Evaluation of Innovation and Entrepreneurship Ability of Lingnan Normal University Students under the Background of Information Technology

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Abstract. With the continuous development of network information and the transformation of the economic situation for college students' innovation and entrepreneurship ability to increase the difficulty of college students' innovation and entrepreneurship practice, so the majority of colleges and universities innovation and entrepreneurship education system needs to be improved. This paper proposes to construct the evaluation index system for innovation and entrepreneurship of college students in teacher training colleges and universities, and weight the college students in teacher training colleges and universities with AHP into 4 first-level indexes, 12 second-level indexes and weighted summation to measure the dual-creation ability of students.

Keywords: AHP; information technology; innovation education; entrepreneurship.

1 Introduction

With the advent of the information age, the cultivation of innovation and entrepreneurship abilities among college students has become one of the important tasks of higher education. In this context, how to accurately and comprehensively evaluate the innovation and entrepreneurship abilities of college students has become a problem that needs to be solved. As a university dedicated to student quality education, Lingnan Normal University has always attached great importance to the cultivation and evaluation of college students' innovation and entrepreneurship abilities. Therefore, this paper selects Lingnan Normal University as the research object, aiming to explore how to comprehensively and objectively evaluate the innovation and entrepreneurship abilities of college students in the context of informatization, and provide useful references for the education and teaching work of Lingnan Normal University.

The significance of this study is that by comprehensively and objectively evaluating the innovation and entrepreneurship abilities of college students, it can effectively reflect their development level, advantages and disadvantages, and provide scientific and effective evaluation methods and reference indicators for education and teaching. At the same time, it

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also has profound significance for promoting the development of innovation and entrepreneurship education.

The innovation of this paper lies in the exploration of a new method for comprehensively and objectively evaluating the innovation and entrepreneurship ability of college students. By introducing a diversified evaluation system and taking into account factors such as students' knowledge level, practical ability, and innovation awareness, it further promotes the development of innovation and entrepreneurship education..

2 Prior studY

2.1 Foreign Prior Study

In foreign countries, the construction of indicator system of innovation and entrepreneurship ability of college students has become an important research topic. Foreign research on the construction of innovation and entrepreneurship ability indexes is relatively mature and in-depth, and a large number of related studies have summarized and proposed two methods, first of all, the "entrepreneurial ability KSA framework", which is mainly divided into three fields: knowledge, skills and attitude, of which the knowledge field mainly includes conceptualization mode, self-insight and explicit knowledge; and the skill field mainly includes Resource Skills, Marketing Skills, Learning Skills, Interpersonal Skills, Strategic Skills, and Opportunity Skills; and finally the Attitude domain mainly includes Self-efficacy, Entrepreneurial Passion, Tolerance, Anticipation, Entrepreneurial Personality, Uncertainty or Ambiguity, Innovation, and Perseverance [1]. Another method is the entrepreneurial competence model, which groups the knowledge-led, business competence elements and personal behavioral interaction-related elements two by two each, and then groups the rest to form three domains of entrepreneurial competence, and then divides each group into three subcategories, which makes it more comprehensive and scientific [2].

As for the index system, Finnish researcher Kuratko proposed a five-dimensional innovation and entrepreneurship competence index system, including innovation thinking ability, business planning ability, resource organization ability, collaboration ability and market-oriented ability [3]. American researcher Morris, on the other hand, proposed a nine-dimensional indicator system, including innovation ability, opportunity identification ability, business plan ability, teamwork ability, and risk management ability [4].

