A Developed Model of Education Quality Assurance System for Applied Universities in Sichuan Province

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ABSTRACT

This study aims to construct and validate an education quality assurance system model applicable to applied undergraduate colleges in Sichuan Province in the context of the popularization of higher education in China, closely adhering to the "five-in-one" evaluation system, in combination with the requirements of the new round of review and evaluation, and in line with professional accreditation standards. The study employed a mixed approach of literature review, expert interviews, and confirmatory factor analysis (CFA), and proposed seven key dimensions: quality objectives, assurance agency, resource assurance, process assurance, internal control, external evaluation, feedback and improvement. The results show that these dimensions are interrelated, and the constructed model has good structural validity and measurement reliability, which can effectively support quality management in application-oriented undergraduate colleges. This study theoretically expands on total quality management and systems theory, while providing practical reform suggestions for policymakers, university administrators, and front-line teachers.
Keywords : Quality Assurance, Application-oriented universities, Higher education

1. Introduction

As China's higher education has entered a stage of massification and popularization, the implementation of a new round of review and evaluation (MOE, 2021), the Engineering Education Accreditation (CEEAA, 2021), and teacher education program accreditation (MOE, 2017) has made educational quality an important indicator of universities' core competitiveness and capacity for social service. The “five-in-one” evaluation framework has emerged as the backbone of the national quality-assurance system. In the context of the “Double First-Class” initiative and the strategy for building a strong education nation, quality assurance now extends beyond teaching itself; it encompasses governance structures, resource allocation, instructional processes, evaluation mechanisms, and continuous improvement (Li et al., 2023; Zhang & Zhang, 2020).Against this national backdrop, Sichuan Province—a major educational hub in western China—hosts many application-oriented undergraduate colleges that serve regional economic growth and talent cultivation in ethnic areas. However, most of these institutions remain at an early stage in developing quality-assurance systems, facing challenges such as unclear objectives, incomplete frameworks, weak internal monitoring, insufficient attention to external evaluation, and delayed feedback for continuous improvement (Office of the Education Supervision Committee of the People's Government of Sichuan Province, 2022). Constructing a systematic and operational quality-assurance model for these colleges is therefore essential, as it can enhance institutional development and contribute to the national higher education quality-evaluation system.

2. Conceptual Framework Construction

The study is theoretically supported by Total Quality Management (TQM) and systems theory, emphasizing continuous improvement and the coordination of organizational subsystems. Previous research has developed various frameworks for quality assurance in universities, highlighting key components such as governance, resources, process, evaluation, and feedback. In Sichuan Province, applied undergraduate colleges face challenges including unclear objectives, incomplete systems, and insufficient feedback mechanisms. Based on literature analysis and expert interviews, the study proposes a seven-dimension quality assurance model covering quality objectives, assurance agency, resource assurance, process assurance, internal control, external evaluation, and feedback improvement. This model integrates TQM principles and systems theory to provide a systematic and operational framework for enhancing educational quality.

