Evaluation of College Students' Innovation and Entrepreneurial Ability for the Science and Technology Service Industry

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Abstract—The development level of the science and technology service industry is an important factor affecting the development speed of regional economy and the formation of innovation ability and development potential of the region, and the construction of talent team is the core and foundation for the development of the science and technology service industry. To measure such ability, this paper constructed an evaluation model for the innovation and entrepreneurial ability (IEA) of college students. First, a corresponding evaluation index system was established, the quantifiable index data were subject to factor analysis, and the structural equation model was subject to regression estimation using the maximum likelihood method. Then, from multiple aspects such as the level of the colleges, the major of the students, and the gender of the students, this paper comprehensively analyzed college students' IEA. And finally, based on one-way analysis of variance, the differences between indexes were analyzed, and a path analysis model was established to analyze the relationship between the science and technology service industry's regional industrial scale, resource input, informatization level, spatial agglomeration degree, and college students' IEA.

Keywords—Science and technology service industry, innovation and entrepreneurial ability (IEA) of college students, ability evaluation

1 Introduction

In China, the state council promulgated the Several Opinions of the State Council on Accelerating the Development of the Science and Technology Service Industry in 2014 and the Modern Service Industry Science and Technology Innovation Special Plan for "13th Five-Year Plan" in 2017, and the two documents had specified the important role of the knowledge spillover effect of the science and technology service industry in promoting the development of the national modern industrial system and the optimization of the industrial structure [1-3].

As an emerging industry, the development level of the science and technology service industry determines the development speed of regional economy and the formation of the innovation ability and development potential of the region; now, the science and technology service industry has received national attention and various supports such as resources, taxes, subsidies from the local governments [4-8]. In 2010, the Ministry of Education issued the Measures for the Certification of College Students’ Science and Technology Entrepreneurship Practice Bases and the Opinions on Vigorously Promoting the Innovation and Entrepreneurship Education of Colleges and Universities and the Independent Entrepreneurship of College Students, and these two documents had pointed out the direction for the development of college students’ innovation and entrepreneurship education [9-10]. Effectively cultivating college students' IEA is not only an objective requirement for promoting the innovation ability of the science and technology service industry, but also a task assigned to colleges and universities during the process of building China into an innovative country.

Scholars at home and abroad have attached great importance to the cultivation and introduction of innovative talents in the science and technology service industry. For example, Sadli et al. [11] believe that the innovative talents of the science and technology service industry should have certain professional knowledge, skills, and good innovation ability; and no matter theory-type talents, application-type talents, or skill-type talents, all of them can become innovative talents via efforts. Yu et al. [12] believed that senior professional titles or honorary titles are not a sufficient and necessary condition for innovative talents in the science and technology service industry. Talents with high professional quality, or certain innovation ability in science, technology or management, or have contributions in promoting scientific and technological achievements in the society, can all be called the innovative talents in the science and technology service industry.

In 1998, UNESCO proposed that the important development goal of higher education in the 21st century is to cultivate students with both entrepreneurial skills and spirits, and thus realizing the transformation of outstanding university graduates from job seekers to entrepreneurs [13-14].

Nearly 1,600 colleges and universities in the United States have opened small business management and innovation and entrepreneurship courses for students at the undergraduate level, various innovation and entrepreneurship competitions have been held to assist and promote such courses. Other developed countries such as Europe and Japan have also provided various supports for college students’ innovation and entrepreneurship via policies, resources, and funding, etc. [15-18].

Efendi et al. [19] constructed a conceptual model of innovation and entrepreneurship education that can distinguish student types and styles, and they argued that the goals and methods of education are jointly determined by students' entrepreneurial needs, awareness, and potential. Perez-Encinas et al. [20] investigated the innovation and entrepreneurship education activities of 6 universities in Germany, and pointed out that entrepreneurship practice is the best way for students to apply the theoretical knowledge they learnt in class.

In China, with “achieving dreams via Internet+ and creating future via innovation and entrepreneurship” as the theme, each year, the country will hold the Internet+

College Student Innovation and Entrepreneurship Competition; and every two years, the country will hold the “Challenge Cup” National College Students' Extracurricular Academic Science and Technology Competition. Under the national call of mass entrepreneurship and innovation, these events aim to cultivate the new force for scientific and technological innovation, and promote the transformation of competition results, and the formation of the new "Internet +" science and technology service industry [21-24]. Gumbi and Van Der Westhuizen [25] explained such competitions and proposed the idea of innovation and entrepreneurship education of "1-center, 3-platforms, 9-training modules", and constructed a long-term operation mechanism integrated four aspect of theory, research, exercise, and practice.

