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PENYELIDIKAN DAN PENGURUSAN TRANSFORMASI SISTEM PENILAIAN KUALITI PENGAJARAN 'EKOLOGI LANDSKAP' BERASASKAN AHP-PCA-IPA

RESEARCH AND MANAGEMENT OF THE TRANSFORMATION OF THE 'LANDSCAPE ECOLOGY' TEACHING QUALITY EVALUATION SYSTEM BASED ON AHP-PCA-IPA

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ABSTRACT
The discipline of landscape architecture, with the course "Ecology of Landscape Architecture" as its ecological orientation, is a development strategy conceived from the perspective of harmonious coexistence between humans and nature. The impact of teaching quality in this course is closely correlated with the acquisition of knowledge and the development of professional competencies among students. Hence, it is of paramount importance to modify the conventional qualitative and singular quantitative systems used for course evaluation. This can be achieved by developing a scientifically sound framework for evaluation indicators and by refining the methods employed for assessing and managing teaching quality. The objective of this article is to provide a scientific assessment framework, which is guided by the hierarchical structure of "Experts-Instructors-Supervisors-Enterprises," and utilizes the multidimensional quantitative data evaluation model known as "AHP-PCA-IPA." By adopting this strategy, the intention is to transcend the constraints imposed by subjective qualitative assessment techniques and one-dimensional quantitative evaluation methods commonly employed in conventional approaches to evaluating teaching quality. Furthermore, the objective is to cultivate rationality inside the curriculum system by developing appropriate evaluation management procedures that align with the evaluation system.

Keywords: *Landscape Ecology, Teaching Quality Evaluation System, Change Management*

1. INTRODUCTION

During the 20th National Congress of the Communist Party of China, General Secretary Xi Jinping introduced novel principles for ecological civilization. These principles encompass the advancement of a visually appealing China, the steadfast commitment to integrated preservation and systematic administration of diverse natural elements such as mountains, waters, forests, farmlands, lakes, grasses, sands, and soil. Furthermore, these principles aim to foster a synergistic approach towards carbon reduction, pollution reduction, afforestation, and economic growth. The city of Zhao Qing, situated in the vicinity of Guangdong Technology College, exhibits a scenic topography characterized by meandering mountains and expansive bodies of water. The urban configuration adheres to the topographical features of mountains and water systems, rendering it a visually appealing city with significant ecological and cultural attributes. The establishment of the Landscape Architecture discipline at Guangdong Technology College places a strong emphasis on ecological principles, with the course " Landscape Ecology " serving as a cornerstone of this ecologically-oriented academic endeavor. This approach is carefully planned to foster a harmonious coexistence between humanity and the natural environment.

Traditional methods of evaluating teachers have predominantly concentrated on qualitative analysis, which is inherently subjective, biased, and largely based on personal experience, hence posing challenges in accurately assessing a teacher′s actual talents. While certain institutions have made efforts to conduct quantitative assessments, their approach has predominantly involved the utilization of one-dimensional quantitative methodologies for developing evaluation systems and assigning scores. Nevertheless, it is important to acknowledge that both qualitative and quantitative techniques possess certain limits.

At now, the predominant methods used in research for developing teaching quality evaluation systems are the Analytic Hierarchy Process (AHP) and Principal Component Analysis (PCA). However, the utilization of the Importance-Performance Analysis (IPA) quadrant technique in this area is rather limited. The principle Component Analysis (PCA) method is deficient in incorporating expert weighing when determining indicators. On the other hand, the Analytic Hierarchy Process (AHP) encounters difficulties in categorizing significant indicators into cohesive clusters for the purpose of identifying shared principle assessment indicators. The IPA quadrant method is a highly effective approach for identifying the specific quadrants that require improvement in the evaluation of teachers. Hence, the integration of " AHP-PCA-IPA " in the study of teaching quality evaluation systems can be considered a promising avenue and novel approach to improve the teaching quality assessment system in the field of " Landscape Ecology. "

2. LITERATURE REVIEW

2.1 Establishment of a Multi-Dimensional Quantitative Teaching Quality Evaluation System

In the first study of its kind, which was published in the Journal of Mathematical Statistics and Management, Wu Qunying used a variety of quantitative statistical analyses to determine ten important variables that are directly related to the evaluation of the quality of teacher teaching. PCA (principal component analysis) was utilized to do this method of analysis on the teaching assessment data collected from 30 different teachers. The work done by Wu served as an early example of the application of multidimensional quantitative statistical analysis to the task of evaluating the quality of teacher instruction published in domestic academic publications (Wu Qunying, 1995). In the article titled "AHP-PCA-SVM Approach to Evaluating Higher Mathematics Teaching Quality," Yu Chaoyang

proposed a combined approach that integrates the Analytic Hierarchy Process (AHP), Principal Component Analysis (PCA), and Support Vector Machine (SVM) to enhance the accuracy of evaluating higher mathematics teaching quality (Yu Chaoyang, 2013).