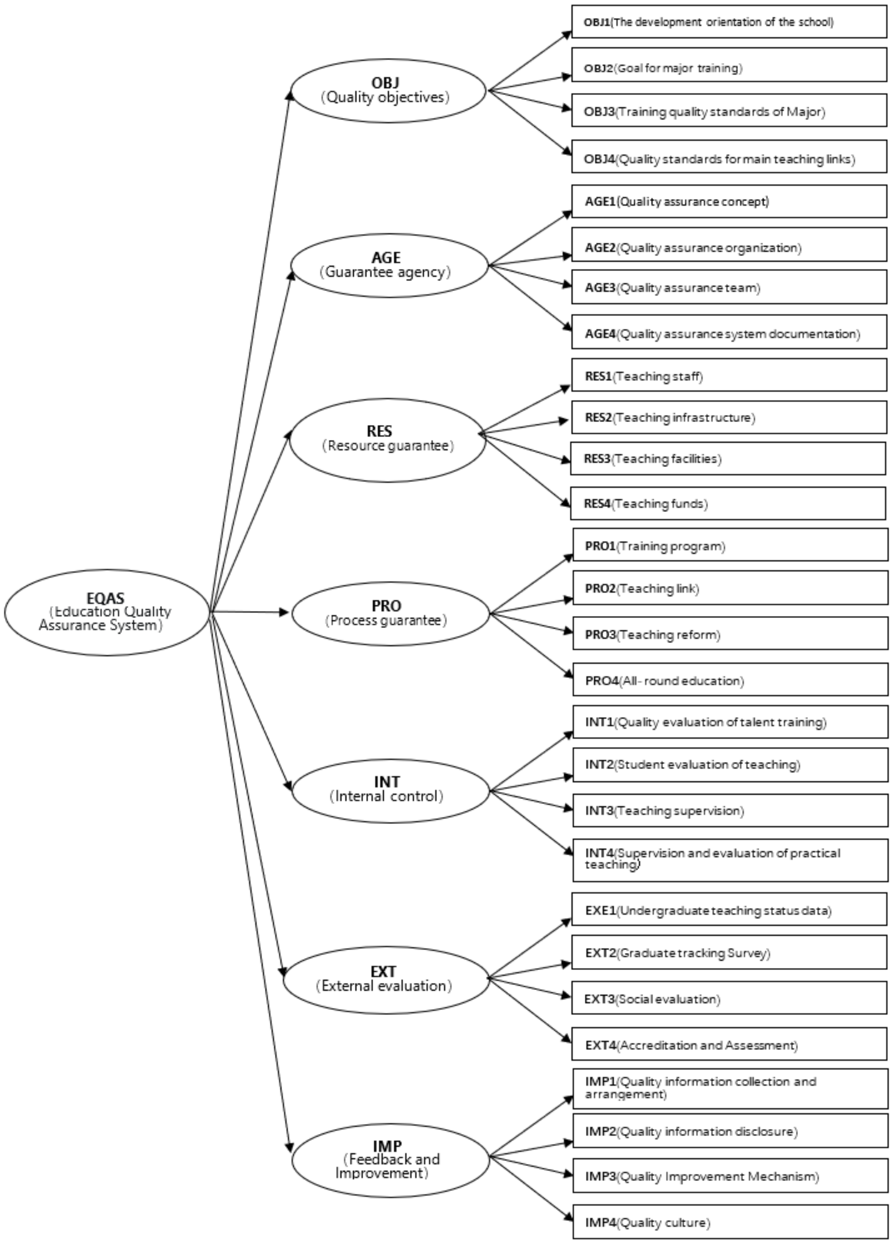


Figure 1 Framework Model of Quality Assurance System

3. Research methods

3.1 Research Design

This study adopts a mixed research approach, divided into two phases: qualitative exploration and quantitative validation. The first phase involves semi-structured interviews to gain an in-depth understanding of the current operation and challenges of the quality assurance mechanism in higher education institutions. The second phase, based on expert consensus and questionnaire survey data, uses confirmatory factor analysis to statistically validate the model, ensuring its structural validity and applicability.

3.2 Interview Sample and Procedure

In the qualitative phase, a total of 10 experts were interviewed, including university leaders, deans of academic affairs, directors of quality assurance offices, heads of evaluation institutions, teaching supervisors, and representatives from employers. The interview questions focused on quality assurance organizations, assurance goals, system construction, process control, the rationality of the indicator system, and the effectiveness of feedback mechanisms. The interview data were coded and categorized using thematic analysis.

3.3 Questionnaire Design and Data Sources

The quantitative phase questionnaire was designed with seven primary dimensions at its core, featuring 28 observed variables and 93 items, using a five-point Likert scale. Through stratified random sampling, 595 valid questionnaires were collected from five universities: Leshan Normal University, Aba Normal University, Xichang University, Sichuan Minzu College, and Sichuan Engineering Vocational and Technical University. The respondents included management officials, department heads, and front-line teachers.

