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Construction of Innovative Ability Evaluation System for College Students Inspired by Engineering Education Accreditation

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Abstract: *Under the background of the new era of building an "Emerging Engineering Education", constructing a scientific and reasonable innovative practice capability system has become an important part of professional education and an important task facing higher education in engineering. Based on the current situation of the research on innovative talent cultivation in local universities in China, the commonality, and differences of the evaluation system for innovative ability are analysed. A comprehensive evaluation system is constructed to evaluate the innovative ability of domestic college students from innovative thinking, innovative consciousness, knowledge ability, and practical ability. Finally, taking the functional material major at Xi'an University of Architecture and Technology as an example, it detailed the establishment of the practical ability evaluation system and pointed out the path for the realization of the system.*

Keywords: *Engineering Education Accreditation, Innovative Ability, Evaluation System*

1. Introduction

Higher engineering education occupies a vital position in higher education in China. As a rapidly developing country, we have recognized the vital importance of nurturing excellent engineering talent to our national sustainable development. To ensure the quality and standard of engineering education, our country has actively promoted the establishment of a professional certification system for engineering education, aiming to ensure the quality of engineering education institutions and courses, improve students' technical capabilities and innovative thinking, and meet the increasing engineering demand. The Ministry of Education's Department of Higher Education clearly pointed out in the notice issued in 2017 that it was necessary to begin research on and conduct practical activities for the new engineering subjects and develop new engineering research and practice policies to promote innovation and development of engineering education [1]. The goal of this policy is to strengthen cooperation with the industry, promote interdisciplinary collaboration, and cultivate engineers with global vision and leadership. Through these efforts, China is committed to building a world-class engineering education system to support the country's technological innovation and economic development.

At present, China is actively committed to accelerating the construction of new engineering disciplines and comprehensively promoting the improvement and perfection of the innovation and entrepreneurship education system, with a view to cultivating talents with interdisciplinary knowledge and comprehensive capabilities. The Ministry of Education and several other departments jointly issued the Opinion in the fall of 2018. In this document, the importance of the education and training of new engineering engineers is emphasized, and reasonable suggestions are put forward for the implementation of the training plan 2.0. It clearly states that the construction and development of new engineering programs are aimed at enhancing the adaptability of engineering education to the new round of scientific and technological revolution, better serving the realization of national strategic objectives, contributing to regional development, and constructing a complete, world-leading, and uniquely Chinese engineering education system that not only covers the fields of engineering, science and technology, and management, but also emphasizes the importance of interdisciplinary integration and collaborative innovation [2]. To this end, the state has increased its investment in universities, providing more resource support and preferential policies to promote the development of new engineering majors and talent cultivation. Through the construction of laboratories, the introduction of advanced equipment and technology, and

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the promotion of academic exchanges and cooperation, it is committed to creating a new engineering education system with international competitiveness. At the same time, the Ministry of Education has actively promoted the reform and development of innovation and entrepreneurship education, strengthened guidance and regulation on innovation and entrepreneurship education in universities, formulated corresponding policies and measures, encouraged universities to offer courses related to innovation and entrepreneurship, and gradually formed a complete system during the process of innovation and entrepreneurship education. It focused on strengthening students' awareness and thinking of innovation, guiding them to develop a good entrepreneurial spirit, and providing practical opportunities and support to help students translate innovation and entrepreneurship concepts into concrete actions. The Ministry of Education issued an opinion document [3] for the improvement of undergraduate education and the quality of talent training, emphasizing the importance of promoting innovation and entrepreneurship education in universities. It is necessary to combine it with professional education to enable engineering students to form digital and critical thinking in their learning activities, to possess a broad engineering perspective, and to gradually enhance their innovation spirit and entrepreneurial awareness through practical training. This is one of the important directions for the reform of higher education in engineering.

In the practice of innovation and entrepreneurship, engineering students will soon become the main force. Colleges and universities should fully realize this and actively carry out reforms in the process of innovation and entrepreneurship education. Improving the innovation awareness and entrepreneurial capabilities of college students is of great significance to the national economic construction. As an important force in scientific and technological innovation, the innovation awareness and entrepreneurial capabilities of college students directly affect the competitiveness and development potential of the country [4]. To enable engineering students to have good innovation and entrepreneurship capabilities, it is necessary to attach importance to the construction of an evaluation index system. A reasonable evaluation system can help assess the abilities and potential of students in the innovation process, and provide targeted training and guidance. A scientific evaluation index system should comprehensively consider students' innovative thinking ability, teamwork ability, scientific research ability, entrepreneurial awareness, and market sensitivity, in order to comprehensively evaluate their innovation and entrepreneurship capabilities. This article focuses on the undergraduates of science and engineering universities, and when constructing an evaluation index system for their innovation and entrepreneurship capabilities, it starts from four dimensions: thinking, awareness, practice, and ability, comprehensively evaluating the innovation capabilities and characteristics of local college students, and exploring specific measures to enhance the innovation and entrepreneurship application capabilities of engineering students, in order to provide reference for the cultivation of innovative talents and the improvement of the quality of education and teaching in local engineering colleges.