Song Lina suggested that one of the most important factors in accomplishing the goals of vocational education is the level of practical experience that one receives. As a result, it is essential to locate appropriate evaluation indicators. She utilized PCA to completely define ten important variables for evaluating the quality of vocational practical training (Song Lina, 2015). Principal component analysis (PCA), which is a method for reducing the number of dimensions in a dataset, was brought up as an example by Ai Hongfu, who stressed the growing significance of data mining in the field of education. Ai Hongfu effectively mined and analyzed the existing teaching evaluation indicator system by employing principal component analysis (PCA) on actual teaching data (Ai Hongfu, 2016). This demonstrates the efficacy of this methodology. With the use of PCA, Lin Shan was able to carry out an in-depth assessment of the quality of classroom instruction provided by instructors working in the Engineering Management Department of the Fuzhou Vocational College of Foreign Languages and Foreign Trade. This evaluation took into account a wide range of important factors, including classroom preparation, teacher quality, teaching content, teaching techniques, and teaching efficiency (Lin Shan, 2019). Wen Hongyan investigated the "project-based" teaching method that was utilized in the Environmental Art and Design major at a number of different colleges in Guangdong province. A methodology for evaluating "project-based" education was developed with the help of the Analytic Hierarchy Process (AHP). This model led to an evaluation of architecture and interior design classes based on four criteria and sixteen indicators (Wen Hongyan, 2020). Cao Yusong developed an all-encompassing model for evaluating teaching based on a variety of considerations, including teacher attitude, teaching material, teaching techniques, and teaching effects. Cao designed a thorough evaluation of teaching performance for college instructors by applying the Analytic Hierarchy Process (AHP). Cao determined the weights of a variety of evaluation indicators and created the evaluation using these weights (Cao Yusong, 2020).

Long Wei performed an analysis of the data on the online teaching quality evaluation for the spring semester of 2020 using the AHP-fuzzy comprehensive approach. The data were obtained by Long Wei through the use of online questionnaires at a specific university located in Yunnan Province. According to the data, both the students' and the teachers' overall comprehensive scores as well as evaluation scores were on the lower end. According to Long Wei's research from 2021, there was a substantial amount of space for growth for both teachers and platforms, with students playing an essential part in online teaching. The importance-performance analysis (IPA) approach was utilized by Xiao Qian in order to assess the level of education provided by university practical classes from the viewpoint of the student. It has been determined that there are a number of factors that play a significant role in improving the overall quality of practical classes. These include the laboratory equipment and atmosphere, teaching faculty, teaching methods, and course schedules. According to Xiao Qian's research from 2022, boosting the efficacy of practical lessons requires addressing not just the scheduling of classes but also the theoretical groundwork laid in earlier classes.

Research conducted on teaching quality evaluation systems all around the world has reached consensus on a number of points, the most important of which is that evaluation questionnaires for teachers should include many main evaluation dimensions as well as specialized evaluation indicators (Marsh, 1981). Marsh's SEEQ questionnaire comprises nine key assessment aspects and 32 particular evaluation indicators, such as learning value, teaching attitude, organizational clarity, and teaching

interaction (Marsh, 1981). Marsh's proposal for the SEEQ questionnaire was published in 1981. According to the findings of research conducted by Centra J.A. in 1979, student assessments of teaching quality primarily involve three dimensions: organizational clarity, teacher-student communication, and teaching skill. Léon argued that teaching quality assessment methods should not be confined to human assessment alone and that a mixed evaluation method might be regularly applied (Léon, 2016). This method would combine various virtual and instrumental procedures.

It is clear from the domestic and foreign research presented above on the subject of evaluating the quality of instruction that academics typically use a method that is composed of a complete multi-index evaluation. To implement this strategy, non-quantifiable multi-dimensional statistical indicators are converted into quantifiable relative assessment values. After gathering these numbers, a synthesis is performed to arrive at an overall evaluation of the subject being reviewed. This method can be broken down into two primary groups: methods that use subjective weighing (such as the Analytic Hierarchy Process and the Delphi Method) and methods that use objective weighting (such as factor analysis and principal component analysis). The first approach involves using scoring techniques that are influenced by subjective considerations, which can either raise or diminish the value of particular evaluation factors. The latter determines weights using coefficients of variation and the degree to which they are correlated with one another. The goal of this method is to eliminate the possibility of subjective bias. The importance-performance analysis, or IPA, is a method that is considered to be part of the objective weighing methods; nonetheless, it is used in the construction of teaching quality evaluation systems to a comparatively lesser extent. As a consequence, there is still a considerable amount of room for research in this field.

2.2 Management Measures for Teaching Quality Evaluation System

This study aims to provide a comprehensive assessment system for assessing teaching quality at local colleges that involves various stakeholders and utilizes big data to improve the quality of undergraduate education. The use of the Apriori algorithm in data mining is employed to extract significant insights from teaching assessment results. This process facilitates informed decision-making for educational management and contributes to the promotion of educational modernization (Zhao, 2021)

This study is based on a detailed analysis of the needs of teaching quality assessment management, in terms of comprehensiveness of assessment and data sources. Then, the teaching evaluation system is designed and developed based on an analysis of the roles of students and teachers. This system can be applied to speed up the efficiency and fairness of teaching evaluation in universities, thereby greatly improving the management of teaching in universities(Qi,Q., 2022).Through research and analysis of the work of teaching quality evaluation at many universities in the country, the basic principles of the management information system have been applied, and the comprehensive quality assessment and management information systems for teaching teachers at universities have been designed and realized (Yu, B. H., 2005).

