Study on Mode of Progressive Cultivation on College Students’ Innovative Ability Based on Industry Demand

Qiang-tian Li\textsuperscript{1,a} and Wei LIU\textsuperscript{2,b,*}

\textsuperscript{1,2}School of Energy and Power, Jiangsu University of Science and Technology, Zhenjiang, Jiangsu, China
\textsuperscript{a}lqttw@163.com, \textsuperscript{b}974392306@qq.com
\textsuperscript{*}Corresponding author

Keywords: Innovative Ability, Progressive, Cultivation Mode.

Abstract. Development of improvement of college students’ innovative ability is strategic need of wealthy and powerful people, as well as the core content of reform and innovation of current higher education. Based on the industry demand, this paper takes the cultivation of innovative ability of college students as its focus, organically integrates various elements of cultivating college students’ innovative ability, tries to construct progressive cultivation mode of college students’ innovative ability, so to improve its effectiveness.

1. Introduction

In modern society, with the increasing update of the knowledge and economy, the improving of national competitiveness, and the comprehensive development of people, there is a higher requirement on college education to pay more attention to the cultivation of college students’ innovative ability, to optimize the cultivation models, to reform teaching methods and the application of modern teaching equipments, to construct practical teaching and platform, and to set up efficient security system for cultivating innovative ability.

This paper mainly studies on how to cultivate college students’ learning ability, application ability, integration ability and creation ability to improve the effectiveness of cultivating college students’ innovation ability, and to cultivate and enhance their innovative ability so as to improve the cultivation quality of college students. The cultivation of innovation ability is of great strategic significance for enriching the theoretical significance and the content of higher education reform as well as promoting the development of higher education.

2. Present Situation of Cultivation of College Students’ Innovative Ability Based on Industry Demand

There exists a gap between the reality and innovative ability of current engineering college students: first, lack of innovative awareness or action, ignoring the dynamic development of the discipline and its cutting-edge knowledge, neglecting the transfer of related knowledge; second, with quick thinking, but lack of innovative thinking ability, which makes them hardly use connected, critical and comprehensive thinking; third, with inspiration, but lack of innovative skills; fourth, lack of innovative interest or perseverance.

Through surveys of industry demand, we found that engineering literacy and practical innovative ability of engineering college students are incompatible with the industry demand, such as the practical operation on production line and hands-on ability, new technology tools’ application design and cross-professional knowledge, jobs and collaboration capacity during manufacturing process, awareness of improving traditional production technology and modern production efficiency, and so on.

In order to promote the cultivation of talents to meet the needs of the industry, the engineering literacy to conform to the technical connotation of the enterprise, the team spirit to adapt to the needs of work and the innovative awareness to promote the enterprise development, this research
project suggests that the cultivation of the applied talents’ ability should take the cultivation of the practical innovative ability as the main line, to strengthen the engineering quality of college students, and to create the five-stage progressive cultivation method, the multi-fusion open teaching system, the dynamic correlation mechanism of teaching content as well as the strong resource sharing platform both inside and outside the school, taking multi-dimensional measures to improve the practical innovative ability of college students.

3. Construction of Cultivation System of Progressive Innovative Ability

The growth of college students has the characteristics of stage and regularity, therefore, the cultivation of their innovative awareness and ability follows some regularity, and this research project puts forward the multi-fusion and closed-loop cultivation model of combining “individual growth” and “systematic cultivation” as shown in Figure 1.

![Figure 1. Cultivation System of Progressive Innovative Ability of College Students.](image)

Progressive cultivation model is industry need-oriented, and it reconstructs the talent cultivation program, in accordance with the ability requirements of “wide foundation, professional excellence, strong practice, multiple creation, sustainable ability, efficient handling”, according to the characteristics of each student to develop personalized cultivation program, opening up in and out of class channels, taking actual production of enterprises and society as students’ training program, which is different from the traditional model of experimental teaching in the classroom, and also is different from the experimental teaching of verification in the laboratory.

In individual growth, integrating the five-stage progressive innovative ability cultivation system of “awareness guidance, interest stimulation, experience enhancement, honor driving, competition innovation” and increasing the scientificity of cultivation. The multi-fusion and closed-loop cultivation method, based on the five processes, according to the regularity of the formation of college students’ innovation ability from awareness to thinking habits, guides students to experience innovation, feel innovation and enjoy innovation in knowledge learning, practice and collaborative competition to form innovative thinking habits eventually.

As for systematic cultivation, students’ scientific and technological practice of extracurricular channels should be put into the talent cultivation system, from simple to complex, to construct
innovative experimental teaching which is divided into four levels: basic cognitive experiment, design-oriented experiment, comprehensive experiment and researching experiment.

The level of basic cognitive experiment is for Grade One students. After students have chosen an integrated project or scientific and technological competition, they will have a comprehensive understanding of the integration project through basic cognitive experiment, being clear about the main task of each module, increasing their interest in the project.

