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Interdisciplinary Teaching Reform of Financial Engineering Majors Based on the Analytic Hierarchy Process in the Post-Pandemic Era

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Abstract: In the post-epidemic era, the labor market has become increasingly complex, making it even more crucial to incorporate sustainability into employment demand. As we enter the post-pandemic era, a globalization trend has become more apparent. It is crucial to modernize employability through educational reform in order to assist employees in enhancing their professional skills. This study began by analyzing the importance of financial engineering practice instruction and graduate employability in the post-epidemic era. Second, the study proposed the content and a plan for interdisciplinary teaching reform to address talent cultivation needs based on labor market requirements. Third, a face-to-face survey and interview were conducted with students affected by changes in teaching, and the results were analyzed and summarized. On this basis, the impact of education reform was evaluated using both the expert scoring method and the analytic hierarchy approach. The results indicated that the suggested financial engineering teaching reform program improved the school's discipline strength, enrollment rate, employment rate, and competition awards, especially discipline strength. This research can be used to inform the teaching of financial engineering majors in various countries, assist job candidates in enhancing their professional skills, and build a formidable talent pool for the labor market.

Keywords: post-pandemic era; teaching reform; professional competency development; talent cultivation; analytic hierarchy process

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1. Introduction

In the post-epidemic era, sustainable development in education has become a crucial concern; therefore, higher education institutions should provide more training opportunities in this area [1,2]. It is uncertain whether current and future generations will survive due to the COVID-19 epidemic, which has made it more difficult for workers to obtain an education and obtain employment. Therefore, it is essential to integrate sustainability into employment [3]. As a consequence of the COVID-19 outbreak, significant changes have been made to the financial engineering curriculum, which has shifted from an offline to an online format. The effective implementation of the teaching process for financial engineering majors in the post-epidemic era still faces numerous challenges, including a lack of scientificity in the curriculum system and environments, a lack of innovation in teaching technology, and a lack of adaptability in practical teaching, among other examples. Practical teaching is a method of instruction that emphasizes experiential learning and the application of knowledge in real-world situations. It typically consists of activities such as experiments, simulations, case studies, and problem-solving exercises that allow students to develop practical skills and acquire field-specific experience. The objective is to help students apply what they have learned to solve real-world problems and prepare them for the challenges they will confront in their careers [4]. These challenges make it difficult to achieve positive outcomes in terms of teaching efficacy and quality, as well as

the efficient development of students' practical and innovative skills. Recently, experts and academics have become interested in the creative employability and professional skill development of financial engineering graduates. In the post-epidemic era, the interdisciplinary teaching reform of financial engineering majors is especially important for training highly comprehensive and interdisciplinary financial talent [5].

Financial engineering is an interdisciplinary field that enables analysts to optimize and analyze numerous financial decisions, such as risk management, financial portfolio planning, forecasting, trading, hedging, and fraud detection [6–8]. Inter-disciplinary instruction can be used to establish and strengthen effective classroom teaching strategies, as well as to enhance key comprehension and recognition [9]. This article explores interdisciplinary teaching reform that integrates financial technology variables such as big data, cloud computing, artificial intelligence, and blockchain technology into the typical financial engineering curriculum. In the post-epidemic era, labor market demand can be addressed more effectively through interdisciplinary teaching reform and instruction that assists graduates in adapting to the labor market.

This study aims to evaluate the effectiveness of educational reform. This paper examines the significance of financial engineering practice teaching and graduate employability in the post-epidemic era and proposes an interdisciplinary financial engineering teaching reform plan based on the traditional financial engineering curriculum system and related theories. Students who actively participated in the interdisciplinary teaching reform were asked to complete a questionnaire and participate in in-depth interviews in order to collect original data for evaluating the reform's impact. On this basis, along with the expert scoring method and hierarchical analytic process, the effect of this interdisciplinary teaching reform is evaluated, and the experience and defects of this teaching reform are evaluated based on the evaluation effect. The report concludes by summarizing the teaching reform and long-term talent development of financial engineering majors in order to aid graduates in adapting to the labor market and to cultivate a large pool of graduates for the labor market.

The novel aspect of this study is the implementation of a pilot interdisciplinary teaching reform program with financial engineering majors from 11 Wenzhou colleges and universities. The sample selection is unique, and the evaluation data on the impact of teaching reform are all factual, first-hand information that can be applied in a scientifically sound and practical manner. In conjunction with the expert scoring method and the analytic hierarchy process, the relevant authoritative departments and industry experts in our city have been chosen to evaluate the effect of the teaching reform. A questionnaire and in-depth interviews with students are included in the evaluation of the impact of the teaching reform. The evaluation procedure may be replicated and enhanced. This paper contributes by serving as a model for colleges and universities as they implement initiatives and programs to reform interdisciplinary instruction. It also makes a concerted effort to incorporate the analytic hierarchy process into college and university teaching reform initiatives. By evaluating the efficacy of this change in cross-disciplinary teaching, graduates' employability can be enhanced through teaching and learning.