3.4 Data Processing Methods

Data analysis was conducted using SPSS 26.0 and AMOS 24.0 software, involving reliability analysis, validity testing, and structural model fitting. Internal consistency was confirmed by Cronbach's Alpha and composite reliability indicators, while structural validity was measured by confirmatory factor analysis model fit indices (CFI, RMSEA, TLI, etc.).

4. Study Results

4.1 Analysis of reliability and convergence in each dimension

4.1.1 Reliability analysis

The Cronbach's Alpha values of the seven dimensions of the reliability and descriptive analysis were all above 0.89, with an overall reliability of 0.969, indicating good internal consistency in each dimension.

Table1 Reliability statistics

The name of the dimension	Cronbach alpha	Number of items
Quality objectives	0.906	13
Guarantee agency	0.904	13
Resource guarantee	0.894	13
Process guarantee	0.906	14
Internal control	0.899	13

External evaluation	0.906	13
Feedback and Improvement	0.913	14
Overall reliability	0.969	93

The average score of each dimension was between 3.403 and 3.476, indicating that respondents' evaluation of the quality assurance system was at a medium level. The main reason is that the construction of the quality assurance system in colleges and universities is generally lagging behind, and the scientificity and completeness of the quality assurance system need to be improved. There is still much room for improvement in the construction of application-oriented undergraduate colleges in Sichuan Province.

Table2 Descriptive statistics(n=595)

VariableName	Minimum	Maximum	Mean	Std	Skewness	Kurtosis
Quality objectives	1.000	5.000	3.403	0.891	0.052	-1.426
Guarantee agency	1.000	5.000	3.457	0.870	-0.261	-1.011
Resource guarantee	1.000	5.000	3.457	0.821	0.027	-1.238
Process guarantee	1.000	4.929	3.476	0.835	-0.031	-1.417
Internal control	1.000	5.000	3.431	0.853	-0.002	-1.108
External evaluation	1.000	5.000	3.452	0.879	-0.097	-1.323
Feedback and Improvement	1.000	4.929	3.447	0.870	-0.098	-1.162

4.1.2 Convergent validity analysis of each dimension

Quality objectives (OBJ), the standardized factor loadings of all observed variables in the OBJ dimension were high (0.700-0.857), and the significance level was ***, indicating a strong relationship between these variables and the factors. AVE =0.541, CR=0.825, indicating that the convergent validity of the factor in this dimension is good, and the observed variables can well reflect the content of the factor.

The standardized factor loadings of all observed variables in the Guarantee agency (AGE) dimension were relatively high (0.720-0.852), and the significance levels were all ***, indicating a strong relationship between these variables and the factors. AVE =0.562, CR=0.840 indicates that the convergent validity of the factor in this dimension is good, and the observed variables can well reflect the content of the factor.

Resource guarantee (RES), the standardized factor loadings of all observed variables in the RES dimension are high (0.700-0.828), and the significance level is ***, indicating a strong relationship between these variables and the factor. AVE =0.536, CR=0.822 indicates that the convergent validity of the factor in this dimension is good, and the observed variables can well reflect the content of the factor.

In Process guarantee (PRO), the normalized factor loadings of all observed variables in the PRO dimension were high (0.709-0.835), and the significance levels were all ***, indicating a strong relationship between these variables and the factor. AVE =0.549, CR=0.829 indicates that the convergent validity of the factor in this dimension is good, and the observed variables can well reflect the content of the factor.

Internal control (INT), the normalized factor loadings of all observed variables in the INT dimension were high (0.700-0.828), and the significance levels were all ***, indicating a strong relationship between these variables and the factor. AVE =0.527, CR=0.817 indicates that the convergent validity of the factor in this dimension is good, and the observed variables can well reflect the content of the factor.

External evaluation (EXT), the standardized factor loadings of all observed variables in the EXT dimension were high (0.727-0.855), and the significance levels were all ***, indicating a strong relationship between these variables and the factor. AVE =0.546, CR=0.828 indicates that the convergent validity of the factor in this dimension is good, and the observed variables can well reflect the content of the factor.

