

Constructing Collaborative Innovation Ecological Environment for College students innovation Ability Cultivation

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Abstract. There are many problems among contemporary college students, such as weak innovation consciousness, insufficient innovation motivation and poor ability of innovation achievements transformation. Through analyzing the relevant elements of innovation chain, ideas about the construction of collaborative innovation ecological environment is proposed for improving the teaching effect of innovation education for college students in this paper. The concrete measures and effects about the practical platform of university-enterprise collaborative innovation, the comprehensive and multi-dimensional innovation education system in universities, and the construction of first-class undergraduate courses in innovation education are introduced in detail. The practice shows that the construction of collaborative innovation ecological environment fundamentally solves the "bottleneck" problem of college students innovation, and provides inexhaustible power for the cultivation of college students innovation ability.

1 Introduction

Due to many reasons such as family environment, exam-oriented education and professional foundation, contemporary college students have problems such as weak innovation consciousness, insufficient innovation motivation and poor ability of innovation achievements transformation, which bring difficulties to the development of innovation education. The specific performance is as follows:

Firstly, due to the pressure of entering school, some families have too much involvement in their only child's life and study, which leads to students' poor self-management ability, lack of social practice ability, lack of necessary attention to social production activities and conditions, all of these result in insufficient innovation motivation and difficulty in finding innovation problems.

Secondly, long-term exam-oriented education makes some students fall into the "only answer" mistake for innovation problem solving, ignoring the new possibility of solving the problem, resulting in the blocking of innovation ideas, lack of the practice ability and means to solve the innovation problem.

Thirdly, some students have a narrow professional vision, lack of engineering consciousness, and have not formed a systematic professional thinking and engineering concept, so the lack of engineering application value of innovative achievements is resulted, and achievements is difficult to transform and apply.

2 Analyzing problems

Through the analysis of the current situation of college students innovation, it is found that there is a big gap

between the goal of cultivating innovative talents in universities and the actual situation of current college students, which requires us to solve the following three problems in innovative teaching practice.

Firstly, where does the innovation problem come from? The problem of innovation must come from practices and arise from real demands. It is necessary to pay attention to individual needs in life practice, to focus on the well-being of the people in social practice, and to focus on technological progress and production efficiency improvement in engineering practice.

Secondly, how are innovative ideas formed? Engineering technology is the foundation of innovation, and innovative ideas are the "east wind" to solve innovation problems. Engineering technology foundation and innovative ideas are complementary to each other, and they are unified in innovation practice. On the premise of having the foundation of engineering technology, breaking the inertia of thinking and forming effective innovation thinking are the key to solve the problem of innovation, which requires scientific innovation method guidance, reasonable logical process and effective evaluation system, combining the system conditions and technology system evolution laws.

Thirdly, how are innovation achievements applied? According to the practical materialism viewpoint of "It is from practice and back to practice", innovation must be applied in practice to play its function and value, and there is still a long way to go from innovation achievements to innovative products, which involves the protection of intellectual property rights and patent achievements and so on questions, whether innovation can meet the needs of the production and living at the same time also must also be tested through practice.

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3 Ideas of solving problems

Obviously, the above innovation issues focus on initial stage, intermediate stage and end stage of innovation respectively. In order to solve these problems, we must set out to establish systematic problem solving thought from macro to micro dimensions. At the social level, a results-oriented university-enterprise collaborative innovation practice platform^[1-3] should be constructed. At the school level, a comprehensive and multi-dimensional innovation education system supported based on innovative methods should be built. At the course^[4-8] level, effective innovation method teaching and assessment mechanism should be established. Further, a collaborative innovation ecological environment^[9] is formed featuring three-ring interaction, iteration and mutual promotion. The schematic diagram of collaborative innovation ecological environment is shown in Figure 1.

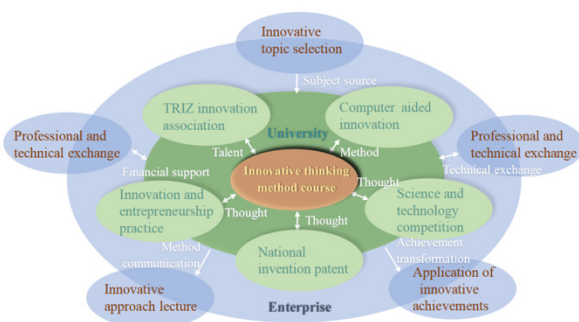


Fig. 1. Schematic diagram of collaborative innovation ecological environment

4 Specific measures

4.1 Constructing a platform for university-enterprise collaborative innovation

4.1.1 University-enterprise collaborative innovation mechanism

According to Schumpeter's theory, the innovation is a kind of practice that introduces a new kind of factors of production to the production practice, thus the goal and destination of innovation are production practice. Enterprises are the main part of production, the driving force of innovation demand lies in enterprises, innovative solutions to technical problems or innovative products will eventually be applied to the actual production of enterprises. Innovation will become nothing without enterprises participation, just as water without source, or tree without roots. University-enterprise cooperation is the only way of collaborative innovation.

