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Framework Construction and Path Analysis of High-end Talent Cultivation for New Electric Power System under Dual-Carbon Background

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SUMMARY: *Talent is the most indispensable intangible assets of modern enterprises. With the comprehensive development of the national power grid, power grid companies have also put forward higher requirements for the business ability and professional quality of our talent team. The study firstly organizes the relevant factors affecting the quality of talent training for undergraduate electrical engineering students and establishes the model of factors affecting the quality of talent training. Then the research hypothesis is put forward, the initial questionnaire is prepared by combining the questionnaire survey, the item analysis and factor analysis are carried out, the modified questionnaire is formed through validation, the questionnaire is tested for validity, the factor analysis is applied to reduce the dimensionality of the question items one by one, and then correlation analysis and multiple regression analysis are carried out. Finally, fsQCA method was applied to explore the group effects of student literacy, teacher literacy, curriculum and school environment on the quality of personnel training in electrical engineering. It is found that student literacy, teacher literacy, curriculum and school environment positively affect the quality of talent cultivation, and the four variables and the quality of talent cultivation show significance at the 0.01 level and a positive correlation. Talent cultivation mechanism of high quality of electrical engineering professional talent cultivation can be summarized as "setting-environment" driven and "setting-environment-student" driven types. Therefore, colleges and universities should pay attention to the construction of students' quality, school environment and curriculum system to improve the quality of electrical engineering talent cultivation.*

KEYWORDS: *multiple regression analysis; fsQCA; talent quality cultivation; electrical engineering*

1 Introduction

With the increase of social demand for electricity, it is important to promote the change of power structure and operation characteristics of the power system. Under the dual-carbon background, a new type of power system based on new energy is gradually emerging. The new power system is based on the premise of carrying out the inherent requirements of realizing carbon peak and carbon neutrality, implementing the new development concept, constructing a new development pattern, and promoting high-quality development; with the primary goal of

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meeting the power demand for economic and social development, and maximizing the consumption of new energy as the main task; with the strong smart grid as the hub platform, and the interaction between source, network, load and storage and multi-energy complementation as the support; and with the basic features of clean and low-carbon, safe and controllable, flexible and efficient, intelligent and friendly, open and interactive. It is a power system with the basic features of clean and low carbon, safe and controllable, flexible and efficient, intelligent and friendly, open and interactive [1, 2].

The development of the new power system will inevitably have a greater impact on the current personnel training model, but also put forward a higher standard of requirements for the ability of the relevant professionals. Therefore, it should strengthen the construction of high-end personnel training framework, mining training path, so as to provide sufficient high-quality talent guarantee for industrial transformation [3]. This requires that in the context of dual-carbon, should be centered on the “dual-carbon” concept of the development goals, focusing on highlighting the work of the forefront and leadership, and clarify the current shortage of talent type [4]. Through the innovation of scientific research projects, in order to establish a high-quality, high-level talent echelon, and effectively cultivate a group of talents who master advanced technology and new energy expertise [5]. In order to strengthen team building, a new energy exchange platform can be set up, utilizing domestic experts, universities and research institutes, through mutual exchange and communication, in order to continuously improve the quality of personnel in all aspects [6, 7]. At the same time, relying on the advantageous conditions of the platform, set up a team of lecturers with rich experience to provide support for the development of new energy talents. In the new power system, the cultivation of high-end talents should comply with the current development trend of the industry, cultivate composite innovative talents, and effectively combine the relevant knowledge in various fields to strengthen the personnel's mastery of knowledge.

For the cultivation of talents in the context of dual-carbon, academics have always attached great importance to, and carried out a series of related research, literature [8] through the investigation of families and colleges in northeastern China, analyzed the relationship between the cultivation of talents and market demand in the context of dual-carbon, pointed out that it is necessary to strengthen the cognition of students and teachers and optimize the evaluation mechanism, and at the same time, examined the positive attitude of overseas talents and the obstacles to the introduction of talents, and put forward a strategic proposal to promote the return of talents. Literature [9] proposes a framework for assessing the quality of engineering management talent training in the dual-carbon context, analyzing key criteria such as curriculum relevance and technology integration by combining multi-criteria decision-making methods, and emphasizing the important role of the framework in cultivating sustainable engineering talent and adapting to the needs of carbon neutral strategies. Literature [10] proposes a tripartite training model for clean energy talents oriented to dual-carbon goals, points out the shortcomings of current education such as disciplinary fragmentation and insufficient industrial participation through cross-country case studies, and emphasizes the key role of interdisciplinary integration and artificial intelligence learning platforms in improving the quality of cultivation based on the effectiveness of the German model's pilot. Literature [11] researched the cultivation path of entrepreneurial ability of higher vocational students for the dual-carbon goal, pointed out the importance of constructing an innovative education assessment system containing carbon neutral parameters to provide talent support by analyzing the key factors such as government support and industry-university-research cooperation, and emphasized that the cultivation of innovative talents is the primary resource for realizing this strategic goal. Literature [12] analyzes the urgency of higher education talent cultivation under low-carbon economy, points out the importance and difficulty of constructing a characteristic