After reviewing relevant literatures, we found that, in terms of the cultivation and introduction of innovative talents for the science and technology service industry and the training of college students’ IEA, different countries and regions have different evaluation standards for students and talents due to the differences in their cultivation modes and education concepts, and their evaluation tools are varied as well. In this context, the construction of a scientific evaluation system for college students’ IEA has become a practical need.

In respond to this need, and in order to obtain accurate evaluation results of college students’ IEA for the science and industry service industry, this paper proposed a novel evaluation model for the said ability, in the hopes of satisfying the requirements of technological innovation, enterprise innovation, regional innovation and national innovation.

The structure of the content in this paper is arranged as follows: the second part built the corresponding evaluation index system for the said model, and conducted SPSS factor analysis and AMOS confirmatory factor analysis on the quantifiable index data, and then performed regression estimation on the corresponding structural equation model based on the maximum likelihood method. The third part comprehensively analyzed college students’ IEA from multiple aspects such as the level of the college, the major of the student, and the gender of the student. The fourth part took the level of the college, the major of the student, and the gender of the student as the independent variables, and college students’ IEA as dependent variable to conduct the one-way analysis of variance. At last, a path analysis model was established to analyze the relationship between the science and technology service industry’s regional industrial scale, resource input, informatization level, spatial agglomeration degree, and college students’ IEA.

2 Evaluation of College Students’ IEA for the Science and Technology Service Industry

The structural equation model (SEM) can handle multiple sets of latent variables that cannot be directly observed in the fields of sociology and psychology, and clearly describe the direct or indirect influence relationship between variables. Using this method, the measurement error of the variables would have little effect on the results, which is obviously better than the traditional statistical method. Figure 1 gives the basic analysis process of the constructed SEM. According to the figure, when using this model to analyze the evaluation indexes of college students’ IEA for the science and technology service industry, there're mainly 5 steps: set index relationship, acquire and identify indexes, linear regression estimation of the model, obtain evaluation results, model adjustment and optimization.

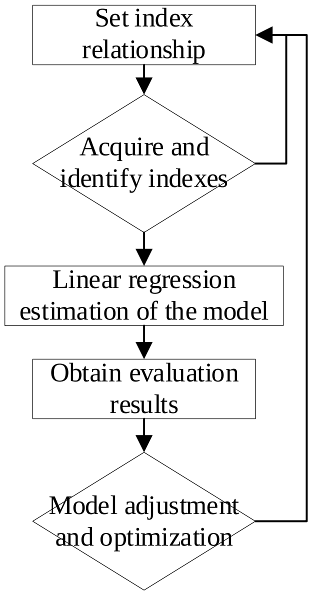

Fig. 1. Analysis flow of SEM

Table 1. IEA evaluation index system

First-level index	Second-level index	Meaning
Basic factors	Talent quality basics	Basic factors of innovative talents for science and technology service industry
	Talent growth carrier basics	
	Talent growth potential basics	
Environmental factors	Regional living environment	Influence of external environment on college students' IEA for science and technology service industry
	Regional economic environment	
	Work environment	
Input factors	Talent cultivation investment	The support and input of government and enterprises in the cultivation of innovative talents for the science and technology service industry
	Scientific research input	
	Talent introduction Policy input	
Personal factors	Innovation and entrepreneurship awareness	Qualities that the innovative talents should have for the science and technology service industry
	Innovation and entrepreneurship thinking	
	Innovation and entrepreneurship spirit	
	Innovation and entrepreneurship knowledge	
	Innovation and entrepreneurship ability	
Achievement factors	Scientific and technological innovation achievements	New contributions of innovative talents for the science and technology service industry
	Achievement transformation	

Based on collected data concerning the evaluation indexes of college students' IEA and the actual situation of innovation and entrepreneurship education in colleges and universities and the development situation of regional science and technology service industry, this paper proposed an evaluation index system of college students' IEA for the science and technology service industry. Wherein the first-level indexes include 5 dimensions, namely: basic factors, environmental factors, input factors, personal factors, and achievement factors, as shown in Table 1. Figure 2 gives a diagram of the constructed model.