The report recommends that universities actively investigate online education management's role and functions, research service models, and educational demand patterns, and maximize online education's efficacy. First, management service functions must be established, teachers' instructional status and students' learning status monitored, and online learning made more practical. Second, a positive online educational environment should be built to help students with psychological concerns, create a humanistic setting, and improve distance education communication and interaction. Use a linear

functional management model. Built a good operational mechanism and management model based on the actual teaching situation, optimized teaching quality and plans, an effective monitoring system, procedural and participative management, and good authority relationships (Zhao, L. L. ,2021). The report recommends that universities actively investigate online education management's role and functions, research service models, and educational demand patterns to maximize online education's efficacy. First, management service functions must be established, teachers' instructional status and students' learning status monitored, and online learning made more practical. Second, a positive online educational environment should be built to help students with psychological concerns, create a humanistic setting, and improve distance education communication and interaction. Use a linear functional management model. Built a good operational mechanism and management model based on the actual teaching situation, optimized teaching quality and plans, an effective monitoring system, procedural and participative management, and good authority relationships. (Pan, H., 2018).

The essay posits that, in light of the unique pedagogical characteristics and demands of art and design majors, it is imperative for teaching management departments to adjust their practices to accommodate the requirements of online instruction during periods of normalized preventive and control measures. The enhancement of teaching management methods by management departments and staff is crucial for elevating the level of teaching management, ensuring teaching quality, and guaranteeing the achievement of stated goals in talent cultivation. (Zhou, Z., 2022). This study examines the innovative mechanism elements of teaching management methods in higher education institutions, drawing on the concept of "big data" and considering the comprehensive characteristics of the information age, including "information sharing," "data analysis," and "data security. This study aims to develop a theoretical framework for innovative mechanisms in teaching management methods, with the objective of improving the quality of teaching management in higher education. This will be achieved through the introduction of innovative teaching management concepts, the reformation of teaching management systems, the enhancement of teaching service systems, and the strengthening of teaching data management. The objective of this endeavor is to foster individuals with skills and abilities that align with the demands of contemporary society in the era of information technology (Li, D. L., 2022). In light of the ongoing progress of society, it is imperative to prioritize students in the realm of daily teaching management within institutions. Recognizing and respecting the different features of students is vital, as it is crucial to prioritize their learning and overall well-being. Hence, it is imperative to use a human-centered approach when imparting education to university students. Both educators and educational institutions should undergo a paradigm shift and acquire a comprehensive understanding of, as well as actively incorporate, the principles of human-centered education (Zhang, X., 2019).

The article suggests that in the teaching process, various tasks such as course arrangement, appointment of teaching faculty, development of teaching plans, classroom attendance, student evaluations, exam scheduling, grade reporting, thesis guidance, thesis defense, organization of teaching records, calculation of teaching hours, and distribution of teaching compensation should be meticulously conducted in strict accordance with the "Opinions on Strengthening Teaching and Student Management in the College of Landscape Architecture on the 'Associate to Bachelor' Program (Gao, X. H., 2019). Agile management is a prominent theoretical framework within contemporary management studies and is currently widely adopted as the predominant approach for management practices on a global scale. This technique can be equally applied to educational management, which is a prominent managerial process in society. This article explores the viability of integrating agile principles into

educational management, evaluates the current challenges and limitations in educational management, and subsequently suggests novel techniques and strategies influenced by traditional agile practices to improve the existing educational management system (Xu, H. L.,2017). In comprehensive universities, teaching quality evaluation and management methods for art disciplines should focus on a number of things, such as the use of flexible management approaches, the improvement of information management models, and the strengthening of electronic record management modes (Tao, X. L., 2021). This article suggests ways to improve the ways that vocational colleges manage the quality of education. First, they should stick to the idea of student-centered and individualized education to move the reform of teaching management methods forward. Second, they should set up a comprehensive evaluation system for educational management systems, which will help them be more flexible (Li, C. Y., 2023).

3. OBJECTIVES

This study aims to investigate the scientific and quantitative development of a teaching quality evaluation system model for "Landscape Ecology" that is endorsed by experts, teachers, students, supervisors, and enterprises. Additionally, this research seeks to propose scientific techniques for effectively administering the evaluation system. In the context of the post-pandemic age, it is imperative to identify and incorporate appropriate adaptive assessment indicators and categories for assessing the "Landscape Ecology" course. This is crucial in order to effectively cater to the evolving requirements of students and provide guidance for future directions in teaching reform. In light of the importance of value and advantages for both educators and learners, this analysis aims to identify areas within the teaching quality evaluation system of the "Landscape Ecology" course that require enhancement. Additionally, any discrepancies in teacher-student growth and resource inefficiencies will be examined.

4. RESEARCH VALUE

4.1 Significance and Value of Disciplinary Construction

The course titled "Landscape Ecology" is a compulsory component within the discipline of landscape architecture. This study utilizes ecological concepts and fundamental laws to examine the interactions and linkages that exist between different ecological elements and garden plants. This study employs dynamic analysis techniques to examine the interplay between plant communities and human activities, with the aim of enhancing urban settings. This facilitates the acquisition of comprehensive understanding in the field of landscape ecology by students, enabling them to effectively use this knowledge in practical scenarios. As a result, they may make valuable contributions towards the development of urban landscape ecosystems, the formulation of ecological garden cities, and the preservation of ecological and social equilibrium.

4.2 Significance and Value of Theoretical Framework Construction

The assessment of instructional excellence among university educators encompasses not only the impartation of fundamental knowledge but also has a direct correlation to the significant value of students' acquisition of subject-specific knowledge and the development of comprehensive critical thinking skills. Hence, the establishment of a scientific evaluation indicator system and the enhancement of the teaching quality evaluation system for the course "Landscape Ecology" hold considerable significance in the pursuit of continuous improvement in teaching management, optimization of teaching processes, and attainment of effective teaching outcomes. The objective of this project is to undertake comprehensive study and engage in scholarly discourse regarding the scientific

dimension of improving the methodologies employed in assessing the instructional effectiveness of teachers specializing in "Landscape Ecology".