course system by exploring the opportunities and challenges faced by energy majors, and examines the practical experience and reference value of the construction of characteristic courses by taking thermal energy and power engineering majors as an example. Literature [13] systematically investigated the current situation of dual-carbon talent cultivation in China, predicted the future demand through GM(1,1)-ARIMA hybrid model, pointed out the structural contradictions such as significant regional differences and the disconnection between production and education, and emphasized that the demand for postgraduate students will grow exponentially, which provides a key decision-making basis for optimizing the cultivation of talents. Literature [14] analyzes the current situation and challenges of energy undergraduate talent training under the dual-carbon goal, and points out that it needs to rely on the support of science and technology innovation to realize the green and low-carbon development through the study of its goals and model innovation path.

In addition, based on an empirical survey of 613 undergraduates, [15] analyzed the cultivation path of sustainable development ability of dual-carbon professionals, pointing out that the course experience has a direct positive influence, and emphasizing that self-efficacy and learning investment play a chain mediating role, which provides a strategic reference for optimizing the cultivation of talents. Literature [16] explored the talent cultivation of higher agricultural education in the context of dual-carbon, analyzed the current situation of animal production students' cognition of carbon neutrality through a questionnaire survey, and pointed out that the integration of the concept of carbon neutrality into undergraduate education is crucial for cultivating green transition talents, and also researched the path of constructing the carbon neutrality knowledge system applicable to this specialty. Literature [17] explored the cultivation of dual-carbon talents from the perspective of new liberal arts, and analyzed its key role in enhancing students' comprehensive literacy and serving the goal of carbon neutrality by proposing seven cultivation mechanisms, and emphasized the importance of cross-disciplinary integration and social practice for talent assurance. Literature [18] analyzed the impact of the teaching reform of petrochemical majors on talent cultivation in the context of dual-carbon, and found through comparative experiments that the overall performance and professional identity of the reformed class were significantly higher than that of the traditional teaching class, thus emphasizing the positive role of the curriculum reform in enhancing the competence of the students and the industry adaptability. It can be seen that the current research mainly focuses on the general path of talent cultivation in the context of dual-carbon, and they mention the strengthening of the integration of industry and education, curriculum reform, interdisciplinary integration, etc., while the research on the content of “cultivation of high-end talents for new power systems” is still insufficient, but the talent cultivation strategies in these studies also provide a framework and path for the cultivation of high-end talents for new power systems. However, the talent cultivation strategies in these studies also provide a reference for the framework and path of new power system high-end talent cultivation.

This paper constructs a theoretical model and puts forward four research hypotheses, selects the quality of talent cultivation of undergraduate electrical engineering majors in Shanghai A University as the research object to conduct a questionnaire survey, distributes the questionnaire to the students by combining online and offline, and conducts a reliability test and a factor analysis of the questionnaire to preliminarily validate the effects of each influencing factor on the quality of talent cultivation. The hypotheses proposed in this paper are verified by correlation analysis and multiple regression model, and fsQCA method is used to carry out necessity test and group analysis of each variable to explore the group effect of each influencing factor on the quality of electrical engineering professional talent training. Based on the results of the study, we construct a new type of power system high-end talent cultivation path to provide theoretical support for the high-quality development of the new type of power system.

2 Research design

2.1 Research model and research hypothesis

2.1.1 Research model

Student literacy, teacher literacy, curriculum and campus environment as the influencing factors of talent cultivation quality, the object of this study is the undergraduate students majoring in electrical engineering in Shanghai A University, each student is an independent individual, and there is a large difference between different students, and the differences in their personal backgrounds may have a significant difference in the quality of talent cultivation, and the construction of the model of the influencing factors of the quality of talent cultivation is as shown in Fig. 1.

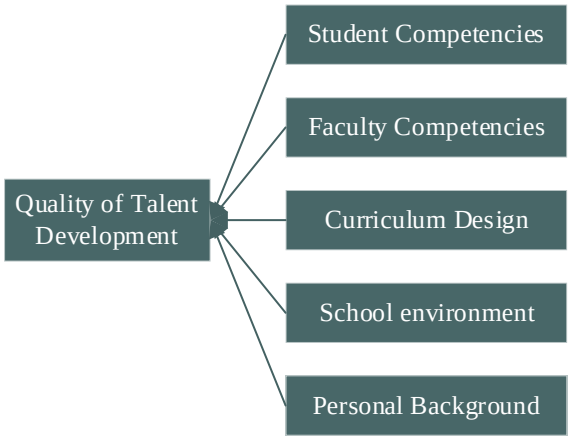


Figure 1: Research model

2.1.2 Research hypotheses

According to the model of influencing factors, this study puts forward the hypothesis of the correlation between influencing factors of talent cultivation quality and talent cultivation quality, and uses independent samples t-test, one-way ANOVA, regression analysis and other methods to verify the hypothesis and draw conclusions. The specific hypotheses are as follows:

H1: Student literacy has a significant positive effect on the quality of talent cultivation in electrical engineering.

