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The contribution of structural equation model analysis to higher education agglomeration and innovation and entrepreneurship

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Abstract

As the pace of national modernisation accelerates, the society urgently needs talents with entrepreneurial qualities and innovative spirit. Therefore, colleges and universities need to vigorously cultivate the entrepreneurial quality and innovative spirit of college students. We believe that the quality evaluation index system for implementing innovation and entrepreneurship education should be constructed from the perspectives of university students, colleges and universities and the external environment. The article constructs a structural equation model (SEM) with seven hidden variables and 23 observed variables. By revising the hypothetical model, it is concluded that the total effect of cultivating innovative and entrepreneurial talents is 0.48. Therefore, we believe that the current development of postgraduate innovation and entrepreneurship education is still very unsatisfactory. The entrepreneurial situation of students has not attracted the attention of colleges and universities. The allocation of resources, full-time teachers and the curriculum system need to be further improved.

Keywords: entrepreneurial quality, higher education, structural equation model, innovation and entrepreneurship, college students**AMS 2010 codes:** 62J10

1 Introduction

The Third Plenary Session of the Eighteenth Central Committee of the Party proposed regulations. Improve preferential policies to support entrepreneurship to form a new mechanism for the government to encourage entrepreneurship, the society supports entrepreneurship, and workers dare to start a business [1]. Implement policies to encourage college graduates to start their businesses and integrate and develop national and provincial college graduates' employment and entrepreneurship funds. Society urgently needs talents with entrepreneurial qualities and an innovative spirit. Therefore, colleges and universities need to vigorously cultivate the entrepreneurial quality and innovative spirit of college students. This article conducts a questionnaire survey on college students from six universities. We use SPSS16.0 for statistical analysis and establish a structural

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equation theoretical model for cultivating entrepreneurial qualities of college students. After using AMOS software to conduct empirical research, suggestions are given further to strengthen college students' entrepreneurial quality.

2 Sample data

We select university students from six universities as research objects. Through the questionnaire survey method, the personal entrepreneurial quality of college students is researched. There are 15 questions in the questionnaire. The content includes opportunity grasping ability, social ability, leadership, decision-making ability, stress resistance, endurance, entrepreneurship education, family environment, entrepreneurial atmosphere, entrepreneurial process, professional background, innovation awareness, entrepreneurial willingness, entrepreneurial attitude and planning ability [2]. We use a 5-point system for scoring. One indicates the strongest degree and five indicates the weakest degree. A total of 1,000 questionnaires were distributed in this survey. One thousand valid questionnaires were collected, and the questionnaire response rate was 100%. This study uses SPSS16.0 and AMOS17.0 for data analysis.

3 Structural equation model (SEM)

3.1 Cranbach's reliability analysis

Calculate the data of the questionnaire to get the *Cranbach's* s_a reliability analysis table, as shown in Table 1. From the data in Table 1, the value of *Cranbach's* s_a is 0.860. It can be seen that the model in this article is reliable. We can proceed to the next step of empirical research.

1. Measurement model: This model is used to describe the relationship between a series of measured variables and the latent variables they load. It is expressed by the following equation:

$$y(p \times 1) = \Lambda_y(P \times m) * \eta(m \times 1) + \varepsilon(p \times 1) \quad (1)$$

$$x(q \times 1) = \Lambda_x(q \times n) * \xi(n \times 1) + \delta(q \times 1) \quad (2)$$

In the formula, y and x are the vectors $(p \times 1)$ and $(q \times 1)$ composed of endogenous and exogenous measurement variables, respectively. Λ_y and Λ_x are the factor loading matrices $(P \times m)$ and $(q \times 1)$ of y versus η and x versus ξ , respectively. η is the vector $(m \times 1)$, ξ formed by endogenous latent variables, and is the vector $(n \times 1)$ formed by exogenous latent variables. ε and δ are the vectors $(p \times 1)$ and $(q \times 1)$ formed by the measurement errors of y and x , respectively. They are assumed to be uncorrelated with ξ and ζ , and they are also uncorrelated with each other.