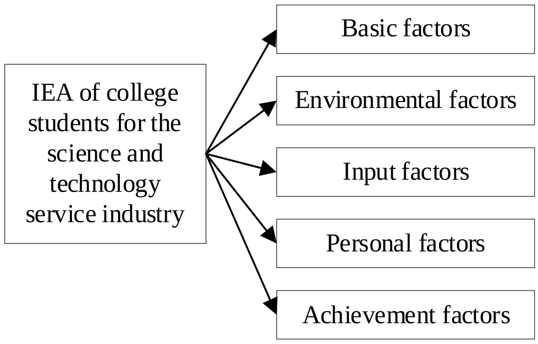

Fig. 2. Structure of IEA evaluation model

Table 2 gives the quantifiable variables of the second-level indexes and theirs codes corresponding to the 5 first-level indexes that are not directly observable in the model shown in Figure 2.

The construction of the above model is based on the following assumptions: indexes of the five dimensions (basic factors, environmental factors, input factors, own factors, and achievement factors) are important factors that affect the IEA of college students for the science and technology service industry, that is, the greater the positive impact of these indexes, the better the IEA of college students.

Above index data were subject to SPSS factor analysis and AMOS confirmatory factor analysis, and the model was subject to regression estimation based on the maximum likelihood method. Figure 3 shows the model after adjustment and optimization.

Table 2. Evaluation details and codes of the IEA evaluation model

First-level index	Second-level index (quantifiable)	Code
Basic factors	Innovative talent stock for the science and technology service industry in current year; Number of college graduates in current year; Proportion of academicians	BE_1
	Net inflow population in the region; Number of colleges and universities in the region	BE_2
	Change rate of innovative talents in science and technology service industry; Number of college students on campus	BE_3
Environmental factors	Maturity of infrastructure in the region	EE_1
	Per capita consumption level in the region; Per capita disposable income in the region	EE_2
	Amount of scientific research funding for innovative talents in the science and technology service industry; Reward for the introduction of innovative talents in the science and technology service industry	EE_3
Input factors	Investment in higher education; Investment in professional skills training; Introduction and investment in high-end technologies	IE_1
	Scientific research expenditure; Number of sponsored scientific research projects	IE_2
	Proportion of innovative talents introduced in the science and technology service industry	IE_3
Personal factors	Needs; motivation; interests; beliefs; values	OE_1
	Divergent thinking; creative thinking; inspirational thinking	OE_2
	Enterprising; self-confidence; pioneering spirit; adventurous spirit	OE_3
	Professional knowledge; innovation and entrepreneurship theory; interdisciplinary knowledge and common sense	OE_4
	Social skills; comprehension; adaptability; observation; judgment; imagination; stress tolerance; learning ability; teamwork ability; self-control; willpower	OE_5
Achievement factors	Number of patent applications and authorizations; Number of academic papers published	RE_1
	Number of technology transformation contracts signed; Per capita horizontal funding received for innovative talents in the science and technology service industry; Incremental output value of new products of enterprises after technology transformation	RE_2

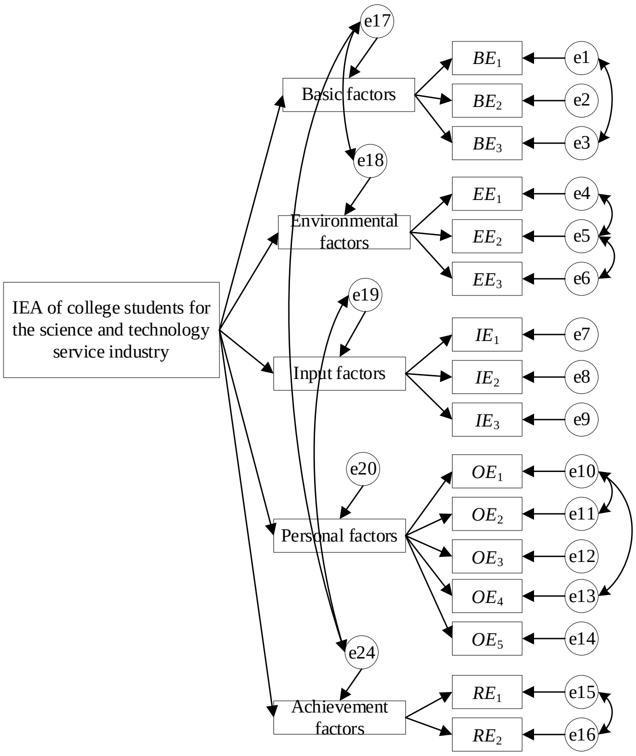

Fig. 3. Structure of the model after adjustment and optimization

Table 3 gives the second-order confirmatory factor analysis and the model fit before and after adjustment and optimization, it can be seen from the table that the fitness values are in an ideal range.

