

Analysis of Influential Factors of Teaching Effect of Innovation and Entrepreneurship Practice in Comprehensive University Based on ISM

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Abstract—This paper determined 24 key influencing factors, and used the ISM method to construct a hierarchical structure model to analyze the progressive relationship of innovation and entrepreneurship practice teaching effect's influencing factors in a comprehensive university. It has found that: (1) orientation and training objectives of the school are the basic factors guiding the practice teaching activities of innovation and entrepreneurship, which directly affect and stimulate the resource support and process management of practice teaching; (2) resource support and process management obviously affect the improvement of students' abilities in entrepreneurship and innovation practice and their satisfaction. The results indicate that school orientation and training objectives should be based on students' specific situation and fully consider their practical needs. Meanwhile strengthening the investment of all kinds of education resources and optimizing the entire process of internship teaching are also necessary.

Keywords—Innovation and Entrepreneurship; Practical Teaching; Influencing Factors; Interpretation Structure Model (ISM)

I. INTRODUCTION

Innovation is the life gene integrated into the blood of the 21st century, and entrepreneurship is the inexhaustible power to promoting social development. In September 2014, Premier Li Keqiang proposed the concept of "mass entrepreneurship and innovation" for the first time at the BBS summer Davos in Switzerland, calling on the whole society to innovate actively. Innovation and entrepreneurship education is the extension and concrete implementation of the definition of entrepreneurship and innovation in the field of education. With the wise development vision and firm reform drive of the top leadership of China, it has penetrated into all aspects of current college education reform. Since then, the party and the state have

attached great importance to the development of innovation and entrepreneurship education and successively issued relevant documents and policies to better guide and promote its education reform. In September 2018, the state council issued "Opinions on Promoting the High-quality Development of Innovation and Entrepreneurship and Creating an Upgraded Version of Mass Entrepreneurship and Innovation", highlighting the importance and urgency of strengthening relevant education and training among university students. In March 2019, "The Notice of the General Office of the Ministry of Education on Doing a Good job in 2019 Construction of Demonstration Universities for Deepening Innovation and Entrepreneurship Education Reform" clearly made important instructions on "promoting innovation and entrepreneurship education reform at a higher, deeper and more critical link level, striving to create an upgraded version of innovation and entrepreneurship education". Under the guidance of "mass entrepreneurship and innovation", many provinces and cities have organized various entrepreneurship and innovation activities through multiple channels. Colleges have also actively carried out practical exploration of entrepreneurship and innovation education. Under this background, how to adjust or reform the current education system and pattern more scientifically and effectively, clarify the influencing factors of innovation and entrepreneurship practice teaching effect, and closely link education with social needs is a serious question that every researcher committed to innovation and entrepreneurship education should think about.

II. RESEARCH STATUS AT HOME AND ABROAD

For a long time, there has been a consensus in the field of Western research: assessing the benefits and importance of entrepreneurship education is a difficult task. Colette believes that many entrepreneurial studies have failed to confirm this view: the completion of formal entrepreneurship initiatives and entrepreneurship management courses can increase the likelihood of individual entrepreneurship^[1]. However, some scholars who are brave enough to explore have been still adhering to the scientific and rigorous spirit of research to carry out the unremitting exploration of the evaluation of entrepreneurship education in a multi-faceted and multi-angled manner. Hemant believes that the key to improving

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entrepreneurship education's quality lies in investigating which specific teaching influence factors can most effectively guide students' entrepreneurial behavior^[2]. Scholars use a variety of research methods, such as Badariah's questionnaire survey^[3] to investigate the effectiveness of entrepreneurship courses in public universities in Malaysia, especially in North Malaysia. The results has shown that entrepreneurship courses offered by the University of North Malaysia are very effective in improving students' entrepreneurial skills. That is, the entrepreneurship education and training in universities can stimulate business skills. In addition, Barringer^[4], Fayolle^[5], Mueller^[6], Packham^[7] measure and evaluate the improvement of entrepreneurship education to participants through the skills and better entrepreneurial attitudes of entrepreneurship courses.