2. Literature Review

2.1. Teaching Reform

Teaching reform is a dynamic and complex social activity that involves a multitude of factors and necessitates accurate analysis and argumentation to achieve the desired outcomes [10]. Teaching reform is one of the most effective methods to improve college students' learning ability and interest, and it also guides the primary direction of teachers' instruction [11]. Sievedova analyzed the factors, such as instructors, students, and teaching resources, that influence teaching reform in colleges and universities. These factors determine the importance and necessity of teaching reform to satisfy the innovation and talent needs of society [12–14]. He outlined the problems associated with the transformation of teaching mode, the revision of teaching objectives, and the presentation of teaching outcomes, and enacted reforms in response. However, his research focuses excessively

on theory, which is not conducive to the development of substantive teaching reform [15]. Magnus et al. [16] presented the development and implementation of an experimental teaching platform in the educational system. The platform consists of a simulation teaching system that facilitates the systematic development of pertinent experimental courses, thereby enhancing student learning, professional formation, and motivation for practical activities. The primary contribution of Srinivasa et al.'s [17] research is experimental validation for the application of Internet of Things technology in the economics and management teaching system. The implementation of the Internet of Things and pervasive computing in the teaching process can aid instructors in gaining a better understanding of their students, thereby enhancing learning efficiency and facilitating communication. During the COVID-19 pandemic, Yao et al. [18] studied the teaching reform methods of the pathophysiology teaching team at Tongji University. By contrasting the efficacy of traditional teaching methods, they discovered that the percentage of students with higher final exam scores ($\geq$90 points) has increased. Diversifying classroom teaching methods has facilitated the learning of some students and improved their enthusiasm and academic performance.

2.2. Reform of the Teaching Mode of Engineering Courses

The reform of engineering course instruction is of practical importance. On this basis, there are an increasing number of documents concerning the reform of the teaching method for engineering courses in application-focused undergraduate institutions. Tian et al. analyzed exhaustively the research status of the teaching paradigm of engineering courses in China and the incorporation of BIM into the teaching of specialized courses [19]. He proposed a "five-in-one" teaching paradigm that incorporates scene creation, new knowledge exploration, knowledge application, thinking training, and teamwork. Wu et al. [20] proposed a blended learning environment that can facilitate face-to-face learning activities in the classroom and allow students to "learn while doing". Their model test results indicate that the blended learning environment, which combines classroom-based and online learning, is generally accepted by all participating students and can increase students' acceptance of a blended learning strategy that combines classroom and online learning. Through "learning while doing" and discussions with internal and external partners, students can enhance their learning outcomes and problem-solving abilities. Estébanez argued that the reform of classroom teaching modes should center on the online class of large-scale open online courses and should be founded on cooperative learning, which can promote the reform of teaching modes in independent colleges and improve the quality of instruction [21]. Engineering training courses play a crucial role in developing the innovative spirit, practical skills, and engineering awareness of college students. Enriching educational resources, optimizing the educational evaluation system, and enhancing the optimization and reform of teaching models such as the practical teaching system can effectively improve the quality and level of engineering education, as well as students' innovative spirit and practical ability [22].

2.3. Discipline System of Financial Engineering

Risks and uncertainties attract a great deal of research for developing complex quantitative models to manage these financial risks, as financial operations are typically associated with large capital flows. The term "financial engineering" was coined using modern information technology. Financial engineering is a multidisciplinary field in which analysts optimize and analyze a variety of financial decisions, such as risk management, financial portfolio planning, forecasting, trading, hedging, and fraud detection [7–10]. It seeks to cultivate high-level, applied financial professionals who are proficient in the fundamental operating rules of financial institutions and businesses as well as the fundamental application skills of financial engineering.

Today, the field of financial engineering has effectively incorporated a variety of quantitative analysis disciplines, including mathematics, statistics, time series, stochastic processes, data mining, and artificial intelligence. Increasing evidence demonstrates

that mathematical distributions and statistical models do not limit the financial environment [16,17]. The majority of current research in computer science employs soft computing techniques to develop more adaptable financial engineering models. In their research, Eğrioğlu et al. [23] propose a new bootstrap hybrid artificial neural network method for predicting stock exchange transaction data. This technique produced more stable and accurate results than the previous benchmark prediction method. Gao analyzed the application of machine learning and data mining technology in the prevention of financial risks; established an analytic hierarchy process evaluation model from five dimensions of solvency, operating ability, profitability, growth ability, and cash flow ability to analyze the financial risks of listed companies; and achieved good prediction results [24]. Huang et al. [25] combined deep learning and canonical correlation analysis (CCA) to develop a new rating prediction system. Using the financial statements of companies trading on Taiwan's securities market, they found that the new model's prediction accuracy is superior to that of traditional data mining techniques. Within the regulatory framework of Basel II and III, the use of models has gradually become an integral element of global banking and financial services activities on the financial market. The trend of financial market development, from financial engineering to model risk management, is of strategic significance to financial institutions and regulators [26]. Teaching reform of financial engineering majors can enhance discipline strength, which refers to the comprehensive strength of a discipline in academic research, teaching level, talent cultivation, and other aspects; the reform should conform to the development of the times, incorporate financial technology factors, and cultivate innovative financial talents [27].

2.4. Curriculum Evaluation Methods

Evaluation methods are used to measure output performance and estimate expectations in various fields [28–31]. Most of the research on curriculum evaluation focuses on the establishment of evaluation dimensions and index systems at present [32–36].

