

Optimization of Quality Evaluation System for Innovation and Entrepreneurship Education in Colleges and Universities Based on AHP-Fuzzy Synthesis Approach

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Abstract: Innovation and entrepreneurship education in colleges and universities is a complex system with the participation of multi-interested subjects. By analyzing the current research status of innovation and entrepreneurship education in colleges and universities, this paper finds that the existing research has the problems of numerous research methods but insufficient holistic and hierarchical evaluation, redundant and insufficient scientific design of evaluation indexes, and difficulties in collecting and processing index data. Therefore, this study constructs an evaluation index system that includes the government, colleges and universities, teachers, students, and relevant subjects of the society by applying the AHP hierarchical analysis method, the principle of subjectivity, the principle of integration, the principle of value shaping, and the principle of synergistic development, and empirically demonstrates that this method and evaluation indexes are able to evaluate entrepreneurship education in a holistic and scientific way, and are difficult to collect and process the index data. The analysis concludes that the method and evaluation indexes can scientifically reflect the development of the quality of innovation and entrepreneurship education in the university.

Keywords: AHP-Fuzzy Comprehensive Evaluation Method; Innovation and Entrepreneurship Education; Quality Evaluation System; System Optimization

Introduction

The Implementation Opinions on Deepening the Reform of Innovation and Entrepreneurship Education in Institutions of Higher Learning in 2015 pointed out that "dual creation" education in institutions of higher learning should be promoted in five aspects, namely, strengthening the construction of the curriculum system, the construction of faculty, carrying out innovation and entrepreneurship practice activities, establishing an innovation and entrepreneurship teaching quality monitoring system, and strengthening the work of research and experience exchange.^[1] The education of "dual-creation" should be promoted in five aspects. At present, the phenomenon of "dual-creation" education in China's colleges and universities is still "not good at evaluation", with unscientific design of the evaluation system, mostly normative research and lack of empirical analysis, as well as a lack of knowledge about the quality of "dual-creation" education in colleges and universities. The quality of "dual-creation" education in universities has not yet been able to provide satisfactory answers to such practical questions as how effective the quality of education is, and in what aspects the results are better.^[2] This paper is based on the AHP-Fuzzy synthesis method. Based on the AHP-fuzzy synthesis method, this paper establishes a quality evaluation index system for "dual-creation" education in colleges and universities based on its systematic and scientific nature, and selects representative colleges and universities as samples for empirical analysis in order to optimize the "dual-creation" education and quality evaluation. In order to provide reference for the optimization of "dual-creation" education and quality evaluation.

1. Formulation of the problem

1.1 Research on quality evaluation indicators for innovation and entrepreneurship education

At present, China's evaluation research on the quality of "dual innovation" education mainly focuses on the construction of indicators and the analysis of their value orientation. For example, Huang Zhaoxin (2019) believes that the evaluation of the quality of innovation and entrepreneurship education requires the establishment of an all-chain evaluation system, so he conducted a survey and analyzed the teachers and students of 1,231 higher education institutions nationwide, and constructed a core indicator that integrates the results and the process.^[3] Zhu Chenglin (2020) analyzed the process elements affecting the effectiveness of "dual-creation" education based on "process-results".^[4] Yang Dong (2021) analyzed the process elements affecting the effectiveness of "dual innovation" education based on

"process-results". Yang Dong (2021) examined the development dilemma of "dual-creation" education from the perspective of connotative development, and proposed optimization paths from the aspects of instrumental rationality, curriculum structure, teachers' professionalism, practice platform and management system.^[5] Ma Yongxia (2022) summarizes the development dilemma of "dual-creation" education. Ma Yongxia (2022) found the internal mechanism affecting the quality improvement of "dual-creation" education by focusing on the antecedent variables of six dimensions, namely, theoretical teaching, faculty allocation, practical activities, service platform, incentive policies and cultural atmosphere, in the two dimensions of environment and organizational ecology, and found that the quality improvement of "dual-creation" education was affected by the internal mechanism of "dual-creation" education.^[6] We have found the internal mechanism that affects the quality improvement of "dual-creation" education.

1.2 Research on Quality Evaluation Methods for Innovation and Entrepreneurship Education

Based on the existing research foundation, this paper believes that from the perspective of the stakeholders involved in innovation and entrepreneurship education in colleges and universities, we can systematically construct a five-dimensional evaluation model of the quality of "dual-creation" education, and at the same time, we select a certain college or university as a sample, and utilize AHP-fuzzy synthesis method to carry out an empirical analysis of it.

2. The design idea of evaluation indexes of innovation and entrepreneurship education quality in colleges and universities based on AHP method

2.1 Design principles

2.1.1 Principle of subjectivity

The principle of subjectivity is subject interaction and subject mobility. The subject interactivity is reflected in the fact that innovation and entrepreneurship education in colleges and universities is an ecosystem of symbiosis and collaboration involving the government, colleges and universities, teachers, students and the society, and the government, as a leader, guides the development of "dual innovation" education in colleges and universities on a macro level.