Table 3. Comparison of indexes before and after adjustment and optimization

Calibration index		Critical value of fitness	After adjustment and optimization
Absolute fit index	x^2/df	<5	3.014
	Root Mean Square Residual (RMSR)	<0.08	0.031
	Goodness of fix index (GFI)	>0.9	0.982
Comparative fit index	Normed fit index (NFI)	>0.9	0.921
	Incremental fit index (IFI)	>0.9	0.977
	Tucker-Lewis index (TLI)	>0.9	0.954
	Comparative fit index (CFI)	>0.9	0.925
Parsimony fit index	Parsimony goodness of fit index (PGFI)	>0.9	0.916
	Parsimony goodness of fit index (PGFI)	>0.9	0.970

This paper adopted Crobach's alpha to test the reliability and validity of the model. Table 4 shows the test results.

Table 4. Test results of the reliability and validity of the model

First-level index	Code of second-level index	Load of normalization factor	Calibration coefficient
Basic factors	BE_1	0.874	0.915
	BE_2	0.827	
	BE_3	0.923	
Environmental factors	EE_1	0.979	0.948
	EE_2	0.862	
	EE_3	0.927	
Input factors	IE_1	0.913	0.926
	IE_2	0.930	
	IE_3	0.919	
Personal factors	OE_1	0.879	0.939
	OE_2	0.911	
	OE_3	0.918	
	OE_4	0.942	
	OE_5	0.904	
Achievement factors	RE_1	0.845	0.873
	RE_2	0.886	

According to the table, the values of Crobach's Alpha of the five first-level indexes are all around 0.9, and values of the load of the normalization factor are between 0.827 and 0.979, indicating that the model has good reliability and validity. The weight values of the indexes were obtained by dividing the factor load of each first-level index by the sum of the factor loads of the five first-level indexes. Table 5 shows the weight values of all first-level indexes.

Table 5. Weight values of indexes

First-level index	Weight value	Code of second-level index	Weight value
Basic factors	0.159	BE_1	0.296
		BE_2	0.325
		BE_3	0.379
Environmental factors	0.178	EE_1	0.316
		EE_2	0.306
		EE_3	0.378
Input factors	0.226	IE_1	0.331
		IE_2	0.337
		IE_3	0.332
Personal factors	0.231	OE_1	0.217
		OE_2	0.195
		OE_3	0.198
		OE_4	0.205
		OE_5	0.185
Achievement factors	0.206	RE_1	0.521
		RE_2	0.479

The evaluation formula can be drawn as: College students' IEA = 0.159 × basic factors + 0.178 × environmental factors + 0.226 × input factors + 0.231 × personal factors + 0.206 × achievement factors.

3 Comprehensive Evaluation of College Students' IEA for the Science and Technology Service Industry

Based on the evaluation model and evaluation indexes proposed above, college students' IEA was measured, compared and analyzed comprehensively using the 5 first-level indexes from the aspects of the level of college, the major of student, and the gender of students in different regions.

Table 6. Evaluation results for colleges of different levels

Level of college	Score	Evaluation of each first-level index				
		Basic factors	***Environmental factors***	***Input factors***	***Personal factors***	***Achievement factors***
First-tier	4.416	4.316	4.325	4.452	4.428	4.561
Second-tier	4.152	4.121	4.212	4.216	4.353	3.859
Others	3.946	4.046	4.131	4.052	4.275	3.227
Mean	4.172	4.161	4.223	4.240	4.352	3.882

Table 6 shows the evaluation results of college students' IEA from the aspect of different-level colleges. According to the table, in terms of the evaluation scores of each first-level index, college students from "double first-class", "985", "211", and "national demonstration higher vocational colleges" and other national-level (first-tier) colleges have the highest-level IEA; followed by college students from provincial colleges and universities (second-tier); and college students from general higher educational schools have the lowest evaluation scores. For students from different-level colleges, their scores of personal factors are the highest, and the scores of basic factors are the lowest. In terms of achievement factors, there are great differences in colleges of different levels.

