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Article

An empirical study on the factors influencing the improvement of education quality within higher vocational colleges—Based on a survey of 13 higher vocational colleges in Hainan Province

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Abstract: The issue of quality of higher vocational education in China has become a common concern in all aspects of society, and promoting the improvement of the quality of education within higher vocational colleges is an important way to realize the high-quality development of higher vocational education. Based on the self-constructed five-dimensional model of factors influencing the improvement of the quality of education within higher vocational colleges, an empirical study was conducted using questionnaires and SPSS27.0 software on the teacher and student groups within 13 higher vocational colleges in Hainan Province, and the results showed that the teacher groups of different genders, titles, ages, academic qualifications and disciplines as well as the student groups of different genders and admission modes have different opinions on factors such as the level of governance, education and teaching, the integration of industry and education, student development and policy guarantees; and that there are different degrees of perception differences between teachers' and students' groups on the effect of internal education quality improvement. In order to promote the internal quality improvement of higher vocational colleges, it is necessary to improve the construction of modern university system to enhance the governance level, deepen the integration of production and teaching to innovate the education and training mode of talents, promote the development of the whole chain of education to improve the comprehensive quality of students, strengthen the construction of teaching staff to deepen the reform of education and teaching, and innovate the internal education policy and system to regulate the management order.

Keywords: higher vocational college; internal education quality improvement; influencing factors

1. Introduction

Innovation-driven high-quality development must rely on scientific and technological progress, while scientific and technological progress must rely on talents, and talents must rely on high-quality education. In the new historical period, the imbalance and inadequacy of the development of higher vocational education between urban and rural areas and between regions are still prominent, which makes it difficult for vocational education to satisfy the people's demand for "suitable education" and the pursuit of "high-quality education", as well as the demand for diversified development and diversified talents (Kuang, 2018). The scale of China's higher vocational education is increasing, and the problem of education quality is the most prominent, mainly manifested as follows: the graduates' vocational ability and vocational quality can not meet the needs of social and economic development; the

management department of vocational education lacks the overall idea of the work, and the passive management of "treating the head when it hurts, treating the foot when it hurts" is still the main way; the foundation of many vocational institutions is relatively weak, the conditions for running schools are not perfect, and there are big problems in the ability and structure of vocational education management personnel and vocational education teachers, etc. (Zhao, 2014). Compared with the national higher vocational education, Hainan Province higher vocational colleges in the number of institutions, the number of students and the number of "double-high programme" selected, its scale and quality have no obvious advantage, and urgently need to expand the scale and improve the quality of education. Therefore, comprehensively promoting the improvement of education quality of higher vocational colleges has become an important hand in deepening the reform of higher education and improving the operation level of higher vocational colleges in Hainan Province. This study focuses on the main stakeholders of vocational colleges in H province, China: full-time teachers, administrative managers, and students from different majors and graduation years. The research subjects are 13 out of 14 vocational colleges in H Province, except for HK Vocational University. Conduct online survey and collect data through the QuestionStar platform. Due to the sample being limited to Hainan province, its representativeness is limited. Meanwhile, respondents may provide false information due to privacy concerns, which may affect the authenticity of the research.

2. Theoretical basis and research framework

2.1. Theoretical foundation

In the current educational landscape, enhancing the quality of education has emerged as a central concern for educational systems worldwide. The quality improvement practice of higher vocational education in China is mainly based on the Talent Cultivation Work Level Assessment Programme for higher vocational colleges (Trial) (No.16 of the Department of Education and Higher Education (2004)), the Talent Cultivation Work Assessment Programme for higher vocational colleges (No.5 of the Department of Education and Higher Education (2008)), and the Guidance Programme for Diagnosis and Improvement of the Internal Quality Assurance System of higher vocational colleges (Trial) (No.168 of the Letter of the Division of Teaching Vocational Training and Development (2015)), and other policy documents as guiding principles, and has been continuously updated with key evaluation indicators, mainly focusing on the role of leadership, faculty, curriculum, practical teaching, special professional construction, teaching management, social evaluation, and the development of the teaching and learning environment, which are the key evaluation indicators for focusing on the role of assessment and diagnosis to improve the quality of talent cultivation. The quality improvement of higher vocational education has developed from "assessment of talent cultivation level" to "assessment of talent cultivation", and the evolution of education quality assurance theory and paradigm has changed from "assessment" to "diagnosis and improvement", and the gradual development of "independent assessment-self-diagnosis-self-improvement"

continuous internal quality improvement mechanism, which is a vivid practice of education quality improvement of China's higher vocational colleges.

The improvement of educational quality is not solely reliant on the study and transmission of theoretical knowledge but also necessitates the integration of theory with practice. This is achieved through reflective learning and problem-solving to enrich the learning experience (Roland and Fjellstrom, 2023). Online teaching, as an emerging pedagogical model, is equally crucial for quality enhancement, which is realized by enhancing online learning experiences and classroom interactivity (Cao, 2023). Empirical research has revealed the multidimensionality of educational quality improvement, encompassing the participation and cognition of students, teachers, and parents. For instance, research by Jiaying et al. (2024) emphasizes the importance of student-centered community education, while Abdullah et al. (2022) explore the significant impact of accreditation on the learning experience through case studies. Additionally, third-party assessments play a vital role in improving the quality and management capabilities of vocational education (Liao, 2019). In terms of curriculum development, Victor et al. (2018) demonstrates how to incorporate the quality improvement process into the renewal of medical education curricula, enhancing student engagement through activities such as quality circles. Regarding policies and strategies, Zhao (2024) analyzes China's first collaborative educational quality improvement plan (SQIPTE) specifically aimed at teacher development, while Chambers (2021) discusses methods of improving educational outcomes through quality assurance and improvement in dental education. In empirical research on higher education quality improvement, Mulay and Khanna (2020) highlight the impact of administrative processes on educational quality, and Joanne et al. (2023) propose theoretical frameworks and practical tools for designing, implementing, and evaluating quality improvement educational programs in physician training.