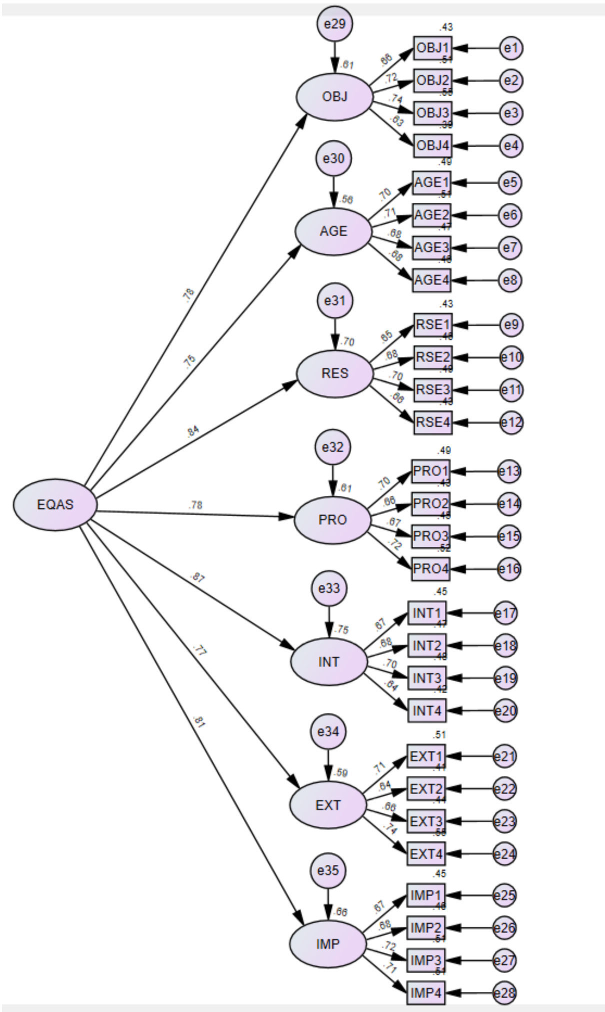
For Feedback and Improvement (IMP), the normalized factor loadings of all observed variables in the IMP dimension were high (0.708-0.854), and the significance level was ***, indicating a strong relationship between these variables and the factor. AVE =0.550, CR=0.830 indicates that the convergent validity of the factor in this dimension is good, and the observed variables can well reflect the content of the factor.

To sum up, the convergent validity of the seven dimensions is good.

4.2 Confirmatory factor analysis results

4.2.1 CFA analysis

Confirmatory factor analysis results AMOS confirmatory results show that the model fits well overall



As shown above, EQAS has a significant impact on all potential variables, with influence coefficients ranging from 0.77 to 0.87, indicating that EQAS is a very important predictor variable in the model.

4.2.2 Model fit

Table3 Fit index of Model

Reference Indicator	x^2/df	GFI	AGFI	RMSEA	RMR	NFI	IFI	TLI
statistical value	1.196	0.953	0.945	0.018	0.035	0.935	0.989	0.988
Reference value	< 3	> 0.9	> 0.9	< 0.08	< 0.08	> 0.9	> 0.9	> 0.9
Conclusion	Qualified	Qualified	Qualified	Qualified	Qualified	Qualified	Qualified	Qualified

An analysis of the model fit metrics showed that the model performed exceptionally well in high consistency with the observed data, with all metrics performing well. χ^2/df=1.196, GFI=0.953, AGFI=0.945, RMSEA=0.018, RMR=0.035, NFI=0.935, IFI=0.989, TLI=0.988. All fitting indicators met or significantly exceeded the reference standard, fully demonstrating that the target-setting model has excellent fit and is fully suitable for subsequent in-depth analysis and theoretical verification.