H2: Teacher literacy has a significant positive effect on the quality of talent cultivation in electrical engineering.

H3: Curriculum has a significant positive effect on the quality of talent cultivation in electrical engineering.

H4: Campus environment has a significant positive effect on the quality of talent cultivation in electrical engineering.

2.2 Design and distribution of questionnaires

2.2.1 Design of questionnaire variables

In order to ensure the scientificity and reliability of this study, the dimensions and specific questions and language expressions of this study are divided into the relevant literature of previous scholars, the characteristics of the talents of electrical engineering majors, and the initial questionnaire is finally compiled through exchanges with students, consulting experts'

suggestions, and discussions in the group. The dependent variable is the quality of talent cultivation of electrical engineering students: moral quality, knowledge quality, ability quality and psychological quality; the independent variable is the factors influencing the quality of talent cultivation of electrical engineering students: student quality, teacher quality, curriculum, and school environment.

(1) Measurement of dependent variables

The dependent variable of this study electrical engineering professional talent cultivation is mainly through the moral quality, knowledge quality, ability quality and psychological quality of the four independent variables, the specific questions are shown in Table 1.

Table 1: dependent variable measurement table

Primary indicator	Secondary indicator	Question number	Test item
Quality of talent training	Moral quality	A1	You recognize social norms and can regulate your own behavior.
		A2	You can consciously study, abide by, and apply the law, thereby upholding the dignity of the law.
		A3	You love your country, your community, and your society.
	Cultural literacy	A4	You have mastered the professional and disciplinary knowledge in your field of study.
		A5	You have a broad range of interests across various fields of knowledge.
		A6	You can utilize modern technological means to access cutting-edge disciplinary information.
	Ability Cultivation	A7	You can adapt well to the real environment.
		A8	Team-oriented and able to collaborate effectively with others
		A9	You have a certain level of self-reflection ability.
	Psychological diathesis	A10	You are able to effectively manage and regulate your emotions.
		A11	You are capable of effectively coping with and managing stress from various sources.
		A12	You are confident about your future studies and life.

(2) Measurement of independent variables

This study's independent variable electrical engineering professional training quality influencing factors are mainly through the four independent variables of student literacy, teacher literacy, curriculum and school environment, the specific questions are shown in Table 2.

Table 2: Independent variable measurement table

Primary indicator	Secondary indicator	Question number	Test item
Student Competence	Learning target	B1	You can set learning goals based on your needs
	Learning content	B2	You can choose learning content that suits you
	Evaluation of learning	B3	You can objectively assess your learning outcomes.
Teachers'quality	Teacher knowledge	B4	The faculty members of this program possess profound expertise in their respective fields.
	Teaching method	B5	Teachers and students in this major engage in frequent classroom exchanges and interactions.
	Professional ethics	B6	The faculty members of this program demonstrate a strong sense of dedication and commitment.
Course offered	Course content	B7	The curriculum design of this major meets the practical needs of socio-economic development.
	Course Structure	B8	The ratio of compulsory courses to elective courses in this major is appropriately set.
School environment	hard environment	B9	Investment in school teaching hardware and software facilities meets the needs
	soft environment	B10	The school has a good learning atmosphere.

2.2.2 Questionnaire distribution and collection

This study, with the help of two counselors and three class leaders of electrical engineering majors, distributed questionnaires through online (questionnaire star) and offline forms, the initial questionnaires recovered 80 for item analysis and factor analysis, through the validation of the questionnaire to form a modified questionnaire, a total of 120 questionnaires recovered, 115 valid questionnaires, questionnaire recovery rate of 95.8%. The target of this questionnaire is the undergraduate students of Shanghai A University majoring in electrical engineering, due to the freshman year just enrolled in the university, less than half a year in school, so the questionnaire sample of this study is mainly sophomores, juniors and seniors, and freshman students are not taken into account for the time being.

2.3 Multivariate linear regression analysis models

Multiple linear regression analysis method is a kind of mathematical and statistical analysis method, which is generally used to study the relationship between the dependent variable dependent on the change of multiple independent variables. The cultivation of high-end talents in power system comes from the influence environment of student literacy, teacher literacy, curriculum, and campus environment, and the multiple linear regression model is used to quantitatively describe the degree of influence of each factor on the cultivation of high-end talents in power system. The general form of its regression model:

$$Y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_i x_i + \varepsilon_i \quad (1)$$

where β_0 is the intercept term, β_1, β_2, ... β_i are called regression coefficients, and ε_i is the residual term.