Modern quality management professionals, such as Deming (1993) and Juran (1999), provide theories, tools and methods for quality improvement to solve product quality problems, which can help higher education institutions to establish quality awareness, problem awareness and improvement awareness, identify quality problems in higher vocational education, and then promote the implementation of step-by-step and phase-by-phase improvement measures in higher education institutions. According to Juran's Trilogy, "quality" has two meanings: firstly, to create product characteristics that satisfy customers; secondly, these characteristics need to be free from failures. In short, failures in product characteristics create customer dissatisfaction, i.e., graduates of higher education institutions must possess quality characteristics such as high quality and innovation in order to meet the quality demands of stakeholders. The aim of quality improvement in higher education institutions is to equip graduates with the necessary quality characteristics, and the quality improvement process is to develop these qualities in students. Graduates of higher vocational colleges, as the "products" output from the education process, are affected by national policies, industrial development, school positioning, faculty strength and other factors in the process of education and training, which will inevitably produce a quality gap between customer expectations and delivery feelings, that is, the quality of graduates is misaligned with the quality standards of the stakeholders such as the purchasers of human resources. Higher education institutions,

as entities operating organizations, have to transform stakeholders' demand for quality human resources into quality products, i.e. quality graduates, and narrow the quality gap with stakeholders' expectations through quality improvement design. From existing research, it can be seen that internal education improvement in vocational colleges covers multiple dimensions such as the connotation of education improvement, system construction, quality standards, evaluation methods, guarantee mechanisms, and improvement strategies. Firstly, the depth and breadth of research are insufficient: existing literature lacks comprehensiveness and depth in the practical operation of improving the quality of education in vocational colleges. Research often focuses on a specific aspect of improvement, while there is a lack of systematic explanation of the constituent elements and their interrelationships of the education quality improvement system, which limits the applicability of the proposed improvement strategies in practice. Secondly, the issue of dimension definition and integration: The dimensions for improving the quality of internal education in vocational colleges have not been fully sorted out and clearly defined. Some studies have mixed internal and external factors for discussion, failing to clearly distinguish the independence of internal improvement from the auxiliary nature of external factors, as well as the multidimensional nature of internal improvement, which affects the scientific and systematic construction of a comprehensive education quality improvement system. Thirdly, there is a lack of regional research, especially on the improvement of educational quality in vocational colleges in Hainan province. Existing research is relatively scarce, lacking a comprehensive and systematic analysis of the current situation, problems, and improvement strategies of educational quality improvement in vocational colleges in Hainan province. In summary, future research should deepen the understanding of the constituent elements and their interactions of the education quality improvement system in vocational colleges, clarify the boundaries of internal and external factors, strengthen systematic research on the improvement of education quality in specific regions of vocational colleges, in order to promote the comprehensive improvement of education quality and the scientific construction of the education improvement system.

2.2. Research framework

The quality of education in higher vocational colleges is the embodiment of the degree of functioning of the internal system of higher vocational colleges, and the process of improving the quality of education is essentially the process of optimizing the elemental structure of the internal system of higher vocational colleges to make it function to the fullest. There are many factors affecting the improvement of the quality of education within higher vocational colleges, mainly including the government, society and colleges and universities at three levels, while the school level is the main influencing factor for the improvement of the quality of education in higher vocational colleges, and the government and the society play the role of guaranteeing or supervising the quality of education in higher vocational colleges. The national education policy and social factors, etc. are for the macro environment of the whole country, and the questionnaire survey cannot effectively measure the objective data in these aspects, so it focuses on the internal of higher vocational colleges in order to

obtain relatively objective and effective data to analyse the influence and effect of these factors on the improvement of the quality of higher vocational colleges' education.

In this model, firstly, external factors such as political, economic, cultural, scientific and technological social environments as well as governmental policies and regulations affecting the quality of education in higher vocational colleges are not discussed for the time being; secondly, taking into account that international exchanges among higher vocational colleges in Hainan Province as a whole are still in the beginning stage, and that internationalization exchanges and co-operation are limited to individual colleges and universities, they are also not taken into consideration for the time being; thirdly, in terms of policy guarantee and integration of production and education, it is mainly examined that under the guidance of the national education policy, higher vocational colleges have made a series of measures to improve the quality of education at the institutional level. Based on the above analysis, we independently construct a five-dimensional conceptual model of the factors influencing the improvement of the quality of education within Hainan's higher vocational colleges, which mainly includes five dimensions of governance level, education and teaching, integration of industry and education, student development, and policy guarantee, each of which contains a number of sub-dimensions Internal education quality improvement is a systematic project that forms a quality improvement relationship model guided by governance level, based on education and teaching, with student development as the core, integration of industry and education as the key, and policy support, as shown in **Figure 1**.

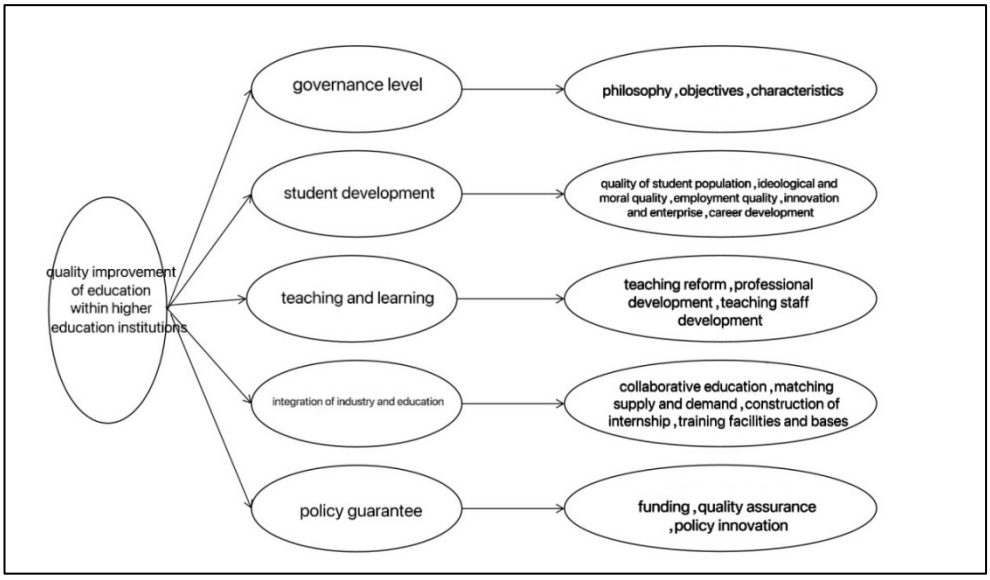

Figure 1. Five-dimensional conceptual model of factors influencing educational quality improvement within higher education institutions.

The quality of education in higher vocational colleges mainly refers to the quality of their educational services, which is the inherent characteristics of higher vocational colleges to meet the needs of their "stakeholders" and to achieve a certain degree of the state (Rong, 2016). Higher vocational colleges to improve the quality of education is higher vocational colleges "stakeholders" around their own interests and needs to

take a series of measures. Teachers and students, as the stakeholders of education quality improvement, are the implementers, participants and promoters of the whole education quality improvement process. In this study, we take the effect of improving the quality of education within higher vocational colleges as the dependent variable (the effect of improving the quality of education is the dependent variable, in which the teacher group includes the effect of education management, the quality of employment of graduates, the personal growth of teachers, the effect of integration of industry and education, the effect of the implementation of the system, and the student group includes the reputation of the school, the quality of employment of graduates, and the effect of classroom teaching), and the other factors affecting the improvement of the quality of education in higher vocational colleges are taken as the independent variables. As shown in **Figure 2**, this model contains a total of six structural variables, and the one-way arrows between these variables indicate the influence of the determinants on the perceived effect of education quality improvement.

