The Study on the Training Mode of Professional Degree on Computer Science Based on Laboratory Simulation

Yu-Jie LIU¹,a,*, Zong-Min LI¹,b, Xue-Li WANG¹,c
China University of Petroleum, Qingdao Shandong, China

¹liuyujie@upc.edu.cn, ²lizongmin@upc.edu.cn, ³wangxueli@upc.edu.cn
*Corresponding author

Keywords: Professional master, laboratory simulation, training mode

Abstract. At present, the cultivation of professional master graduate students has gradually become the vital subject of graduate education in China. It’s necessary for the cultivation of professional master graduate students to have a deep discussion in both training target and training mode in order to make it more fit to the country’s developments of economy and society. In this paper, we put forward a laboratory simulation of computer professional master's training mode to solve the problems like Matthew effect existed in the internship practice which the professional master graduate students encounter. In this training mode, professional masters strengthen their basic skills by the laboratory simulation environment; improve their abilities of projection management by link of comprehensive practice.

Introduction

In order to satisfy the demand of country’s economic and social development for high-level talents, the Ministry of Education released “Several opinions about working better for the cultivation of full-time master’s degree graduate students [1]” in March 2009, and emphasized the engineering practical ability in the professional master’s cultivation.

In may the same year, the degree Office of the State Council forwarding “The guidance cultivating plan of full-time master’s degree (classification) for graduate students[2]” set by the interdisciplinary professional degrees steering committee, pointed out that “professional master degree of engineering is professional degrees associated with engineering qualifications, and cultivate applied, composite high-level and engineering management talents”, “engaged in engineering design, project implementation, project research, project development, project management ability in a certain direction of the field independently”, “practice teaching is an important link of graduate education in full-time master of engineering, and engineering graduate student should be encouraged to practice in the enterprises, using with segmented practice or combination of practice. During the education of engineering master graduate students, must make the pledge that the practice teaching shall not be less than half a year and practice teaching of undergraduate course graduates should be not less than 1 year time in principle”. And participate in the enterprise practice work [3].

Related Works

Paper [5] performs a professional research on the performance of the current training mode of 1400 full-time professional degree postgraduate students in 14 universities nationwide and points that the current training mode of professional master cannot meet the needs of cultivation of the professional master’s strengthening engineering practice ability. On how to improve their professional master of engineering practice ability, many experts have gave their views. Paper [6] proposed diversified practice teaching using multi-level practical teaching bases. On the dissertation, highlight the feature of the engineering practice and classified guidance. Build the system of "three levels, progressive type, the whole process of" graduate practice curriculum. Paper [7] proposed to establish a multi-level
practice base including campus university-enterprise joint training base, bases relying on the scientific research cooperation platform to adjust the training mode from between tutors and graduate students, more level. Paper [8] also puts forward the writers and the engineering practice of the combination of centralized and decentralized mode and a professional graduate practice innovation platform. Paper [9] analyzes the tutorial GSwE2009 international software engineering graduate students from the perspective of education knowledge system on software engineering master’s training. Paper [10] comprehensive compares Japan, Australia, Europe and the United States some countries with Chinese graduate course, points out problems existing in Chinese graduate courses. The Paper points out that the graduate programs in the European and American countries, emphasizes the developments of the practical ability.

These papers on the whole give related proposes of full-time master of professional training from the macro level, that is strengthening engineering ability training, combination the practices and learning. But how to implement integration of practices and learning to the reality, improve the ability of develop professional master of engineering and project management skills effectively? In the actual training, we found that both are difficult to achieve in computer professional master’s enterprise cultivation practice link.

Because of the internship units thinking from its realistic interests, caused the practice effect on the "Matthew effect", that is the professional postgraduates with good developing skills base will be able to participate in the internship units in the engineering development for no needing to be further training, so they get more opportunity to exercise on the professional skills and ability to project to obtain larger ascension in practice unit; while for the professional postgraduates with poor developing skills base, the internship units is not willing to spend manpower and funds to cultivate them, so they become a office assistant in the internship units, not getting exercise opportunity and development technology doesn’t improve. Comparatively speaking, this situation widened the gap. That fails to hit the target of raise the capacity of engineering development of postgraduate.

At the same time, for the same reason, postgraduate students most can only participate in the second part of the engineering process flow, such as engineering development and testing, maintenance in the process of enterprise practice. But they rarely have the opportunity to attend to cultivate engineering management ability such as demand analysis, project design and so on. It is almost impossible to improve the project management ability of graduate students in the process of enterprise practice.

How to break this Matthew effect caused in the practice of enterprise of a kind of contrast that the better will be better, worse with poor and effectively improve of engineering management ability the postgraduate student? We proposed a kind of laboratory based computer professional master’s training mode with simulation environment.

**Cultivation mode of “laboratory simulation”**

According to the feature of computer major, we designed and established a laboratory based computer professional master’s training mode with simulation environment. In the laboratory simulation training unit for hierarchical practice, make sure to improve the ability of professional master, to reach the basic standard which practice unit employ persons on, to ensure that graduate students during the period of internship smoothly into the engineering implementation of the enterprise and to ensure the practice effect and improve the professional master of engineering practice ability. In the laboratory simulation environment at the same time, we can improve the ability of graduate engineering management by the methods of junior students led by a senior postgraduate in simulation training.