4.3 Significance and Value of Promotion and Application

The envisaged utilization of the teaching quality evaluation system model, known as "Landscape Ecology," which was developed using the Analytic Hierarchy Process (AHP), Principal Component Analysis (PCA), and Importance-Performance Analysis (IPA), will be expanded to encompass end-of-semester assessments for students enrolled in the 20th, 21st, and 22nd cohorts of the landscape architecture program. This expansion will encompass students across all levels, including freshmen, sophomores, and juniors. This study entails the comparison of assessment data gained through the implementation of the proposed system with the data derived from the pre-existing evaluation system employed by the school. The integration of school evaluation data with the evaluation data derived from the multidimensional quantitative teaching quality system holds promise for synergistic advantages. The utilization of a multi-dimensional and multi-perspective strategy facilitates the collection of diverse viewpoints from multiple stakeholders, hence assisting educators in identifying and addressing deficiencies in their endeavors to enhance the quality of their teaching practices.

5. RESEARCH CHALLENGES AND KEY POINTS

Investigating the Extensive Disparities in Multi-Dimensional Stakeholder Focus on the Quality Evaluation Indicators of "Landscape Ecology" Instruction: The primary objective of this study is to conduct a complete examination of the variations in the attention given by several stakeholders to the quality evaluation indicators of the "Landscape Ecology" course. This will be achieved via the gathering of relevant data. Participants are solicited to complete questionnaires and participate in interviews in order to assess the quality measurement indicators of teaching at Guangdong Technology College, drawing on their own experiences. This study utilizes descriptive statistical analysis to investigate the impact of various elements on the evaluation system for teaching quality in the field of "Landscape Ecology." This is achieved by comparing and summarizing the indicator preferences and particular reasons of different stakeholders. The primary objective of this study is to ascertain the dimensions and measuring elements that are acknowledged by specialists, teachers, students, supervisors, and enterprises for evaluating teaching quality in the field of "Landscape Ecology."

Exploring the Rational Connections between Five Dimensions and the Evaluation System for Teaching Quality in "Landscape Ecology" by Multi-Quantitative Analysis: The primary objective of this study is to investigate the correlations between five distinct aspects, namely expert evaluation, student evaluation, teacher self-evaluation, supervisor evaluation, and enterprise evaluation, and the assessment system for evaluating the quality of "Landscape Ecology" instruction. This will be achieved through the application of various quantitative analysis techniques. Various quantitative data analysis approaches possess both strengths and weaknesses. For example, principle component analysis does not incorporate expert weighing in the formation of indicators, but the analytic hierarchy approach encounters difficulties in categorizing primary indicators of similar characteristics for the purpose of identifying shared principal evaluation indicators. However, the utilization of IPA quadrant analysis has proven to be an excellent method for identifying areas in teaching quality evaluation that require improvement. Hence, the primary obstacle resides in investigating the optimal integration of diverse quantitative analysis methodologies for the study of the assessment system pertaining to teaching quality.

Suggesting Approaches for Managing Scientific Evaluation Systems Drawing from the "Landscape Ecology" Teaching Quality Evaluation System: The establishment of a teaching quality evaluation system using multi-quantitative analysis is of utmost importance. However, it is equally necessary to implement appropriate management approaches to ensure the smooth functioning of the system. These approaches facilitate the completion of teaching quality evaluations and feedback by students, adhering to procedural norms. Simultaneously, teachers can rapidly modify their teaching strategies in response to the feedback received from the evaluations. The incorporation of a scientific assessment system for evaluating teaching quality, along with the implementation of associated management strategies, enables a positive feedback loop of advancement for the "Landscape Ecology" course.