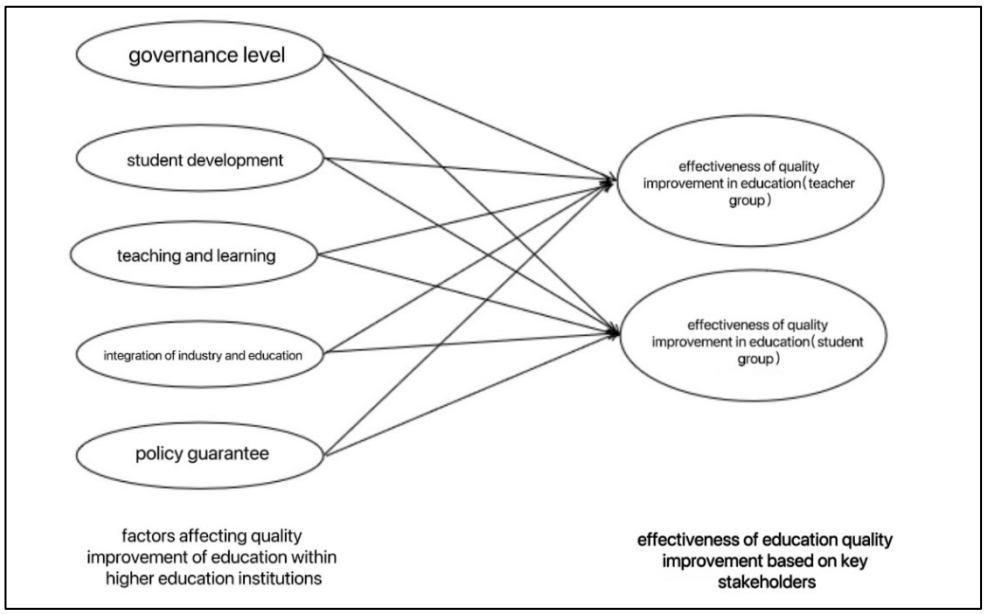

Figure 2. Study path and relationship diagram.

3. Research ideas and methods

3.1. Data sources

The target of this survey is the main stakeholder groups within the higher vocational institutions in Hainan Province, i.e., the teacher group and the student group. The teacher group is mainly full-time teachers, including different ages, titles, and subject backgrounds; the student group is mainly graduates of different majors and graduation years. These survey respondents are familiar to the operation of the internal system of higher vocational colleges, and they are not only the formulators, supervisors and managers of the internal quality management and improvement of higher vocational colleges, but also the actual participants as the target of quality improvement, and they have the personal feelings and experiences about the quality of the whole higher vocational colleges, and they can objectively sense the problems of the quality of higher vocational colleges and the status of the improvement of the

quality of education. The online questionnaire was created through the Questionnaire Star online questionnaire platform, and then distributed through the school leaders, deans of second-level colleges, and full-time teachers of various higher vocational colleges that we know, and a total of 13 higher vocational colleges (excluding vocational undergraduates) in Hainan were collected.

As for the questionnaire of teachers group, among 960 valid questionnaires of teachers group, female teachers accounted for 64.2% of the overall sample, and male teachers accounted for 35.8%, and there were significantly more female teachers than male teachers; as for the teaching age of teachers in higher vocational colleges, the teaching age of more than 10 years accounted for 44.2%, and that of 3 years or less accounted for 32.1%, and the overall teaching age of the teachers' sample of more than 3 years totaled 67.9%; in terms of the titles of teachers in higher vocational colleges, they are divided into four levels: assistant professor, lecturer, associate professor and professor, with a proportion of 4.6% in the top level, 20% in the associate level, 37.9% in the lecturer level, and the majority of teachers with intermediate titles and below; in terms of academic qualifications, a bachelor's degree accounted for 39.6%, a master's degree accounted for 58.3%, and a doctor's degree accounted for 2.1%, with the postgraduate degree being the main part. In terms of age, 47.1% are under 35 years old, 39.2% are between 36 and 45 years old, and 13.8% are above 45 years old, with middle-aged teachers as the majority; in terms of academic disciplines, there are a total of 14 academic disciplines, with all disciplines being covered, of which more than 10% are management, education, literature and engineering, with humanities and social sciences being the main categories.

As for the questionnaire of the student group, the graduates of various higher vocational colleges and the graduates of the class of 2023 (the third year of college) are the main body, with 1,352 valid questionnaires, among which the proportion of female students is 44.7%, and the proportion of male students is 55.3%; in terms of the mode of admission, the proportion of the high school students is 67.1%, and the proportion of the single-enrollment students is 16.9%, and there are also the middle and high school 3+2, adult education and other forms of admissions, which shows the diversification of student source admission methods of the higher vocational colleges, but still take the college entrance examination admission as the main source of channel, single enrollment source proportion can not be ignored; in the original questionnaire, there are for the institution and the student's professional settings, but taking into account the Hainan Province higher vocational colleges are fewer, related to the sensitivity of the data and other issues, the source of the university is hidden; effective student samples are involved in a large number of majors, covering a wide range, the statistics are more complex and cumbersome, and have no practical significance for this study, so the relevant statistics are not done in terms of the majors studied.

3.2. Research method

Using the module function of SPSS27.0 software, the teacher group questionnaire and student group questionnaire on the factors influencing the improvement of education quality within higher vocational colleges were subjected to reliability analysis and CFA (Marsh, 1994) validity analysis, in order to verify the internal

consistency of the questionnaire scales, and to lay the foundation for further relevant research. Perceived difference analyses of the teacher group and student group in the five dimensions of governance level, education and teaching, integration of industry and education, student development and policy guarantee were carried out from different perspectives of demographics to further examine the correlation and difference between the variables of the dimensions, and to provide a strategy for the subsequent promotion of quality improvement.

4. Analysis of research data

4.1. Reliability and validity analysis

4.1.1. Questionnaire reliability

The internal consistency of each dimension of the questionnaire for different groups was analyzed by the Cronbach's coefficient (Cronbach's α, 1951) reliability test method (see **Table 1**). According to Nunnally's (1994) criterion, Cronbach's α should be above 0.7, which indicates a good reliability. As can be seen from **Table 1**, in the teacher group questionnaire, the α coefficients of the dimensions of the factors influencing the improvement of the quality of education ranged from 0.793 to 0.931, and the coefficient of the effect of the improvement of the quality of education was 0.934; in the student group questionnaire, the α coefficients of the dimensions of the factors influencing the improvement of the quality of education ranged from 0.877 to 0.933, and the α coefficient of the effect of the improvement of the quality of education was 0.908. The reliability coefficients of each of these dimensions were within the range of 0.7–1, which indicates that the scales used in both types of group questionnaires have good internal consistency and good reliability.