In the domestic aspect, research scholars rationally analyze the significance of the evaluation of innovation and entrepreneurship education's effect and quality in Europe and the United States for China. For example, Wang Zhongkui and Hu Xiaotian have summarized the experience of undergraduate teaching quality performance evaluation in UK universities^[8]. Li Zuozhang analyzes the practical significance of British education based on the British "Excellent Teaching Framework" and proposes its enlightenment on the improvement of domestic teaching quality^[9]. In the construction of specific innovation and entrepreneurship teaching quality evaluation index system, according to each evaluation subject, Yan Mingming builds evaluation indicators from the school level (school philosophy, management system), teacher level (teacher team, curriculum system setting), student level (innovative entrepreneurship spirit, innovation and entrepreneurial ability, assessment results)^[10]. Combining the level, characteristics, objectives, content, structure of research-based innovation and business skills education in university, its quality evaluation system established by Feng

Yanfei, Tong Xiaoling^[11] is as following: university environment (soft environment, hard environment), faculty (teacher background, innovation and entrepreneurship capacity, innovation and entrepreneurship teaching ability), teaching links (course design, teaching methods), student evaluation (student background, student performance, student satisfaction), social reputation (social influence, external academic links, graduate evaluation).

III. RESEARCH METHODS AND RESEARCH DESIGN

A. Research Methods

The Interpretative Structural Model (ISM) was proposed by Professor JN Wolfer in the United States in 1973. The method mainly applies to solving the problems of the hierarchical structure of complex systems such as society and economy. The core idea is: (1) extract the key components of the problem through various technical methods such as questionnaires and interviews. (2) use the matrix, directed graph and other technical methods to analyze the elements and their mutual relations, and draw a multi-level hierarchical directed (MLHD) graph. (3) explain the MLHD graph to achieve the purpose of clarifying the overall structure and level of the problem and raising the degree of understanding. The basic working principle of ISM is shown in Fig. 1:

B. Data Collection (Interpretation and Description of Indicators)

On the basis of systematically combing the research literature related to innovation and entrepreneurship teaching, this study comprehensively considers the multi-dimensional influence factors such as student satisfaction, colleges and universities, and finally screens and determines the following 24 key indicators that affect the effect of innovation and entrepreneurship practice teaching.

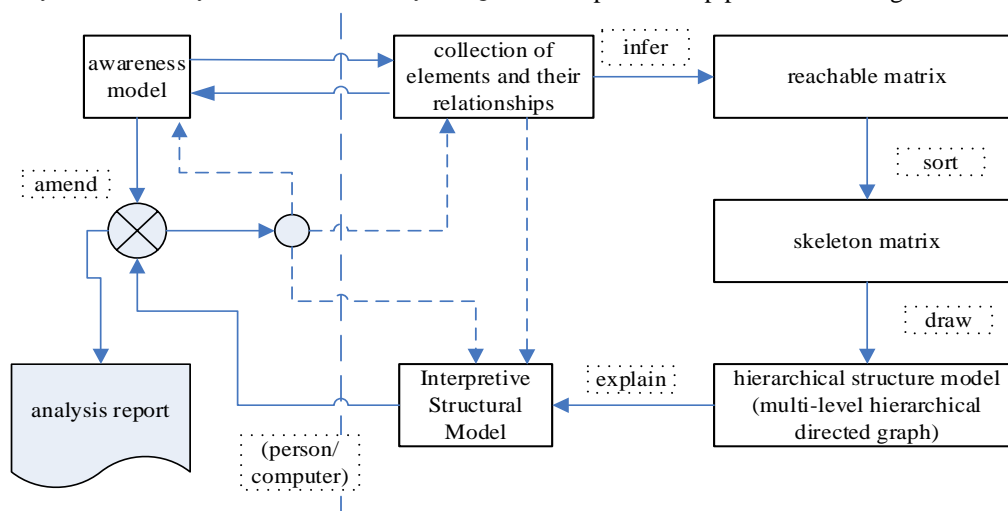


Fig. 1. ISM working principle diagram

TABLE I. KEY INDICATORS AND ITS CONNOTATION

Indicator	Indicator connotation
Satisfaction	A state of pleasure or disappointment that a student feels after comparing the expected education and teaching with the actual education and teaching services ^[12] .
Employment effect	Employment impact after the settlement of investment projects.

Cont. to TABLE I.