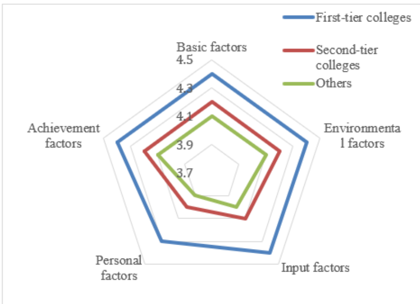

Fig. 4. Evaluation of colleges of different levels (radar chart)

Figure 4 gives the comparison and analysis results in the form radar chart. According to the figure, on the one hand, for colleges of different levels, the students' IEA levels are different as well. First-tier college students' IEA level is the highest, college students from general higher educational schools have the lowest IEA level; on the other hand, for colleges of a same level, their scores in the five first-level indexes are also different. Through observation, we can know that, for colleges students from second-tier colleges and general higher educational schools, the score in the achievement factors is the lowest and the difference is the largest, respectively 3.859 and 3.227, and the score of first-tier colleges in achievement factors is 4.561. Except for the scores of achievement factors, the scores of other first-level indexes are all above 4, and the difference between different indexes is less than 0.2.

Table 7 shows the evaluation results of college students' IEA from the aspect of different major students. According to the table, in terms of different-type majors, the rank of scores of college students' IEA from high to low is: comprehensive majors, engineering majors, science majors, medicine majors, art majors, management majors, law majors, and liberal art majors. In terms of the mean value of each first-level index, the IEA level of college students majored in liberal arts is the lowest; and they have a great gap with college students of other type majors in terms of the scores of two first-level indexes: the input factors and the achievement factors.

Table 7. Evaluation results for students of different type majors

Type of major	**Score**	**Evaluation of each first-level index**				
		Basic factors	***Environmental factors***	***Input factors***	***Personal factors***	***Achievement factors***
Comprehensive majors	4.399	4.327	4.353	4.466	4.432	4.421
Engineering majors	4.254	4.311	4.278	4.274	4.126	4.281
Science majors	4.145	4.175	4.097	4.259	4.125	4.069
Medicine majors	4.091	4.059	4.021	4.195	4.156	4.025
Management majors	3.997	4.011	4.152	4.032	3.845	3.946
Law majors	3.920	4.033	4.021	3.941	3.847	3.759
Liberal art majors	3.278	3.528	3.587	3.142	3.459	3.178
Art majors	3.998	3.845	3.974	4.018	4.278	3.876
Mean	4.010	3.998	4.022	4.090	3.996	3.944

Table 8 shows the evaluation results of college students' IEA from the aspect of different gender students. According to the table, male college students' IEA scores are generally higher than female college students, the overall IEA score of male students is 0.053 higher than that of female students, and the difference in each first-level index is not obvious.

Table 8. Evaluation results for students of different genders

Gender	Score	Evaluation of each first-level index				
		Basic factors	***Environmental factors***	***Input factors***	***Personal factors***	***Achievement factors***
Male students	4.359	4.375	4.298	4.336	4.428	4.361
Female students	4.306	4.221	4.241	4.331	4.387	4.354
Mean	4.333	4.298	4.2695	4.3335	4.4075	4.3575

4 Influencing Factors of College Students' IEA for Science and Technology Service Industry

Based on one-way analysis of variance, this paper took the level of college, the major of student, and the gender of student as the independent variables, and the college students' IEA as dependent variable to construct a path analysis model, so as to analyze the relationship between the science and technology service industry's regional industrial scale, resource input, informatization level, spatial agglomeration degree, and college students' IEA.

4.1 Difference analysis

First, college students' IEA was subject to the difference analysis. Table 9 shows the difference analysis results. According to the table, there are significant differences in the scores of the five first-level indexes of college students from different level colleges, students from general higher education schools have lower mean score in their IEA.

Table 9. Difference in IEA of students from different level colleges

First-level index	Level of college	Mean	Standard deviation	F value
Basic factors	First-tier	4.316	0.689	8.691^{***}
	Second-tier	4.121	0.727	
	Others	4.046	0.628	
Environmental factors	First-tier	4.325	0.625	10.274^{***}
	Second-tier	4.212	0.779	
	Others	4.131	0.693	
Input factors	First-tier	4.452	0.684	10.943^{***}
	Second-tier	4.216	0.728	
	Others	4.052	0.684	
Personal factors	First-tier	4.428	0.774	14.372^{***}
	Second-tier	4.353	0.827	
	Others	4.275	0.769	
Achievement factors	First-tier	4.561	0.779	12.735^{***}
	Second-tier	3.859	0.749	
	Others	3.227	0.670	
Average level	First-tier	4.416	0.698	13.932^{***}
	Second-tier	4.152	0.743	
	Others	3.946	0.638	