4.2.3 convergent validity

Table 4 Convergence validity of model

Factor	Observation variable	Unstd.	Std.	S.E.	C.R.	P	AVE	CR
OBJ	OBJ1	1	0.658				0.471	0.780
	OBJ2	1.152	0.716	0.082	14.023	***		
	OBJ3	1.07	0.739	0.075	14.322	***		
	OBJ4	0.895	0.626	0.071	12.649	***		
AGE	AGE1	1	0.701				0.482	0.788
	AGE2	0.947	0.712	0.064	14.678	***		
	AGE3	0.945	0.684	0.066	14.216	***		
	AGE4	0.969	0.68	0.069	14.147	***		
RES	RES1	1	0.653				0.453	0.768
	RES2	1.003	0.679	0.075	13.429	***		
	RES3	1.053	0.701	0.077	13.743	***		
	RES4	1.024	0.658	0.078	13.109	***		
PRO	PRO1	1	0.699				0.472	0.781
	PRO2	0.991	0.656	0.072	13.724	***		
	PRO3	0.978	0.674	0.07	14.042	***		
	PRO4	1.106	0.718	0.075	14.765	***		
INT	INT1	1	0.67				0.453	0.768
	INT2	1.049	0.683	0.075	13.918	***		
	INT3	1.009	0.695	0.072	14.106	***		
	INT4	0.958	0.644	0.072	13.265	***		
EXT	EXT1	1	0.712				0.475	0.783
	EXT2	0.848	0.639	0.062	13.594	***		
	EXT3	0.858	0.662	0.061	14.024	***		

Factor	Observation variable	Unstd.	Std.	S.E.	C.R.	P	AVE	CR
IMP	EXT4	0.931	0.739	0.061	15.341	***	0.481	0.788
	IMP1	1	0.668					
	IMP2	0.979	0.677	0.071	13.766	***		
	IMP3	0.99	0.717	0.069	14.388	***		
	IMP4	1.016	0.712	0.071	14.311	***		
EQAS	OBJ	1	0.658				0.607	0.915
	AGE	1.011	0.779	0.095	10.689	***		
	RES	0.991	0.751	0.092	10.808	***		
	PRO	0.956	0.836	0.088	10.88	***		
	INT	1.083	0.782	0.097	11.146	***		
	EXT	1.103	0.865	0.101	10.88	***		
	IMP	1.056	0.767	0.097	10.838	***		

In this analysis, the CR values of all factors were above 0.7 (ranging from 0.768 to 0.915) indicating a high internal consistency among the measurement variables under the same latent variable. This suggests that the scale has good stability and reliability, and the measurement results are trustworthy. However, for the AVE values, except for the last factor with an AVE value of 0.607 exceeding the threshold of 0.5 the AVE values of the other factors (ranging from 0.453 to 0.482) were all below 0.5 Nevertheless since the AVE values of the seven dimensions in this study all reached or exceeded the 0.5 standard it indicates that each dimension has a good explanatory power for its measurement indicators. Although the overall model's AVE value was slightly below 0.5 this was mainly due to the differences in the number of indicators and explanatory power among different dimensions. In structural equation model analysis, the AVE of each dimension is usually used as the judgment criterion, so the measurement model of this study still has good convergent validity.

4.2.4 Discriminant validity

Table 5 Discriminant validity

	IMP	EXT	INT	PRO	RES	AGE	OBJ
IMP	.602						
EXT	.423	.732					
INT	.404	.420	.554				
PRO	.367	.358	.366	.528			

RES	.373	.376	.381	.333	.498		
AGE	.354	.405	.396	.331	.378	.642	
OBJ	.377	.404	.379	.353	.342	.348	.586

Overall conclusion: Based on the comparison of AVE square roots with correlation coefficients between variables, the AVE square roots of all scales were greater than their correlation coefficients with other variables, indicating good discriminant validity for each scale. This means that the different dimensions or variables in the scale are independent of each other, there is no excessive correlation, and it can effectively distinguish different concepts.