2. Latent variable model: This model represents the causal relationship between exogenous and latent variables [3]. This relationship can be direct or indirect. It is written as follows:

$$\eta(m \times 1) = B(m \times m) * \eta(m \times 1) + \Gamma(m \times n) * \xi(n \times 1) + \zeta(m \times 1) \quad (3)$$

where B is the $m \times m$ matrix of the effective coefficient of the endogenous latent variable on the endogenous latent variable $\{\eta\}$, Γ is the $m \times n$ matrix of the effective coefficient of the exogenous latent variable (ξ) on the endogenous latent variable $\{\eta\}$ and the last term is the vector $(m \times 1)$ formed by the residual term. It is assumed to be close to 0 and irrelevant to ξ .

Test statistics are also called KMO. In general, the closer the KMO test value is to 1, the larger the sample size. The Bartlett test of sphericity is a test method to test the degree of correlation between various variables.

Table 1 Reliability analysis table

Cronbach's α (Cronbach's coefficient)	Cronbach coefficient based on standardization project	Number of items
0.86	0.858	15

Table 2 Results of KMO test and Bartlett test

	KMO measures the adequacy of sampling	0.871
Bartlett's sphericity test	Approximate chi-square value	3413
	Degree of freedom	105
	Significance level	0

Generally speaking, if the significance level of the Bartlett sphericity test is ≤ 0.05 , the test model is reliable. The two test results in this paper are shown in Table 2.

From Table 2, the test value of the test statistic is 0.871. This shows that the survey data are suitable for principal component analysis [4]. The approximate chi-square value in the Bartlett sphericity test is 3413. The corresponding probability p is close to zero. Significance level $\alpha \leq 0.05$. Therefore, except the original hypothesis that the data collected this time is suitable for principal component analysis.

SPSS16.0 is used to perform principal component analysis on the original data of 15 indicators. According to expert opinions, three main components that affect the entrepreneurial quality of college students are obtained, namely entrepreneurial ability, entrepreneurial awareness and entrepreneurial knowledge. Entrepreneurship ability is embodied by grasping opportunities, social skills, leadership, decision-making, stress resistance and endurance. Entrepreneurship consciousness is embodied by innovation consciousness, entrepreneurial willingness, entrepreneurial attitude and planning ability. Entrepreneurship knowledge is embodied by entrepreneurial education, family environment, entrepreneurial atmosphere, entrepreneurial process and professional background.

3.2 The initial SEM overall fit

To study the status quo of the cultivation of college students' entrepreneurial quality and explore the influencing factors and improvement paths of college students' entrepreneurial quality, the article combines principal component analysis and expert opinions to determine three latent variables and 15 observed variables [5]. It is shown in Table 3. Construct a structural equation theoretical model based on the above variable system and research. F1 represents entrepreneurial ability, F2 represents entrepreneurial awareness, F3 represents entrepreneurial knowledge and e_i represents path deviation, as shown in Figure 1.

Table 3 Variable system of the theoretical model

Latent variable	Observed variable	Symbol
Entrepreneurial ability	Opportunity grasping ability, social ability, leadership, decision-making ability, stress resistance, endurance	X11, X12, X13, X14, X15, X9
Entrepreneurial awareness	Innovation awareness, entrepreneurial willingness, entrepreneurial attitude, planning ability	X6, X7, X8, X10
Entrepreneurial knowledge	Entrepreneurship education, family environment, entrepreneurial atmosphere, entrepreneurial process, professional background	X1, X2, X3, X4, X5

Fig. 1 The theoretical model of the structural equation for the cultivation of undergraduates' entrepreneurial quality

3.3 Path coefficient estimation

Table 4 shows the unstandardised path coefficients of the structural equation theoretical model for cultivating college students' entrepreneurial qualities. Through this data, the relationship between latent variables and observed variables can be seen very intuitively. However, further significance testing is needed to confirm its existence [6]. It can be seen from Table 4 that all the path coefficients in this paper have reached a significant level of 0.05. The critical ratio values are all >1.96 . The probability values are all $p < 0.05$. This shows that all path coefficients are overall significant. The measurement errors are all positive, which shows that there is no problem with the theoretical model.