Table 10. Post hoc test results of the difference in IEA of college students from different level colleges

First-level index	Level of college	Level of college	Mean difference	Significance difference
Basic factors	First-tier	Second-tier	0.195	0.002
		Others	0.27	0.002
Environmental factors	First-tier	Second-tier	0.113	0.001
		Others	0194	0.001
Input factors	First-tier	Second-tier	0.236	0.002
		Others	0.4	0.003
Personal factors	First-tier	Second-tier	0.075	0.000
		Others	0.153	0.001
Achievement factors	First-tier	Second-tier	0.702	0.056
		Others	1.334	0.104
Average level	First-tier	Second-tier	0.264	0.002
		Others	0.470	0.041

Table 10 shows the post hoc test results of the difference in the IEA of college students from different level colleges. According to the table, the IEA of students from first-tier colleges in terms of the five first-level indexes is significantly higher than those from second-tier colleges and general higher education schools, this indicates that the IEA of students from second-tier colleges and general higher education schools needs to be strengthened; in terms of input and achievement factors, the assistance and promotion measures need close attention.

Then, the majors were sorted into three major types: science and engineering, liberal arts, and others. Table 11 shows the one-way variance analysis results of the IEA of college students of different major types. According to the table, the IEA of college students majored in science and engineering is better, while the IEA of college students majored in liberal arts needs to be improved.

Table 11. Difference in IEA of college students of different major types

First-level index	Type of major	Mean	Standard deviation	F value
Basic factors	Liberal arts	3.528	0.726	19.241***
	Science and engineering	4.271	0.779	
	Others	3.987	0.864	
Environmental factors	Liberal arts	3.587	0.831	17.428***
	Science and engineering	4.242	0.774	
	Others	4.042	0.824	
Input factors	Liberal arts	3.142	0.816	15.953***
	Science and engineering	4.333	0.774	
	Others	4.046	0.943	
Personal factors	Liberal arts	3.459	0.875	17.353***
	Science and engineering	4.228	0.971	
	Others	4.031	0.942	
Achievement factors	Liberal arts	3.178	0.881	16.943***
	Science and engineering	4.257	0.735	
	Others	3.901	0.821	
Average level	Liberal arts	3.379	0.733	17.379***
	Science and engineering	4.266	0.790	
	Others	4.001	0.874	

Table 12 shows the post hoc test results of the difference in college students' IEA of different major types. According to the table, the IEA of college students majored in science and engineering is significantly better than those majored in liberal arts and other disciplines; the IEA of college students majored in law, management, and other disciplines is also better than liberal arts students. In terms of achievement factors, there is a large gap between liberal arts students and other students.

Table 13 shows the difference analysis of the IEA of college students of different genders. According to the table, the overall level is relatively balanced, but male students' scores in basic factors and personal factors are significantly higher than female students. The results of independent sample T-test show that, the overall IEA level of male and female students is consistent, indicating that the gender difference has little impact on the IEA of college students.

Table 12. Post hoc test results of the difference in IEA of college students from different majors

First-level index	Type of major	Mean	Standard deviation	Significance
Basic factors	Others	Liberal arts	0.337	0.003
	Science and engineering	Others	0.297	0.002
		Liberal arts	0.576	0.005
Environmental factors	Others	Liberal arts	0.221	0.002
	Science and engineering	Others	0.297	0.003
		Liberal arts	0.659	0.008
Input factors	Others	Liberal arts	0.227	0.002
	Science and engineering	Others	0.275	0.003
		Liberal arts	0.753	0.010
Personal factors	Others	Liberal arts	0.348	0.004
	Science and engineering	Others	0.327	0.003
		Liberal arts	0.783	0.011
Achievement factors	Others	Liberal arts	0.278	0.003
	Science and engineering	Others	0.347	0.004
		Liberal arts	0.772	0.011
Average level	Others	Liberal arts	0.397	0.005
	Science and engineering	Others	0.212	0.002
		Liberal arts	0.828	0.014

Table 13. Difference in IEA of college students of different genders

First-level index	Gender	Mean	Standard deviation	T value
Basic factors	Male	4.375	0.523	3.014*
	Female	4.221	0.621	
Environmental factors	Male	4.298	0.619	2.316
	Female	4.241	0.622	
Input factors	Male	4.336	0.610	1.536
	Female	4.331	0.626	
Personal factors	Male	4.428	0.593	3.162*
	Female	4.387	0.563	
Achievement factors	Male	4.361	0.618	1.168
	Female	4.354	0.637	
Average level	Male	4.359	0.653	2.254
	Female	4.306	0.627	