4.2.5 Regression coefficient analysis

Table 6 Regression coefficient analysis

			Unstandardized Regression Coefficient	S.E.	C.R.	P	Standardized Regression Weights
OBJ	<---	EQAS	1.000				.779
AGE	<---	EQAS	1.011	.095	10.689	***	.751
RES	<---	EQAS	.991	.092	10.808	***	.836
PRO	<---	EQAS	.956	.088	10.880	***	.782
INT	<---	EQAS	1.083	.097	11.146	***	.865
EXT	<---	EQAS	1.103	.101	10.880	***	.767
IMP	<---	EQAS	1.056	.097	10.838	***	.811
OBJ1	<---	OBJ	1.000				.658
OBJ2	<---	OBJ	1.152	.082	14.023	***	.716
OBJ3	<---	OBJ	1.070	.075	14.322	***	.739
OBJ4	<---	OBJ	.895	.071	12.649	***	.626
AGE1	<---	AGE	1.000				.701
AGE2	<---	AGE	.947	.064	14.678	***	.712
AGE3	<---	AGE	.945	.066	14.216	***	.684
AGE4	<---	AGE	.969	.069	14.147	***	.680
RSE1	<---	RES	1.000				.653
RSE2	<---	RES	1.003	.075	13.429	***	.679
RSE3	<---	RES	1.053	.077	13.743	***	.701
RSE4	<---	RES	1.024	.078	13.109	***	.658

PRO1	<---	PRO	1.000				.699
PRO2	<---	PRO	.991	.072	13.724	***	.656
PRO3	<---	PRO	.978	.070	14.042	***	.674
PRO4	<---	PRO	1.106	.075	14.765	***	.718
INT1	<---	INT	1.000				.670
INT2	<---	INT	1.049	.075	13.918	***	.683
INT3	<---	INT	1.009	.072	14.106	***	.695
INT4	<---	INT	.958	.072	13.265	***	.644
EXT1	<---	EXT	1.000				.712
EXT2	<---	EXT	.848	.062	13.594	***	.639
EXT3	<---	EXT	.858	.061	14.024	***	.662
EXT4	<---	EXT	.931	.061	15.341	***	.739
IMP1	<---	IMP	1.000				.668
IMP2	<---	IMP	.979	.071	13.766	***	.677
IMP3	<---	IMP	.990	.069	14.388	***	.717
IMP4	<---	IMP	1.016	.071	14.311	***	.712

In summary, each latent variable has a significant positive impact on its observed variable (all P values less than 0.001). The normalized regression weights were between 0.626 and 0.865, indicating that these observed variables had a better measurement effect on the latent variables. C.R. values (t values) for all paths were greater than 1.96 (actual range 10.689 to 15.341), indicating that these observed variables had a good effect on the latent variables.

4.3 Qualitative Findings

An analysis of qualitative interviews with 10 university administrators, external experts, industry representatives and policymakers found that experts generally agreed that the quality assurance system model of this study has a strong fit and practical guiding significance for application-oriented undergraduate universities in terms of structural setup, core elements and adaptability. The key words "quality culture", "continuous improvement", "feedback", "structure", "process" appeared frequently, reflecting the experts' high attention to the endogenous dynamics, operational logic and continuous improvement capabilities of the quality assurance system. However, the interviews also focused on revealing the deep-seated problems currently faced by colleges and universities in quality assurance practice: a serious disconnection between institutional design and actual implementation, the absence of responsibility chains and coordination mechanisms, resulting in a prominent phenomenon of institutional "virtualization"; The internal monitoring system lacks professionalism and independence, the collection and utilization of teaching data are superficial, and the feedback mechanism fails to form a complete loop; The quality culture has not been truly integrated into the entire process of university governance and teaching, and the sense of responsibility and improvement momentum of teachers, students and administrators have not been systematically stimulated. These problems not only limit the application of the model in colleges and universities, but also suggest that the construction of the quality assurance system must be continuously optimized from the systematic dimension of "structural design - mechanism operation - cultural internalization".

