The New-model of Practice Courses for New Energy Science and Engineering Under the Background of Engineering Education Accreditation

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ABSTRACT

The education accreditation for higher education brings a clipping development opportunity, but also causes some problems simultaneously. The new-model of professional practice courses has been discussed based on the background of outcome-based education for the new energy science and engineering majors. The principle problems existing in the current practice courses have been sorted. Meanwhile, new practice teaching and training system is established in light special characteristics of various courses. The cultivated goal, centered on the outcomes-based education, is achieved, according to the echelon team training mode in the whole grade.

INTRODUCTION

The new energy science and engineering is one of new engineering and technical majors and first permitted to establish by the Ministry of Education in 2011. This major is fully supported by national 12th five year plan, and also one of the characteristic majors mainly developed in the national 13th five year plan\textsuperscript{[1,2]}. Due to the relatively late establishment for this major, most universities have set up the individual school or faculty. Thus, according to the characteristic of the major itself, this major is relied on other schools, such as school of power and energy, material, environment and physics. It’s obvious to find major disciplines intersect with each other. In addition, since this

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major is still in the initial stage from the national point of view, there are not sufficient successful experiences to reference. That’s the urgent reason why it deserves a deep discussion and straightforward plan\(^3\). In light of both the guiding ideology from the Ministry of Education to run the universities and the characteristics of engineering majors, the current developing status of disciplines home and abroad and the demand status of different industries are combined. Our university has set up the objective to cultivate talents for the major of new energy science and engineering, taking the development orientation and the basic conditions as well as the advantages of this discipline into consideration. The cultivated talents could well adapt into the need for national energy strategy, master the fundamental theories and engineering techniques of the new energy science and be equipped with extensive knowledge and practice ability and high-quality creative spirit. Therefore, the task to strength practice, cultivate the ability of both engineering practice application and research innovation and get the comprehensive quality advanced, reaches this state\(^4\).

THE PROBLEMS CONFRONTED WITH NEW ENERGY MAJOR UNDER THE SYSTEM OF OBE

Engineering education accreditation is one of education concepts, centered on outcomes-based education, to organize, carry out and evaluate education\(^5\). It stresses the new-model education theory, which is centered by students, oriented by production and tasked by sustained improvement. This accreditation system extremely focuses on the cultivation of innovation ability, negotiation and cooperation ability and the solving ability for practical engineering problems. In contrast, it’s scarcely possible to get these abilities gained via theoretical courses and specialty experiments. As a result, the current practice courses methods should be modified to improve the abilities of operation, innovation, analysis and solving practice problems\(^6\).

As a fresh member of Washington Agreement, most domestic engineering degrees have been certificated. However, because of the late establishment of the new energy major, all declarations are still in preparation. Besides, it highly intersects with other engineering majors, mostly deduced from energy, material, mechanics, chemistry and environment disciplines. In summary, this major has some drawbacks, including complicated background, multiple structures, late establishment and incomplete supporting facility for practice courses, leading to the present situation that the students cultivated by higher education system are hardly meet the requirement of the society\(^6\).

There are still major problems existing according to the past situation of practice courses, mainly expressing as the absence of practice equipment. To fill this blank, a large volume of fundamental physical experiments have been launched. It first contributes the disorder in the basic thinking ability of students and the loss of the essence of engineering subject. Additionally, the short of qualified teachers, especially that with well engineering background pushes most of teachers equipped with merely science background have to burden this task to instruct the practice activities for students, leading to the severe lack of high-quality and long-time guidance. Moreover, the lecture method has been limited to lack of flexibility and scarcely reaches the goal for the students’ ability cultivation such as contact ability between theoretical and practical knowledge, practice ability and innovation ability. Finally, the weakness in operational ability of students makes the loss of creative innovation ability.
Specifically, junior students would like to take part in practice activities with high enthusiasm, but with little knowledge base. While the senior students have a good sense of fundamental knowledge, unfortunately due to the lack of early training, it is reasonable that they are short of abilities to solve practical problems, summarize and express. Furthermore, these potential shortcomings decrease the confidence, limit the performance in practical competitions and restrict the improvement of their comprehensive quality and core competitiveness.

THE ESTABLISHMENT OF INNOVATION TRAINING SYSTEM IN PRACTICE COURSES

The cultivation objective has been set up as the student-centred cultivation for practical professional talents, on the other hand, it highlights the two-centre core concept, one is centred by students, and the other is centred by practical engineering requirements. The ability to recognize the practical engineering projects deserves much attention, by which the ability to detect solve and summarize the problem they come across can be strengthened. Besides, in light of the principle of overall consideration for both reality and advance, the training projects are designed hierarchically and the graduates are cultivated periodically. Based on that, the training content can be gradually updated, resulting that the students could grasp modern engineering application techniques autonomously.

The cultivation model sticks to centre students on and lays equal stress on the autonomous innovation ability. The ways of cultivation for talents include team organizing based on requirement, standard designing based on projects and talents selecting based on task. The new practice and innovation training model could be achieved, that is, students manage projects first, then students manage students themselves and finally projects select students. This new model stands out to improve the practice ability and the innovation ability of students. And the practice innovation training system for the new energy scientific and engineering majors can be established and completed step by step. To reach this goal, the training sessions are divided into three levels on the basis of grade difference.

The first layer pays attention on basic knowledge technologies to make training for fundamental skills. The second layer is mainly focused on the coordination and distribution of responsibilities to cultivate the ability for utilization of comprehensive knowledge and independent design. The last one is the autonomous innovation abilities composed by detecting, analysis and solving problems.

For more detailed implement contents, the students are assigned with different tasks according to their grade levels, and then the team is organized as a ladder layout (1-2-3-1 fresh team model), which includes two core leaders, two skeleton staff, three reserved talents, one professional guidance teacher and a comprehensive coaching team. Afterwards, to keep the continuity of team training, the radiation type of cultivation method is adopted, in which the specific training goals decide the significant points the students should undertake. Six measures are built up to guarantee the achievement of this project content and its final goals, i.e. guarantee there exists different tasks in a signal team, guarantee every team is guided by an experienced member, guarantee there are young team members requiring training, guarantee the task could be completed independently by each team, guarantee all teams have the
opportunity to take part in competitions, and guarantee each team could leave valuable heritages, that is, precious experience. The practice innovation training had better cover all grades from the freshmen to senior students for the improvement of their engineering practice ability. This new cultivation model can achieve the ideal pattern that senior students lead the junior students, whereas, the junior students autonomously learn from the senior ones. There are advantages in keeping the continuity of training and students’ enthusiasm, distributing the resources of the university reasonably, and reducing the large amount of instructing work of teachers. Thus, the cultivation quality for students could be guaranteed even in the situation of the deficient teachers.

CONCLUSIONS

In summary, different grades complete different training tasks to assure the continuity of team and students cultivation. Then, the competitions can promote the initiative of students in study to fix the integrity of the process that teachers guide students to complete project. The courses aiming at cultivation abilities for autonomous innovation and specialized and versatile have been formed entirely. By this way, it will be easy for students to get involved in solving the engineering practice problems. Finally, the duration to adapt the society after graduation from university will be shortened since they could use what they’ve learn to solve the problems they come across.

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