2.4.1. Research on Evaluation Dimension

As a multidimensional evaluation index, curriculum quality can be evaluated from a variety of perspectives and categorized in a variety of methods [32]. The curriculum quality evaluation index system of American colleges and universities includes not only the quantitative evaluation of instructors' instruction, but also the evaluation of the curriculum setting and the content of the corresponding configuration. Marsh (1987) proposed nine dimensions for evaluating teaching quality: learning value, teaching enthusiasm, organizational clarity, group interaction, interpersonal harmony, knowledge breadth, examination score, homework assignments, etc., encompassing evaluation indicators [33]. Marsh and Dunkin (1992) proposed five evaluation dimensions, including teaching skills, teacher–student relationships, structure, and organization [34]. Kolitch (1999) suggested four evaluation dimensions: curriculum organization, behavior management, evaluation of student achievement, and teacher–student relationships [35].

2.4.2. Research on the Evaluation Index System

Due to the various evaluation angles and evaluation index systems, there is no unified standard for university course quality evaluation index systems. For instance, the University of Washington's teaching evaluation system (IAS: Instructional Assessment System), the University of Arizona's teacher curriculum evaluation system (TCE: Teacher-Course Evaluation), Kansas State University's IDEA: Individual Development and Educational Assessment, etc.

A student-centric evaluation index system is in place. Marsh's (1981) [36] questionnaire for evaluating a teacher's teaching quality (Student's Evaluation of Educational Quality, or SEEQ for short) is the most representative and extensively used scope. It comprises indicators as well as nine dimensions of learning value, teaching attitude, organizational clarity, teaching interaction, interpersonal relationships, breadth of knowledge, examina-

tion scores, assignment volume, and teaching difficulty. The Columbia Teachers College Student Assessment Form includes quantitative evaluation indicators, inquiries regarding background characteristics, and narrative questions. The quantitative indicators comprise four sections: the course description, the course discussion, the course homework and evaluation, and the course overall. Students respond by selecting from six options: extremely satisfied, satisfied, neutral, dissatisfied, extremely dissatisfied, and not applicable [37].

2.4.3. Introduction to the Analytic Hierarchy Process

The analytic hierarchy process (AHP) is a combination of qualitative and quantitative decision analysis methods developed by American business researchers and Professor T. L. Saaty of the University of Pittsburgh [38,39]. The analytic hierarchy process (AHP) is a hierarchical weight decision analysis method that utilizes network system theory and a multicolored comprehensive evaluation technique. In this method, factors are organized into multiple hierarchical structures based on their distinct characteristics and dominance relationships, and then the pairwise comparison method is used to calculate and arrange the relative importance of various factors. The calculation is systematic and logical, based on decomposition, pairwise comparison, and comprehensive ranking processes. It accomplishes a high degree of adaptability in the face of a dearth of quantitative data or strong subjective preferences. Additional indicators will increase the quantity of data and complicate the calculation process. We are only able to select the finest of existing options and cannot provide any new ones.

In conclusion, the existing research has yielded a number of accomplishments in the areas of teaching reform content, engineering teaching reform practice, financial engineering development trends and challenges, teaching effect evaluation methods, and other areas. However, the existing literature has largely neglected to investigate the teaching modes of professional courses from the standpoint of financial technology backgrounds and inter-disciplinary development trends. In the context of financial technology, it is worthwhile to investigate how to assist students effectively and systematically learn and develop their cognitive structure of the financial industry. This paper presents the content and plan of inter-disciplinary teaching reform in the post-pandemic era and evaluates the impact of teaching reform by combining the expert scoring method and the analytic hierarchy process.

3. Methodology

AHP offers the concept of hierarchy when handling problems related to a number of criteria and alternatives [40]. In this model, factors involved in the corresponding level are compared in a pairwise manner, and a numeric scale is designed to calibrate the subsequent results. AHP usually employs the following subsections [41,42].

(1) Establishing a Hierarchical Structure Model of the Analytic Hierarchy Process

Hierarchical problems must be investigated, and a multilevel structure model is constructed. Typically, the levels are divided into the three categories below: the objective of the first level is to resolve an issue, and only one element is permitted. The problem-solving criterion is the intermediate layer (criterion layer), and this level is typically one or two layers. The second layer is commonly referred to as the subcutaneous layer; it is a decomposition of the first layer's components and contains the necessary components to reach the target layer. The lowest level (solution layer) represents the solution to the problem, while the highest level represents the optimal solution.

(2) Construct Judgment Matrix

On the middle tier (rule layer), as the analytic hierarchy process progresses after the class structure model is established in this paper, the two elements are compared, and the relative significance of these numerical representations, structure importance, and comparative judgment matrix is determined. Consider there to be n factors in the sub-criteria layer [43–45]. When comparing the importance of n factors to the indicators of the

previous layer, refer to the nine-point judgment scale table of the analytic hierarchy process (AHP), as shown in Table 1, and use $a_{i,j}$ to represent the comparison result of the ith factor with the jth factor. The judgment matrix C shall meet the formula $a_{i,j} = 1/a_{j,i}$. Construct an $A = (a_{i,j})$ $n \times n$ judgment matrix.

Table 1. Nine-point judgment scale table of the analytic hierarchy process.

