

Innovative Training Model Integrating Theory and Practice for Professional Masters Majoring in Mechanics

Mingsheng JIN*, Ye PAN, Shiming JI, Li ZHANG

Key Laboratory of E&M, Ministry of Education & Zhejiang Province, Zhejiang University of Technology, Hangzhou, Zhejiang, 310032, China

Abstract — In terms of the lack in practical ability of professional masters students majoring in mechanics, an innovative training model integrating theory and practice is proposed and analyzed in detail. It is suitable for these students from several aspects including: i) the establishment of student comprehensive practical platform, ii) integrated training model of theory and practice, iii) team construction of double qualified tutors. With the combination of many years of teaching experience of postgraduates, this paper puts forward the idea that “Enterprise project-student-tutor-tutor team” training model should be adopted in-campus while “Enterprise internship-student-enterprise tutor” model applied off-campus. In this way, students who are trained through the integration of those two models in and off campus can meet expectations better of both society and enterprises.

Keywords - mechanics; professional masters; double qualified; tutor team; integration of theory and practice

I. INTRODUCTION

During the two decades of implementation of the professional master's degree education program since 1990, rapid development of cultivation of professional master's degree has been achieved. At present, a master's degree system has been established which focuses on master's degree with joint development of doctor, masters and bachelor degrees [1]. Particularly, since 2009, Ministry of Education of the People's Republic of China decided to enroll fresh undergraduates to study for professional master's degree and initiated the cultivation of full-time education. It quickens the pace of development of professional master's degree. However, with years of growth, there still exist quite a few common problems in need of solution and improvement.

In terms of academic and practical competence, professional masters is no match for academic masters and students from higher vocational colleges. Therefore, there is little difference between professional and academic masters in the eyes of quite a few enterprises. Nevertheless, the diploma acquired by postgraduate students and demand for higher salaries and welfares result in an embarrassing situation in job hunting. Admittedly, the above-mentioned problem does not refer to original intention of professional masters but some common issues which exist in training program worked out by the majority of institutions of higher learning. Due to the cultivation far from comprehensive implemented in the past decades, the training program of academic masters is still applied in most universities and colleges, which leads to a partial and unsatisfactory result of cultivation of professional masters.

The distinctive difference between professional and academic masters lies in the enhanced cultivation of engineering practical ability and richer practical experience. While it is solid theoretical basis and improved theoretical

system that distinguish professional masters from students graduated from vocational colleges. Based on the research of USEM model [2], it is found that the cultivation of “ability” is the most important training program and that the so-called ability refers to employability for professional masters. But, this capability is exactly a critical step lacking in training program of professional masters.

The main reason for ability deficiency of professional masters is insufficient practice in training program which is brought about by several causes including following three aspects.

First of all, most institutions of higher learning still adopt the traditional training program of academic masters in which little practice is involved.

Secondly, no perfect practice platform for students is established. Strong in will but weak in power, colleges and universities hope to set up relevant practice links for cultivation of professional masters but no ideal approach for practice is available.

Thirdly, lack of a high-level team of “double qualified” teachers or no perfect dual tutorial system lead to limited academic instructions provided by tutors without sufficient training nor effective guidance to students in the aspect of practice related to theories.

Based on analysis of current situation and combination of years of experience in cultivation of professional masters, this paper presents a training model of integration of theory and practice for professional masters majoring in mechanics which can be transplanted and extended to other science majors to a certain extent.

II. EXPLORATION OF TRAINING MODELL OF INTEGRATION OF THEORY AND PRACTICE FOR PROFESSIONAL MASTERS

Currently, the integration of theory and practice is a new teaching method that vocational colleges explore from professional teaching [3]. Different from traditional mode of teaching, this method realizes integrated education of theory and practice. It is not an organic combination of theoretical and practical teaching but an integration of theory and practice, namely a “learn-practice-relearn-re-practice” repetitive process [1]. Moreover, the synchrony of learning and practice is emphasized. The training model of integration of theory and practice is very applicable for professional masters, especially those majoring in mechanics.

Based on experience of long-term training for professional masters majoring in mechanics, this paper believes that the teaching mode of integration of theory and practice should be carried out in several aspects below.

A. Establish a Good Platform of Practice for Students

As the most crucial part of implementation of training model of integration of theory and practice for professional masters majoring in mechanics, practice is the most fragile component of training of postgraduate students. In order to strengthen their engineering ability, the only way is to offer them more opportunities to participate in engineering practice directly which calls for the establishment of a good platform of practice. For those who major in mechanics, their practice can be started in following three ways.

