Research on the Teaching Mode Reform of Energy and Power Engineering Basic Courses for Postgraduates

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Abstract. With the purpose of cultivating senior professional talents who could be well prepared to international cooperation, it is necessary to profoundly reform the teaching mode of postgraduate education in higher education institutions. Taking the energy and power engineering basic course of postgraduates as example, the teaching mode orient towards talent cultivation is reformed, and some relevant strategies for cultivating postgraduate student's practical abilities are proposed in order to establish the foundation for cultivating professional higher talents.

Keywords: teaching mode reform · postgraduate education · innovative complex talents · energy and power engineering

1 Introduction

Postgraduate education is major path to cultivate higher innovative complex talents, in the great process of implementing the innovation-driven development strategy, postgraduate education reform and innovation are getting more and more attention. At present, the reform of the innovative postgraduate cultivating system has acquired substantial achievements, played an important role in turning our country into an innovative country. However, current postgraduate education teaching system cannot completely fulfill rapid social and economic growth in our country, there is also huge gap compared with advanced level worldwide. Therefore, with the purpose of cultivating higher professional talents who could meet international standard, it is necessary to profoundly reform and innovate the teaching mode of postgraduate education in higher education institutions. Graduate school should explore systems which is appropriate and fits for its development path, to cultivate innovative talents. Eventually we shall find a path for postgraduate education and teaching reform that is suitable for China's national conditions [1].

The course of Advanced Fluid Mechanics is the most fundamental postgraduate course in energy and power engineering, it is an expansion from Fluid Mechanics course. Multiphase coexistence of materials and associated multiphase turbulent flow is explored in this course and their analytical methods for special problems with obvious phase

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interfaces of mixed flow dynamics are studied. Traditionally, teaching of Advanced Fluid Mechanics is barely the explanation of theoretical knowledge in classroom, lacking of new technologies and application introduction. From the course achievement point of view, students could simply master some basic theory to solve simple textbook cases, when it comes to actual difficulties in practice, they have absolutely no clue to process [2]. All in all, it is clear that traditional teaching modes cannot achieve the goal of cultivating innovative and practicing abilities of postgraduate students, it is necessary to reform the teaching mode of Advanced Fluid Mechanics course for postgraduates.

2 The Nature and Objectives of the Course

Advanced Fluid Mechanics is a basic course for academic master's degree in power engineering and engineering thermophysics; it is also basic course for professional master's degree in energy and power engineering. This course mainly includes theory, methods and application of fluid mechanics, students shall acquire the ability to further master expertise of fluid mechanics and the theoretical analysis ability to study, and solve fluid flow problems in engineering practice. Students are required to master the basic theory of Fluid Mechanics, including basic principles of fluid properties, models, kinematics and dynamics; application of above mentioned principles of fluid mechanics; understand the current situation of cutting-edge research on fluid mechanics.

The course objectives of Advanced Fluid Mechanics are:

Course objective 1: master field theory and tensor preliminary, basic equations of Fluid Mechanics, vortex motion, fluid stability, turbulent, boundary theory, environmental fluid mechanics and so on, further understanding of the basic concepts and theories of fluid dynamics.

Course objective 2: master the physical basis and important applications of fluid flow, laying a good foundation for follow-up courses.

Annotation: the curriculum objectives of general knowledge courses for engineering majors should cover the corresponding general standards for engineering education certification graduation requirements.

3 Existing Postgraduate Teaching Problems

In the past, scientific research achievements have become most important criterion for evaluation the quality of colleges, universities and also for teachers. "Only scientific achievement oriented policy" force university teachers regard scientific research projects and associated publication as their top priority work [3], while ignoring the postgraduate teaching. University teachers do not pay enough attention to the classroom teaching of graduate students, and the willingness of teaching situation optimization needs to be improved. Teachers often adopt cramming indoctrination way to teach knowledge, while students have to passively accept it. It is far from student oriented approach. Due to lack of pertinence and feasibility of teaching, to a certain extent, the dull classroom atmosphere, low study efficiency are unavertable. Some teachers even copy teaching methods from other schools directly in order to accomplish teaching reform project of graduate students as soon as possible. On the other hand, students cannot really

participated into the classroom, limited by the hardware and software conditions of the school, personal knowledge foundation and other reasons, resulting in quite inefficient situation of graduate teaching reform.

Have obsessed with the traditional classroom, ignored the experimental classroom, theory and practice separation is another major obstacle that the graduate teaching needs to reform. Experiment makes the truth more truthful. The fluid mechanics course is basic subject involving many specialties. Only mastering the basic knowledge and the actual process of the project, can the problem be analyzed in proper way and the solution be given.

In order to diversify the training of higher talents, full-time postgraduates have been divided into two categories: academic degree postgraduates and professional degree postgraduates [4]. The cultivation of academic degree postgraduates focuses on improving the discipline logic, aiming at developing academic ability, and taking into account the improvement of practical ability. The training objectives of professional degree postgraduates are mainly professional wise, while taking into account the nature of scientific research. The training objectives and knowledge reserve basis of the two type are obviously different, but many college teachers do not make a clear distinction between them. The teaching methods and content selection are similar. The phenomena of excessive academic training of professional graduate students is normal, which to a large extent leads to inefficient teaching effect. The integration of scientific progress and practical application is the rigid requirement of social development. However, both the scientific research innovation ability of academic degree postgraduates and the practical application ability of professional academic degree cannot be exercised properly without properly organized teaching.

