high-tech equipment, and the tendency of "leaning academically" in the course of engineering master's training. This system is based on the cultivation of high level talents, from the teaching plan, the curriculum system, the network teaching, the strict implementation of the double tutor cooperation system, the engineering master dissertation reform. decision-making communication system mechanism and other aspects to effectively put facing and applying in practice into the whole process of master of Engineering education. This training system has practiced the high level talent training mechanism, formed the systematic science part-time engineering Master training system, and promoted the pioneer technicians engineering innovation ability remarkably.

A. Innovation Ability Remodeling

Combined with the 12th Five-Year key construction of graduate project innovation program and other related projects organically, the proposed innovative education system achieve engineering innovation ability remodeling for both students and tutors.

The teaching team and the related innovation platform in the field of instrument and meter engineering have strengthened the knowledge system of the students in the typical information processing system and achieved the establishment of the students' relevant innovation ability. At the same time, it validates the relevant professional knowledge through the teaching process, and also promotes the innovation ability of the tutor and the improvement of the teaching ability, and stimulates the students' enthusiasm to assiduous research of specified technology, and improves the quality level of the dissertation of professional degree [5].

B. Students' Innovative Ability and Prizes

The proposed education system whose target is to form students' innovative ability and has achieved excellent training and practical innovation results.

Combined with teaching theory and practical application, an engineering master class students who developed innovative equipment in actual job, which won several scientific and technological progress award, technical achievements award. The awards include 2 first prizes in science and technology progress of provincial level, 4 second prizes in science and technology progress of provincial level, 17 third prizes in science and technology progress of provincial level. Behind each award is an innovation in the technical field, but also proof of students' innovative ability.

C. Supporting Construction

Through a series of measures as the construction of the first-class curriculum system of professional degree postgraduates in the field of instrumentation engineering, the quality of whole period education system for non-fulltime high level professional degree postgraduates is creatively established.

Through the school 12th Five-Year key construction of graduate students first-class curriculum system 'instrumentation engineering graduate student first-class

curriculum system', 'instrument science and technology graduate student first-class curriculum system construction', in the course system overall design and optimization, teaching content reform, textbook construction, teaching team construction, teaching mode reform and other related phases, a scientific and reasonable part-time professional postgraduate training system is achieved. Through the research on the teaching reform of postgraduate education, 'the research on the exploration and practice of the whole-period innovation education system of part-time engineering master', the research and practice of the quality assurance system for the education of the part-time postgraduate students is validated significant.

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