Estimates of the model parameters β_0, β_1, β_2, ... β_i are obtained based on the sample data, and the estimates of the model parameters b_0, b_1, b_2, b_i thus obtaining the multiple

linear regression equation:

$$Y = b_0 + b_1 x_1 + b_2 x_2 + ... + b_i x_i \tag{2}$$

Y is an estimate of the dependent variable Y, i.e., it represents the average value of Y for a set of independent variables x_1, x_2, ..., x_i when they take a particular value.

3 Empirical results and analysis

3.1 Sample selection

The questionnaire is mainly divided into two parts, the first part is mainly the basic situation of the respondents, mainly including the respondents' majors, grades, political appearance, whether they serve as student cadres, and whether they aspire to work in electric power after graduation and other aspects. The second part is a survey on the current status of talent training and other aspects of the electrical engineering program in Shanghai A University.

In terms of basic information. Gender distribution of respondents, of which 31.83% are female and 68.17% are male, with a slight gap between the gender ratios, indicating that the proportion of male students enrolled in the electrical engineering program is greater, and male students have a greater interest in the study of electrical engineering, which is in line with the expectations of the electrical engineering program enrollment.

Next is the aspect of political appearance. Among them, party members or reserve members accounted for 12.59%, activists accounted for 19.43%, members of the League accounted for 59.21%, and the masses accounted for 8.77%, which is in line with the current distribution of undergraduates' political profiles in society. Once again, it is the aspect of the reasons for choosing this major. The current undergraduate electrical engineering students choose their majors for the reasons that account for the most is the advice of family and friends, their own interests and professional popularity, while the professional transfer accounts for less. The high acceptance rate of the first volunteer indicates that the professional recognition and reputation of electrical engineering is high, and students have greater interest in their majors.

Finally, there is the aspect of future planning. The survey on the undergraduate students' intention after graduation shows that more than half of the students want to continue their education. This shows that students generally pay more attention to the academic qualifications; the survey on whether they aspire to work in electric power after graduation shows that most of the current students want to work in electric power, accounting for 67.47% of the total, and the percentage of those who do not want to work in electric power is only 10.55%. This shows that students have already planned for the direction of work after graduation and the employment rate of the industry is high, which is conducive to optimizing the cultivation effect of the school on students' ability.

3.2 Analysis of the reliability of the questionnaire

3.2.1 Reliability test

Reliability reflects the reliability and stability of the measurement results of the questionnaire. Cronbach's α coefficient test of the questionnaire, the data show that the α value of the post-expansion students' learning experience and the school's expansion in all aspects of the work arrangements are more than 0.9, which indicates that this questionnaire has a high level of reliability and the total reliability of the questionnaire has reached 0.917, which indicates that the internal consistency and stability of this questionnaire is good. The results of the

questionnaire reliability and validity test are shown in Table 3.

Validity refers to the validity of the questionnaire content. In terms of content validity, the questionnaire design has been pre-tested, debugged, and discussed and analyzed by relevant experts. In terms of structural validity, the overall KMO value of the questionnaire is 0.977, and the test of sphericity is $P < 0.01$. The KMO values of all dimensions of the questionnaire are higher than 0.89, and the P value is less than 0.01. The synthesis shows that the questions of this questionnaire are reasonably set up, and it has a high validity.

Table 3: Test of questionnaire validity and reliability

Variable	Reliability analysis		KMO measure	Bartlett's test	
	Alpha value	Number of terms		df	Sig
Student Competence	0.952	5	0.906	11	0.000
Teachers‘quality	0.983	5	0.929	11	0.000
course offered	0.981	5	0.929	11	0.000
Campus environment	0.964	8	0.938	13	0.000
personnel training	0.936	5	0.899	11	0.000
Ensemble	0.917	28	0.977	57	0.000

3.2.2 Factor analysis

On the basis of good reliability and validity test of the scale, the correlation of 8 variables in the research model was analyzed by principal component analysis, and the specific measurements are shown in Table 4. Factor analysis of the scale was performed with SPSS 23.0, and principal component analysis was used to extract the common factors, and the variance maximization orthogonal rotation method was used to rotate the extracted common factors, so that the factors had more satisfactory explanations. The explanatory variable with a large correlation coefficient of the first factor is A3 (0.955), so the first factor variable is defined as A3 (you love the country, the collective and the society); the explanatory variable with a large correlation coefficient of the second factor is B4 (0.848), so the second factor variable is defined as B4 (the teachers of this specialty have profound professional knowledge); and the third factor with a large correlation coefficient of the explanatory variable is A12 (0.797), so the third factor variable is defined as A12 (You are confident in your future study and life); the explanatory variable with a large correlation coefficient of the fourth factor is B8 (0.846), so the fourth factor variable is defined as B8 (The ratio of compulsory and elective courses in this major is set appropriately); the explanatory variable with a large correlation coefficient of the fifth factor is B1 (0.963), so the fifth factor variable is defined as B1 (You are able to set learning objectives according to your needs).