Table 4 Parameter estimation in modified SEM structure model

Variable			Estimated value	Measurement error	Critical ratio
Opportunity grasping ability	←	Entrepreneurial ability	1		
Social skills	←	Entrepreneurial ability	1.168	0.063	18.512
Leadership	←	Entrepreneurial ability	1.158	0.07	16.584
Decision-making power	←	Entrepreneurial ability	1.083	0.066	16.387
Compressive ability	←	Entrepreneurial ability	1.151	0.073	15.672
Endurance	←	Entrepreneurial ability	0.907	0.065	13.963
innovative mind	←	Entrepreneurial awareness	1		
Entrepreneurial willingness	←	Entrepreneurial awareness	0.872	0.06	14.484
Entrepreneurial attitude	←	Entrepreneurial awareness	0.791	0.058	13.606
Planning ability	←	Entrepreneurial awareness	0.706	0.063	11.168
Entrepreneurship process	←	Entrepreneurial knowledge	1		
family environment	←	Entrepreneurial knowledge	0.991	0.129	7.69
Entrepreneurial atmosphere	←	Entrepreneurial knowledge	1.396	0.173	8.088
Entrepreneurship Education	←	Entrepreneurial knowledge	1.329	0.161	8.241
Professional background	←	Entrepreneurial knowledge	1.4	0.162	8.648

SEM, structural equation model

3.4 SEM model revision

It can be seen from Figure 1 that the path deviation between the variables is relatively large. This requires the continuous establishment of correlations between variables to reduce the deviation. A new revised model and related path coefficients are obtained (Figure 2).

Fig. 2 Standardised estimation of the SEM for the cultivation of college students' entrepreneurial qualities. SEM, structural equation model

4 Discussion

4.1 Analysis of the relationship between latent variables

The regression coefficient between the entrepreneurial awareness factor and entrepreneurial ability factor is 0.62. This shows that the entrepreneurial awareness factor increases by 1% every time. This will lead to a 62% increase in the entrepreneurial ability factor. The regression coefficient between the entrepreneurial awareness factor and the entrepreneurial knowledge factor is 0.84. This means every 1% increase in the entrepreneurial awareness factor [7]. This will directly increase the entrepreneurial knowledge factor by 84%. The regression coefficient between entrepreneurial knowledge and entrepreneurial ability is -0.46 . This shows that there is a negative correlation between them. This may be because the survey subjects are college students. With the improvement of their entrepreneurial ability, their knowledge of entrepreneurship in books will correspondingly decrease, and their practical experience will correspondingly increase.

4.2 Analysis of the relationship between latent variables and observed variables

4.2.1 The relationship between entrepreneurial ability and observed variables

The six factors that affect entrepreneurial ability all reach a significant level of 0.05, which shows that all six factors significantly impact entrepreneurial quality. The influence coefficient of social ability is 0.74,

which shows that social ability has the greatest influence on entrepreneurial ability [8]. Leadership (0.72) and decision-making (0.68) have the second-highest impact on the entrepreneurial quality of college students. The impact of stress resistance and endurance is relatively small. This shows that the entrepreneurial qualities of college students themselves, such as interpersonal skills, have a greater impact on entrepreneurial ability, which is also in line with reality.

4.2.2 Analysis of the relationship between entrepreneurial awareness and observed variables

Among the four influencing factors of entrepreneurial consciousness, entrepreneurial willingness (0.61) and innovation consciousness (0.67) significantly impact college students' entrepreneurial consciousness. Entrepreneurship attitude (0.56) and planning ability (0.47) have little influence. This shows that the innovation consciousness and entrepreneurial willingness of college students greatly affect the entrepreneurial consciousness of students. This also provides a working direction for further cultivating students' sense of innovation and increasing entrepreneurial willingness.

4.2.3 The relationship between entrepreneurial knowledge and observed variables

Among the five influencing factors of entrepreneurial knowledge, the coefficient of influence of professional background on the entrepreneurial quality of college students is 0.57. This shows that professional background has the greatest impact on entrepreneurial knowledge. This shows that innovation and entrepreneurship must rely on professional knowledge and disciplinary background to have core competitiveness [9]. Entrepreneurship atmosphere (0.51) and entrepreneurial process (0.51) also have a certain impact on the entrepreneurial quality of college students. Entrepreneurship education and family environment have relatively little impact on the entrepreneurial quality of college students. Undergraduates have a certain academic background in entrepreneurship, and entrepreneurial activities using professional knowledge generally achieve better results. It can be seen that the fit of the modified model is significantly improved. Combined with the path coefficient, the total effect of other variables on entrepreneurial quality can be obtained (Table 5).