2.1.2 Principle of integration

Educational resources for "dual creation" in colleges and universities include teaching resources, management resources and social resources. Teaching resources are the most basic and core resources, and management resources connect social resources to maximize the value of teaching resources through rational allocation.^[7] The cross-domain integration of these three types of resources is an important bridge to open up the barriers between the main bodies of "dual-creation" education, so the principle of integration must be taken into account in the setting of indicators.

2.1.3 Value-shaping principles

The purpose of innovation and entrepreneurship education is to enhance the subjective innovation consciousness and innovation ability of the educated, and the creative ability of the subject is affected by the concept and value reshaping of the educated subject by the "dual-creation" education, therefore, it is necessary to comprehensively consider from the external force and internal force, the external force includes the innovation and entrepreneurship value guidance and service system provided by the government and universities, whether the universities set up the fundamental concept of "cultivating people with moral integrity", and whether the universities set up the "education for people". External forces include the value guidance and service system provided by the government and colleges, whether colleges and universities set up the fundamental concept of "cultivating people with moral integrity", and whether teachers respect the subjective status of students.^[8] The external forces include the guidance and service system of innovation and entrepreneurship provided by the government and colleges, whether colleges establish the fundamental concept of "cultivating morality and educating people", whether teachers respect the students' subjective position and emphasize the self-development of the students, whether humanistic literacy education is integrated into the curricula and practices, whether the teachers' teaching methods are advanced, and whether the employers give feedbacks.^[9] The feedback from employers.

2.1.4 Principle of synergistic development

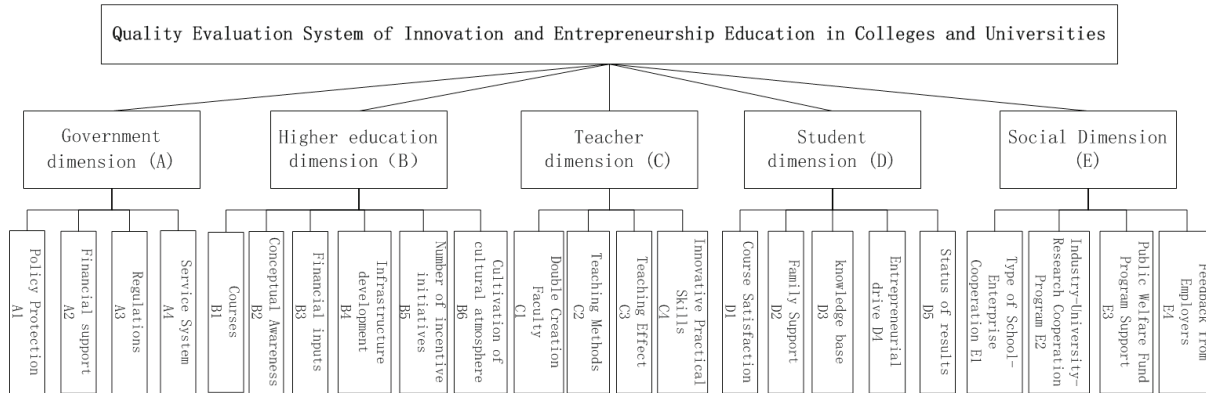
Innovation and entrepreneurship education not only cultivates students' innovative thinking and ability, but also enables them to serve the innovative development of the industry on higher industries such as science and technology, engineering processes, etc., which need to be attuned to the future needs of the market and enterprises^[10].

2.2 Indicator system design

On the basis of existing research, this paper constructs an evaluation index system that includes the government, universities, teachers,

students, and relevant subjects of the society from the principles of subjectivity, integration, value shaping, and synergistic development, and establishes 23 secondary indexes based on these five primary indexes, and then employs the fuzzy comprehensive evaluation method to carry out empirical analyses after setting up a good evaluation index system.

Fig. 1 Hierarchical diagram of quality evaluation system of innovation and entrepreneurship education in colleges and universities



3. Calculation of indicator weights and fuzzy comprehensive evaluation based on AHP method

3.1 Selection of evaluation subjects

Since the development of "dual-creation" education in W universities, they have made remarkable achievements in all kinds of innovation and entrepreneurship competitions, and they have also sent a large number of "dual-creation" talents to the society.

3.2 Calculation of indicator weights

The AHP technique was used in this study to infer the weights between the indicators. By comparing the data of the two-by-two correlation relationship between the indicators, the judgment matrix A was obtained using the 1-9 scale calculation method (the result is retained to four decimal places). In the following, taking the first-level indicators as an example, the expert evaluation of the first-level indicators was obtained based on the views of several experts, as shown in Table 2^[11].

Table 2 Weights of first-level indicators for evaluating the quality of innovation and entrepreneurship in colleges and universities (CR=0.0837<0.1)

indicator level	A	B	C	D	E	weights (w)
A	1	1/5	1/3	1/3	1/3	0.0569
B	5	1	3	5	5	0.4831
C	3	1/3	1	3	3	0.2316
D	3	1/5	1/3	1	3	0.1393
E	3	1/5	1/3	1/3	1	0.0891

3.3 Fuzzy integrated evaluation

The fuzzy comprehensive evaluation method transforms the original qualitative evaluation into quantifiable quantitative evaluation with the help of fuzzy mathematics in the affiliation theory. It can consider multiple factors of things or objects for comprehensive evaluation^[12].