Table 4: Rotated component matrix

Variable	Ingredient				
	1	2	3	4	5
A1	0.785	0.102	0.039	0.061	-0.059
A2	0.796	0.081	0.058	0.033	-0.069
A3	0.955	0.145	0.019	0.074	0.036
A4	0.860	0.113	0.018	0.109	0.014
A5	0.843	0.121	0.037	0.035	0.002
A6	0.881	0.109	-0.04	0.087	0.045
A7	0.892	0.079	0.019	0.008	0.019
A8	0.783	0.171	-0.03	0.066	0.009
A9	0.809	0.198	-0.034	0.135	0.045
A10	0.826	0.096	0.092	0.028	0.065
A11	0.857	0.136	0.029	0.028	0.056
A12	0.092	0.071	0.797	0.044	0.486
B1	0.067	0.035	0.046	-0.014	0.963
B2	0.022	-0.034	0.727	0.13	-0.08
B3	0.018	0.121	0.771	-0.037	-0.04
B4	0.37	0.848	0.125	0.073	0.009
B5	-0.079	0.622	0.309	-0.092	0.117
B6	0.502	0.662	-0.035	0.141	-0.061
B7	0.353	0.371	0.054	0.757	-0.005
B8	0.003	-0.078	0.089	0.846	-0.021
B9	0.001	0.018	-0.082	0.096	0.018
B10	0.522	0.442	-0.065	0.405	0.037

3.3 Analysis of Influencing Factors of Cultivation of High-end Talents of New Power System

3.3.1 Correlation analysis

The results of the correlation analysis of the main influencing factors of electric power system talent cultivation are shown in Table 5. Calculating the correlation coefficients of each of the four variables with the talent cultivation of electrical engineering students, it can be found that all of them present significance at the 0.01 level and are positively correlated with each other. Among them, student literacy, campus environment and the variables of the main influencing factors of electrical system talent cultivation present a strong correlation.

Table 5: Correlation analysis of influencing factors

Variable	Moral Quality	Knowledge Quality	Ability Quality	Psychological Quality
Student Competence	0.649**	0.632**	0.594**	0.675**
Teachers‘quality	0.361**	0.349**	0.327**	0.377**
Course offered	0.381**	0.378**	0.359**	0.399**
Campus environment	0.733**	0.712**	0.654**	0.719**

Note: **Significantly correlated at the 0.01 level (bilateral).

3.3.2 Regression analysis

Regression analysis can find out which independent variables have the most significant influence on the dependent variable through factor analysis, so as to distinguish between important and minor factors, and regression analysis is divided into linear and nonlinear regression analysis.0. This study is the relationship between one dependent variable (quality of training for electrical engineering majors) and four independent variables (students' literacy, teachers' literacy, curriculum, and the school environment) in the multiple regression analysis of variables, the results are as follows. In the multiple regression of the variables, the default "ENTER" analysis of SPSS22.0 was used to analyze the data of the independent variables and the dependent variables, and the results of the analysis are as follows:

(1) Goodness-of-fit and Durbin-Watson test

In a multiple linear regression model, the decidability coefficient R^2 is used to illustrate how well the estimated model fits the observations, and R^2 is the degree to which the linear equation is able to reflect the real data. R^2 is in the range of 0-1, and the closer it is to 1, the better the model fits the data. In general, R^2 above 0.6 indicates a good fit. The model fit summary table of this study is shown in Table 6, which shows that the decidable coefficients R =0.847, R^2 =0.713, and the corrected R^2 =0.709, indicating that the constructed linear regression equation can reflect 70.9% of the real data and has a high degree of fit.

Table 6: Quality of Talent Training Fitting Degree and Durbin-Watson Test

Model	R	R^2	Revised R^2	standard error of estimate	Durbin-Watson
1	0.847	0.713	0.709	0.5518462	2.221

a. Predictive value: (constant), student literacy, teacher literacy, curriculum, school environment
b. Dependent variable: quality of training for electrical engineering majors

(2) Analysis of Variance (ANOVA)

The analysis of variance (ANOVA) is able to test the significance of the means between multiple related samples. The original hypothesis of ANOVA H_0: the probability that the regression coefficient $\beta = 0$ will hold is 0.000, i.e., it is assumed that none of the independent variables will have a significant effect on the dependent variable. Based on the hypothesis H_0, the ANOVA results are shown in Table 7. In the table, F=168.291, which corresponds to the significance level Sig=0.001<0.5, indicates that the probability that none of the independent variables will have a significant effect on the dependent variable is 0.001, and the regression effect is extremely significant, thus rejecting H_0. This means that at least one of the independent variables will have a significant effect on the dependent variable. ANOVA only shows that the independent variables will have an effect on the dependent variable, but which variable will have a significant effect and how much will need to be analyzed through the regression coefficient table.