Entrepreneurial potential	The potential for entrepreneurship which is not realized.
Scientific research potential	The potential capabilities and strengths of an organization's scientific research activities, or a certain trend of research activities at different time periods.
Social evaluation	The socially relevant departments organize social organizations and relevant persons to participate in the evaluation of a certain project and matter according to certain social demand criteria.
Interpersonal ability	The ability to properly handle the relationship between peoples.
Practical ability	The practical ability of students to apply theory to practice.
Innovative ability	The ability to propose existing ideas and materials to improve or create new things and achieve certain beneficial effects in a specific environment ^[13] .
Scientific research ability	The ability of scientific research personnel to solve problems through research, academic exchanges, and research projects.
Professional interest	A positive cognitive tendency and interest of learners in a field of expertise.
Professional knowledge	A relatively stable and systematic knowledge within a certain scope.
Management ability	The comprehensive capabilities of planning, decision making, execution, monitoring, and evaluation around a specific project ^[14] .
Internship management	The process of carrying out planned and targeted scientific management of interns in the entire educational internship course according to the professional nature of the internship discipline.
Supervisory assessment	The statistics, analysis and evaluation of the completion of the tasks performed by the leaders on the management personnel to ensure that each job is correct ^[15] .
Guidance level	Direct and indirect guidance that individuals receive during workplace learning.
Internship method	The innovative entrepreneurship education internship method designed under the guidance of certain educational theories.
Task content	The learning content in a task and project.
Expenditure	The expenditures for the innovation and entrepreneurship education in colleges and universities.
Internship base	A relatively large-scale and relatively stable internship and social practice venue.
Faculty	The organic combination of all kinds of specialized talents that can be fully utilized by colleges and universities ^[16] .
Teacher structure	The proportional relationship of each part of the teacher team and its structure.
Internship plan	It includes the content of each internship, the planning and the budget of the internship.
School orientation	The overall goal and direction of school development in a long historical period ^[17] .
Training objectives	The specifications and standards that the training subject must achieve.

C. Matrix Analysis and Model Establishment

The establishment of the adjacency matrix of the factors influencing innovation and entrepreneurship practice teaching's effect is the basis of the explanatory structure model construction. Its role is to clarify the causal link between the elements. The specific definition is as below: the set of influencing factors is:

$$S = \{S_i | i = 1, \dots, n\}$$

The adjacency matrix is a square matrix that represents the direct contact of the features. $A=(a_{ij})_{n \times n}$ is specifically defined as follows:

$$a_{ij} = \begin{cases} 1, i \neq j, S_i \text{ affects } S_j \\ 0, i \neq j, S_i \text{ has no effect on } S_j \end{cases}$$

Through the investigation of five professors in the practice of teaching practice, three entrepreneurial intermediaries heads, and 32 students who participated in the innovation and entrepreneurship teaching, combined with the relevant literature research, the adjacency matrix of the factors influencing the teaching effect of innovation and entrepreneurship practice is as TABLE II.

TABLE II. ASYMPTOTIC MATRIX OF INFLUENCING FACTORS

	S ₁	S ₂	S ₃	S ₄	S ₅	S ₆	S ₇	S ₈	S ₉	S ₁₀	S ₁₁	S ₁₂	S ₁₃	S ₁₄	S ₁₅	S ₁₆	S ₁₇	S ₁₈	S ₁₉	S ₂₀	S ₂₁	S ₂₂	S ₂₃	S ₂₄
S ₁	0	1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S ₂	1	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S ₃	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S ₄	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S ₅	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
S ₆	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
S ₇	0	0	0	0	0	0	0	0	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0
S ₈	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S ₉	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	0	0
S ₁₀	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	1	0	0
S ₁₁	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	0	0
S ₁₂	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0
S ₁₃	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	0	0	1	0
S ₁₄	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0

Cont. to TABLE II.																							
S ₁₅	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
S ₁₆	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
S ₁₇	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0
S ₁₈	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
S ₁₉	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
S ₂₀	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
S ₂₁	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S ₂₂	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S ₂₃	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1
S ₂₄	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

In order to perform location and hierarchy, the reachable matrix corresponding to the adjacency matrix is first calculated. The reachable matrix refers to the direct and indirect links between the factors affecting the matrix. There is a transitive binary relationship between S_i and S_j , which means that S_i can reach S_j .

The reachable matrix comprehensively expresses the direct and indirect connections in the matrix. Add the same-order unit matrix I to the adjacency matrix A according to the Boolean

operation rule, and perform a power operation according to the Boolean algebra, namely: $M=(A+I)^k=(A+I)^{k-1} \neq (A+I)^{k-2} \neq \dots \neq (A+I), (k \leq n-1)$. From the reachable matrix, the reachable set, the first set and the common set of the elements are further analyzed, and the location division and the hierarchical division are carried out. The result is the MLHD graph of the influencing factors of the innovation and entrepreneurship practice teaching effect which is as shown in Fig. 2.