$a_{i,j}$	Definition	Explanation
1	A_i and A_j are equally important	The preference of the two comparison schemes is of equal importance
2	Between equally important and slightly important	Must be used in the middle
3	A_i and A_j are slightly more important	Slightly like A_i scheme
4	Between slightly important and relatively important	Use when making a compromise
5	A_i and A_j are important	Strong preference for A_i solutions
6	Between relatively important and very important	Use when making a compromise
7	A_i and A_j are very important	Strong preference for A_j solutions
8	Between very important and absolutely important	Use when making a compromise
9	A_i and A_j are absolutely important	Definitely prefer A_i solutions

According to Table 1, ask questions similar to the following:

Q1: Based on the above table, please compare the importance of elements *i* and *n*.

A1: Element *n* is slightly more important than element *i* (between equally important 1 and slightly important 3).

Q2: Based on the above table, please compare the importance of elements *i* and *j*.

A2: Element *i* is slightly more important than element *j* (between 3 and 5).

Based on the above questions, construct the judgment matrix in Table 2.

...

Table 2. Judgment matrix of elements in the middle layer (criterion layer) to target layer A.

	$\mathbf{A_1}$	...	$\mathbf{A_i}$	...	$\mathbf{A_n}$
A_1	a_{11}	...	a_{1i}	...	a_{1n}
...	...	...		...	
A_j	a_{j1}	...	a_{ji}	...	a_{jn}
...	...	...		...	
A_m	a_{m1}	...	a_{mi}	...	a_{mn}

(3) Hierarchical Single Ranking

Hierarchical single ranking is used to calculate the importance ranking of elements in criterion layer 2 relative to an element in criterion layer 1 according to the judgment matrix of target layer A. In essence, hierarchical single ranking is essentially the largest eigenroot λ_{max} and eigenvector of the judgment matrix. The calculation is as follows:

First, calculate the product of each row of elements of the judgment matrix of target layer A:

$$m_i = \prod_{j=1}^{n} a_{ij} (i, j = 1, 2...n) \quad (1)$$

Next, calculate the n-th root of m_i:

$$\overline{W_i} = \sqrt[n]{m_i} \quad (2)$$

Thirdly, normalize the above-obtained root vectors $\overline{w(A)} = [\overline{w_1}, \overline{w_2}, ..., \overline{w_m}]^T$:

$$w_i = \frac{\overline{w_i}}{\sum_{j=1}^{n} \overline{w_i}} \tag{3}$$

$w = [w_1, w_2, ...w_n]^T$ is the judgment matrix to be solved and the eigenvector.
Finally, calculate the maximum eigenvalue ω of the eigenvector:

$$\lambda_{\max} = \frac{1}{n} \sum_{i=1}^{n} \frac{(CW)_{\mathrm{i}}}{nw_i} \tag{4}$$

(4) Conduct a one-time test on the judgment matrix of target layer A:

A consistency test is used to determine whether there is a significant difference between the average values or variances at a certain significance level, if there is no significant difference.
First, calculate the consistency indicator *CI*,

$$CI = \frac{\lambda_{\max} - n}{n - 1} \tag{5}$$

The smaller the *CI* value, the better the consistency of one-time inspection on the judgment matrix of target layer A; the larger the *CI* value, the worse the consistency of one-time inspection on the judgment matrix of target layer A. The average random consistency index value (freedom index) *RI* of the judgment matrix is introduced to calculate whether the consistency of the judgment matrix is acceptable.
Then calculate the consistency ratio *CR*,

$$CR = \frac{CI}{RI} \tag{6}$$

When $CR < 0.1$, the one-time test of the judgment matrix of target layer A is acceptable; otherwise, the element values of the judgment matrix of target layer A need to be modified until the one-time test of the judgment matrix of target layer A is acceptable.
For a 1–9-order judgment matrix, *RI* values are shown in Table 3.

Table 3. Average random heterogeneity index value.

Dimension	1	2	3	4	5	6	7	8	9
RI	0.00	0.00	0.52	0.89	1.12	1.26	1.36	1.41	1.46

(5) Overall hierarchy sorting

The overall ranking of levels refers to calculation of the upper to lower levels according to the hierarchical structure model, and the relative importance of the two-layer factors of the criterion layer relative to the target layer is calculated. The overall hierarchical ranking needs to be checked for consistency to ensure the rationality and logicality of the model.

4. Content of Teaching Reform

We consulted the official websites of domestic colleges and universities specializing in financial engineering and made a careful study of the regulations on professional construction and personnel training programs, combined with national policy documents on the requirements of financial innovation personnel training and a review of the relevant literature [19]. On this basis, we summarize the current domestic financial engineering professional education in terms of the curriculum system, curriculum, teaching methods, practice teaching and examination system, and typical questions. We take these

five questions as the content of reform and a set of indicators and questionnaires to conduct a questionnaire survey of students majoring in financial engineering in colleges and universities in Wenzhou [24,26].

Six of the eleven colleges and universities in Wenzhou are undergraduate institutions. The author works at the Business School of Wenzhou University, where financial engineering has a 10-year history and was authorized as a national first-class major in 2020. It is also a significant major at the university and in Wenzhou. The protagonist and vanguard of China's private economy is Wenzhou. It has historically been distinguished by a robust economy and active community finance. Additionally, Wenzhou embodies the Wenzhou spirit of "having the courage to be the first and being especially capable of entrepreneurship and innovation." In Wenzhou, Zhejiang Province, a pilot zone for comprehensive fiscal reform was established in 2012, marking the commencement of China's financial reform. Wenzhou has contributed "Wenzhou experience" and "Wenzhou wisdom" to financial reform within the nation. Therefore, it is rational and scientific to use Wenzhou universities as the primary testing ground for financial engineering instruction reform.