1) Tutors' Research Projects Supported by Enterprises

The best way for students' participation in engineering practice and most classical training model of integration of theory and practice are tutors' scientific research projects supported by enterprises. Generally speaking, design, production and experiment are accomplished by students while tutors act as supervisors and instructors in scientific research projects sponsored by corporations. In this process, students' practical ability of engineering has been significantly improved and tutors' unscheduled instructions make for golden opportunities for students to learn and replenish their theoretical knowledge. During the course of exploration of the mode “tutors' instruction-student practical exploration-tutors' instruction-student practical exploration”, “learn-practice-relearn-practice again” mode is naturally completed which enriches theoretical knowledge and enhances engineering practical ability. In addition, with the participation and training in the whole process of projects funded by enterprises, students' comprehensive abilities including teamwork and interpersonal communication are fully developed, laying a solid foundation for students' future career. The authors of this paper always believe great importance should be attached to opportunities for students to be coached for their active participation in projects and that freedom should be given to students to think, design

plans, establish an experimental platform and verify key technologies by themselves. In this way, remarkable improvement has truly been achieved in students' comprehensive abilities.

2) Set up a College Platform and Let Students Participate in Enterprise Projects Voluntarily Led by College

For those tutors who have few or no scientific research projects supported by companies, it is quite difficult for their students to practice. Through practical experiment and trial, a feasible way for student's practice is raised. With a considerable number of small and medium-sized enterprises in Zhejiang Province, the establishment of college platform and introduction of small enterprise projects offer engineering practical opportunities to students. For some enterprises, engineering projects are not difficult but cannot be completed independently due to limited ability of developers or time. In this regard, colleges should take the lead to undertake small enterprise projects and companies should invite students to finish the projects with sponsorship. Responsible for each project, students should be provided with project instructions by tutors. Similar to the above-mentioned students' participation in scientific research projects funded by enterprises, this type of practice enables students to complete the teaching process of integration of theory and practice. Furthermore, colleges will create a perfect database of tutors and enterprises, seek for closer cooperation among various corporations and provide more engineering practical chances for students when the time comes.

3) Students Practice in Enterprises Directly

The cooperation between universities and enterprises is a necessity for development of higher vocational education, which inspires the training of professional masters [4]. Therefore, colleges and schools should actively seek for good cooperation with corporations, adopt the training method that combines colleges with companies and let students practice in enterprises directly after finishing their postgraduate studies. Apart from this, all students should be allocated enterprise tutors who instruct them to address problems occurring in the process of practice. The method that allows students to participate in the practice directly in enterprises enables them to experience the atmosphere of enterprise and understand the practical demands of enterprise, spurring them to find out their deficiencies and study practical subjects according to needs of companies. In this way, postgraduate students can adapt themselves to the environment of enterprise more quickly and play their roles better.

B. Build an Excellent Team of “Double Qualified” Tutors

No matter what kind of engineering practice that students participate in, tutors play an indispensable role. While training that combines theories and practice for professional masters make higher demands for tutors. With the rapid development of professional master system, certain tutors are

unable to provide students with overall guidance, mainly because of lack of engineering practical experience of tutors who can just pass on theoretical knowledge without self-owned scientific research projects and sufficient engineering experience of instructions for students' practice. For this purpose, an excellent team of "double qualified" tutors should be built in universities and colleges.

The so-called "double qualified" tutors, who can accurately impart knowledge to students with rich theoretical knowledge and good engineering experience, are capable of guiding engineering practice. Tutors' practical ability determines that of their students and those inexperienced in engineering practice are not suitable for training of professional masters. Consequently, a large number of "double qualified" excellent tutors are needed to meet urgent demands of faculty for launch of training integrating theory and practice in both colleges and schools. What's more, universities and colleges can carry out the training model combining theory and practice by designating tutors and type of students.

The training approach of "double qualified" tutors include following two aspects.

1) *Tutors' Learning and Practice*

In order to become a "double qualified" tutor, tutors themselves should keep learning and practicing. While universities and colleges should provide tutors with a platform for learning and practice to improve their comprehensive abilities of both theory and practice.

2) *Effect of a Team of Tutors on Tutors*

The training of "double qualified" tutors largely depends on the comprehensive training effect that a team of tutors exerts on tutors themselves. Every time a team of tutors give instructions to students, it is also an opportunity for tutors to learn and practice. Students of different types and features will be given all-round guidance by the team in which tutors can also learn from others' strength to offset their weaknesses, thus creating a good academic atmosphere of learning in process of teaching and facilitating the establishment of "double qualified" team.