2. Summary of Evaluation System for College Students' Innovation Ability

Innovation and entrepreneurship education is not a one-time accomplishment, it requires long-term accumulation and cultivation, and is influenced by many factors. Currently, the innovation and entrepreneurship education in China's universities is still in its initial stage, and there are a series of challenges and problems. One of them is the lack of a unified evaluation system, which is a major bottleneck in the development of innovation and entrepreneurship education in universities. In the past few years, although many universities have offered innovation and entrepreneurship education courses and projects, the evaluation criteria have not formed a system. There is a lack of consistent evaluation indicators between different universities and disciplines, which leads to the inability to evaluate the results of innovation and entrepreneurship education objectively and comprehensively. Innovation and entrepreneurship education in universities cannot be satisfied with the current situation and needs to develop to a higher level. This requires the construction of an evaluation index system to ensure the scientific and necessary nature, rationality, and feasibility of each index, covering students' innovative thinking, entrepreneurial ability, practical experience, etc. It can more accurately evaluate students' performance and achievements in innovation and entrepreneurship education, provide them with more targeted training and guidance. At the same time, it can facilitate communication and cooperation among universities, and jointly promote the improvement and development of innovation and entrepreneurship education. In the era of innovation across the country, the value of cultivating innovative talents is constantly highlighted, and more and more scholars are conducting research on the construction of an evaluation system for college students' innovation ability, resulting in many excellent research results.

In the process of constructing an innovation ability evaluation system for college students, experts and scholars have different opinions. In the study, scholars use diverse methods to set indicators that can

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objectively evaluate college students' innovation ability. Through literature reading and comparison, it is found that some indicators have been recognized by the academic community, including practical ability, knowledge application ability, learning ability, etc. Yang Yuanyuan et al. used questionnaire surveys, interviews and other methods to conduct in-depth analysis of the problems encountered in the innovative process of engineering students. It was found that when evaluating the innovation ability of this group, attention should be paid to the students' own situation, starting from aspects such as school management, professional characteristics, and social environment. To construct an innovation ability system for engineering students, diversification of indicators is a prerequisite, operability is key, and long-term effectiveness is the direction [5]. Wang Jian et al. used DelphiAHP method and followed basic principles such as scientificity and operability to construct a set of evaluation system containing 4 first-level indicators and 17 second-level indicators, and proposed training strategies for college students' innovation ability, providing a scientific basis for effective evaluation and improvement of college students' innovation ability [6]. Li Junhong et al. based on the analysis of the factors that constitute college students' innovation ability, fully utilized the advantages of fuzzy comprehensive evaluation method to construct a model for describing college students' innovation ability. For objectively measuring this group's innovation ability, an evaluation index system was constructed that includes six dimensions and 21 specific indicators, paying attention to students' innovative thinking, awareness, learning ability, skills, knowledge foundation, and environment. When setting specific evaluation indicators, attention was paid to their rationality and feasibility. Through application analysis, it has been proven that the constructed evaluation index system for college students' innovation ability and evaluation model have scientific and operable characteristics [7], which can provide important reference for the evaluation of college students' innovation ability.

3. Construction of Evaluation System for College Students' Innovation Ability

The construction of the evaluation system aims to stimulate college students' active learning and in-depth exploration, and the college students' innovation ability evaluation system includes both qualitative and quantitative indicators. The qualitative indicators can be measured through assessing students' innovative thinking, problem-solving ability, team cooperation, etc., to comprehensively understand students' innovative potential and ability literacy. The quantitative indicator system can be used to quantify students' innovative ability and achievements through measuring their achievements in innovative projects, scientific research outputs, the number of patent applications, etc. However, finding a unified quantitative indicator system that is applicable to all schools is a challenging task. Different schools have different characteristics, positioning, and development goals, so the evaluation index system should consider the special circumstances of the school and be flexible and customizable. This means that it is necessary to develop an innovation ability evaluation index system that is suitable for the characteristics and goals of each school based on its own development needs. To evaluate the innovative ability of college students accurately and comprehensively in different stages of learning, the project team referred to relevant research results and practical experience, visited many enterprises and universities both inside and outside the province, and designed it based on the educational philosophy, teaching mode, and training goals of our school. Finally, an index system was constructed as shown in Figure 1, which can objectively evaluate the innovative ability of engineering college students. In this evaluation system, there are four first-level indicators, each with four second-level indicators. Through 16 second-level indicators, the innovative ability of college students can be objectively measured, which improves the accuracy and reliability of the evaluation."