Since 2016, I have been involved in the teaching and research of the financial engineering major, and I have a relatively in-depth comprehension of the major's curriculum structure and training methodology. Wenzhou University's financial engineering specialized courses began in the sophomore semester, and until the end of the senior year's next semester, I and 25 similar professional teachers established teaching reform with a test team, beginning in September 2017 and ending in July 2022, with three classes of graduates. They received their bachelor's degrees in June 2020, June 2021, and June 2022, respectively. For the team of those personally involved in the questionnaire investigation and interview of the teaching reform for June's graduates, after three years, the total of effective questionnaire recycling was 588 and the recovery rate was 98%. Seniors who were about to graduate were chosen as subjects for the questionnaire survey and interview because they had completed all their undergraduate courses and had a basic understanding of the training mode for their major, allowing them to make more objective and scientific evaluations.

The curriculum system, teaching reform, curriculum design, teaching methods, and a practical teaching and assessment system comprise the five aspects of the financial engineering major's education reform. Specifically, a secondary index is set beneath each primary index. Under the first-level index of the curriculum system, for instance, five secondary indicators are established, including a fundamental course, a research-based course, a mathematical course, a financial professional course, and a computer course. Five second-level indicators are established in the first-level index system: data mining course, data analysis method course, machine learning course, block chain technology course, and artificial intelligence course. Five second-level indicators are established for first-level indicators of teaching methods: experimental method, split classroom teaching method, discussion method, visiting teaching method, and on-site teaching method. Under the first-level indicators of practical teaching, five second-level indicators are established: practical hardware facilities, the proportion of instructors with dual qualifications, industry lectures, post-skills training, and industry–university–research cooperation. Under the evaluation system's first-level indicators, there are five second-level indicators: assessment time, assessment content, assessment method, whether there is a sense of participation in the assessment process, and the level of communication between teachers and students during the assessment process. The specific indicators are presented in Table A1 in Appendix A.

5. Evaluation of the Teaching Reform Effect of the Financial Engineering Major

5.1. Selection of Evaluation Index of Teaching Reform Effect

When using the analytic hierarchy process to evaluate the effect of teaching reform, it is extremely important to select appropriate indexes. On the principles of typicality, relevance, and applicability, and considering the actual situation of Wenzhou University's financial engineering, we refer to the experts and scholars of existing research results. Through sorting and research, we select discipline strength, students' postgraduate/doctoral examination rate,

student employment rate, and competition awards as first-level indicators. The following three specific indicators are selected as second-level indicators to establish a hierarchy analysis model that can take into account the effect of the teaching reform more comprehensively.

Three second-level indicators are established under the first-level index of discipline strength: discipline evaluation level, dissertation quality, and faculty construction quality. There are three second-level indicators under the first-level index of students' postgraduate/doctoral examination rate: the rate of postgraduate entrance examination, the rate of PhD entrance examination, and the rate of admission to double first-class universities. Three second-level indicators are established under the first-level index of student employment rate: the employment rate of the major, the evaluation of employers, wage income, and development prospects. As second-level indicators, the number of competition participants, the proportion of competitive awards, and the net transfer ratio of majors are established. Through the analysis presented above, this paper selects four first-level indicators and twelve second-level indicators as specific evaluation items for the establishment of a hierarchical structure, as shown in Figure 1.

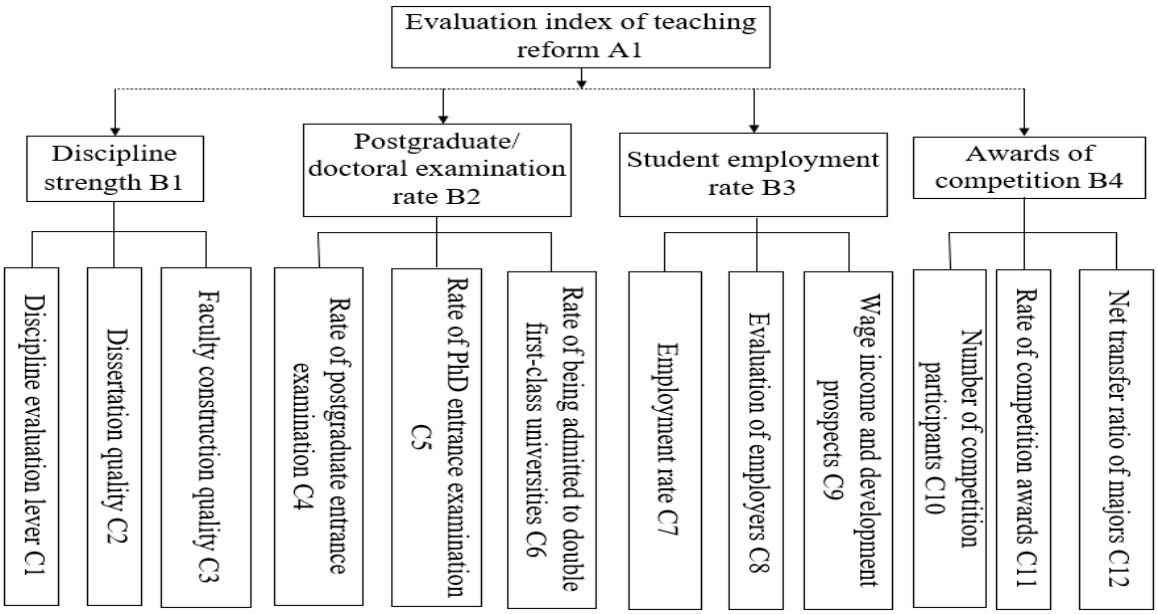

Figure 1. Progressive hierarchy of evaluation indicators for effect of teaching reform.