III. TRAINING METHOD INTEGRATING THEORY AND PRACTICE FOR PROFESSIONAL MASTERS

Based on the establishment of perfect platform for practice and excellent team of "double qualified" tutors in both universities and colleges, the training that combines theory and practice for professional masters can be successfully carried out. The training methods for integration of theory and practice for professional masters majoring in mechanics are mainly divided into two categories.

A. *Enterprise Project-Student-Tutor-Team of Tutors*

Geared to the needs of professional masters of all grades, this training model is mainly applied in campus. Its primary

practical source comes from enterprises projects provided by tutors or college platform and theoretical source from students' tutors and team of tutors mainly through tutors' instructions and secondly with the team of tutors. Students should be guided to solve various problems occurring in the practice of engineering project in this approach, thus truly realizing individualized teaching of students in accordance with their aptitude and implementation of theoretical and practical teaching both at the same time and in the same space.

B. *Enterprise Internship-Student-Enterprise Tutors*

However, this combined training model is mainly launched in enterprise for those who have finished classroom learning. With the agreement signed by universities and enterprises, enterprise tutors are arranged to lead students to practice. This type of enterprise internship should be realized based on a certain enterprise engineering project rather than some regular assistant secretary work. Besides, enterprises should provide specific guidance of comprehensive professional knowledge for students. Students' gradation theses can be finished in corporations and their main direction of research should be enterprise project [5]. So, the training model integrating theory and practice for professional masters majoring in mechanics can be described as Fig.1.

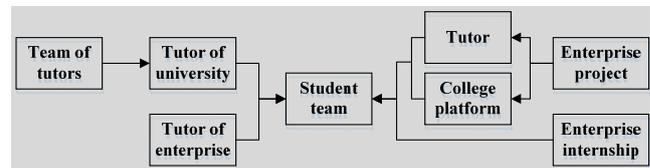


Figure 1. Training model integrating theory and practice for professional masters majoring in mechanics

IV. CONCLUSIONS

The training model that integrates theory and practice contributes to the improvement of comprehensive abilities of professional masters majoring in mechanics. Through important exploration of the training model, it is found that students trained in this model can reach the expectations of professional masters in both society and enterprises.

Certainly, some problems that need attention or solution are also discovered in the process of training for professional masters as follows.

Reasonable arrangements should be made for curriculum of professional masters. First and foremost, practice and application should be highlighted in course content to satisfy the engineering practical demands of students and courses without engineering practical significance should be arranged as few as possible [6]. In the second place, class

hours should be intensive so as to facilitate the students' participation in practice.

A good relationship among universities, colleges and enterprises should be established and overall standards and requirements for fear that students cannot receive good theoretical instructions during their internship in enterprises.

Trained with the model integrating theory and practice, some students put excessive energy to engineering practice while ignorant of efforts on graduation thesis. However, some tutors still make it a rule that students select topics from their own scientific research projects supported by government, which increases the difficulty of graduation to some extent and does no good to effective implementation of education model integrating theory and practice. Therefore, tutors should expand the sources of graduation dissertation to encourage students to take engineering projects as their topics.

ACKNOWLEDGMENTS

The authors thank the Training Program of Excellent Engineers Postgraduate-level (Mechanical Engineering)

issued by the Ministry of Education/Funding Project of Demonstration Base for Educational Innovation of Postgraduates in Zhejiang Province (JY200811).

REFERENCES

- [1] H. J. Wang, "Developmental path selection of local professional master's postgraduate education," *Journal of Yunnan Institute of Socialism*, pp. 185, 2012.
- [2] Z. X. Huan and X. Yao, "The thinking about talents cultivation pattern on professional masters," *Journal of the Chengdu Municipal Party College of C.P.C*, pp. 90-93, 2012.
- [3] C. J. Zhao, Y. Q. Guan and X. H. Yan, "Teaching practice analysis and thinking about the theory-practice integration," *Adult Education*, pp. 61-63, 2012.
- [4] H. Jin, "The inevitable way of higher vocational education deepen school-enterprise cooperation," *Educational Research*, pp. 56-59, 2010.
- [5] D. R. Tan and S. Gao, "Research on the training and thesis mode of engineering degree postgraduate students," *China Electric Power Education*, pp. 19-20, 2012.
- [6] X. Y. Li and P. S. Zhong, "Education exploration on mechanical full-time professional degree graduate students," *China Electric Power Education*, pp. 22-23, 2013.