Here ten experts evaluated the indicators at each level and obtained a fuzzy composite matrix as shown below: (Table 3)

Based on the scores for each dimension $Z_m = V \times B_i^T$ The total score of the final model is then derived $Z_{\#} = A \times Z_m^T$ According to the size of the V value, the quality of "dual-creation" education is evaluated.

After obtaining the scores of each sub-indicator, the overall score of the quality of "dual-creation" education in University W is calculated according to the principle of maximum affiliation. $V = A \times V_m^T = 0.638$, It can be concluded that the quality of innovation and entrepreneurship education in this university is at a good level.

4. Analysis of the results of the AHP-fuzzy comprehensive evaluation

The AHP-fuzzy synthesis method was used to analyze the evaluation scores of "dual innovation" education in university W as follows:

At the governmental level, the evaluation process of the indicators by various experts shows that HEI W has a high rating in financial support (0.5254), but an average or poor rating in policy protection (0.0565) and regulations (0.1393), which suggests that the government should make improvements in policies and regulations.

At the teacher level, teaching effectiveness (0.5229) and dual-creation faculty (0.2626) received high recognition, indicating that teach-

Table 3 Fuzzy Comprehensive Matrix of Quality of Innovation and Entrepreneurship Education in Colleges and Universities

target level	weights W_{ij}	indicator lawyer	weights W_{ij}	V_1	V_2	fuzzy matrix V_3, V_4, V_5			
A	0.0569	A_1	0.0565	0.1	0.2	0.4	0.3	0	
		A_2	0.5254	0.1	0.1	0.4	0.4	0	
		A_3	0.1393	0.1	0.1	0.3	0.5	0	
		A_4	0.2788	0	0.3	0.5	0.1	0.1	
B	0.4831	B_1	0.0648	0.3	0.5	0.2	0	0	
		B_2	0.1517	0.1	0.2	0.3	0.4	0	
		B_3	0.4014	0.2	0.2	0.5	0.1	0	
		B_4	0.2397	0.2	0.3	0.4	0.1	0	
		B_5	0.0978	0.3	0.2	0.4	0.1	0	
		B_6	0.0445	0	0.1	0.3	0.4	0.2	0
C	0.2316	C_1	0.2626	0	0.4	0.6	0	0	
		C_2	0.1158	0	0.2	0.4	0.2	0.2	
		C_3	0.5229	0	0.2	0.3	0.2	0.3	
		C_4	0.0988	0.2	0.3	0.4	0.1	0	
D	0.1393	D_1	0.0891	0.2	0.3	0.4	0.1	0	
		D_2	0.0569	0.2	0.2	0.4	0.2	0	
		D_3	0.1393	0.1	0.2	0.3	0.2	0.2	
		D_4	0.2316	0	0.2	0.2	0.5	0.1	
		D_5	0.4831	0.1	0.2	0.4	0.2	0.1	
E	0.0891	E_1	0.0834	0.3	0.3	0.4	0	0	
		E_2	0.2321	0.2	0.3	0.4	0.1	0	
		E_3	0.1347	0.1	0.3	0.3	0.2	0.1	
		E_4	0.5499	0.1	0.3	0.4	0.1	0.1	

ers are able to encourage and guide students' passion for innovation and entrepreneurship and give them motivation through a variety of ways, and therefore there is a need to train teachers in advanced theoretical knowledge and teaching methods. From the student level, students are good at accepting new things and developing new ideas (0.2316), and receive high ratings on the publication of academic papers and patent journals in innovation and entrepreneurship (0.4831), but the intuition of innovation and entrepreneurship courses is insufficient. At the social level, the feedback evaluation from employers (0.5499) is better, but still needs further improvement in school-enterprise cooperation and program support.

5. Conclusion

Using AHP-fuzzy synthesis method to evaluate the "dual-creation" education in colleges and universities, we can clarify the score of the evaluation object in each index through the relatively perfect index stratification, the weight setting of the indexes of the hierarchy and the scientific fuzzy evaluation of the experts, which is helpful to analyze the operation status of the complex system of "dual-creation" education with the participation of many subjects. It is useful for "anatomical" analysis of the operation status within the complex system of "dual-creation" education, which involves multiple subjects, and the results of the analysis are clearer and clearer, which is useful for colleges and universities to make further improvements in "dual-creation" education.

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Fund project: 1. Exploration and practice of new liberal arts Innovation and Entrepreneurship Education in science and engineering universities of the first national new liberal arts research and reform practice project "New Demand traction-Science and Technology Integration-Double cycle drive" (2021120030) 2. Science and Technology Innovation Think Tank Project of Wuhan Science and Technology Association "Research on the New Strategy of High-quality Integrated Development of Wuhan Science and Technology Innovation: A New Path of Innovation Chain-Industrial Chain-Talent Chain Integration" (WHKX202305)