2.2 Domestic Prior Study

China's college students innovation and entrepreneurship education started late, the implementation of innovation education in higher education from the 1980s, the development of various types of education-related policies to support the development of innovation and entrepreneurship education, until 2008, the number of innovation and entrepreneurship-related research began to rise significantly, and the research in the depth of the college students' innovation and entrepreneurship education theoretical system is gradually perfected, and the construction of relevant index system and evaluation indicators The construction of the relevant index system and evaluation indexes are also becoming more mature day by day. For example, college students' innovation and entrepreneurship ability is divided into four levels,

entrepreneurial spirit, innovation ability, entrepreneurial ability and entrepreneurial management ability [5]. As well as through the principles of integrating college students' innovation and entrepreneurship education with practice, interaction between on-campus and off-campus and domestic and international, and combining online and offline, building practice bases for innovation and entrepreneurship education in colleges and universities, and using wisdom education to build a system of innovation and entrepreneurship competence cultivation with wisdom education as the background [5]. There is also the use of AHP to construct the evaluation index system of college students' innovation and entrepreneurship ability.

3 Empirical Study

3.1 Selection of Indicators

In this paper, the innovation ability of college students is decomposed into innovation and entrepreneurship ability, innovation and entrepreneurship design, innovation and entrepreneurship team resources, innovation and entrepreneurship team cooperation and innovation and entrepreneurship results application, totaling 4 first-level indicators and 12 second-level indicators. Through principal component analysis, the indicator system is reconstructed to get the final results as shown in Table 1, including knowledge and ability, environment and resources, team management and construction, and results promotion and transformation.

Table 1 Index system composition.

Overall indicators	Primary indicators	Secondary indicators
University students Student Innovation Innovation Creation business Ability Ability(A)	Knowledge and competence(A1)	Fundamentals of specialized knowledge(A11)
		logical thinking (A12)
		Critical learning skills (A13)
	Environment and resources (A_2)	Double Creation Policy (A21)
		Double Creation Funding (A22)
		Dual Creation Curriculum (A23)
		Bicentennial Competition Practical Training
	Team management and building (A_3)	Team Communication (A31)
		Leadership collaboration (A32)
		Team Analysis and Evaluation (A33)
	Dissemination and translation of results (A4)	Practice and application of results (A41)
		Popularization and dissemination of results (A42)

3.2 Evaluation Methodology

Determine the weights of each indicator of college students' dual-creation ability under informationization according to the AHP method.

Establish an n×n judgment matrix A for the n evaluation indicators in each layer to quantify the relative importance evaluation of different indicators. For pairwise comparison, let the indicators in row i (i=1,2,⋯,n)be measured relative to the indicators in row j (j=1,2,⋯,n), e.g., a_{ij}=k, then a_{ji} =1/k. Evaluation benchmarks can be showed in table 2.

Table 2 Evaluation benchmarks.

scale	hidden meaning
1	Row i factors have the same impact as column j factors
3	Row i factors have a slightly stronger impact than column j factors
5	Stronger impact of factors in row i than factors in column j
7	Row i factors have a significantly stronger impact than column j factors
9	Row i factors are stronger than column j factors affecting absolute

Note: 2, 4, 6, and 8 indicate the median value of the neighboring ratings of the i-th governance factor in relation to the j-th governance factor.

The CI, CR and RI values were calculated for the consistency test of the dual innovation capacity indicator can be demonstrated by formula 1.

$$\mathrm{CR} = \frac{a_1 CI_1 + a_2 CI_2 + \cdots a_m CI_m}{a_1 RI_1 + a_2 RI_2 + \cdots a_m RI_m}, CR < 1 \tag{1}$$

Due to the difficulty in reflecting the fuzziness and uncertainty of subjective evaluation of indicators using traditional comparison matrices, fuzzy data is introduced into the Analytic Hierarchy Process to more accurately reflect subjective information in the evaluation process of college students' entrepreneurship and innovation data.

$$\begin{gathered} \mathrm{U}_{\mathrm{ij}}^{\sim} = (L_{ij}, M_{ij}, U_{ij}); L_{ij} \le M_{ij} \le U_{ij} \\ L = \min(E_{ijk}) \\ M_{ij} = \prod_{n} E_{ijk} \\ \mathrm{U}_{\mathrm{ij}} = \max（E_{ijk}） \end{gathered} \tag{2}$$