Table 1. Reliability measures of questionnaire scales for different groups.

variant		**Cronbach's α coefficient**	
		questionnaire for teacher groups	**questionnaire for student groups**
factors affecting the improvement of the quality of education	governance level	0.931	0.877
	student development	0.889	0.889
	teaching and learning	0.793	0.937
	integration of industry and education	0.929	0.960
	policy guarantee	0.878	0.933
quality of education improved effectiveness		0.934	0.908

4.1.2. Questionnaire validity

Validation factor analysis is a research method used to measure whether the correspondence between factors and scale items remains consistent with the researcher's predictions. Since Cronbach's coefficient does not allow for the observation of specific measurement reminder errors and it does not recognize the existence of a correlation between measurement question item errors, a validation factor analysis is needed for the dimensions of quality improvement in education. Breckler (1990) argues that when a model satisfies more than one indicator, it indicates a good fit. In this study, several indicators such as X^2/df, RMSEA, IFI, TLI, and CFI

were used to determine the validity of the model, and each dimension test is shown in **Table 2**.

Table 2. CFA model fit test for different group questionnaire scales.

index	reference standard	Actual results			
		questionnaire for teacher groups		questionnaire for student groups	
		factors affecting the improvement of the quality of education	quality of education improved effectiveness	factors affecting the improvement of the quality of education	quality of education improved effectiveness
X^2/df	1–3 is excellent, 3–5 is good	3.337	4.313	4.436	2.664
RMSEA	< 0.05 is excellent, < 0.08 is good	0.070	0.073	0.050	0.035
IFL	> 0.9 is excellent, > 0.8 is good	0.962	0.971	0.986	0.997
TLI	> 0.9 is excellent, > 0.8 is good	0.953	0.953	0.982	0.995
CFI	> 0.9 is excellent, > 0.8 is good	0.961	0.971	0.986	0.997

In the teacher group questionnaire, the X^2/df value for the dimension of factors influencing the improvement of educational quality is 3.337 (3–5 is good), and the model is acceptable; the RMSEA value is 0.070 (< 0.08), which indicates that the model fits well; the IFL value is 0.962 (> 0.9), the TLI value is 0.953 (> 0.9), the CFI value is 0.961 (> 0.9) , all indicators reached above 0.9, and the research data had high fitness and good validity with each dimension of the questionnaire structure. In the dimension of education quality improvement effect, the X^2/df value is 4.313 (> 3 is good), the RMSEA value is 0.083 (< 0.08 is good), the IFL value is 0.971 (> 0.9 is excellent), the TLI value is 0.953 (> 0.9 is excellent) and the CFI value is 0.971 (> 0.9 is excellent). In the student group questionnaire, the X^2/df value of the education quality improvement influencing factors dimension was 4.436 (3–5 is good), the RMSEA value was 0.050 (< 0.08 is good), and the test results of the IFL, the TLI, and the CFI were 0.986, 0.982, and 0.986, which were all above the excellent level of 0.9. The X^2/df value in the dimension of educational quality improvement effect is 2.664 (1–3 is excellent), the RMSEA value is 0.035 (< 0.05 is excellent), and the test results of IFL, TLI, and CFI reach the excellent level of 0.9 or more. Therefore, combining the values of this model fit test, the CFA model for each dimension of the teacher group questionnaire and the student group questionnaire has a good fit, and the overall fit of the questionnaires is high and has good validity.

4.2. Pearson correlation analysis between different dimensions

In order to further explore the relationship between internal education improvement influencing factors and the effect of teacher groups on education quality improvement in higher vocational colleges, this study analyzed the correlation between the variables using Person correlation coefficient. As shown in **Table 3**, the correlation coefficients between the five dimensions of internal education quality improvement influencing factors range from 0.635 to 0.838, presenting a strong correlation, while the correlation coefficients with the effect of education quality improvement range from 0.553 to 0.855, which suggests that a strong correlation is presented between the dimensions of internal education quality improvement influencing factors and the effect of education quality improvement. Overall, the

correlation value of governance level to education management effect is 0.817, the correlation coefficients of students' development and graduates' employment quality and the effect of integration of industry and education are 0.726 and 0.730, and the correlation coefficients of education and teaching, policy guarantee and integration of industry and education reach 0.873 and 0.838, and the correlation coefficients of the dimensions are close to the value of 1, which means that they present a significant correlation.

Table 3. Pearson's correlation analysis between different dimensions (teacher group questionnaire).

dimension	governanc e level	governanc e level	governance level	governanc e level	governanc e level	governance level	governance level	governance level	governance level	governanc e level
governance level	1									
student development	0.667**	1								
teaching and learning	0.635**	0.669**	1							
integration of industry and education	0.683**	0.713**	0.837**	1						
policy guarantee	0.695**	0.734**	0.796**	0.838**	1					
education management effectiveness	0.817**	0.726**	0.750**	0.769**	0.787**	1				
quality of graduate employment	0.655**	0.728**	0.628**	0.692**	0.685**	0.720**	1			
teachers' personal growth	0.573**	0.638**	0.738**	0.737**	0.674**	0.645**	0.588**	1		
effectiveness of industry-education integration	0.691**	0.730**	0.789**	0.855**	0.836**	0.812**	0.641**	0.704**	1	
effectiveness of system implementation	0.553**	0.603**	0.647**	0.672**	0.717**	0.571**	0.482**	0.643**	0.668**	1

** At the 0.01 level (two-tailed), the correlation is significant.

Pearson correlation coefficient was used to analyze the dimensions of the student group questionnaire to explore the relationship between internal education quality improvement influencing factors and education quality improvement effects in higher vocational colleges. The results are shown in **Table 4**, the correlation coefficients between the five dimensions of internal education quality improvement influencing factors under the student population perspective range from 0.598 to 0.819, and the correlation between these dimensions is high. Based on the results of the analysis, it can be seen that there is a significant correlation between all the variables and all of them are significant at the 99% level of significance. In terms of coefficient values, the correlation between the level of governance and education and teaching, school reputation and student development is significantly higher than the other dimensions, the coefficient of student development and education and teaching is 0.768, the coefficient of education and teaching and integration of industry and education and teaching effectiveness in the classroom is 0.854, 0.897, and the contribution of the integration of industry and education and service is 0.819, which are significant, and

this will be used for the subsequent enhancement of the internal quality of education improvement by providing strategies.

Table 4. Pearson's correlation analysis between different dimensions (student group questionnaire).

dimension	governance level	governance level	governance level	governance level	governance level	governance level	governance level	governance level
governance level	1							
student development	0.694**	1						
teaching and learning	0.671**	0.768**	1					
integration of industry and education	0.646**	0.750**	0.854**	1				
policy guarantee	0.589**	0.677**	0.767**	0.819**	1			
school reputation	0.795**	0.718**	0.770**	0.756**	0.716**	1		
quality of graduate employment	0.558**	0.636**	0.663**	0.655**	0.643**	0.599**	1	
effectiveness of classroom teaching	0.600**	0.699**	0.897**	0.778**	0.698**	0.688**	0.570**	1

** At the 0.01 level (two-tailed), the correlation is significant.

4.3. Demographic-based analysis of perceived differences in factors affecting internal education quality improvement

4.3.1. Perceived differences in internal education quality improvement influencing factors among teachers of different genders.