As figure 1 shows, we established a laboratory simulation environment to simulate enterprise project development process. This environment uses the training subject library as the center and is carried out with professional master of engineering development and project management training all around training subject library. The training subject is divided into different steps according to its own
development process of demand analysis, engineering design, project development practice, testing maintenance, each step has the related documents and the corresponding outputs.

![Diagram](https://via.placeholder.com/150)

**Figure 1.** The flow chart of “laboratory simulation” Cultivation mode.

**The first stage**

After professional postgraduate admitted, they are organized by the laboratory evaluation of students and are distributed to stage of engineering practice project plans, design, development and test maintenance; and perform engineering practice for its initial stage according to the evaluation results. After the corresponding stage training, if they are tested after up to standards, the study will go to the next stage work.

Because professional master degree courses in professional learning are opened at the same time their first academic year in the most schools, in this stage, setting of courses can be designed to match the engineering practice. Set up the related professional courses, professional quality courses except for these basic courses and humanities courses.

Improving students’ comprehensive quality should be the core of the setting of professional curriculum, and jobs of the industry should be the template of the professional requirements, and the setting of professional curriculum guided by the demands of industry application. Increase courses related to the industry engineering development of. Add the case-analysis courses and practice courses.

And the target of professional course is to cultivate professional postgraduates in the aspects of social sciences, business management and the ability of intellectual property rights. Arrange the trainings about software copyright and patent application, technical standard draft, software analysis, design and development of documentation, the subject of science and technology application and other technical documents[4]. At the same time, train professional master’s ability of interpersonal communication and language expression.

Comprehensive above training and courses, in the second semester of their first academic year to a comprehensive evaluation of professional master’s assessment of professional master’s ability in the aspect of the basic knowledge, basic skills and professional qualities step by step. Those who pass the
test on schedule can get into the enterprise to carry out the practice work, but those who do not meet the standard will be back again into the first stage of intensive training.

The second stage
In this stage, the professional masters get into the relevant enterprise internship. Because of the direct results of the professional master degree’s full in-depth technical training in the first stage, they can enter the atmosphere to develop their ability of project process of enterprise industry and experience in the environment of the enterprise to improve their ability of engineering development further. At the same time encourage professional master to use their own knowledge and skills to solve the problems encountered in the enterprise project.

In this stage, use the process management theory to guide the enterprise practice. Decompose master’s overall goal of the enterprise practice to fragmented goals in the enterprise internships at various stages and form a goal clear, and implement a manageable internship program process. Track during the process of professional master degree in the enterprise practice through the internship program. Adjust the internship process according to the situation of the implementation of the internship program.

At the same time, evaluate professional master’s internship according to the internship program. Professional master degree write stage summary and summarize the gain and loss after completion of every stage of practice and summarize later stage of the improvement plan. Professional master degree hand on an internship report after completing corporate internship which is detailed including instructions on enterprise performance during the internship, internship program’s execution, his harvest, contribution to the enterprise, the existing problems, and future goals.

The third stage
In this stage, the professional master degrees have a lot of harvest and also encounter a series of problems at the same time after you finish your internship.

First of all, set up the training topic link. Sort out the professional master's courses in internship units involved in the project subject and transform, upgrade and enrich the library to practice subject after the allowance from internship unit. The professional master summarize the practice during the internship harvests further and enhance their understanding of industry environment and work flow in the process of sorting practice subject out. At the same time, guide their thinking problems during the internship and prompt them to find the methods to solve the problem.

Then, let the professional master degree participate in his subject’s new master of professional skills training and organization management of development process of the subject project. In the process of subject of engineering development, senior professional masters will further deepen understanding from the viewpoint of the project process management of the entire development process. For requirements analysis, project design, project development and testing in the process of maintenance, to experience the whole process, from the perspective of management of the project schedule, staffing and other issues. It can improve the coordination, organization and project management skills through this process. It will also reflect on the technical problems in engineering, expand the cognition to the related technology and improve the ability of application of relevant technology.

Construction and Update of practice subject library
In the “laboratory simulation” training mode, training project undertakes the role of professional engineering development ability and the responsibility of project management ability, and a good training subject library is very important to the effect of the training mode. In this paper, we give two practical subject sources. One source is to filter and expand the subject from the subjects that the team ever to participate in project; the other is the analysis of the mainstream technology to extract typical examples as a practical subject in the field of computer application.
Then, organize manpower to complete the training task of requirements analysis, engineering design, engineering developing and test maintenance work to form the initial subject library. Training subjects include project user demand, the overall solution, module design and specification, the internal functions of the modules and complete ideas and so on.

After the complement of enterprise practice of professional master degree and permitting from internship unit, students organize the practice subject and add to join the training subject library after the transformation and upgrade. At the same time, regularly evaluate the practical subject in the library project and delete the development training thoughts and the development technology with outdated subjects. Keep subject of library active and practical.

In this way, it will form a professional master practice ability training mode with form self-organizing and update content sustainably.

Conclusion

In this paper, according to the problems existed in the professional master's internship study, we put forward a kind of enterprise training mode of laboratory simulation. Through this mode, professional master graduate student can enter the laboratory simulation environment for technical training, achieve enterprise basic standards, ensure that after it into the enterprise to participate in enterprise engineering development and complete engineering practice in enterprises before entering the enterprise; it can further improve their project management capability and effectively improve the quality of professional master’s cultivation after the completion of the internship back to the lab.

Acknowledgement

This research was supported by the optional subject of national engineering professional degree graduate education “The study of computer professional master’s cultivation mode based on laboratory simulation (2014-JY-056)”.

References