5.2. Determination of the Weight of the Evaluation Index of the Teaching Reform Effect

5.2.1. Acquisition of Survey Data

To ensure the pertinence and effectiveness of the questionnaire and to enhance the quality of the evaluation results, questionnaires and interviews were utilized to collect data. In addition to questionnaires from 600 financial engineering students, the survey targeted direct and indirect participants in teaching reform and had a specific personnel composition. Ten members of the Wenzhou Education Bureau, fifteen members of the Wenzhou Financial Engineering Teaching Committee, and ten members of the Wenzhou University Teaching Reform Research Office were interviewed.

The questionnaire was primarily intended for financial engineering majors in the city. Some 600 offline questionnaires with a total of 20 questions, including 18 objective questions and two subjective queries, were distributed. The questionnaire's content consists of five components: curriculum system, curriculum design, teaching methodologies, practical teaching, and evaluation system [46]. Some 588 legitimate questionnaires were recovered in the end. We performed data entry, analysis, and conversion of the original data into computer-approved data for the effective questionnaire we collected. On this basis, we utilized Excel 2019 and SPSS 24 software for preliminary analysis and drawing purposes.

Additionally, face-to-face interviews were conducted offline and on-site. The personnel recorded the interviewees' responses during the course of the interview. After the interview, the interviewees' responses were filtered, converted into machine-readable data, and explained. This sampling and data collection procedure is scientific and reasonable, thereby ensuring the precision of the obtained data. Figure 2 depicts the detailed sampling and data collection procedure.

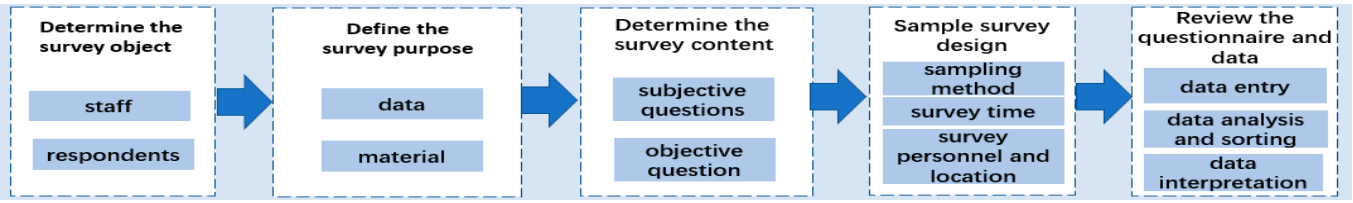

Figure 2. Sampling and data collection process.

The questionnaire on the Evaluation System of Financial Engineering Major Teaching Reform was distributed to experts in order to solicit their opinions on the index weight of the financial engineering major teaching reform. Similarly, an electronic report of the teaching data and significant situation of financial engineering disciplines in Wenzhou colleges and universities over the past five years was also made available for reference.

To ensure the highest level of scientific precision, the questionnaire content was primarily scored by experts based on the subjective evaluation results, the postgraduate entrance examination/doctoral examination rate of students, the employment rate of students, and the awards of provincial and cross-discipline/professional competitions. The importance of each reform effect index was compared in pairs, and a specific score was recorded by referring to the scale table in Table 4.

Table 4. Scale quantization table.

Degree of Importance	Definition
1	The *i* factor is equally important compared to the *j* factor
3	The *i* factor is slightly more important than the *j* factor
5	The *i* factor is significantly more important than the *j* factor
7	The *i* factor is strongly important compared to the *j* factor
9	The *i* factor is extremely important compared to the *j* factor
2, 4, 6, 8	The level of importance falls somewhere in between

According to Table 4, experts were asked questions similar to the following:

Q1: Based on the above table, please compare the importance of subject evaluation results with student employment rates.

A1: I think the student employment rate is slightly more important than the subject evaluation results (between equally important 1 and slightly important 3).

Q2: Could you please compare the importance of subject evaluation results and student postgraduate/doctoral entrance examination rates.

A2: Subject evaluation results are slightly more important than students' postgraduate/doctoral entrance examination rates (between 3 and 5).

...

5.2.2. Processing of Survey Data

After the questionnaire was collected, the experts' scoring results were summarized, and the average value was calculated. According to the average value, a judgment matrix was constructed. Then, Matlab 2021 statistical software was used to process the data, and the weight of each index was calculated. The scoring results and weight consequences of each judgment matrix are shown in Tables 5–9, where CI is the random consistency index,

RI is the random one-time index, CR is the consistency ratio, and λ_max is the maximum characteristic root.

Table 5. Total judgment matrix A–B.