This study uses independent samples *T*-test method (Fleiss, 1981) to test the differences between teachers of different genders on internal education quality improvement and education quality improvement effects in higher vocational colleges, as shown in **Table 5**. In the comparison of perceived differences in internal education quality improvement influencing factors among teachers of different genders, it is found that the *T*-statistics of the teacher gender variable in the test of the four variables of governance level, education and teaching, integration of industry and education and policy guarantee do not reach the level of significance, and the probability value of significance is $P > 0.05$, which suggests that there is no significant difference between teachers of different genders in these four dimensions, but the *T*-value of the teacher gender difference in the variable of students' development reached the level of significance ($P < 0.05$), which indicates that there is a significant difference between teachers of different genders in the dimension of student development of internal education quality improvement influencing factors. In the dimension of education quality improvement effect, there is no significant difference between teachers of different genders in the *T*-value test of the four variables of education quality improvement effect of education management effect, teachers' personal growth, the effect of integration of industry and education, and the effect of system implementation ($P > 0.05$), while there is a significant difference in the *T*-value test of the variable of quality of graduates' employment ($P < 0.05$), which indicates that there are significant differences in the *T*-value test of the variable of quality improvement effect of education of teachers of different genders in the dimension of quality improvement of education. Overall, there is a low correlation strength between the

gender variable and variables other than student development and quality of graduate employment.

Table 5. Differences in teachers' perceptions of factors affecting internal education quality improvement by gender.

test variable	male (n = 344) (M ± SD)	female (n = 616) (M ± SD)	T-value	P-value
governance level	4.22 ± 0.91	4.15 ± 0.92	0.889	0.375
student development	4.05 ± 0.75	3.88 ± 0.73	2.551	0.011
teaching and learning	3.85 ± 0.86	3.84 ± 0.73	0.211	0.833
integration of industry and education	4.05 ± 0.89	4.05 ± 0.85	0.002	0.999
policy guarantee	3.97 ± 0.96	3.91 ± 0.85	0.730	0.466
education management effectiveness	3.89 ± 1.00	3.80 ± 0.93	1.035	0.301
quality of graduate employment	3.96 ± 0.86	3.77 ± 0.81	2.413	0.016
teachers' personal growth	3.94 ± 0.95	4.03 ± 0.79	−1.105	0.270
effectiveness of industry-education integration	3.93 ± 0.92	4.03 ± 0.74	−1.326	0.186
effectiveness of system implementation	4.13 ± 0.86	4.28 ± 0.74	−1.901	0.058

4.3.2. Differences in teachers' perceptions of internal education quality improvement influencing factors in different job titles

In order to test whether there is a difference between teachers with different titles on the factors influencing the improvement of internal education quality and the effect of education quality improvement in higher vocational colleges, univariate analysis of variance (ANOVA) was used, and the results are shown in **Table 6**. From the perspective of the perceived differences between teachers with different titles on the factors influencing the improvement of internal education quality, on the F-value test of the teachers with full senior titles on the variables of the level of governance, students' development, integration of industry and education and the protection of policies, the P-values were respectively 0.254, 0.059, 0.178, 0.125 ($P > 0.05$), which indicates that there is no significant difference between teachers of different titles in the above four variables; in the F-value test on the variable of education and teaching, the F-value is 3.498, $P = 0.031$ ($P < 0.05$), which indicates that there is a significant difference between teachers of different titles in their perception of the factors influencing the improvement of the quality of internal education in terms of teaching and learning, i.e., teachers with different titles have a significant influence on education and teaching. In the dimension of the effect of improving the quality of education, the F-value test of each variable shows that the P-value is more than 0.05, which indicates that there is no significant difference between teachers with different titles in their perception of the dimensions of the effect of improving the quality of internal education.

Table 6. Perceived differences in factors affecting internal education quality improvement among teachers with different titles.

test variable	top level (n = 44) (M ± SD)	associate level (n = 192) (M ± SD)	under lecturer level (n = 724) (M ± SD)	F-value	P-value
governance level	4.48 ± 0.88	4.13 ± 0.95	4.17 ± 0.91	1.375	0.254
student development	4.29 ± 0.55	3.88 ± 0.83	3.93 ± 0.72	2.848	0.059
teaching and learning	4.25 ± 0.83	3.77 ± 0.76	3.84 ± 0.78	3.498	0.031
integration of industry and education	4.30 ± 0.80	3.94 ± 0.93	4.07 ± 0.85	1.731	0.178
policy guarantee	4.21 ± 0.98	3.81 ± 0.93	3.94 ± 0.87	2.092	0.125
education management effectiveness	4.09 ± 1.09	3.76 ± 0.89	3.83 ± 0.96	1.076	0.342
quality of graduate employment	4.00 ± 0.69	3.77 ± 0.88	3.85 ± 0.82	0.746	0.475
teachers' personal growth	4.32 ± 0.73	4.02 ± 0.83	3.97 ± 0.87	1.816	0.164
effectiveness of industry-education integration	4.12 ± 0.91	3.87 ± 0.82	4.02 ± 0.80	1.650	0.193
effectiveness of system implementation	4.46 ± 0.41	4.14 ± 0.83	4.24 ± 0.79	1.584	0.206

4.3.3. Differences in teachers' perceptions of internal education quality improvement influencing factors across age groups.

In order to test whether there are differences between teachers of different ages on the factors influencing the improvement of the quality of education within higher vocational colleges and on the perception of the effect of the improvement of the quality of education, univariate analysis of variance (ANOVA) was used to test the results of the dimensional variables as shown in **Table 7**. The age grouping of the teachers was mainly divided into three groups, with 35 years old and 45 years old as the dividing point. From the value of the test variable N, the age of the teacher group in Hainan Province is dominated by young and middle-aged teachers. In the dimension of factors influencing the improvement of education quality, there is a significant influence of teachers of different ages on student development (F = 6.988, P=0.001) and policy guarantee (F = 3.889, P = 0.021) (P < 0.05), and especially there is a significant difference between teachers over 45 years old in these two aspects, while there is no significant difference in the three variables of the level of governance, teaching and learning and integration of industry and education (P > 0.05). In terms of teachers' perceptions of the effect of education quality improvement at different ages, there are no significant differences in the effect of education management, the quality of graduate employment and the effect of system implementation (p > 0.05), but there are significant differences in the variables of teachers' personal growth (F = 5.512, p = 0.004) and the effect of integration of industry and education (F = 4.522, p = 0.011), with the older the teacher, the greater the perception of personal growth, the greater the perception of the effect of education teaching and the greater the perception of the effect of integration of industry and education (F = 4.522, p = 0.011). The older the age, the more significant difference on personal growth and the integration of industry and education.