5. Conclusions and Recommendations

5.1 Conclusions

5.1.1 Structural validity and measurement reliability of the model

The quantitative analysis results show that the constructed model has good structural validity and measurement reliability. Cronbach's α values were above 0.894 for each dimension and reached 0.969 overall; The composite reliability (CR) values were generally above 0.80, and the mean variance draw (AVE) was greater than 0.50, meeting the basic requirements for construct validity. The fitting indicators of the structural equation model (such as RMSEA, CFI, TLI, etc.) are also within the reasonable range, indicating that the model as a whole has good fit and explanatory power.

5.1.2 Practical feasibility of the model

The qualitative interview results further verified the practical feasibility of the model and the direction for improvement. An analysis of interviews with 10 people from university management, external experts, industry representatives and policymakers found that experts generally believed that the quality assurance system model of this study had a strong fit and practical guiding significance in terms of structural setup, core elements and adaptability. However, the interviews also revealed deep-seated problems currently faced by universities in quality assurance practices, such as the disconnection between institutional design and actual implementation, the lack of professionalism and independence in the internal monitoring system, and the failure of the quality culture to truly integrate into the entire process of university governance and teaching. These problems not only limit the application of the model in colleges and universities, but also suggest that the construction of the quality assurance system must be continuously optimized from the systematic dimension of "structural design - mechanism operation - cultural internalization".

5.1.3 Current status of quality assurance System construction in application-oriented universities

The study found that the overall quality assurance level of applied undergraduate colleges in Sichuan Province is "above average", and there is still room for improvement. The main problems include incomplete quality assurance agency, imperfect institutional systems, mismatch between indicator systems and educational positioning, and imperfect feedback mechanisms. These problems indicate that although universities have made some progress in the construction of quality assurance systems, there is still a need to further strengthen systematic and coordinated operation mechanisms, enhance data-driven quality monitoring capabilities, deepen quality culture construction, and strengthen the support and capacity building of talent teams.

5.2 Policy and Practice Recommendations

Based on research findings, the following policy and practice recommendations are presented:

1. Build a systematic and collaborative quality assurance operation mechanism: Break down departmental barriers and achieve full-process quality monitoring and feedback.

2. Enhance data-driven quality monitoring capabilities: Utilize big data and AI technologies to precisely analyze quality data and provide scientific basis for decision-making.

3.Strengthen the connection between professional certification and quality standards: Ensure that educational activities comply with advanced international and domestic standards.

4. Deepen quality culture construction: Through publicity, training and incentive mechanisms, cultivate the intrinsic motivation of teachers, students and staff.

5. Strengthen talent team support and capacity building: Attract and cultivate high-quality professional talents.

6. Enhance policy guidance and resource support from local education administrative departments: Provide strong guarantees for quality improvement.

5.3 Future Research directions

Future research directions will focus on the following key areas:

1. Strengthen regional comparative and multi-school expansion research: Comprehensively test the applicability and universality of the model.

2. Conduct dynamic tracking and intervention experimental research: Deeply explore influencing factors and their mechanism of action.

3. Develop an "Application-oriented University Quality Assurance Evaluation Toolkit": Provide practical assessment and improvement tools for universities.

4. Deepen cross-research on "Quality Culture - Organizational Behavior": Reveal the intrinsic connection and interaction mechanism between the two.

5.Systematically integrate intelligent quality governance paths such as AI and big data: Explore innovative quality management methods and models.

To sum up, the model of the education quality assurance system constructed in this study is highly scientific and systematic in theory, and highly feasible and instructive in practice. Through further optimization and promotion, the model is expected to provide an effective quality assurance framework for applied undergraduate colleges in Sichuan Province and even the whole country, helping colleges improve educational quality and serve regional economic and social development.

(1) Universities should establish dedicated quality assurance offices and incorporate them into the strategic level of the university. (2) Education authorities should set up regional quality support centers. (3) Quality culture should be embedded in daily management through systems, training and incentive mechanisms. (4) Personnel at all levels need to enhance their awareness of quality responsibility and their ability to assess and improve.

5.4 Directions for Future Research

It is suggested that future research should focus on comparing the model's adaptability across regions, exploring student-centered quality assessment indicators, and conducting follow-up evaluations of the effectiveness of the quality system.

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