Although universities and enterprises are two important parts of innovation, the difficulty of cooperation in innovation practice is caused due to the difference of function and goal. In the construction of university-enterprise collaborative innovation platform, emphasis should be placed on university-enterprise communication and collaboration, as well as the

converging transformation of university-enterprise functional goals. Universities have the advantages of talent and technology gathering, and their main functional goals are talent training, technological development and cultural output, while enterprises aim at producing products that meet people's needs, and the production process and technical process are important guarantees for their realization of product output. From the perspective of collaborative innovation, they have the same functional objectives. Universities can cultivate innovative talents to satisfy the demands of enterprise by changing the educational ideas and methods, and enterprises can realize the transformation of production process and technology by absorbing innovative talents to better meet the needs of product production, while promoting the growth of creative talents. Universities and enterprises have the relationship of "supply and use". In turn, the demand of enterprises for innovative talents also affects the mode and direction of talent training in universities. They have similar goals in innovative talent training, and are unified ideas in the cultivation and use of innovative talents. Therefore, there is a natural fit between universities and enterprises in the cultivation of innovative talents.

4.1.2 University-enterprise collaborative innovation initiatives

On the practical level, college students' innovative topic selection must be originated from production practice and served for engineering technology innovation. Innovation achievements must be applied to the actual production of enterprises for meeting the actual production needs; Innovation scheme determination and innovation design must be combined with the actual production of enterprises and in line with enterprises norms; The test and evaluation of innovation achievements must be based on the acceptance of products and technologies by enterprises and society. The innovative methods and practical experience formed in the whole innovation practice are not only applied to the practice of talent training in universities, but also used to guide the practice of collaborative innovation in enterprises.

In the concrete practice, first of all, a long-term cooperation mechanism between the university and enterprise is established through the strategy of introducing and leading out for not only carrying out scientific research and technology exchange, but also furthering strengthen the integration of engineering consciousness and university culture, and sharing innovative ideas and innovative methods. Secondly, by strengthening the close connection with the national innovation organization, a long-term communication mechanism is established with the purpose of creating a good external atmosphere for college students' collaborative innovation. Finally, we will actively carry out engineering technology and innovation method consultation, a collaborative innovation practice platform led by the Institute for Application of Innovation Methods is built, and it actively meet the needs of enterprises, and actively participate and guide the technological research and innovation practice of enterprises.

4.2 Constructing an comprehensive and multi-dimensional innovation education system in universities

4.2.1 Construction emphasis of innovation education system^[10]

University is the main place to realize innovation, for college students innovation practice, students innovation psychology and innovation consciousness are always affected by the humanistic and technological environment of the university. Therefore, the comprehensive and multi-dimensional innovation education system in universities plays a positive and important role in promoting college students innovation practice activities and is the core driving force for the agglomeration of innovation driving force. The construction of comprehensive and multi-dimensional innovation education system involves all aspects of teaching and educating people in universities, but the most important thing should be how to deal with the initiative of innovation subjects, the diversity of innovation carriers and the transformation of innovation achievements. In the practice of college students innovation, the main body of innovation is college students, and the cultivation of their innovation consciousness and innovation ability is the problem^[11] that higher education must face, and it is the subject that universities should try their best to study. Innovation carrier is the technological projects or product development process that carry the innovation practice activities of college students. Without the support of innovation projects, it is impractical to talk about the cultivation of innovation ability; The transformation of innovation achievements is the bottleneck of the current university innovation drive plan, which needs to be solved urgently.

4.2.2 Construction measures of innovation education system

In terms of the cultivation of innovation consciousness and innovation ability of innovation subject, emphasis should be placed on the cultivation of students' ability to discover innovation problems, solve innovation problems and develop comprehensive innovation thinking ability by innovation theory courses. In terms of course system construction, we should combine online courses and offline courses, theoretical courses and practical courses, undergraduate courses and postgraduate courses, public elective courses and compulsory courses, innovative projects and innovative competitions, and implement them for all students by classification ways. Through the establishment of "TRIZ" innovation club, gather innovative fellows and ideas, so that students who really have innovative ideas form a sense of belonging .