Table 7. Differences in teachers' perceptions of factors affecting internal education quality improvement by age.

test variable	under 35 (n = 452) (M ± SD)	36–45 (n = 376) (M ± SD)	over 46 (n = 132) (M ± SD)	F-value	P-value
governance level	4.21 ± 0.86	4.08 ± 0.97	4.34 ± 0.91	2.309	0.100
student development	4.00 ± 0.7	3.80 ± 0.78	4.15 ± 0.67	6.988	0.001
teaching and learning	3.90 ± 0.74	3.79 ± 0.79	3.78 ± 0.89	1.400	0.248
integration of industry and education	4.13 ± 0.82	3.96 ± 0.89	4.05 ± 0.94	1.876	0.154
policy guarantee	4.03 ± 0.80	3.79 ± 0.94	3.97 ± 1.02	3.889	0.021
education management effectiveness	3.89 ± 0.91	3.72 ± 1.03	3.94 ± 0.88	1.986	0.138
quality of graduate employment	3.89 ± 0.79	3.78 ± 0.88	3.82 ± 0.85	0.880	0.416
teachers' personal growth	4.08 ± 0.78	3.84 ± 0.88	4.14 ± 0.95	5.512	0.004
effectiveness of industry-education integration	4.09 ± 0.78	3.86 ± 0.82	4.08 ± 0.82	4.522	0.011
effectiveness of system implementation	4.26 ± 0.79	4.15 ± 0.81	4.33 ± 0.68	1.685	0.187

4.3.4. Differences in teachers' perceptions of internal education quality improvement influencing factors at different academic levels

In order to test the differences in the perception of teachers with different academic levels on the factors influencing the improvement of internal education quality and the effect of education quality improvement in higher vocational colleges, univariate analysis of variance (ANOVA) was used to test the results of the dimensional variables as shown in **Table 8**. Teachers in higher vocational colleges in Hainan Province were analyzed mainly from bachelor's degree, master's degree and doctor's degree levels, and from the sample N-value, teachers' qualifications were mainly concentrated in the master's degree level, and the number of doctor's degrees was small. In terms of internal education quality improvement influencing factors, there is a significant difference in the perception of student development variables (F = 9.639, $P < 0.001$) among teachers of different education levels, while there is no significant difference in the four variables of governance level, education and teaching, policy guarantee, and integration of industry and education. On the dimension of the effect of education quality improvement, there were significant differences ($P < 0.05$) between teachers of different academic levels on the effect of education management (F = 4.229, P = 0.015), the quality of graduate employment (F = 4.143, P = 0.016), and the effect of system implementation (F = 7.147, $P < 0.001$), of which the effect of system implementation was the most significant in terms of the effect on the improvement of the quality of education.

Table 8. Differences in teachers' perceptions of the factors affecting internal education quality improvement by academic qualification.

test variable	bachelor's degree (n = 380) (M ± SD)	master's degree (n = 560) (M ± SD)	doctor's degree (n = 20) (M ± SD)	F-value	P-value
governance level	4.26 ± 0.94	4.12 ± 0.87	4.00 ± 1.63	1.540	0.215

Table 8. (*Continued*).

test variable	bachelor's degree (*n* = 380) (M ± SD)	master's degree (*n* = 560) (M ± SD)	doctor's degree (*n* = 20) (M ± SD)	*F*-value	*P*-value
student development	4.12 ± 0.69	3.82 ± 0.73	4.00 ± 1.08	9.639	<.001
teaching and learning	3.84 ± 0.81	3.85 ± 0.73	3.65 ± 1.49	0.306	0.736
integration of industry and education	4.12 ± 0.86	4.02 ± 0.84	3.80 ± 1.55	1.292	0.276
policy guarantee	3.99 ± 0.87	3.90 ± 0.88	3.80 ± 1.55	0.691	0.501
education management effectiveness	3.98 ± 0.87	3.73 ± 0.98	3.80 ± 1.55	4.229	0.015
quality of graduate employment	3.96 ± 0.79	3.76 ± 0.82	3.50 ± 1.41	4.143	0.016
teachers' personal growth	4.03 ± 0.84	3.99 ± 0.83	3.40 ± 1.54	2.616	0.074
effectiveness of industry-education integration	4.07 ± 0.82	3.94 ± 0.81	4.13 ± 0.72	1.735	0.178
effectiveness of system implementation	4.32 ± 0.69	4.19 ± 0.80	3.40 ± 1.54	7.147	<.001

4.3.5. Differences in teachers' perceptions of the factors affecting internal education quality improvement in different disciplines

Currently, there are 14 discipline categories in China, under which there are several first-level disciplines. Due to the large number of professional names included in the discipline categories taught by groups of teachers, humanities (philosophy, literature, history, and education), science (science, medicine, and agriculture), social sciences (law, management, and economics), engineering (engineering), and interdisciplinary subjects were mainly categorized in this study. Univariate analysis of variance (ANOVA) was conducted to test the differences in teachers' perceptions of the factors influencing the improvement of internal quality of education in different disciplines and the results are shown in **Table 9**. In terms of the percentage of different disciplines, humanities and social sciences account for the majority of disciplines in Hainan's higher education institutions, and science and technology are relatively less offered. From the *F*-value and *P*-value of the test variables of each dimension, except that there is no significant difference in the variable of the effect of system implementation, there is a significant difference in the test of the other nine variables ($P < 0.05$), which indicates that from the perspective of discipline categories, the teachers belonging to different disciplines have a significant difference in the factors influencing the improvement of education quality and the perceived effect of the improvement of education quality, which provides a good research perspective for the study of the quality improvement of higher vocational colleges within education.

Table 9. Differences in teachers' perceptions of factors influencing internal education quality improvement across subjects.

test variable	humanities (*n* = 472) (M ± SD)	science (*n* = 52) (M ± SD)	social sciences (*n* = 236) (M ± SD)	engineering (*n* = 152) (M ± SD)	interdisciplinary subjects (*n* = 48) (M ± SD)	*F*-value	*P*-value
governance level	4.02 ± 1.00	4.08 ± 0.88	4.32 ± 0.70	4.43 ± 0.81	4.33 ± 1.10	4.286	0.002
student development	3.85 ± 0.75	4.03 ± 0.84	3.96 ± 0.67	4.18 ± 0.75	3.90 ± 0.59	3.231	0.012

Table 9. (*Continued*).

