

# University Students' Cultivation of Science and Technology Innovation Ability Based on Analytic Hierarchy Process and Fuzzy Comprehensive Evaluation

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**Abstract:** The evaluation of college students' innovative quality plays an important role in cultivating innovative talents. Because the innovative qualities of college students are comprehensive, hierarchical, ambiguous, and other characteristics, they are influenced by many factors such as innovative consciousness, innovative thinking, innovative ability, and innovative personality. Some commonly used quantitative and semi-quantitative methods include AHP and fuzzy comprehensive evaluation. The assessment of the overall quality of college students is an important measure to improve the level of education management, promote the improvement of the overall quality of the college students, and promote the all-round development of the different countries. Although most colleges have implemented the evaluation of college students' overall quality, the main evaluation criteria are still the students' test scores, and they are not comprehensive enough in measuring the overall quality and ability of college students. Based on the comprehensive and multi-angle requirements for the evaluation of college students' comprehensive qualities, this paper constructs a hierarchical structure model for the evaluation indexes of college students' comprehensive qualities. On this basis, the relative weight of each index is calculated using fuzzy analytic hierarchy process, and then a comprehensive evaluation of the comprehensive quality of college students is made using the fuzzy comprehensive evaluation method.

## 1. Introduction

At present, there are many factors that reflect the overall quality and ability of modern college students, but most colleges and universities still use the test scores of students as the main evaluation criteria. This kind of evaluation system is not conducive to the overall development of students' morality, intelligence, body, and beauty, and the improvement of the overall quality of college students. On the other hand, it is not conducive to the education and management of students. Through the comprehensive quality evaluation of college students, students can find out their advantages and disadvantages in a timely manner. They can constantly understand themselves and improve themselves. They can provide management teachers with an excellent reference for students to have an objective, accurate and fair competition. In terms of multi-index comprehensive evaluation, currently used methods are: Analytic hierarchy process, fuzzy comprehensive evaluation, etc., but all of them have certain limitations, and the evaluation method involves more content and more complicated calculation.

$$B = A \cdot R = (a_1, a_2, \dots, a_n) \cdot \begin{bmatrix} r_{11} & r_{12} & \dots & r_{1m} \\ r_{21} & r_{22} & \dots & r_{2m} \\ \dots & \dots & \dots & \dots \\ r_{n1} & r_{n2} & \dots & r_{nm} \end{bmatrix} = (b_1, b_2, \dots, b_m) \quad (1)$$

The Analytic Hierarchy Process (AHP) is a qualitative and quantitative multi-criteria decision-

making method proposed by the American operational scientist T.L. Saaty et al. in the 1970s. The basic principle is to divide each index in a complex problem by dividing each other. The relationship between them is decomposed into a number of ordered hierarchical levels, so that the decision problem is derived through a simple pairwise comparison. Because the context of many decisions in the real environment is often ambiguous, the analytic hierarchy process is mainly applied to non-fuzzy decision-making, and cannot cover the uncertainty of the things' cognition, plus the subjective judgments, choices, and preferences of the decision makers. There will be deviations from the results of the AHP assessment. Therefore, the traditional AHP cannot effectively deal with ambiguity in real situations. Fuzzy Analytic Hierarchy Process (FAHP) uses the hierarchical refinement of AHP to describe the intermediate transition of objective differences using the degree of membership, and the fuzzy consensus relationship based on fuzzy set theory and the establishment of fuzzy consistency matrix to make decision models and people's thinking. Consistent with the habit, it is easier to test the consistency of the core judgment matrix. The fuzzy comprehensive evaluation method is based on the subjective judgment of the experts on risks and uses the principles of fuzzy mathematics to synthesize the opinions of the experts and obtain the overall assessment results. In the assessment of the college students' innovative qualities, if the combination of fuzzy analytic hierarchy process and fuzzy mathematics comprehensive evaluation methods can be then combined, the weights of each index are firstly calculated by the fuzzy analytic hierarchy process, and then comprehensive evaluation is performed by the comprehensive evaluation method in fuzzy mathematics. The result will be more effective.

In the face of this stage of our business, economic development in the new situation, innovation policy is built not only to carry out our various meetings, but also on the basis of this stage of modern economic development needs, the correct handling of the government and market, the relationship between the companies and the introduction of the market-oriented, business-driven innovation policy system build. Because at this stage, our policies are still at an early stage, therefore, it is necessary to pay the special attention to these policies are explored in depth. To realize the transformation of economic development pattern, we must reform the traditional performance evaluation method. The traditional performance evaluation index system focuses more on financial evaluation, although non-financial indicators have been considered. But the emphasis on technology is far from enough in its content. China has entered the rely on science and technology innovation to promote the economic and social sustainable development of historical period, the Chinese government attaches great importance to the sustainable development of the social economy, the sustainable development strategy to determine major strategic to the nation.