Each year, universities provide a large number of funds named "college students' innovative undertaking experimental plan project", and it actively encourage innovation practice project of college students. Under the school good incentive mechanism, full-time teachers combined with the actual scientific research subject are

establish multiple innovation practice for students to choose to participate in the project. Through the joint efforts of students, teachers and school, the diversified mechanism of innovation carrier has been formed, so that students with innovative ideas can actively participate in innovation practice projects, and it provides a broad space for the growth of innovation "seedlings".

The achievements of innovation must be transformed into innovative products that are truly beneficial to the society and bring rich spiritual and material returns to the innovation subject, as well as bring a sense of achievement to the innovation subject. Innovation achievements can be protected and transformed through technology patent application and transfer. Innovation achievements can be evaluated and publicized through discipline competition and innovation design competition, so it can promote the promotion of innovation theory and practice achievements.

4.3 Creating first-class undergraduate courses of innovation education

The innovation education of college students is a systematic engineering, and the online course of "Innovative Thinking Method" is an important starting point to lead the systematic engineering into depth. It must be constructed and improved pertinently, and give full play to its carrier role of innovation education. On the premise of clarifying course objectives and considering course ideology and politics, the course of "innovative thinking method" is fully deconstructed and completely designed with the help of online open course resources, including course learning objectives, teaching content, teaching methods and teaching activities, in combination with the course characteristics of systematicness and complexity.

4.3.1 Reconstructing course objectives^[12]

According to the above concept of innovation education, the course objectives are reorganized and clarified, which are divided into four dimensions, namely, knowledge dimension, ability dimension, quality dimension and emotion dimension. The diagram of four dimensional innovative course objectives is shown in Figure 2.

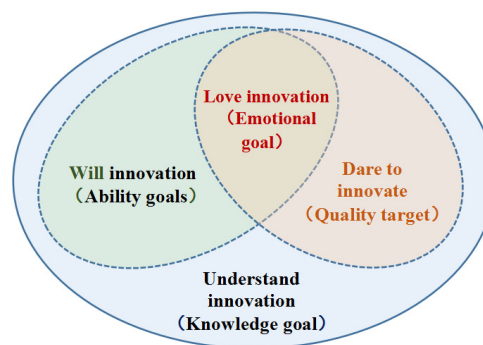


Fig. 2. Schematic diagram of four dimensional innovative course objectives

Knowledge goal(Understanding innovation): Students are required to understand the connotation of innovation, be familiar with the application system of innovation methods, understand the process of transformation and application of innovation achievements, and form the awareness of using innovation tools to solve innovation problems.

Ability goals(Innovation): Students are required to have ability to find innovative problems, have innovation ability to analyze functional and innovative problems, have the ability to excavate and utilize innovative resources, have the ability of solving innovative problems to resolve conflicts, improve functions and promote the evolution of technological systems, have the ability to evaluate innovative schemes with both ideal and reality as well as the combination of qualitative and quantitative methods. Students can actively recommend the transformation and application of innovative achievements.

Quality target(Daring to innovate): Students are required to set up correct innovative values, cultivate the pioneering and enterprising spirit of overcoming difficulties and not being afraid of challenges, form a rigorous and serious work attitude and realistic scientific research style, have a sense of national feelings, sense of responsibility, sense of norms, environmental awareness and professional ethics, and pay attention to the harmonious development of man and nature.

Emotional goal(Love innovation): Through innovation theory and innovation practice teaching, students can gain the sense of mission to solve difficult problems, the sense of responsibility of division of labor and cooperation, the sense of achievement of innovation, the pleasure of sharing experience, and the sense of acquisition of achievements transformation.

4.3.2 Optimizing course design

Course content design is the basis to achieve course objectives. In teaching practice, course design is constantly optimized and perfected. Firstly, combined with the learners' different needs, the learning objectives of the course are set up in layers, namely cultivating innovation consciousness (level 1), grasping the method of innovation (level 2) and exercising innovation ability (layer 3), different teaching contents and tasks are set combined with different hierarchy of needs. Secondly, course teaching content is designed based on problem orientation, focusing on systematic contradictions, focusing on resource mining, breaking through thinking inertia and leading innovation in a positive way. On the macro level, it emphasizes the systematization of innovation process, and on the micro level, it emphasizes the fragmentation of knowledge points. On the basis of emphasizing the independence of knowledge nodes, it strengthens the complementarity of course contents and closely combines the elements of knowledge, ability, quality and emotional education. The hierarchical diagram of learning objectives is shown in Figure 3.