Table 5 Index of influencing factors of college students' entrepreneurial quality

First level indicator		Secondary indicators		Three-level indicators		
Overall index 57.82	Impact factor Entrepreneurial ability	Index 66.27	Sort 1	Individual index		Sort
				Opportunity grasping ability	56.8	8
				Social skills	63.7	5
				Leadership	67.9	3
				Decision-making power	71.7	1
				Compressive ability	73.9	2
	Entrepreneurial awareness	57.88	2	Endurance	63.6	6
				Innovative mind	47	13
				Entrepreneurial willingness	56.2	10
				Entrepreneurial attitude	61.4	7
				Planning ability	66.9	4
				Entrepreneurship Education	56.7	9
	Entrepreneurial knowledge	49.32	3	Family environment	51.1	12
				Entrepreneurial atmosphere	51.2	11
				Entrepreneurship process	45.8	14
				Professional background	41.8	15

From Table 5, we can see that the overall index of college students' entrepreneurial quality is 57.82. This is consistent with the current status of undergraduate entrepreneurship. This shows that the index evaluation system adopted in this article is effective. But we see that the index is not high, which shows that college students are not optimistic about entrepreneurship. We need to strengthen guidance in the employment training of students. Observe the three potential variables that affect the overall index of college students' entrepreneurial quality [10]. The most influential is entrepreneurial ability (66.27), followed by entrepreneurial awareness (57.88) and finally entrepreneurial knowledge (49.32). This also shows that if college students have certain entrepreneurial abilities and awareness, they can gradually start entrepreneurship. Entrepreneurship knowledge can be continuously learned in entrepreneurship. Whether or not they have a wealth of entrepreneurial knowledge at the beginning has relatively a little impact on college students' entrepreneurship.

5 Suggestions

5.1 Strengthen practice, accumulate experience and enhance students' entrepreneurial ability

Schools should actively mobilise and encourage college students to participate in various entrepreneurial social practice activities to enhance their entrepreneurial capabilities. Entrepreneurial experience through various practices should be accumulated, such as improving problem-solving skills, social skills and teamwork skills. In the process of continuous practice and learning, exercise your planning and decision-making ability and improve your leadership [11]. Through continuous research and practical work, to find out the market conditions and industry background, cultivate their entrepreneurial ability and grasp various opportunities. At the same time, encourage and support students to participate in various innovation and entrepreneurship competitions at all levels and increase policy support and guidance. We need to provide human, financial and material guarantees to guide college students to improve themselves, continuously enhancing their entrepreneurial capabilities.

5.2 Create an entrepreneurial atmosphere and stimulate students' entrepreneurial awareness

With the support of the four schools, government, society and families, enterprises can set up entrepreneurial projects or entrepreneurial funds [12]. Enterprises can set up entrepreneurial awards according to the situation, actively encourage college students to start their businesses and create a good entrepreneurial atmosphere for society. Let some students with entrepreneurial ideas taste the 'sweetness' to stimulate their entrepreneurial potential. The government can give full play to its service function to promote and establish an entrepreneurial culture. We will do a good job in supporting policies and material guarantees for college students' entrepreneurship. The media can give full play to the role of propaganda media to create an entrepreneurial atmosphere and provide sufficient information for entrepreneurial college students promptly. We create a good interactive and orderly entrepreneurial atmosphere in the whole society. Schools can develop undergraduate entrepreneurship parks to provide a suitable platform for entrepreneurship education, encourage and support students' entrepreneurship and calculate relevant credits.

6 Conclusion

The most important issue in cultivating college students' entrepreneurial quality is the concept of talent cultivation in colleges and universities. To form a 'four-in-one' training mechanism, it requires the government, society, school and family to form a consistent understanding of the cultivation of students' entrepreneurial qualities. Clearing out the current ideological misunderstandings in entrepreneurship education lays a solid ideological foundation for cultivating college students' entrepreneurial quality. Through the empirical research of the SEM, this paper discusses the influencing factors of college students' entrepreneurial quality from three aspects: content entrepreneurial knowledge, entrepreneurial awareness and entrepreneurial ability. Therefore,

colleges and universities should cultivate the personal entrepreneurial qualities of college students and strengthen the entrepreneurial quality education.

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