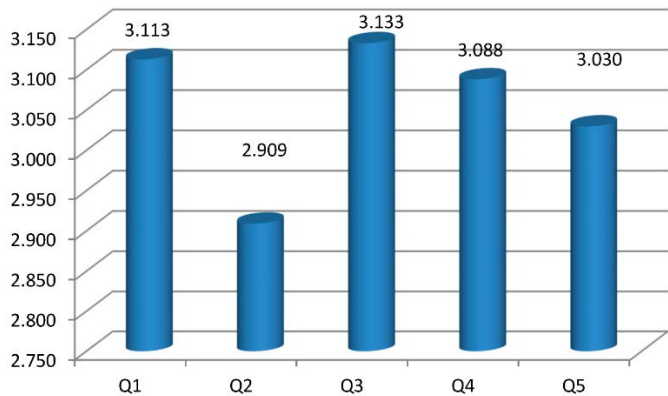


Fig.1 The Statistical Data.

Table 1 the Special Focuses of the Science and Technology Innovation.

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| Taking enterprise as the main body of innovation | At the present stage, China mainly focuses on innovation by the state. This model cannot fully promote the development of scientific and technological innovation. Therefore, to actively make changes, we should focus on inclusive policies and give priority to supporting enterprises in the development of technological innovation. We want to make the appropriate economic market development environment for building, on the basis of this stage every industry market |
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|  | development, related laws and regulations, and continuously improve the importance of intellectual property rights laws and rules and regulations. The further strengthening of industrial and scientific research combined with each other, and guide enterprises to introduce innovative elements, so that the enterprise has become the subject of scientific and technological innovation.   |
| Strengthen the transformation of scientific and technological achievements                         | The state should introduce the corresponding incentive policy to encourage the community to transform the actual productive forces of the existing scientific and technological achievements, to achieve the effective combination of production, research and research, to better promote the conversion rate of scientific and technological achievements, and to provide a strong support for the better realization of the transformation of the mode of economic development. Therefore, it is necessary to improve relevant laws and regulations, and come up with the necessary support for independent innovation legal documents on social and economic development, fiscal and financial systems with efforts to improve the building with Chinese characteristics according to market demand, enterprise development, industrial studies and scientific research in the context of the general technological innovation system. |
| Improve the top-level design of the collaborative innovation in science and the general technology | The government of new industries and high-tech industries in scientific and technological research and development, provide the necessary policy support to allow the use of the bond market to expand its direct financing channels, and in the context of risk control appropriate to encourage such as venture capital, intellectual property rights pledge, as well as finance leases and other new financing channels for participation in scientific and also the general technological innovation.  |

## 2. University Students' Cultivation of Science and Technology Innovation Ability Based on Analysis Hierarchy Process and Fuzzy Comprehensive Evaluation

### 2.1 Analytic Hierarchy Process

Analytic hierarchy process (AHP) is a combination of quantitative and qualitative evaluation methods. The key link is to establish a judgment matrix. The judgment matrix is reasonable and scientifically affects its application effect directly. However, there are several deficiencies in the application of AHP. First, there is a difference between the consistency of the judgment matrix and the consistency of human thinking. Second, it is difficult to test the consistency of the judgment matrix. Third, when the judgment matrix does not have consistency, adjustment to consistency is more troublesome; Fourth, test the judgment matrix. Consensus judgment standards lack scientific basis.

The advantage of the AHP method is that under the condition that the judgment target (factor) structure is complex and lacks necessary data, the evaluation factors that are difficult to quantify by other methods can be quantified through the comparison of the two factors, and the complex evaluation factors can be constructed as a hierarchical structure at a glance, can effectively determine the relative importance of various factors in the multi-factor assessment, and then evaluate. However, the AHP does not have a uniform and specific quantitative method for the overall evaluation of the judgment target. Therefore, in practical use, it should only be used to analyze the index weight, and then quantify the index value using other methods. Evaluation.

Therefore, it is necessary to combine the fuzzy analytic hierarchy process method with the fuzzy comprehensive evaluation method to evaluate the overall quality of the students. Firstly, the fuzzy analytic hierarchy process is used to calculate the weight of each index, and then the comprehensive evaluation method in fuzzy mathematics is used for comprehensive evaluation.