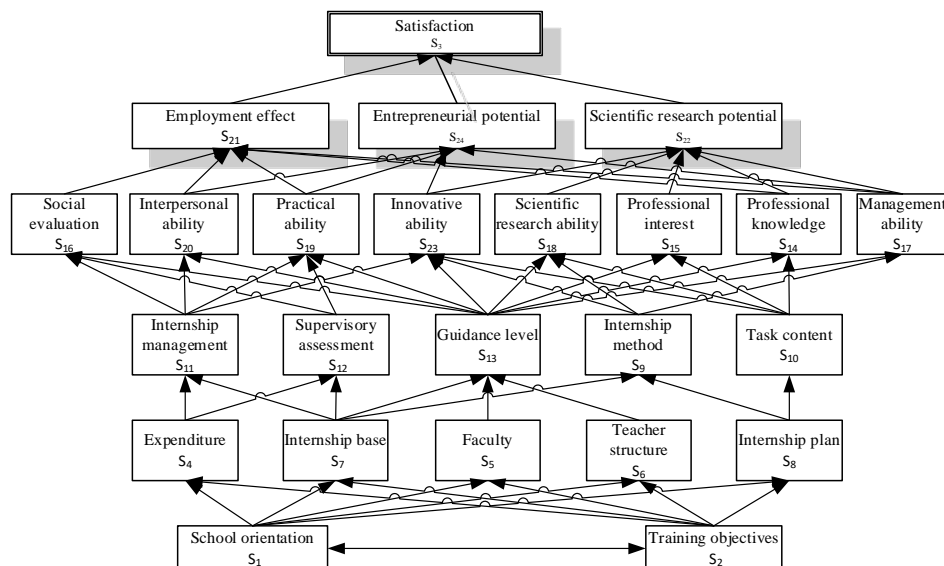


Fig. 2. Innovative entrepreneurial practice teaching effect influencing factors multi-level hierarchical directed graph

IV. ANALYSIS OF RESULTS

Combined with the above analysis and research results, the main factors influencing students' satisfaction with innovation and entrepreneurship practice are presented in a five-level multi-level hierarchical structure (as shown in Fig. 1): These factors, basic elements, resource support elements, process management elements, capacity improvement elements and satisfaction show significant differences between the levels of the perceptual elements. Among them, the orientation and training goal of the school are the macroscopic factors that affect the satisfaction of students' innovation and entrepreneurship practice teaching, which mainly play a basic guiding role. The development orientation of the school has an important impact on the overall humanistic quality of teachers and students, thus establishing a reasonable school mechanism and campus environment is critical. It directly influences the

students' satisfaction of business skills education. Therefore, the school orientation and training objectives should be student-centered, fully consider the students' practical needs, and improve their ability to innovate and start their own business as the core goal of teaching and educating people. In addition, the necessary supporting elements such as school investment in innovative internships, construction of internship base, teacher structure, and internship plan have a micro-impact on the students' satisfaction, and further influences the internship management, supervision and assessment, guidance level, task content and other specific teaching guidance. The teaching and guidance work will directly serve the mastery of students' professional knowledge and the cultivation of professional interests, as well as the interpersonal, practical, innovative, scientific, management and social evaluation of students. These will significantly affect the

specific perceptual factors of student internship teaching satisfaction such as employment effect, entrepreneurial ability and scientific research potential.

It is not difficult to see that the practice teaching process is a closely related logical structure, and there are obvious progressive hierarchical structures among the influencing factors. Therefore, in the procedure of school innovation and business skills practice, the overall development direction should be grasped by guiding documents such as school positioning, training goal establishment firstly. Secondly, it should focus on infrastructure construction and resource investment such as hardware, funding, teachers, and scientific long-term and short-term internship planning. On this basis, it is necessary to attach great importance to standardizing and improving the internship management process and level, strengthen teachers and relevant management personnel's guidance and supervision and evaluation of teaching behaviors, enhance the level of teaching, and continuously promote the optimization and improvement of the internship methods and task content, paying attention to the comprehensive improvement and in-depth exploration of students' innovative capability. In the end, we will achieve good employment, entrepreneurship, and study, and truly implement the concept of "mass entrepreneurship and innovation" in the field of education, so that we can achieve a satisfactory education for the people.

V. CONCLUSION

Based on the existing literature, this study uses the explanatory structure model to mine and refine the influencing factors affecting students' innovation and entrepreneurial satisfaction, and systematically analyzes the hierarchical relationship between the influencing factors. The role of combining elements is summarized as follows: basic elements, resource supporting factors, process management elements, capacity improvement factors, and satisfaction perception factors. It explains the various levels of elements' role and function in the procedure of innovation and business skills practice teaching. However, due to the lack of quantitative supporting data, the mechanism and incentive of various factors playing a role cannot be studied in depth. In the future, relevant cases and historical data will be collected and sorted out to analyze and put forward conceptual models, and empirical and policy analysis will be conducted to enrich existing research results.

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