Among formula 2, Eijk is the comparative evaluation value of the importance of indicator i and indicator j of the k-th expert's innovation and entrepreneurship ability, and then continues to be introduced α Confidence interval, building a triangular structure of college students' entrepreneurship and innovation fuzzy comparison matrix like formula 3.

$$\begin{gathered} \mathrm{a}_{\mathrm{ij}}^{\sim} = [(M_{ij} - L_{ij}) \cdot \alpha + L_{ij}, U_{ij} - (U_{ij} - M_{ij}) \cdot \alpha] \\ V\alpha \in [0,1] \end{gathered} \tag{3}$$

The evaluation of the innovation and entrepreneurship capability system needs to introduce an optimistic coefficient and linearly process the above innovation and entrepreneurship capability matrix function to produce the final comparison matrix of innovation and entrepreneurship capability indicators, as shown in formula 4.

$$\alpha_{\mathrm{ij}}^{\alpha\mu} = [\mu \cdot \mathrm{L}_{\mathrm{ij}}^{\alpha}(1-\mu) \cdot \mu_{ij}^{\alpha}]$$
$$0 \le \mu \le 1 \tag{4}$$

Normalization calculation of the eigenvectors of bi-initiative capabilities to obtain the final weights of bi-initiative capabilities indicators as formula 5.

$$(\mathrm{a}_{ij}^{\alpha})\ \mu - \lambda_{\max} \cdot \mathrm{W} = 0 \tag{5}$$

3.3 Indicator weights

Sixty experts and 1,000 students were selected for weighted scoring, and 385 valid scores were selected from the students, in which the experts included multi-dimensional disciplinary backgrounds such as pedagogy, economics, management, civic education, and applied sciences. The final results of the weighting calculation are as table 3:

Table 3 Weight distribution table.

Overall indicators	Primary indicators	weights	Secondary indicators	weights
A	A1	0.339	A11	0.1357
			A12	0.0981
			A13	0.0876
	A2	0.187	A21	0.0824
			A22	0.1283
			A23	0.0348
			A24	0.0856
	A3	0.224	A31	0.0891
			A32	0.1032
			A33	0.0588
	A4	0.25	A41	0.0415
			A42	0.0549

3.4 Evaluation of Innovation and Entrepreneurship Ability of College Students in Lingnan Normal University

Based on the scoring of college students' entrepreneurship and entrepreneurial ability in the context of information technology, with 10 as the upper limit value, and the weights of each index, weighted sum and other related data processing, we get the scores of each of the innovation and entrepreneurship ability of Lingnan Teachers' College in engineering, liberal arts, business, and science disciplines, as shown in Table 4.

Table 4. Score of Innovation and Entrepreneurship Ability of Lingnan Normal University Students.

	E	H	B	S
A	4.546	3.447	3.214	3.511
A1	4.27	2.83	1.72	3.19

A2	1.52	2.54	3.46	1.93
A3	1.33	2.69	2.95	1.22
A4	2.88	1.94	1.87	3.66
A11	1.553	1.272	0.719	1.121
A12	1.381	1.123	0.764	1.274
A13	0.976	1.061	0.681	1.061
A21	0.624	0.915	1.053	0.915
A22	0.883	1.124	0.741	1.124
A23	0.648	0.625	0.836	0.625
A24	0.656	0.334	1.091	0.334
A31	0.491	1.237	1.217	0.537
A32	0.532	0.916	1.124	0.816
A33	0.388	0.659	0.547	0.659
A41	1.045	0.294	0.360	1.094
A42	0.823	0.440	0.867	0.440
E represents engineering，H represents humanities，B represents Business，S represents science				

The first-level indicators for engineering, liberal arts, business, and science undergraduates at Lingnan Teachers College are represented in Figure 1 to make comparisons more clearly.