test variable	humanities (*n* = 472) (M ± SD)	science (*n* = 52) (M ± SD)	social sciences (*n* = 236) (M ± SD)	engineering (*n* = 152) (M ± SD)	interdisciplinary subjects (*n* = 48) (M ± SD)	*F*-value	*P*-value
teaching and learning	3.75 ± 0.81	3.71 ± 0.79	3.95 ± 0.71	3.82 ± 0.78	4.38 ± 0.56	4.488	0.001
integration of industry and education	3.93 ± 0.90	3.95 ± 1.12	4.16 ± 0.72	4.16 ± 0.91	4.50 ± 0.47	3.683	0.006
policy guarantee	3.79 ± 0.89	3.95 ± 0.91	4.05 ± 0.85	4.08 ± 0.96	4.19 ± 0.67	3.086	0.016
education management effectiveness	3.63 ± 1.02	3.92 ± 1.02	4.01 ± 0.78	4.04 ± 0.90	4.13 ± 0.81	5.315	<.001
quality of graduate employment	3.65 ± 0.87	4.04 ± 0.79	3.87 ± 0.68	4.22 ± 0.80	4.04 ± 0.76	8.311	<.001
teachers' personal growth	3.84 ± 0.91	4.00 ± 0.89	4.11 ± 0.75	4.15 ± 0.81	4.42 ± 0.55	4.564	0.001
effectiveness of industry-education integration	3.89 ± 0.82	3.82 ± 1.03	4.16 ± 0.72	4.06 ± 0.81	4.25 ± 0.70	3.327	0.011
effectiveness of system implementation	4.15 ± 0.78	4.42 ± 0.84	4.25 ± 0.80	4.24 ± 0.80	4.58 ± 0.65	2.277	0.060

4.3.6. Differences in students' perceptions of internal education quality improvement influencing factors by gender

Table 10. Differences in perceptions of students of different genders on factors influencing the improvement of the quality of internal education.

test variable	male (*n* = 748) (M ± SD)	female (*n* = 604) (M ± SD)	*T*-value	*P*-value
governance level	3.76 ± 1.01	3.81 ± 0.95	−0.858	0.391
student development	3.81 ± 0.99	3.87 ± 0.96	−1.219	0.223
teaching and learning	3.90 ± 0.92	3.95 ± 0.88	−1.032	0.302
integration of industry and education	3.82 ± 1.00	3.83 ± 0.96	−0.209	0.834
policy guarantee	3.74 ± 1.05	3.73 ± 1.00	0.130	0.896
school reputation	3.75 ± 0.97	3.74 ± 0.94	0.177	0.860
quality of graduate employment	3.53 ± 1.05	3.44 ± 1.00	1.653	0.098
effectiveness of classroom teaching	4.00 ± 0.96	4.10 ± 0.86	−2.081	0.038

In order to test the differences in the perception of students of different genders on the factors influencing the improvement of internal education quality and the effect of education quality improvement in higher vocational colleges, the independent samples test was adopted, and the results are shown in **Table 10**. From the test of each variable, the *P*-value is more than 0.05 in governance level, student development, education and teaching, integration of industry and education, policy guarantee, school reputation, and employment quality of graduates, which indicates that students of different genders tend to be consistent in their perceptions of these variables, and the gender difference is not significant. However, there is a significant difference in classroom teaching effectiveness between students of different genders ($p < 0.05$), which indicates that male and female students have different perceptions of the

effectiveness of classroom teaching, which has a positive significance for the study of the effect of education quality improvement from the perspective of student groups.

4.3.7. Perceived differences in internal quality education improvement influencing factors among students with different admission methods

In September 2022, the Ministry of Education released a report focusing on the reform of the examination and admission system, giving colleges and universities more autonomy in enrollment based on the principle of "classified examination, comprehensive evaluation, and diversified admission". The enrollment and admission of higher vocational colleges in Hainan Province also presents a diversified trend, mainly divided into the college entrance examination, single enrollment, middle and higher vocational 3 + 2, five-year system and other forms, and there are certain differences in the main sources of student sources of higher vocational colleges. In this study is mainly divided into the college entrance examination, single enrollment and other three major categories, using univariate analysis of variance to test, the results are shown in **Table 11** below. From the sample data obtained, the number of students enrolled in the college entrance examination accounts for the main body of the enrollment scale of higher vocational colleges in Hainan Province, followed by single enrollment. The *P*-values of higher vocational students enrolled in different admission methods in the dimensions of internal education quality improvement influencing factors and education quality improvement effects are all more than 0.05, which indicates that the differences between higher vocational students enrolled in different admission methods in these variables are not significant, and the individual variables are of a kind of low correlation strength, which has not reached a statistically significant level.

Table 11. Differences in perceived factors influencing internal education quality improvement among students with different admission methods.

test variable	college entrance examination (n = 907) (M ± SD)	single enrollment (n = 229) (M ± SD)	alternative (n = 216) (M ± SD)	*F*-value	*P*-value
governance level	3.80 ± 0.98	3.85 ± 0.93	3.66 ± 1.04	2.483	0.084
student development	3.88 ± 0.99	3.77 ± 0.98	3.73 ± 0.94	2.680	0.069
teaching and learning	3.94 ± 0.89	3.91 ± 0.90	3.87 ± 0.94	0.626	0.535
integration of industry and education	3.84 ± 0.98	3.82 ± 0.94	3.79 ± 1.02	0.216	0.806
policy guarantee	3.75 ± 1.02	3.67 ± 1.02	3.74 ± 1.06	0.563	0.570
school reputation	3.74 ± 0.95	3.77 ± 0.91	3.70 ± 1.02	0.340	0.712
quality of graduate employment	3.51 ± 1.03	3.43 ± 1.00	3.46 ± 1.04	0.667	0.514
effectiveness of classroom teaching	4.07 ± 0.89	4.01 ± 0.96	3.96 ± 0.97	1.389	0.250

5. Research results and discussion

There is a significant correlation between the five dimensions of the factors influencing the improvement of internal quality of education in higher vocational colleges. There is a significant difference in the perception of teachers' groups of different genders, titles, ages, qualifications and disciplines, and students' groups of different genders and admission modes, on the influence of the factors of the level of

governance, teaching and learning, integration of industry and education, student development and policy guarantee on the generation of internal quality; and the teacher group and the student group have different degrees of differences in their perceptions of the effects of internal education quality improvement. The reliability and validity of the two types of questionnaires are within the reference standard, indicating that the questionnaire scales have good internal consistency and can reflect the real situation of internal education quality improvement. The Pearson correlation analysis of different dimensions shows that the five-dimensional coefficients of the two groups are significantly correlated, which lays a good foundation for the following analysis.

In the first place, there are significant differences in the perceptions of different groups on the dimension of governance level, which plays an important coordinating and leading role in the improvement of education quality within higher education institutions. The highest correlation coefficient between the level of governance and policy guarantee is found in the questionnaire of the teacher group, which indicates that a good level of governance requires rules and regulations as the fundamental guarantee for its implementation; the highest correlation between the level of governance and student development is found in the questionnaire of the student group. In addition, there is no significant difference in the dimension of governance level between teachers of different genders, titles, ages and qualifications, but there is a significant difference in governance level between teachers of different disciplines, which may be closely related to the difference between liberal arts thinking and science thinking in looking at problems and solving them, and there is no significant difference in the dimension of governance level between student groups.