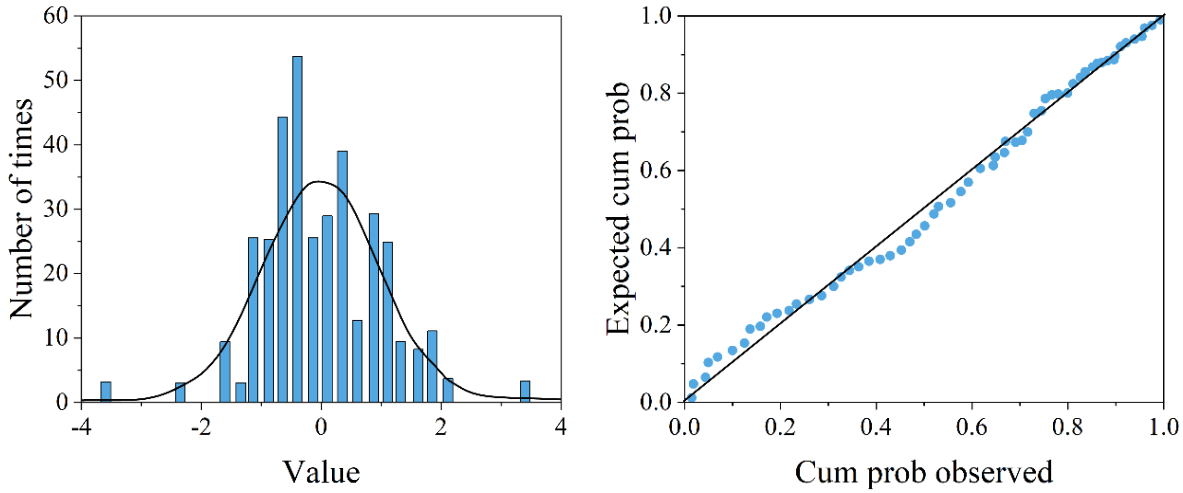
Table 7: Analysis of variance of factors affecting the quality of talent training

Model		Quadratic sum	df	Mean square	F	Sig
1	Regression	246.13	5.013	50.215	168.291	0.001
	Residual	99.091	341.052	0.305		
	Total	345.001	345.015			

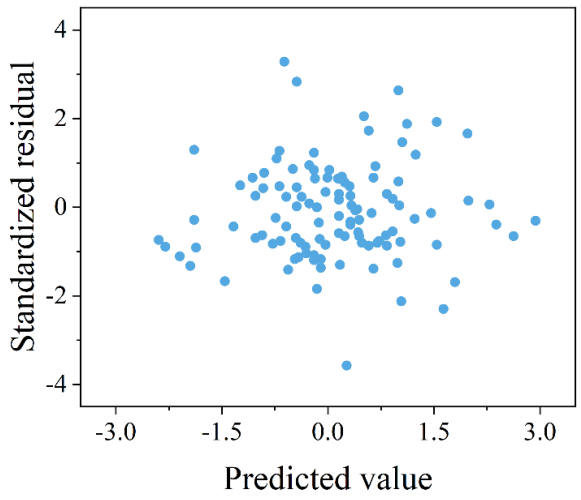
a. Predictive value: (constant), student literacy, teacher literacy, curriculum, school environment
b. Dependent variable: quality of talent training for electrical engineering majors

(3) Residual analysis

In the regression analysis, it is assumed that the residuals ε obey normal analysis, and the standard residuals of the output dependent variable regression are shown in Figure 2. From the distribution histogram and the normal distribution curve, the ε distribution does not appear to be clearly obeying a normal distribution, probably because the sample size is too small, so the assumption that the ε obeys a normal distribution cannot be rejected. From the cumulative probability plot of the observations, the diagonal line corresponds to a normal distribution with mean zero, and the scatter points in the plot are closely scattered around the diagonal line, indicating that the residuals of the random variable t follow a normal distribution, and the assumption is valid.



(a)Residual distribution (b)Cumulative probability of observation



(c)Scattered residual prediction values

Figure 2: Residual analysis results

(4) Regression analysis

Before analyzing the regression results, the test of multicollinearity between variables is carried out, and multicollinearity means that the independent variables are related to each other in the regression model. In this paper, it is determined by the VIF index, the larger the VIF, the more serious the covariance between variables. The covariance results are shown in Table 8, where the VIF of the respective variables is 1, which is much lower than 10, indicating that

there is no serious multicollinearity problem among the independent variables.