Establish a system of innovative quality factors and reviews. A comprehensive analysis of the innovative quality of college students and the identification of their impact factors are the basis for evaluating the quality of college students' innovation. This paper refers to the collection of influential factors of innovation as the set of innovative quality factors. In addition, this article uses a five-level comment system, which in turn shows five ratings of very good, good, average, poor, and very bad.

Perform single factor assessment of innovation quality. The purpose of the single factor assessment of the quality of innovation is to establish a fuzzy mapping from a set of innovation factors to a comment set, generally using the expert scoring method. Based on the score results, the comment membership vector of the innovation factor is calculated.

According to the logical relationship of the influencing factors of innovation quality, build a core hierarchical structure model. Based on the principle of step-by-step calculation based on FAHP's evaluation model of innovation quality, the evaluation subordinate vectors of each layer are calculated layer by layer. Finally, calculate the evaluation vector of the evaluation quality system node, and use the principle of maximum membership to obtain a comprehensive assessment of the innovative quality.

## **2.2 The Establishment of Evaluation System of College Students' Comprehensive Quality**

The overall quality of college students is a large and complex system, reflecting its level, and there are many factors that affect its change. In order to make an objective, accurate, and complete assessment of the overall quality of students, it is necessary to screen out evaluation indicators that can reflect the overall quality of students from all aspects and from multiple perspectives, and reflect the hierarchical structure of multiple indicators. According to the principles followed by a comprehensive evaluation of a student's comprehensive qualification assessment in a normal college, the following principles are: comprehensiveness principle; feasibility principle; guiding principle; dynamic principle, and a comprehensive analysis of factors and practical experience of college students. The overall quality can be attributed to the following four major aspects: ideological and moral quality, scientific and cultural artistic quality, physical and psychological quality, and practical development and the further advancement. Each aspect includes more specific evaluation content.

The innovative quality system of college students is relatively large and complex. In order to make an objective, accurate and complete assessment of the innovative quality of college students, it is necessary to screen out evaluation indicators that can reflect the students' creative qualities in an all-round and multi-angle manner, and qualitatively analyze the factors of college students' innovation quality. Based on the above, we establish an evaluation index system according to the hierarchical structure of the AHP according to the objectives of the cultivation of innovative talents in universities in our country and the characteristics of foreign innovative talents. To conduct the overall analysis, the evaluation steps can be summarized as the follows:

- To collect data, we must first collect data, which can be collected according to historical records of similar projects, but we must ensure that data relate to this innovation project. If historical data fail to meet demand, it may be necessary to obtain some subjective but professional evaluations by solicit expert opinions;

- An uncertainty model was established and based on the obtained data as relevant risks were clearly quantified to form a risk assessment model;

- In general, setting up the index system of risk factors to be able to do a comprehensive, accurate and effective, can explain all the risks in the innovation project, in addition to the already appeared, and reflect on the potential risk of does not appear.

The innovation quality evaluation system for the innovative talents in Chinese universities is divided into the general quality assessment, innovative quality assessment and reasonable knowledge structure assessment. Besides this, we should also consider the innovation considering issues as the final references. Economic development cannot be separated from the increase in demand through the promotion of scientific and the technological innovation, to a large extent on the inside and outside of a structure, promote the optimization and upgrading of consumption and investment structure of balanced development and a better guarantee social and economic stability of the healthy growth. If science and technology innovation ability, in achieving economic growth, tend to remain in a dependent on the capital-driven, it is easy to create the relationship between the consumption and investment imbalances, to improve the living standards of the population had a very negative impact. In particular, the investment is too hot as the residents' spending power will

be greatly constrained, leading to the production of relative surplus capacity.

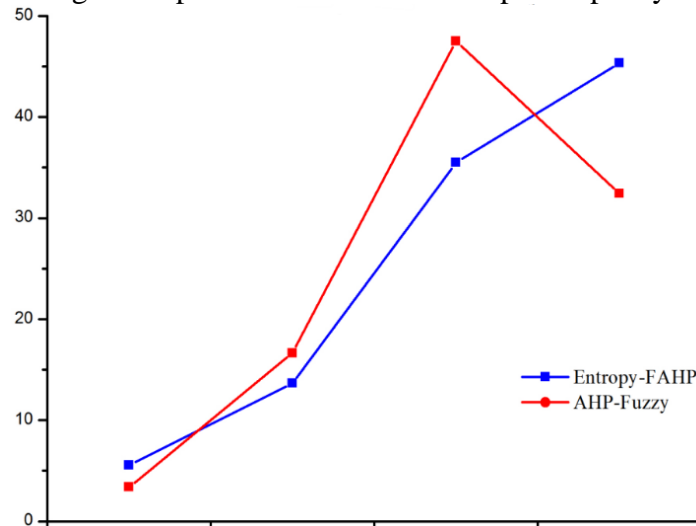


Fig.2 The Simulated Data Curve for Referring.