4.2 Construction of influencing factor model

As a service industry, the service efficiency of the science and technology service industry will increase with the expansion of the industrial scale of the industry in the region, and the reduction in the fixed costs of corporate service is helpful to release and invest more funds and resources in innovative talent cultivation and introduction. Also, the expansion of the industrial scale can promote the cooperation among industries, universities and research institutes, which will further promote the transformation of scientific and technological achievements of both schools and enterprises. The expansion of the industrial scale of the science and technology service industry has a positive effect on the improvement of college students' IEA, and they constitute a positive feedback relationship.

The scientific research investment in science and technology service industry is the economic support for knowledge and technological innovation. The innovation and research activities of innovative talents are the basis for the improvement of the innovation ability of the science and technology service industry in the region, and the patents and new products are the outcomes of such activities. Therefore, there is also a positive feedback relationship between the resource input of the science and technology service industry and the IEA of college students.

To promote the transfer and exchange of knowledge and technology between schools and enterprises, it’s necessary to improve the informatization level of the region. For schools and enterprises in different regions and in different industries, the research and development cooperation platform between these schools and enterprises can reduce the R&D costs and time, improve the management efficiency of enterprises, and contribute to the improvement of the innovation ability of the science and technology service industry. Therefore, the informatization level of the science and technology service industry is positively correlated with the IEA of college students.

The science and technology service industry has the characteristics of high intelligence level and high added value; therefore, it requires to make full use of the “knowledge spillover effect” of services, equipment and other related factors generated in the process of school-enterprise clustering, and at the same time, it has to find suitable innovative talents with relatively low manpower costs, so as to improve the core competitiveness and advantages. The clustering effect can also reduce the fixed costs of corporate service and promote the introduction and cultivation of innovative talents in the science and technology service industry. Therefore, the degree of spatial agglomeration of the science and technology service industry is the last influencing factor, which also has a positive feedback relationship with the IEA of college students.

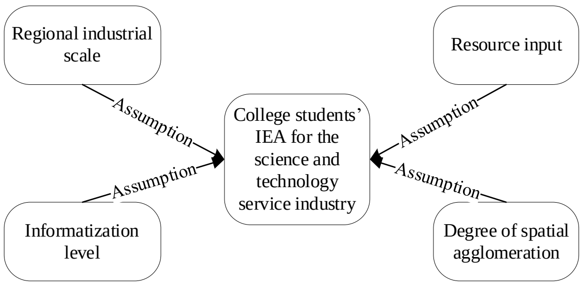

Fig. 5. Structure of the IEA influencing factor model

Based on the four influencing factors of the science and technology service industry, namely industrial scale, resource input, informatization level and the degree of spatial agglomeration, a college student IEA influencing factor model was constructed, as shown in Figure 5. The premise of the construction of this model is: the greater the positive impact of the four influencing factors, the stronger the IEA of college students for the science and technology service industry.

Based on Amos software, the path of the normalized influencing factor model was constructed as shown in Figure 6. The normalized regression coefficients are all less than 1 and greater than 0.9 or 0.08, which has verified that the influencing factor model can fit well.

Table 14. Evaluation details and codes of the IEA influencing factor model

First-level index	Details of second-level index (quantifiable)	Code
Regional industrial scale	Service efficiency of the science and technology service industry	RIS_1
	Service object efficiency	RIS_2
	Fixed cost of corporate service	RIS_3
	External service utilization	RIS_4
	Proportion of enterprises in the industry-university-research cooperation	RIS_5
Resource input	Number of schools in school-enterprise R&D cooperation	STR_1
	School-enterprise R&D investment	STR_2
	Education and training resource input of school-enterprise cooperation	STR_3
Informatization level	Number of school-enterprise R&D cooperation platforms	IL_1
	Number of schools and enterprises implementing intensive management	IL_2
Degree of spatial agglomeration	Number of schools and enterprises in the region	SC_3
	Number of cooperative R&D institutions sharing resource with schools and enterprises	SC_2