6. PROPOSED RESEARCH FRAMEWORK

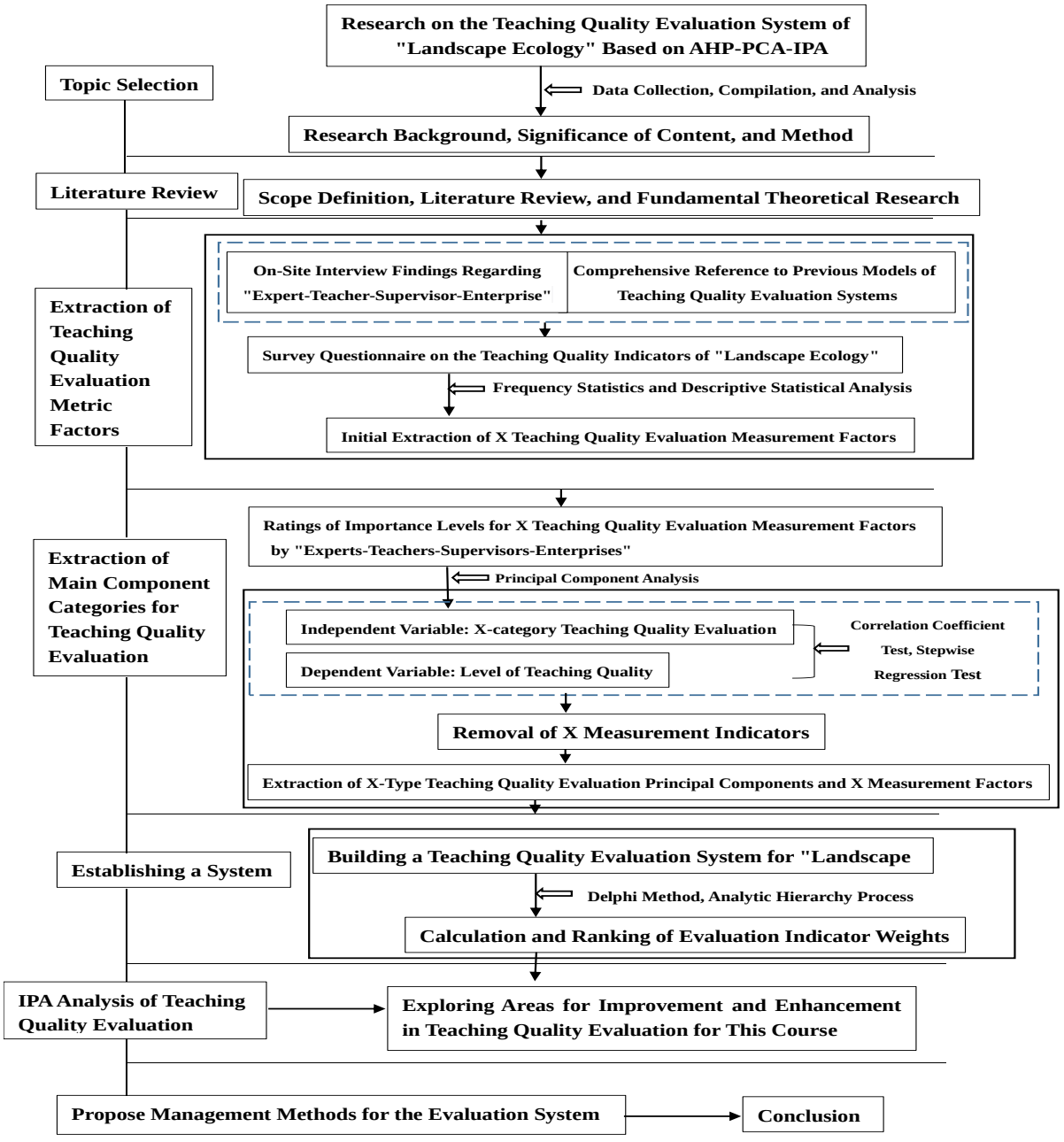

Figure 1: The Conceptual Framework

7. RESEARCH DESIGN

7.1 Principal Component Analysis Method (PCA)

7.1.1 Selection of Research Subjects

Based on the unique specificity and multidimensionality of the research in this paper, the research subjects are categorized into five groups: landscape architecture experts and professors, teaching supervisors with relevant disciplinary experience from Guangdong Technology College and Zhao Qing College, students majoring in landscape architecture from the 20th, 21st, and 22nd grades at Guangdong Technology College, as well as teaching staff, and employees from organizations such as the Forestry Science Research Institute of Zhao Qing City, Landscape Design Institute of Guangdong Province Transportation Planning & Design Research Institute, China Communications International Landscape Design Institute, and others.

7.1.2 Questionnaire Distribution

The survey activity is divided into two phases: in September 2023, questionnaires and interviews are distributed to the 21st and 22nd grade landscape architecture students and teaching staff of Guangdong Technology College; in October 2023, questionnaires and interviews are distributed to landscape architecture experts, professors, supervisors, and researchers from relevant industry enterprises. The survey takes the form of online and offline questionnaires, along with random interviews. A total of 300 questionnaires are planned to be distributed to the five categories of respondents (200 from Guangdong Technology College students, 50 from experts and disciplinary supervisors, and 85 from researchers of relevant enterprises), with a target effective response rate of over 90%.

Questionnaire Content

The content mainly involves collecting demographic characteristics of experts, supervisors, teachers, and employees, as well as conducting a survey on the indicators of teaching quality in "Landscape Ecology" from the perspective of the "Expert-Teacher-Supervisor-Enterprise" (Questionnaire 1). This survey focuses on five dimensions: expert assessment, student evaluation, teacher self-assessment, supervisor evaluation of lessons, and enterprise evaluation of excellence. Each dimension contains several optional questions (single-choice or multiple-choice) for respondents to select from. The final selection of teaching quality evaluation metrics is based on descriptive statistical results, which collectively represent the common concerns and acknowledgments of the "Expert-Teacher-Supervisor-Enterprise. The extracted significant teaching quality evaluation metrics related to visitors' perceived value from Section 1 of the questionnaire are used as options for Questionnaire 2. In this questionnaire, the expert-teacher-Supervisor-Enterprise" rates the importance of these metrics (the same number as in Questionnaire 1) using the Likert five-point scale rating method ("very unimportant, not very important, moderately important, quite important, extremely important"), corresponding to values 1 to 5. Sample rating data obtained from Questionnaire 1 is treated as a numerical variable available for analysis. Scientific and appropriate linear combinations of the original numerical variables are conducted using SPSS 17.0 software to create new variables and successfully extract principal components with information contribution rates greater than eigenvalue 1 from the sample rating data. These principal components constitute the dimensions of the extracted teaching quality evaluation factors in "Landscape Ecology. Based on the common characteristics reflected by the measurement factors included in each evaluation dimension, the factors are named for each teaching quality evaluation dimension. This results in the expert-teacher-Supervisor-Enterprise" recognized dimensions

of teaching quality evaluation in "Landscape Ecology" and their measurement factors. Additionally, in Questionnaire 2, the "Expert-Teacher-Supervisor-Enterprise" will rate the level of teaching quality development in "Landscape Ecology," following the same rating principles. Subsequently, using SPSS 17.0, correlation analysis and stepwise regression analysis are performed on the two numerical variable datasets (importance of significant teaching quality evaluation metrics and level of teaching quality development). After excluding teaching quality evaluation metrics that are not related to the level of teaching quality development, the final teaching quality evaluation system for "Landscape Ecology" is determined. Based on this, corresponding management measures for the evaluation system are formulated.