In the second place, there is no significant difference in the perception of student development dimensions between teachers of different titles and student groups, and there are significant differences in student development between teachers of different genders, ages, qualifications, and disciplines. This suggests that teachers' titles do not have a significant impact on student development in improving the quality of education within higher education institutions, and that all other factors of teachers have a significant impact on student development, which is related to the fact that higher education institutions focus on students' skill development rather than academic literacy. As the main stakeholders within higher vocational colleges, the student group is the main audience in education quality improvement, and can be said to be the product of quality improvement, the quality of which is directly related to the quality of education. Although there are differences in individual students, when they enter the higher vocational stage and receive the same learning atmosphere, educational environment, etc., they will produce roughly the same development. At the same time, we also need to see that student development is also affected by the quality of the source of students, different ways to enter the student's learning ability, ideological and moral character and employment quality, etc., showing a certain degree of variability, which is a common problem in higher vocational colleges.

In the third place, there is no significant difference in the perception of education and teaching dimensions between teachers of different genders, ages and academic qualifications and student groups, while there is a significant difference in education and teaching between teachers of different titles and disciplines. Education and

teaching, as the implementation of internal education quality improvement, carries an important nurturing function and influences the improvement of teaching quality in the whole higher vocational institution, and the promotion of title also implies the improvement of teachers' professional ability. The significant correlation between education teaching and the integration of industry and education and policy guarantee indicates that the integration of industry and education is an important link in the implementation of education teaching reform, which largely affects the quality of higher vocational personnel training. For student groups, education and teaching is an important link for students in higher vocational colleges to acquire professional knowledge and skills, and it is also a position to promote the improvement of education quality. Under the perspective of student groups, the correlation coefficient value between education teaching and the integration of industry and education is the highest, and the correlation is significant. Therefore, in enhancing the improvement of education quality, based on the demands of student groups, we should combine education teaching and integration of industry and education with each other, and organically integrate the construction of faculty, the quality of classroom teaching, and the construction of professionalism, so as to continuously improve the quality of education.

In the fourth place, there is no significant difference between the perception of teachers and student groups in the dimension of industry-teaching integration by gender, title, age and education, while there is a significant difference between teachers of different disciplines in the dimension of the integration of industry and education. The integration of industry and education can be beneficial to inspire the creativity and innovation of students, improve the business level of teacher groups, and promote the prosperous development of local economy and the healthy development of higher vocational education. Therefore, in promoting internal education quality improvement, it is necessary to pay attention to the role of teachers of different disciplines in the implementation of the integration of industry and education, which is quite different from the equipment and facilities used in the implementation of different disciplines, practical training links, teaching methods and concepts, especially the implementation of the integration of industry and education in different majors such as arts and sciences. The more in place the implementation of the integration of industry and education, the higher the quality of student training, the skills acquired by students will be closer to the skills of talents needed for industrial and economic development. On the contrary, the implementation of the integration of industry and education is not in place, then the skills of higher vocational students will be difficult to highlight, and the quality of graduate training will be difficult to match with the regional economic development of the skills of talents. In short, higher vocational colleges to deepen the integration of industry and education, you can build the professional in the industrial chain, the classroom is located in the production line, enrich the content of education, improve the teaching method, the formation of the school and the enterprise to train together, and jointly overcome the technical difficulties of a very good training mode, so that you can cultivate to meet the needs of the industry and the development of enterprises of highly skilled talents.

In the fifth place, there is no significant difference between the perceptions of teachers of different genders, ages, titles, academic qualifications and student groups

on the dimension of policy guarantee, and there is a significant difference between teachers of different disciplines on the dimension of policy guarantee. From the Pearson coefficient, there is a significant correlation between the policy guarantee and each variable, and the correlation coefficient with the integration of industry and education is the largest. Policy guarantee is an important premise for the normal operation of higher vocational colleges, and a perfect and reasonable policy system can make the teaching operation and administration of colleges and universities smoother and more conducive to the improvement of internal education quality. From the demographic point of view, there is no significant difference between the two groups on the dimensions of policy guarantee for higher vocational colleges, which indicates that the policies for improving the quality of internal education in each higher vocational college and university tend to be reasonable, and can effectively promote the improvement strategies and so on. Differences in policy guarantee for teachers of different disciplines suggest that it is important to pay attention to the different roles played by teachers of different disciplines in the improvement of educational quality, and the impact that the policy system has on teachers of different disciplines.

In the sixth place, there are differences in the perception of internal education quality improvement effects among teachers of different genders, ages, titles, qualifications, and subjects, while the student group has a weaker difference in the perception of improvement effects. Teachers' perceptions of the effects of education quality improvement were mainly examined in terms of the effects of education management, the quality of graduate employment, teachers' personal growth, the effects of the integration of industry and education, and the implementation of the system, while students' perceptions were examined in terms of the quality of graduate employment, the reputation of the school, and the effects of classroom teaching. There are significant differences between teachers of different genders in the quality of graduate employment, between teachers of different ages in the effects of teachers' personal growth and the integration of industry and education, between teachers of different academic qualifications in the effects of system implementation, and between teachers of different disciplines in the effects of education management, the quality of graduate employment, teachers' personal growth and the effects of integration of industry and education. There is a significant difference between different gender student groups in the dimension of classroom teaching effectiveness. Therefore, in evaluating the two groups' perception of the effect of internal education quality improvement, it is necessary to combine the different identities of teachers and the student sources to make a comprehensive judgement.

6. Conclusion

This study constructs a five dimensional model of internal education quality improvement in Hainan province's vocational colleges from the perspective of the main body of internal education quality improvement. This model systematically explores the practice of internal education quality improvement in Hainan province's vocational colleges and reveals the current situation and problems of internal education quality improvement. By designing an internal education quality improvement questionnaire, a survey is conducted on the main stakeholders involved

in education quality improvement, in order to obtain information on the implementation of internal education quality improvement and their satisfaction with quality improvement. The survey also reveals their demands for education quality and the relationship network between the dimensions of internal education quality improvement. Through this empirical study, not only can we solve many problems and drawbacks in the initial construction of the internal quality assurance system in China's vocational colleges, but we can also promote the high-quality development of vocational education in H Province. This has certain learning and reference significance for the formation and improvement of the internal education quality improvement system. To gain a more comprehensive understanding of the improvement of educational quality in vocational colleges, it is possible to conduct relevant research from a systematic theoretical perspective. To view the improvement of educational quality in vocational colleges as a "system", and to study the relationship between the improvement of educational quality in vocational colleges and quality elements, quality elements and quality elements, as well as the relationship between educational quality improvement and the environment from a systematic perspective, in order to reveal the changing patterns of educational quality improvement.

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