Through scientific and technological innovation, the ability to raise the economic growth approach to development model, which is no longer dependent on capital investment to achieve economic growth, and this will to a large extent on the needs of the optimization and general upgrading of the structure, through the demand for increased capacity to further contribute to the socio-economic development. Also, the following issues should also be considered. (1) In the process of formulating policies related to scientific and technological innovation, we should attach importance to the construction of a community for the relevant policy research. Through this construction, we can further improve the diversification level of general decision-making information. (2) Theoretically, the total amount of input is always limited, and technological innovation is unlimited, therefore, in the scarcity of resources today. Only through the progress of science and technology can enterprises produce more benefits under equal input of resources. Therefore, realizing the transformation of economic development mode is the key to China's economic transformation.

### 2.3 Construction of Undergraduate Entrepreneurial Support System

Undergraduate entrepreneurship has met with a series of difficulties in policies, funds, talents, and services. It is not possible to solve the problem by relying on the relevant national departments to formulate several preferential policies, relying on local governments to establish several startup incubators, and setting up venture capital funds based on several universities and colleges. Supporting college students to start a business is a systematic project that requires a complete and mature support system. Entrepreneurship provided plenty of time to form a set of benevolent and interactive entrepreneurial support systems that combined government, society, and schools, providing a strong guarantee for college students' entrepreneurship, and enabling the success rate of college students in the United States to reach 20%. In comparison, under the current economic environment in our country, the success rate of undergraduate entrepreneurship is less than 5%, so as to promote college students' entrepreneurship, China urgently needs to strengthen the construction and perfection of university entrepreneurial support systems.

Entrepreneurship courses are included in the credit system. For modern undergraduate students in the university, courses in entrepreneurship awareness training are offered. For higher school students, courses in entrepreneurship and related knowledge are offered. Each college has targeted entrepreneurial courses according to the core characteristics of its own majors, and effectively combines professional knowledge and skills with the general entrepreneurial projects to enhance students' entrepreneurial interest, entrepreneurial confidence, and entrepreneurial success rate.

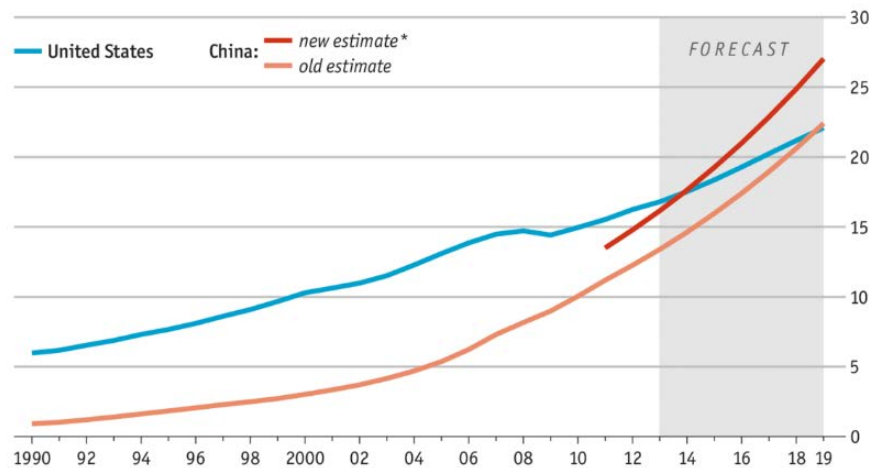


Fig.3 The Comparison Analysis of the Collected Data.

### 3. Conclusion

The entrepreneurial support system for college students is a systematic project that involves the entire social force. The government, schools, families, and society all play a special role in the system. They all need to take charge of organizing and building a business support service system, and guide and deploy entrepreneurial education resources. To create a good environment for entrepreneurial policies, to coordinate business services, and to guide social capital investment in innovation and entrepreneurship. We believe that with the continuous strengthening and continuous improvement of the university student entrepreneurial support system in China, more and more university students will join the flood of entrepreneurship.

### 4. Acknowledgment

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