7.2 Analytic Hierarchy Process (AHP)

7.2.1 Selection of Research Subjects

The author plans to invite a total of 23 experts, including 5 full-time teachers specializing in plant landscape from the Department of Landscape Architecture at the School of Construction, Guangdong Technology College, 3 landscape architecture industry expert professors, 5 teaching supervisors from Guangdong Technology College and Zhao Qing College, 5 research experts from related industry enterprises, and 5 doctoral students majoring in landscape architecture.

7.2.2 Questionnaire Distribution and Content

In November 2023, the author will distribute the weighted survey questionnaire (Questionnaire 3) to the experts through WeChat, email, or face-to-face interactions. A total of 23 questionnaires will be distributed, allowing each expert to compare and rate the importance of indicators at the same level. This process will result in the establishment of judgement matrices for the first-level indicator layer relative to the overall goal layer and the second-level indicator layer relative to the first-level indicator layer. Subsequently, Excel will be used to calculate the weights of the first-level and second-level indicator layers and perform a consistency test with $CI < 1$. The calculated weights of each indicator in the second-level indicator layer will be multiplied by the corresponding weights of the first-level indicator layer to obtain the composite weights of the second-level indicator layer. Finally, a consistency test will be conducted to ensure $CI < 1$ for the overall hierarchy ranking. In order to understand the actual performance and management suggestions for the teaching quality of "Landscape Ecology," the author has designed a rating questionnaire for the 21st and 22nd grade landscape architecture students at Guangdong Technology College. To ensure uniformity, convenience, effectiveness, and comparability of the research, this questionnaire will be combined with Questionnaire 3 to form a comprehensive survey questionnaire. The process involves two main steps: (1) clarifying the rating criteria for each measurement indicator, dividing them into five levels: very poor (1 point), poor (2 points), fair (3 points), good (4 points), and excellent (5 points). Once the questionnaire is designed, it will be distributed to the 21st and 22nd grade landscape architecture students at Guangdong Technology College and collected on the spot. (2) Excel will be used to calculate the average rating for each measurement indicator, multiply it by its composite weight, and finally derive the score for each measurement indicator.

7.3 IPA Quadrant Analysis Method Questionnaire Content

In Questionnaire 3, based on the performance rating data provided by the 21st and 22nd grade landscape architecture students at Guangdong Technology College, we conducted an analysis of their satisfaction with the teaching quality of "Landscape Ecology. Subsequently, we performed an IPA analysis by considering the mean importance and actual performance of the teaching quality evaluation

dimensions and their measurement factors. The IPA quadrant chart places the importance of teaching quality evaluation dimensions and their measurement factors, along with their actual performance, into a two-dimensional grid. This visually presents the distribution of different teaching quality evaluation dimensions and their measurement variables. This method helps figure out how to improve the "Landscape Ecology" teaching quality evaluation system and create a more thorough and effective way to manage the evaluation system. It also makes sure that the whole teaching quality assessment and management system works well, taking into account the needs of experts, supervisors, faculty, students, and businesses.

8. LIMITATION

8.1 Scope Limitation

The present study is confined to the examination of the "Landscape Ecology" course offered at Guangdong Technology College, without considering other courses or institutions. Hence, it should be noted that the findings and conclusions of this study may not readily lend themselves to broad generalization across other courses or institutions.

8.2 Sample Size and Representativeness

The potential limitation of the study lies in the restricted sample size of participants, which may have implications for the extent to which the findings can be generalized. Furthermore, it is vital to acknowledge that the sample used in this study may not comprehensively encompass all relevant stakeholder groups, which could result in the exclusion of significant perspectives.

8.3 Subjectivity of Evaluation Criteria

The process of determining evaluation criteria and indicators entails a certain level of subjectivity, as various stakeholders may assign varying degrees of importance to different facets of teaching quality. The presence of subjectivity has the potential to impact the outcomes and interpretations of the research.

8.4 Complexity of Analysis Methods

The integration of Analytic Hierarchy Process (AHP), Principal Component Analysis (PCA), and Importance-Performance Analysis (IPA) approaches provides a holistic framework for analysis. However, the intricate nature of these techniques may provide difficulties in interpretation and introduce the possibility of errors during the analysis procedure.

8.5 Temporal Limitation

The conclusions of the study may be subject to the effect of the particular time period in which the data was gathered and the prevalent circumstances that existed during that period. The aforementioned conditions may not provide a realistic depiction of the current dynamics within the realm of evaluating instructional quality.

8.6 External Factors:

The study does not consider possible external factors, such as alterations in educational policy or fluctuations in socio-economic conditions, that may influence the efficacy and applicability of the proposed assessment system for evaluating teaching quality.

8.7 Cultural and contextual variations

The outcomes and suggested remedies of the study can be impacted by the distinct cultural and contextual elements inherent to the study's setting, hence limiting its generalizability to other locations characterized by diverse educational and cultural contexts.