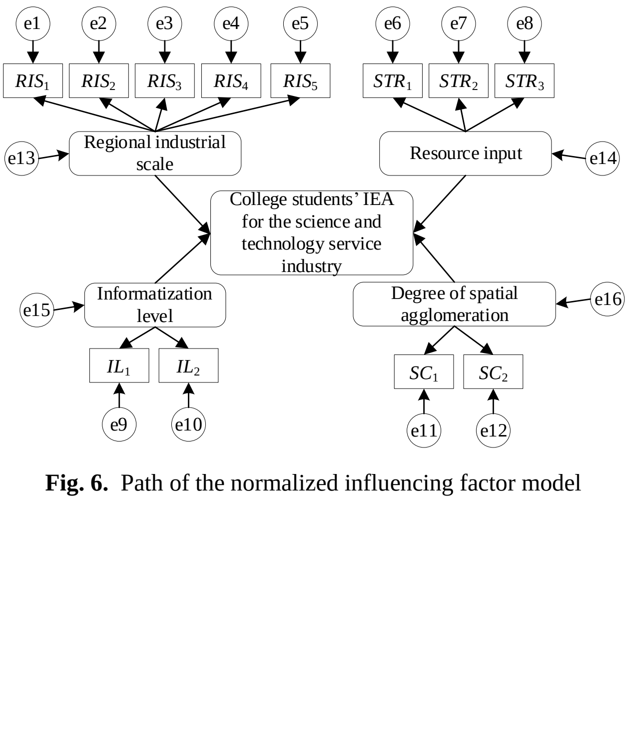

Fig. 6. Path of the normalized influencing factor model

Table 15. Fitness of the influencing factor model

Calibration index		Critical value of fitness	Fitness
Absolute fit index	x^2/df	<5	2.307
	Root Mean Square Residual (RMSR)	<0.08	0.027
	Goodness of fix index (GFI)	>0.9	0.931
Comparative fit index	Normed fit index (NFI)	>0.9	0.954
	Incremental fit index (IFI)	>0.9	0.958
	Tucker-Lewis index (TLI)	>0.9	0.924
	Comparative fit index (CFI)	>0.9	0.977
Parsimony fit index	Parsimony goodness of fit index (PGFI)	>0.9	0.979
	Parsimony goodness of fit index (PGFI)	>0.9	0.916

Table 15 gives the calibration index values of the fitness of the influencing factor model, and all values are within an ideal normalization range, which further verified that the model fits the evaluation index data well. Table 16 gives the corresponding reliability and validity test results. The reliability and validity of each quantifiable second-level index are good.

Table 16. Reliability and validity test results of the influencing factor model

First-level index	Code of second-level index	Load of normalization factor	Calibration coefficient
Regional industrial scale	RIS_1	0.821	0.889
	RIS_2	0.833	
	RIS_3	0.896	
	RIS_4	0.921	
	RIS_5	0.907	
Resource input	STR_1	0.951	0.921
	STR_2	0.867	
	STR_3	0.937	
Informatization level	IL_1	0.911	0.919
	IL_2	0.927	
Degree of spatial agglomeration	SC_3	0.857	0.883
	SC_2	0.905	

Table 17. Path effect analysis of the influencing factor model

Correlation	Path coefficient	Significance	Test result
Regional industrial scale——> IEA of college students	0.685	*	Not support
Resource input——> IEA of college students	0.843	***	Support
Informatization level---> IEA of college students	0.798	***	Support
Degree of spatial agglomeration---> IEA of college students	0.698	*	Not support

The path effect analysis results of the influencing factor model are shown in Table 17. When the path coefficient from the resource input and informatization level to the IEA of college students is respectively 0.843 and 0.798, it obeys the assumption, indicating that the resource input and informatization level of the science and technology service industry in the region has a significant impact on the IEA of college students; the regional industrial scale and degree of spatial agglomeration have an impact on it, but the influence has not reached a significant level.

5 Conclusion

This paper innovatively constructed an evaluation model of college students' IEA for the science and technology service industry. First, the paper constructed a corresponding evaluation index system and conducted factor analysis on the quantifiable index data, then, based on the maximum likelihood method, the corresponding structural equation model was subject to regression estimation. Second, from multiple aspects such as the level of the college, the major of the student, and the gender of the student, this paper comprehensively analyzed college students' IEA and performed difference analysis and post hoc test. At last, this paper constructed an influencing factor path analysis model and analyzed the relationship between regional industrial scale, resource input, informatization level, and degree of spatial agglomeration of the science and technology service industry, and college students' IEA; it also gave the fitness of the model, the reliability and validity test results, and the path effect analysis results of the influencing factor model.

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