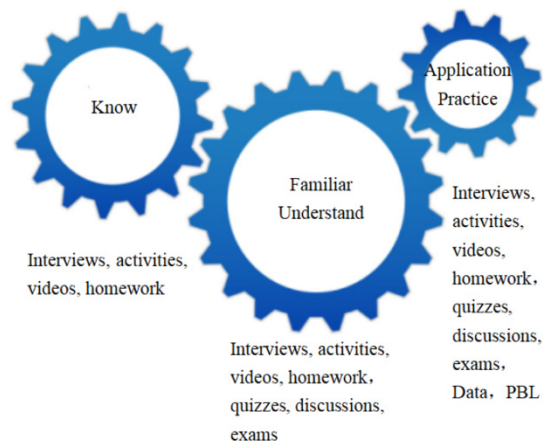


Fig. 3. The hierarchical diagram of learning objectives

4.3.3 Flexible teaching method^[12]

Different teaching methods and means should be implemented according to the content of the course and the characteristics of the students. On the one hand, according to the learning objectives and teaching requirements of learners at different levels, the teaching effect is improved by comprehensive application of "case-based teaching", "flipped classroom", "discussion-based teaching", "online assisted teaching", "PBL", "CAI" and other methods. On the other hand, combined with the learning objectives and abilities of different learner groups, various forms of teaching activities are carried out, including routine task-based (video, homework, unit test, examination), interactive (discussion), independent exploration (PBL), and extended consulting (teaching materials), etc. The schematic diagram of teaching method application is shown in Figure 4.

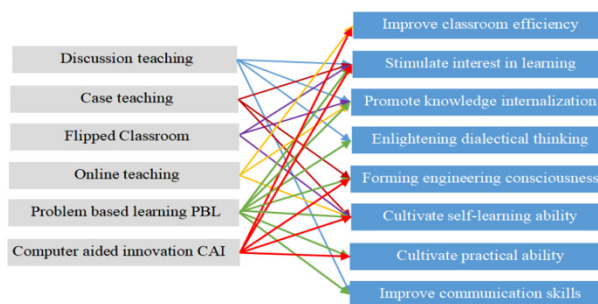


Fig. 4. The schematic diagram of teaching method application

4.3.4 Refinement assessment system

According to the needs of different learners, a diversified, multi-level and multi-dimensional curriculum assessment system is established. Firstly, a diversified subjective and objective assessment mechanism is established; Secondly, multi-level assessment task requirements is formulated; Thirdly, multidimensional assessment content is set. In addition, according to the requirements of course credit recognition and course nature management in different universities, the course assessment is classified and set according to different learning objectives.

5 Conclusion

Through the formulation and implementation of corresponding systems and measures, the topics of college students' scientific and technological innovation activities is more in line with the reality of production and life, and comes from the reality world truly. In recent years, the topics of college students innovation and entrepreneurship experimental plan is more in line with the actual engineering production under the guidance of the teaching team, and the students' engineering consciousness has been further enhanced. Each link of the process chain of college students' product innovation runs smoothly and is more targeted with the construction and implementation of collaborative innovation platform; The concept of open cooperation and win-win cooperation has been deeply rooted in the hearts of the students, the efficiency of innovation practice has been improved greatly; The enthusiasm of carrying out innovation activities of college students is unprecedented high, the innovation achievements are remarkable, and the number of patent applications is increasing year by year; The production-university-research cooperation mechanism has become more smooth, and the results of university-enterprise cooperation are showing up. The operation of the collaborative innovation platform is guaranteed by the establishment of the collaborative innovation system. The subjective initiative of each innovation subject is given full play under the constraints of the system, more students participates in the innovation practice actively, and follows the road map and schedule strictly. Internal synergy and external synergy promote each other and complement each other. By frequent communication and interaction among innovation subjects, the product innovation process chain runs smoothly, and the cultural and information exchange among innovation subjects are enhanced, and a community of interests and goals of "we are interconnected" are formed, so the efficiency of innovative products is greatly improved, and the transformation of innovation achievements is promoted. Though the construction of collaborative innovation ecological environment, the "bottleneck" problem of college students innovation is fundamentally solved, and a steady flow of power for the cultivation of college students innovation ability is provided, and references are provided for the reform of innovative talent training mode in universities.

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