8.8 Long-Term Impact

The study may not comprehensively assess the enduring effects and viability of the proposed

teaching quality rating system in the long run. Evaluating the long-term efficacy and pertinence of the system is of utmost importance.

8.9 Limitations in Resources

The successful implementation of the suggested system for evaluating teaching quality and its associated management approaches may necessitate supplementary resources and institutional backing, hence posing practical obstacles in terms of financial, technological, and personnel aspects.

Taking into account these constraints and including them into the analysis of the study's results helps bolster the reliability and relevance of the research findings.

9. RESEARCH FINDINGS

9.1 Effectiveness of Multidimensional Evaluation Model

The "AHP-PCA-IPA" multidimensional and multiquantitative data evaluation model employed in the study demonstrated outstanding effectiveness in empirical applications. The integration of Analytic Hierarchy Process (AHP), Principal Component Analysis (PCA), and Importance-Performance Analysis (IPA) allowed for a more comprehensive and objective assessment of the teaching quality in "Landscape Ecology." The implementation of this model provided a scientific foundation for identifying crucial teaching quality indicators.

9.2 Stakeholder Perspectives and Preferences

The research delved into the perspectives of stakeholders such as experts, teachers, students, supervisors, and businesses, revealing their unique preferences in assessing teaching quality. By synthesizing these viewpoints, a better understanding of diverse evaluation needs was achieved, providing a basis for designing a flexible evaluation system.

9.3 Practical Application of Teaching Quality Evaluation System

Successful implementation of the teaching quality evaluation system in "Landscape Ecology" revealed its practical impact on elevating teaching practices. Utilizing expert opinions, student feedback, and industry insights, a comprehensive evaluation system was established, offering a viable approach for the sustainable development of education.

9.4 Key Findings from Evaluation Results

The study unveiled critical discoveries in teaching quality assessment, including different stakeholder emphases on indicators, variations between faculty self-assessment and student evaluations, and potential areas for improving teaching quality. Specifically, the following key indicators were identified:

Expert Assessment: Experts universally focused on the disciplinary depth and practical applicability of course design.

Student Assessment: Students emphasized the liveliness and interactivity of teaching methods, as well as the practicality of course materials.

Faculty Self-Assessment: Faculty highlighted communication and feedback with students, as well as the innovation of teaching techniques.

Supervisor Assessment: Supervisors concentrated on the management and organization of the teaching process, along with the updating of subject knowledge.

Business Assessment: Businesses were more concerned with students' practical abilities and their capacity to solve real-world problems.

9.4.1 Expert Assessment Indicators

Key assessment indicators in expert evaluation included:

Disciplinary Depth: Whether course design covered a wide and in-depth range of disciplinary knowledge.

Practical Applicability: Whether course content could be applied in real scenarios and had guiding significance for solving practical problems.

9.4.2 Student Assessment Indicators

Students, with unique concerns about teaching quality, emphasized the following key indicators:

Vividness and Interactivity: Whether teaching was engaging and could foster student interaction and participation.

Practicality of Course Materials: Whether course materials were practical and provided solutions to real-world problems.

9.4.3 Faculty Self-Assessment Indicators

Faculty specified evaluation indicators for their own teaching practices, including:

Communication and Feedback with Students: Whether faculty actively communicated with students and were adept at receiving and responding to student feedback.

Innovation in Teaching Techniques: Whether faculty employed innovative technological means in teaching to enhance effectiveness.

9.4.4 Supervisor Assessment Indicators

Supervisors focused on the management and organization of the teaching process, evaluating:

Management and Organization of Teaching Process: Whether teaching was orderly and management was efficient.

Updating of Subject Knowledge: Whether faculty timely updated subject knowledge to maintain professional competitiveness.

9.4.5 Business Assessment Indicators

Businesses presented specific assessment indicators, including:

Actual Abilities: Whether students possessed practical abilities suitable for real-world work.

Problem-Solving Skills: Whether students could solve real-world problems and handle workplace challenges.

10. RECOMMENDATIONS

10.1 Refinement of Indicator System

To better align with stakeholder expectations, the following recommendations are proposed for further refining evaluation indicators:

Expert Assessment: Expand specific dimensions of disciplinary depth, ensuring coverage of a broader range of professional fields. Deepen the detailed portrayal of practical applicability, focusing on how theoretical knowledge translates into practical operational capabilities.

Student Assessment: Delve deeper into the connotations of vividness and interactivity, emphasizing teaching methods like case analysis and group discussions. Specify expectations for practical skills students should acquire through the course.

Faculty Self-Assessment: Strengthen specific means of communication and feedback with students, such as establishing regular communication channels. Pose more specific requirements on innovative teaching technologies, encouraging faculty to explore new teaching methods.

Supervisor Assessment: In the management and organization of the teaching process, explicitly focus on aspects such as classroom discipline and efficient use of teaching resources. Regarding the update of subject knowledge, require periodic participation in relevant industry seminars.

Business Assessment: Provide specific expectations for professional skills and soft skills that students should possess in terms of actual capabilities. Specify requirements for problem-solving abilities through detailed explanations of real cases.

10.2 Customized Management Measures

Tailor management measures based on different dimensions of the evaluation results:

Expert Assessment: Suggest organizing regular professional seminars, inviting experts to share the latest disciplinary knowledge and application trends. Encourage expert participation in practical case studies to better understand how theoretical knowledge functions in practice.

Student Assessment: Advocate for the implementation of practical projects, allowing students to apply theoretical knowledge to real projects. Propose the establishment of a student feedback group to regularly collect opinions and suggestions on teaching, facilitating timely adjustments to teaching methods.