The level of design-oriented experiment is for students of Grade One and Two. Students will complete the design-oriented experiment disintegrated from the integrated project. This level emphasizes on students’ practice, and pays attention to basic skills training.

The level of comprehensive experiment is for students of Grade Two or Three. Students will complete the comprehensive experiment disintegrated from the integrated project. This level emphasizes on students’ autonomy, and focuses on the research of comprehensive use of knowledge.

The level of innovative experiment is for students of Grade Three or Four. Students will choose an innovative project according to their own interest or expertise, and complete the project or participate in a competition under the guidance of their teachers. This level emphasizes on students’ innovation, and focuses on the research process rather than research results.

In addition, the mode of carrying out a variety of research teaching, and research-oriented experiment in class, is combined with diverse independent innovation experiment studies out of class. This model forms the students of different grades and majors into a project group in accordance with their interest. Each of them bears the corresponding experimental module according to his own expertise, and does the experiment autonomously under the guidance of his teacher. It emphasizes more on “student-centered”, “system as the object”, and “product as the goal”.

4. Paths to the Implementation of Progressive Cultivation Mode

According to the system theory, talents cultivation, as a systematic project, needs to consider both the individual development and system design, so the individual development is in accordance with the five stages of “guidance, inspiration, experience, honor and innovation”, to achieve promotion from innovative awareness to innovative ability. Meanwhile, in the specific implementation, these five stages need to be achieved through gradual guidance, taking good advantage of the situation in the system design.

![Figure 2. Implementation of Progressive Cultivation System.](image-url)
4.1 Frontier lectures as guidance to cultivate innovative and practical awareness of college students

As for the situation of lacking specialized courses for the popularization and training of the knowledge of practical innovation during the process of cultivating innovative talents, training courses of practical innovation in general education curriculum could be offered, or invite experts to give lectures or hold seminar for students instead of related courses teaching so as to improve students’ interest in learning and innovation and broaden the thinking ways of innovation.

Taking project design as orientation, engineering capacity cultivation as goal, guiding students into engineering practice field from the initial stage through introductory lectures, combining the related courses organically around the project design in the process of classroom teaching and experimental teaching, this research tries to make students experience the process of advanced design while learning professional knowledge, and to form a benign interaction between knowledge learning and application.

4.2 Innovation plan, science and technology activities as the carrier to stimulate students’ practical innovation interest

Implementation of college students’ innovation research training plan, and establishment of a perfect scientific research training guidance system, can encourage students to participate in the whole process of scientific research training. Students should be guided and stimulated to participate in the scientific research projects of their teachers actively to cultivate students’ innovative spirit and practical ability with the help of scientific research projects as well as to keep abreast of the latest research trends and determine their own research direction as soon as possible.

Setting up a number of comprehensive integration projects, and emphasizing on interdisciplinary, enable students of different grades and majors to participate, and learn project-related knowledge under the project-driven learning, so as to make them take a good grasp of theoretical knowledge in the experiment and self-learning.

4.3 Independent innovation laboratory as a platform to enhance college students’ DIY practical innovation experience

Various types of school practice innovation activities studios are formed to provide necessary basic hardware and software conditions for students’ innovative activities. Opening the laboratory for the project, and providing equipments and lab materials, helps students to use the organic combination of test equipments to verify their own ideas and experimental programs, reorganize and transform the instruments, practice the ability of practical operation, and stimulate their innovative thinking and innovative awareness so as to realize their creative wish.

Students personally participate in and design experiments, experiencing the sense of achievement brought about by DIY practice innovation experiment. They are encouraged to apply for open optional experiments, and allowed to integrate into the laboratory, which is in favor of enhancing the ability of scientific research innovation by means of experiments.

4.4 Science and technology innovation competition as hand-grab to stimulate the innovation-driving force of college students

Through different levels of science and technology innovation competitions of the nation, province and university, to stimulate college students’ sense of honor and sense of achievement, and to cultivate students’ scientific research quality and innovative ability. Practice innovation activities need to be guided by interest and driven by the project. The source of the project can be the creativity of the teacher or the student, and the team can be freely organized according to the interest, and the instructor is employed to guide the implementation of the project and recommend the project and apply for the subsidies of school or enterprise.

Carrying forward the innovative activities at all levels, to ensure that the largest number of students to participate in practice innovation activities. Actively organizing students to participate in national or provincial scientific and technological innovation activities provides a larger stage for outstanding students to show their ability of practice innovation.
The progressive innovation ability training mode puts forward the training of systematic capacity, the full implementation guidance, and the standards of implementation and inspection, which allows the engineering graduates’ ability to be strengthened in terms of four levels of ability, that is, the engineering basic knowledge, personal ability, team capacity and engineering system capacity, taking the comprehensive way of cultivation to improve students’ systematic comprehensive capacity as the goal, which is also in accordance with innovative education’s goal of cultivating students innovative spirit and practical ability.

Acknowledgement
This paper is one of the stage results for the 12th Researching Project of Five-year Education Plan of Jiangsu Province (D/2015/01/80).

References