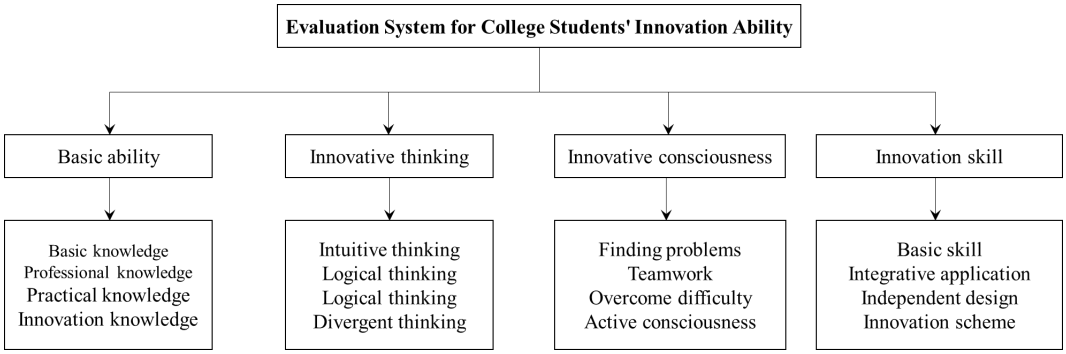

Figure 1: The schematic of innovation ability evaluation system

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4. Achievement of Evaluation System for College Students' Innovation Ability

When measuring students' personal learning ability, basic ability is an important quantitative criterion, supported by the construction of a curriculum system to provide a comprehensive evaluation. The curriculum system can be divided into several modules, each of which is an independent sub-curriculum system, including course design, professional knowledge, and basic knowledge. Based on the role of each module in cultivating students' learning ability, weights are set to establish reasonable evaluation values for specific indicators [8]. In the process of building an innovation ability evaluation system for college students, it is important to highlight the importance of innovation and entrepreneurship knowledge education. The "Three Innovations United" concept should be implemented in classroom teaching, and expansion education should be carried out during extracurricular time to deeply tap students' potential. In the development of talent training plans, general education is a key component. An innovation and entrepreneurship module should be established, and each major should integrate the "Three Innovations United" concept into its preliminary courses to encourage students to be creative, dare to start a business, and be innovative. Good situations should be created in classroom teaching to cultivate students' exploratory thinking ability, tap their internal potential, and enhance their learning initiative. Colleges and universities should focus on cultivating students' innovative skills and encourage them to flexibly apply knowledge and exercise their practical abilities. In the past, colleges and universities overemphasized the importance of theoretical learning without organizing diverse practical activities. The course schedule was not reasonable, with professional theoretical knowledge as the core, and even if practical activities were carried out, they did not reflect the comprehensiveness of the Internet and did not provide a good engineering project experience environment for students. In the process of practical teaching, practical activities should be organized in a step-by-step manner along the path of "basic - professional - comprehensive - innovative", with reasonable weights assigned to each practical activity to provide a comprehensive evaluation of students' innovative abilities. Experimental and practical training should be regarded as two important main lines in practical teaching to cultivate practical application ability of students and enable them to more fully apply theoretical knowledge to practical activities.

Schools should build a favorable platform for students' innovation and strengthen the construction of software and hardware environment. In a superior innovation environment, the standard of teachers should be up to standard, the teaching platform should have rich functions, and the whole campus should be permeated with a strong innovative atmosphere. Strengthening the system construction is the material conditions for cultivating students' innovation ability. Students' innovation ability can be reflected in various ways, such as competition results, subject research, invention patents, etc. All disciplines have strong uniqueness, and we can't make a generalization in terms of the form of achievement expression. We should fully consider the differences between disciplines and according to the specific needs of each discipline, Characteristics encourage students to demonstrate innovative achievements in multiple ways. This article takes the functional materials major at Xi'an University of Architecture and Technology as an example to analyze the evaluation methods for college students' innovation ability. The functional major of Xi'an University of Architecture and Technology is among the top undergraduate majors in the province. In terms of practical application teaching, the school's experimental teaching demonstration center has reached provincial standards and should be regarded as an important practical teaching platform. Make good use of the on-campus laboratories and training centers and organize simulation experiment and practical activities with experimental and practical projects as the carrier. In the implementation of professional basic courses, teachers should enable students to enhance their abilities while mastering basic knowledge, guide and motivate students to innovate, and enhance their design and practical abilities in a progressive manner. The engineering practical ability consists of innovative and entrepreneurial projects, mathematical modeling, research and practical training, curriculum design, graduation internship and design, and other highly practical aspects. In the process of learning basic professional courses, students should be trained to develop their multiple abilities in professional practice activities, promoting their innovative practical abilities and laying a foundation for innovation. So far, a complete closed loop has been formed in cultivating students' practical application ability.

5. Conclusions

Our work focuses on the evaluation of university students' innovation and entrepreneurship ability and sets reasonable paths for how to enhance their innovation and entrepreneurship abilities. Through literature research, an evaluation index system for university students' innovation and entrepreneurship ability has been defined, and specific measures for evaluation have been proposed. This research provides

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a strong theoretical foundation for us to further understand and measure the innovation and entrepreneurship abilities of university students. The evaluation index system can comprehensively and objectively evaluate the innovation and entrepreneurship abilities of university students and provide targeted guidance for their personal development and career planning. Through these measures, it can strengthen their awareness of innovative thinking and innovation. An understanding of business backgrounds, develop practical operational skills, and master the key elements in the process of innovation and entrepreneurship. This will lay a solid foundation for their future innovation and entrepreneurship path and improve their competitiveness and adaptability in a competitive society. The research results can guide the work of innovative and entrepreneurial education curriculum and practical base construction in colleges and universities, promote the deepening of education reform and generate a certain reference value.

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