Faculty Self-Assessment: Provide training and workshops for faculty on innovative teaching methods, encouraging the adoption of new teaching technologies and tools. Establish regular teaching salons to promote the sharing of experiences and exchanges among faculty.

Supervisor Assessment: Recommend that supervisors regularly participate in classroom observations to strengthen their focus on classroom management and organization. Provide lifelong learning opportunities for supervisors to ensure they maintain professional expertise in relevant fields.

Business Assessment: Establish closer partnerships with enterprises, involving industry professionals in curriculum design and assessment. Organize regular internships or project practices for students to cultivate the practical skills required in the workplace.

10.3 Continuous Improvement and Adaptability

Regular Evaluation Cycles: Suggest establishing a systematic evaluation cycle to promptly adjust and improve the evaluation system. Regular evaluations can capture trends in teaching quality changes, better adapting to the constantly changing educational environment.

Stakeholder Participation: Encourage all stakeholders to participate in the construction and optimization of the evaluation system. Hold regular stakeholder meetings to gather their opinions and suggestions, ensuring that the evaluation system is closer to actual needs.

Transparency and Communication: Recommend establishing a comprehensive information transparency mechanism, publicly disclosing evaluation standards, processes, and results to all stakeholders. Through regular communication, enhance understanding and trust in the evaluation system.

Professional Development Opportunities: Provide diverse professional development opportunities for faculty, including participation in academic seminars, teaching training, and industry exchange activities. This helps improve faculty teaching levels and professional competence.

10.4 Rational Resource Allocation

Technical Support and Facility Investment: Ensure the effective operation of the evaluation system by providing adequate technical support and teaching facilities. Recommend investing appropriate funds to update technical equipment and enhance the digitization of evaluations.

Human Resources: Ensure a rational allocation of a professional team responsible for the design, implementation, and analysis of the evaluation system. Train team members to ensure they possess sufficient professional knowledge and skills.

Financial Support: Provide necessary financial support for the evaluation system to ensure its sustainable operation. Establish partnerships with relevant enterprises to share resources and

collaboratively promote the improvement of teaching quality.

11. CONCLUSION

The management measures for the teaching quality evaluation system involve designing and implementing strategies to ensure the effective functioning of the evaluation process. These measures are crucial for maintaining and enhancing the overall quality of education.

On the one hand, the current stage of the reform of the conventional teaching quality evaluation system and the higher education teaching quality evaluation system is of utmost importance. In the contemporary climate, it is imperative to implement bold reforms and adopt creative practices in order to effectively adapt to the rapid speed of societal and technological advancements. The use of multi-dimensional indicators for evaluating teaching quality has emerged as a significant component of the assessment of teaching quality in higher education. However, there is a limited amount of study on this particular element in China, resulting in substantial research gaps, particularly in the examination of higher education teaching quality evaluation using a multi-dimensional quantitative approach. The use of the "AHP-PCA-IPA" multidimensional and multi-quantitative data evaluation model offers a logical and systematic basis for the development of indicators to assess teaching quality. This approach overcomes the constraints associated with subjectivity in conventional techniques of evaluating teaching quality, such as qualitative assessments that heavily rely on subjective judgements and single-dimensional quantitative approaches.

On the other hand, to ensure the normal operation of the higher education teaching quality evaluation system, it is essential to establish scientifically effective management methods. The following outlines the key components of the management measures:

Framework Establishment and Clarity: Develop a clear and well-defined framework for the teaching quality evaluation system. This framework should encompass the objectives, criteria, and indicators for evaluating teaching quality. It should also outline the roles and responsibilities of various stakeholders, including faculty, students, administrators, and external experts.

Data Collection and Analysis: Implement a systematic approach to collecting data for evaluation. This may include surveys, assessments, and feedback mechanisms. The collected data should undergo rigorous analysis to derive meaningful insights into teaching effectiveness and student satisfaction.

Regular Evaluation Cycles: Establish a regular cycle for conducting teaching quality evaluations. This could be done annually, semester-wise, or as per the academic calendar. Regular evaluations enable the identification of trends, areas for improvement, and the tracking of progress over time.

Stakeholder Engagement: Engage all relevant stakeholders in the evaluation process. Encourage faculty members to reflect on their teaching practices, involve students in providing feedback, and consider inputs from external experts in the field.

Feedback Mechanisms: Implement effective mechanisms for providing feedback to faculty members based on evaluation results. Constructive feedback can guide instructors in making improvements to their teaching methods and approaches.

Transparency and Communication: Ensure transparency in the evaluation process by communicating the evaluation criteria, process, and outcomes to all stakeholders. This transparency builds trust and credibility in the evaluation system.

Continuous Improvement: Use evaluation results as a basis for continuous improvement. Identify strengths and weaknesses in teaching quality and take corrective actions to enhance the overall educational experience.

Professional Development: Provide faculty members with opportunities for professional development based on evaluation outcomes. Offer workshops, training sessions, and resources to help instructors refine their teaching skills.

Resource Allocation: Allocate resources effectively to support the implementation of the evaluation system. This includes providing technological infrastructure, human resources, and financial support as needed.

Adaptability: The management measures should be flexible and adaptable to changing educational trends, technologies, and needs. Regularly review and update the evaluation system to align it with the evolving landscape of higher education.

By implementing these management measures, educational institutions can establish a robust and effective teaching quality evaluation system that contributes to the continuous improvement of teaching practices and overall educational excellence.

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