All the independent variables are entered into the regression model of the factors influencing the quality of talent cultivation in electrical engineering, and the regression coefficients of the independent variables are: students' literacy (0.279), teachers' literacy (0.382), curriculum (0.491), and school environment (0.264), and the regression coefficients of them on the quality of talent cultivation of electrical engineering are all positive, and at the level of 0.01 the Sig is all 0.00, significant correlation between the variables, and the regression model setting is acceptable. Therefore, the research hypotheses H1, H2, H3, and H4 proposed in this paper are verified.

Table 8: Regression Coefficient of Factors Affecting the Quality of Talent Training

Dependent variable	Argument	Nonstandardized coefficient		Standardized coefficient	T	Sig	Collinearity data	
		B	Std.Error	Beta			Franchise	VIF
Quality of talent training	Constant	0.00238	0.025		0.001	1.000		
	Student Competence	0.279	0.025	0.287**	9.275	0.000	1.000	1.000
	Teachers‘quality	0.382	0.025	0.389**	12.083	0.000	1.000	1.000
	Course offered	0.491	0.025	0.489**	15.431	0.000	1.000	1.000
	Campus environment	0.264	0.025	0.265**	9.075	0.000	1.000	1.000

Note: **Significantly correlated at the 0.01 level (bilateral).

3.4 Cultivation path of new type of power system high-end talents

3.4.1 Necessity test

Before the qualitative comparative analysis of fuzzy sets, the necessity test of the antecedent variable is needed. Consistency is usually used to measure the degree of necessity of the antecedent variable to the result, that is, to what extent the result originates from the influence of the antecedent variable, and when the consistency is greater than or equal to 0.9 the antecedent variable can be judged to be a necessity for the result, and the test results are shown in Table 9. From the results in Table 9, it can be seen that when the outcome variable is "high quality of talent cultivation" and "non-high quality of talent cultivation", the consistency of all the antecedent variables and their negations is less than 0.9. This indicates that none of them can independently constitute the necessary conditions for "high quality of talent cultivation" and "non-high quality of talent cultivation". Therefore, it is still necessary to conduct configurational analysis to explore which factors jointly influence the quality of talent cultivation in the electrical engineering major.

Table 9: Necessity test results

Condition variable	Consistency of outcome variables	
	Improve the quality of high-level personnel training	Quality of non-high level personnel training
Student Competence	0.745	0.439
~Student Competency	0.446	0.737
Teachers‘quality	0.688	0.435
~Teachers‘quality	0.437	0.681
Course offered	0.747	0.415
~Course offered	0.405	0.726
School environment	0.857	0.309
~School environment	0.322	0.857

3.4.2 Conditional configuration analysis

The construction of a fuzzy set truth table produces three types of solutions: complex, parsimonious, and intermediate. The antecedent variables that appear in both the intermediate and parsimonious solutions are defined as “core conditions”, and the antecedent variables that appear only in the intermediate solution but not in the parsimonious solution are defined as “edge conditions”. The degree of their contribution to the results is not the same, the core conditions have an important impact on the results, while the marginal conditions only play a supplementary role in the group analysis results are shown in Table 10.

1. Group state analysis of high talent cultivation quality

1) “Setting-environment” driven type. H1 is curriculum*school environment*teacher quality, which shows that schools can still improve the quality of electrical engineering training as long as they design a good curriculum with rich knowledge and a good campus environment, even if the faculty is not too strong.

2) “Setting-environment-student” driven. Configuration H2 is Curriculum*School Environment*Student Literacy, which indicates that the school has a curriculum that meets the talent cultivation objectives, promotes the overall development of talents and meets the needs of society, rich professional knowledge and a good campus environment, which can improve the cultivation quality of electrical engineering professionals regardless of whether they have a high level of student literacy or not.

2. Group analysis of non-high talent cultivation quality

Considering the causal asymmetry of the QCA (Qualitative Comparative Analysis) method, in order to comprehensively and deeply explore the influencing factors of the quality of the training of electrical engineering professionals, this paper further analyzes the groupings that lead to the quality of their non-high talent training.

1) “Student-setting-environment” constraints. The pattern NH1 is ~ curriculum * ~ school environment * ~ student literacy, indicating that the school electrical engineering professional curriculum knowledge system is imperfect, the school environment is poor, the student literacy is low, in this case, no matter how the professional teacher literacy, will restrict the improvement of the quality of personnel training. This pattern is called “student-setting-environment” constraints.