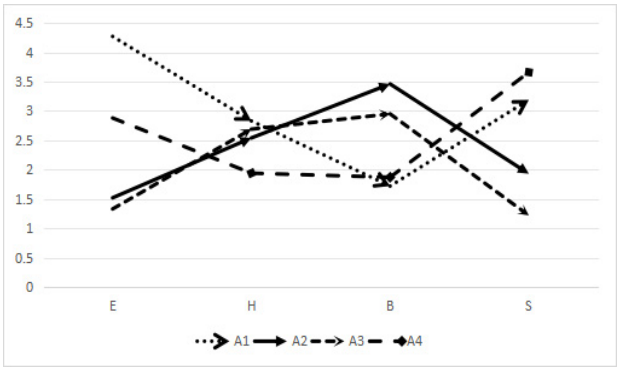

Figure 1 Trend of primary indicator scores.

The secondary indicators for engineering, liberal arts, business, and science undergraduates at Lingnan Teachers College are represented in Figure 2 to make comparisons more clearly.

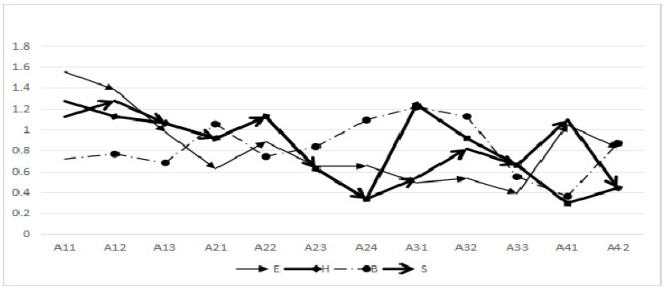

Figure 2 Trend of Secondary indicator scores.

4 Recommendation

With the advent of the information age, digital technology and network technology have profoundly changed people's way of life and work. In this context, how to use information technology to enhance the innovation and entrepreneurship abilities of college students has gradually become an important research issue. Here are several suggestions for improving the innovation and entrepreneurship abilities of college students in the context of informatization.

4.1 Provide diversified resources and platforms

Provide diversified resources and platforms: Universities should provide students with diverse resources and platforms, such as technology innovation laboratories, entrepreneurship incubation centers, business incubators, etc. Especially, digital and network technologies can be utilized to provide online innovation and entrepreneurship resources and platforms, such as online innovation and entrepreneurship mentors, online entrepreneurship marketing courses, etc., to meet the needs of different students.

4.2 Strengthen the cultivation of digital technology and business models

Based on the characteristics and market demands of different disciplines, universities should strengthen the cultivation of digital technology and business models. In terms of teaching, courses on digital technology and business models should be added, and students should be encouraged to participate in innovation and entrepreneurship competitions and practical activities, in order to better grasp the core points of digital technology and business models.

4.3 Strengthen student communication and cooperation

Provide students with diverse and convenient online and offline communication platforms to encourage interaction and communication between students. In addition to conventional social tools such as QQ and WeChat, it is also possible to consider building open forums, educational platform forums, and other communication platforms. Schools can strengthen team collaboration training and training to help students better understand how to collaborate efficiently. Schools can provide students with more opportunities and resources to participate, such as organizing students to participate in various entrepreneurship competitions, innovation and entrepreneurship practice competitions, and other projects.

4.4 Improving students' innovation and thinking abilities

Improving students' innovation and thinking abilities: Universities should focus on improving students' innovation and thinking abilities, guiding them to carry out diversified practical activities, such as technology competitions, patent applications, technology transformation, etc. To enhance students' practical ability and creativity, allowing them to have more innovative ideas and solutions when thinking about problems.

5 Conclusion

Engineering college students have good knowledge and ability of innovation and entrepreneurship and ability of promoting and transforming achievements, and are good at

critical learning, but lack the environment and resources for innovation and entrepreneurship, and the policy support is not obvious. Liberal arts college students have strong logical thinking ability and critical learning ability, but lack of practical ability. Business undergraduates have rich experience in team management and construction, and can communicate with each other in a timely manner, but have poor knowledge and ability in innovation and entrepreneurship, and lack of specialized knowledge. Science college students have strong social practice ability, but lack experience in team leadership and cannot analyze and evaluate the team in time.

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