4 Talent Training Oriented Reform of Postgraduate Teaching Model

4.1 Heuristic Teaching Model

It is different from basic course in Fluid Mechanics for graduates, the Advanced Fluid Mechanics is more inclined to theoretical derivation and the engineering application, the content of the course is profound and effort shall be paid to cultivating students' innovative ability [5]. Before the formal start of each chapters, teachers can introduce one real application issue related to new knowledge, within this problem-based learning model, students are required to check relevant study materials before the class, and discuss in groups, it helps students to form their own insights on new content, cultivate students' ability to learn and solve problems themselves. Employing Heuristic teaching model, students' initiative and creativity are leveraged in the classroom, introduction question is kept as the main line in class, guiding students to put forward their own opinions and questions after learning and discussion, pursing student's participation in the classroom to the greatest extent. Meanwhile teacher need to carry out pointing, analysis and explanation accordingly.

Fig. 1. Generalized fluid

Fig. 2. Iconic achievements of engineering technology

4.2 The Classroom Attaches Equal Importance to Scientific Research

In the process of teaching academic degree graduate students, teacher should pay equal emphasis on the classroom and scientific research, combine their own scientific research results with the latest research progress worldwide to deepen understanding the basic theory of textbooks and inspire students to solve practical problems encountered in their own research process. Taking generalized fluids teaching module for example, the definition and properties of generalized fluids can refer to natural phenomena or engineering examples, as shown in Fig. 1.

Students' critical and innovative thinking shall be cultivated. It should be encouraged that students learn textbook knowledge quite well and then be able to challenge the quality of existing research results when some loophole may be discovered [6]. At the same time, more landmark or splendid achievements shall be introduced, as shown in Fig. 2.

4.3 Optimizing Course Content

To improve the quality of the course, the content of the course should be considerate thoroughly. Basic concept must focused on and cutting-edge and innovative contents also need to be involved for its comprehensive characteristic. Teachers should keep

pace with the latest development in this field, update outdated theories, delete problem-solving skills, and introduce the latest research results and practical technologies in relevant aspects into the course content to improve class efficiency and deepen students' understanding on key issues [7]. In the process of classroom teaching, the analysis and explanation of research papers shall be interspersed into course content, guiding students to acquire knowledge from the perspective of academic research and practical application, and realize the transformation from learning to research and application.

4.4 Promote Education with Evaluation

With the improvement of the management concept of higher education practitioners, the concept of curriculum evaluation is gradually transitioning from "judging quality level" to "improving teaching quality". The evaluation system is no longer just meagre auxiliary system for teaching and research, rather than an important part of curriculum construction. Establishing a standardized and complete curriculum review mechanism, improving postgraduate curriculum teaching, optimizing the curriculum assessment system, strengthening curriculum teaching management and supervision, improving the postgraduate curriculum evaluation system, and putting "promoting teaching with evaluation" into practice are all the basic requirements of the Ministry of Education for postgraduate courses, and they are also indispensable key steps in the actual teaching process of graduate students [8].

As it is mentioned in above four aspects, talent training oriented reform of postgraduate teaching model is employed to facilitate the postgraduate students in energy and power related majors to analyze and solve complex engineering problems, as shown in Fig. 3.

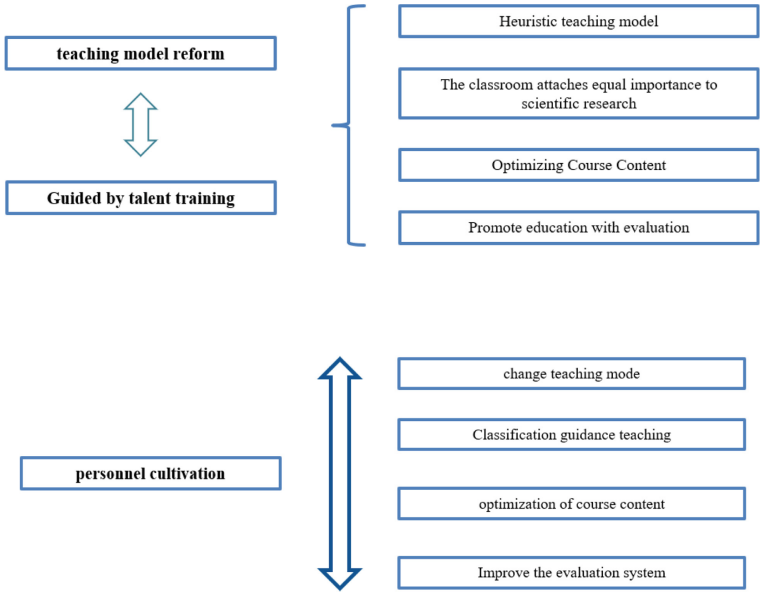

Fig. 3. Reform of postgraduate teaching model guided by talent training

Student oriented teaching reform is the main direction of future education reform and it is the main way to realize applied talents in Energy and Power Engineering under the context of new engineering.

5 Concluding Remarks

Postgraduate course teaching is important component of postgraduate education, it is not only of great practical significance for graduate students to master subject knowledge and improve their scientific research ability, but also promote the globalization and the development of science and technology in the new century. However, traditional postgraduate teaching methodology, that adopts simple teaching method and cannot handle the relationship well between teaching and scientific research, still exists despite rapid social development. Therefore, there is an urgent need to reform postgraduate teaching according to the current social and educational development trends. Reform of talent training-oriented teaching model has been established for basic courses for graduate students in energy and power engineering, which puts forward corresponding reform strategies for the cultivation of postgraduate' innovation and practical ability. This innovative postgraduate teaching model is designed suitable for current social and industrial development, laying solid foundation for the training of senior talents in various professions.

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