A	B1	B2	B3	B4	Weight
B1	1	4	3	6	0.5417
B2	1/4	1	1/2	4	0.1548
B3	1/3	2	1	5	0.2467
B4	1/6	1/4	1/5	1	0.0568
	λ_{max}	CI	RI	CR	
	4.1398	0.0463	0.8900	0.0520	

Table 6. Subject strength judgment matrix B1–C.

B1	C1	C2	C3	Weight
C1	1	3	6	0.6442
C2	1/3	1	4	0.2706
C3	1/6	1/4	1	0.0852
	λ_{max}	CI	RI	CR
	3.0536	0.0268	0.5800	0.0516

Table 7. The judgment matrix of postgraduate/doctoral examination rate of students B2–C.

B2	C4	C5	C6	Weight
C4	1	2	5	0.5695
C5	1/2	1	4	0.3331
C6	1/5	1/4	1	0.0974
	λ_{max}	CI	RI	CR
	3.0246	0.0123	0.5800	0.0236

Table 8. Student employment rate judgment matrix B3–C.

B3	C7	C8	C9	Weight
C7	1	3	2	0.5278
C8	1/3	1	1/3	0.1396
C9	1/2	3	1	0.3325
	λ_{max}	CI	RI	CR
	3.0536	0.0268	0.5800	0.0516

Table 9. Judgment matrix B4–C for awards in provincial or above discipline/specialty competitions.

B4	C10	C11	C12	Weight
C10	1	1/3	4	0.2706
C11	3	1	6	0.6442
C12	1/4	1/6	1	0.0852
	λ_{max}	CI	RI	CR
	3.0536	0.0268	0.5800	0.0516

Each judgment matrix was input into Matlab software, the maximum eigenvalue of the matrix was obtained, the weight of each index was calculated, and then the consistency of each judgment matrix was checked to ensure the reliability of the data. When the resultant CR $\leq$ 0.1, this indicates that the consistency test has passed, so it can be observed that the consistency of the above judgment matrix passes the test.

5.3. Analysis of Evaluation Results of Teaching Reform Effect

In this financial engineering professional teaching reform, the weight coefficient of the evaluation index is available on the basis of calculating the total sequencing weight. The calculation method of the comprehensive weight is the weight of the primary index, and the resultant index is multiplied by the weight of one by one, so step by step from bottom to top. Finally, the comprehensive weight coefficients of different indicators in Table 10 are obtained.

Table 10. Financial engineering teaching reform evaluation index weight coefficients.

Target Level	First-Level Index	Second-Level Index	Comprehensive Weight Coefficient	Rank
Evaluation system of Financial Engineering teaching reformA1	Discipline strength B1	Discipline evaluation level C1	33.90%	1
		Dissertation quality C2	15.66%	2
		Faculty construction quality C3	4.72%	7
	Postgraduate/doctoral examination rate B2	Rate of postgraduate entrance examination C4	8.71%	4
		Rate of PhD entrance examination C5	5.26%	6
		Rate of being admitted to double first-class universities C6	1.41%	11
	Student employment rate B3	Employment rate C7	13.12%	3
		Evaluation of employers C8	3.34%	9
		Wage income and development prospects C9	8.30%	5
	Awards of the competition B4	Number of competition participants C10	1.44%	10
		Rate of competition awards C11	3.68%	8
		Net transfer ratio of majors C12	0.46%	12

By utilizing the analytic hierarchy process (AHP) to analyze the effect of major teaching reform, further financial engineering to dissect the goal of teaching reform using specific indicators for measurement results in a more accurate analysis of the effects of teaching reform and the key factors of teaching reform, which can be used to adjust teaching reform in content and improve its effect.

According to Table 10, which shows index weight coefficients, the greater the comprehensive weight associated with the index, the greater the impact on teaching reform, and the reform should be strengthened accordingly. From the perspective of the weight distribution of the first-level indicators, the sum of the comprehensive weight coefficients of the three subitems reveals that the weight of discipline strength is the highest, followed by the rate of postgraduate or doctoral examination, followed by the student employment rate, and the weight of competition awards is the lowest. It is demonstrated that in the process of teaching reform, we should prioritize subject strength as an important teaching reform objective and then work to increase the percentage of students who pass postgraduate entrance exams and doctoral examinations.

From the comprehensive weight of the secondary indicators, the first four indicators ranked in order of importance of reform effectiveness are subject evaluation level, paper quality, employment rate of this major, and graduate enrollment rate of this major. The level of subject evaluation and the quality of papers are secondary indicators of subject strength, reflecting the need to pay more attention to subject strength in teaching reform. In addition, the employment rate of this major ranks third, indicating that the employment status of students is a key focus of teaching reform in the field of financial engineering. The graduate enrollment rate of this major ranks fourth, indicating that teaching reform will also have an impact on students' graduate enrollment rate. Specifically, this teaching reform has increased graduate enrollment rates. The above prominent factors have improved the effectiveness of teaching reform.

In addition, after statistical analysis of the student interviews and the results of the 600 questionnaires collected, it was determined that all five of the aforementioned teaching reform objectives have been adequately attained. In particular, the ranking of financial engineering majors in Wenzhou has risen consistently in discipline evaluation over the past five years, and the rate of postgraduate entrance examinations and admissions examinations has also risen annually. In Wenzhou, the employment rate for financial engineering majors has surpassed 95% over the past three years. In provincial and inter-discipline/professional competitions, students have performed admirably. In the past five years, students majoring in financial engineering have won awards in competitions such as the Zhejiang Securities Investment Competition, the Zhejiang Financial Innovation Competition, and others. Therefore, practice has demonstrated that the teaching reform experiment for financial engineering majors in our city has had a positive impact and has contributed significantly to the development of innovative financial professionals with a background in financial technology.