2) “School environment” constraints. The pattern NH2 is student literacy*teacher literacy*curriculum*~school environment, which indicates that the influence of the school environment will constrain the improvement of the quality of the training of electrical engineering majors, and the result will not change even if the conditions of a sound curriculum system, a high level of teacher literacy, and a complete knowledge of the curriculum are all met. This configuration is called the “school environment” constraint.

Table 10: Configuration analysis result

Covariate	Improve the quality of high-level personnel training		Quality of non-high level personnel training	
	H1	H2	NH1	NH2
Student Competence		●	⊗	●
Teachers‘quality	⊗			●
Course offered	●	●	⊗	●
Campus environment	●	●	⊗	
Consistency	0.885	0.869	0.897	0.913
Coverage	0.268	0.647	0.619	0.176
Unique coverage	0.045	0.422	0.535	0.089
Consistency of solution	0.867		0.902	
Coverage of solution	0.685		0.708	

Note: ● indicates that this core condition exists, ⚬ indicates that this edge condition exists; ⊗ indicates that this core condition does not exist, ⊗ indicates that this edge condition does not exist; and blank indicates that the presence or absence of this antecedent variable has no significant effect on the results.

3.4.3 A New Power System Top Talent Training Framework

Based on the above, the electrical engineering profession analyzes the growth laws and constraints affecting the new power system high-end talent team from four aspects: student quality, teacher quality, curriculum and school environment, and puts forward the "high-skilled talent cultivation model based on the ‘six-dimensional’ model based on the status quo and practice " as shown in Figure 3.

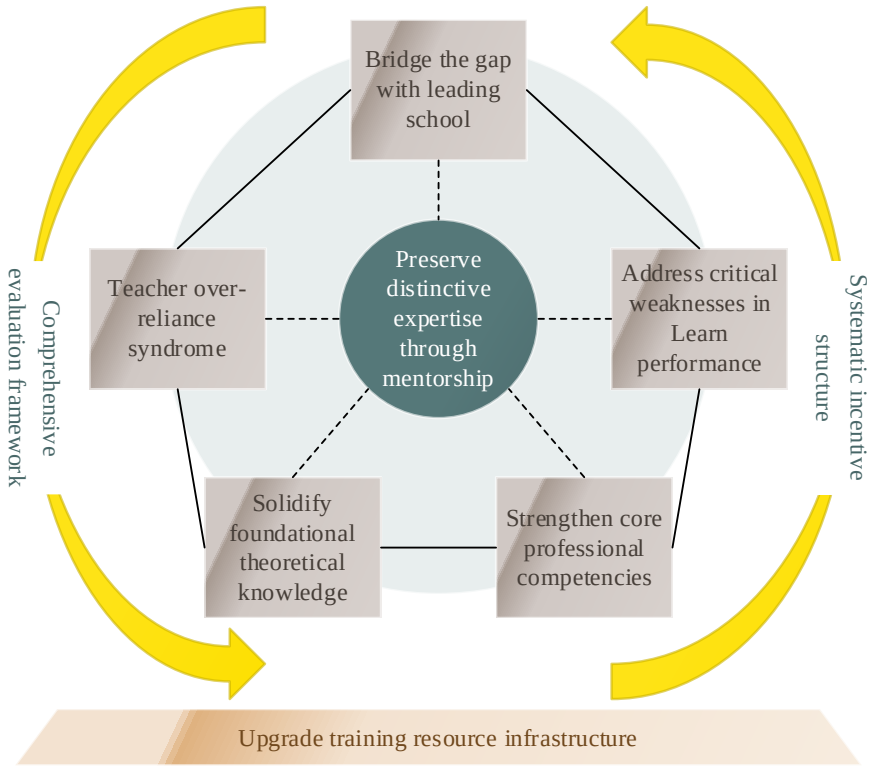


Figure 3: The Talent Training Mode Based on the "Six Dimension" Model

4 Conclusion

The study selected the quality of talent cultivation of undergraduate students majoring in electrical engineering in Shanghai A University as the research object, and made a formal questionnaire by constructing a theoretical model of the study and proposing hypotheses, amending the initial questionnaire, and extracting four independent variables through the reliability and validity test. Correlation analysis and regression equation modeling of each variable were conducted to empirically test the hypotheses and explore the group effect of student literacy, teacher literacy, curriculum and school environment on the quality of talent cultivation of electrical engineering majors. The results of the empirical analysis showed that the correlation between the four independent variables and the talent cultivation of electrical engineering students showed significance at the 0.01 level and a positive correlation. The four factors of student literacy, teacher literacy, curriculum and school environment have a positive and significant effect on the quality of talent cultivation of electrical engineering majors, and the hypotheses proposed in this paper are all verified. The mechanism of high-quality personnel training in electrical engineering can be categorized as “setting-environment”-driven and “setting-environment-student”-driven.

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