6. Discussion and Conclusions

This article employs both expert assessment and questionnaire survey methods. On the one hand, how to guarantee the authority of experts and rationality of the composition of expert groups in the selection of experts is a problem to be solved by actual research. On the other hand, expert evaluations are inevitably subject to a degree of subjectivity. It is difficult to ensure the response rate, the efficiency of the questionnaire, and the representativeness of the sample when conducting a questionnaire survey. AHP is utilized extensively throughout this paper. The benefits of the analytic hierarchy process are straightforward to implement and comprehend. When quantitative data information is insufficient, it can help to solve a practical problem. Fewer quantitative data and more qualitative components, which are subjective, are limitations of the analytic hierarchy process. When there are more indicators, the data statistics are extensive and determining the weight is problematic.

This paper examines the significance of teaching financial engineering practice and the employability of graduates in the post-epidemic era. The content and programs of an inter-disciplinary teaching reform were then proposed in accordance with labor market requirements in order to meet employability criteria. Thirdly, students who participated in the teaching reform were surveyed and personally interviewed, and the resulting data were compiled and analyzed. This study combined the expert scoring method with the analytic hierarchy procedure to evaluate the impact of education reform. The results demonstrated that the financial engineering instruction reform program had a positive effect on the school's competition performance, enrollment rate, employment rate, and discipline strength. This research can be used as a guide for colleges and universities to develop professional employability and teaching materials, as well as for the content and strategy of interdisciplinary teaching reform in relevant courses.

To help higher education institutions better provide graduates with the necessary employment skills, build an efficient and sustainable education system, and cultivate graduates' relevant industrial skills, the following should be continuously improved: restructuring the teaching curriculum system, continuously optimizing teaching methods and means, and paying close attention to the deep integration of teaching and research.

Even though this experiment in interdisciplinary teaching reform has produced excellent results, it typically requires a considerable amount of time and is limited to universities in the city of Wenzhou. To assist graduates in adjusting to the labor market through teaching and learning, it is necessary to expand the scope of reforms and experiments, increase the number of groups and objects participating in questionnaires and interviews, and gradually expand the interdisciplinary teaching reform of financial engineering majors to universities in Zhejiang Province and, eventually, the entire nation.

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Appendix A

Table A1. Content and indicators of teaching reform.

First-Level Indicator	Second-Level Indicators	Indicator Meaning
Curriculum system	Professional basic curriculum	The courses mainly include English, Political Economy, Western Economics, Accounting, Money and Banking, Finance, Management, International Finance, International Trade, Commercial Banking Operation and Management, etc.
	Research-based curriculum	Corporate finance, applied finance, financial research methods, financial analysis, and research-based courses are mainly for students to choose topics for research, and to study around the topics
	Mathematics and physics course	Including calculus, probability theory, linear algebra, and financial mathematics
	Major courses in finance	Including financial analysis, applied statistics, investment banking, financial derivatives, financial engineering, financial risk management, options and futures, and other courses
	Computer course	Contains statistics, econometrics, C language, and JAVA programming
Curriculum provision	Data mining course	Helps students master the basic concepts, algorithms, principles, and related technologies of data mining, so as to proficiently use data mining technology and tools to solve practical application problems, and lay a foundation for research topics
	Data analysis methods class	Descriptive analysis and data distribution are used to express data characteristics. Using regression analysis and other methods for big data modeling and solving; according to the data model, it is realized by a programming language, and test results are analyzed and interpreted
	Machine learning course	This course focuses on introducing the core algorithms and theories of machine learning, enabling students to master the classical theories of machine learning through theoretical learning, understand the latest developments, and learn to design machine learning algorithms for specific problems of their own disciplines
	Blockchain technology class	Dissecting what Bitcoin and blockchain are. What are the values of bitcoin and blockchain, what are their development trends, what are the attitudes of various countries, and what career development opportunities do they bring to ordinary people?
	Artificial intelligence class	Master the comprehensive skills of artificial intelligence algorithm engineers, and easily enter the field of AI; complete projects independently and build models to solve various data-related problems

Table A1. *Cont.*

First-Level Indicator	Second-Level Indicators	Indicator Meaning
Teaching methods	Experimental method	Under the guidance of teachers, students start with understanding the experimental background and learning relevant theoretical knowledge, and complete the process of literature review and experimental design by themselves, so as to cultivate their innovative thinking ability and exploration spirit
	Flipped classroom teaching method	Students watch the teacher's video explanation before class or after class, and learn independently. In class, the teacher and students interact with each other, including answering questions, exploring cooperatively, and completing their studies, so as to achieve better educational effects
	Discussion method	Under the careful preparation and guidance of teachers, in order to achieve certain teaching objectives, through design and organization in advance, inspire students to express their own opinions on specific issues, so as to cultivate their independent thinking ability and innovative spirit
	Visiting teaching method	According to the requirements of teaching tasks, students are organized to go to factories, villages, exhibition halls, nature, and other social sites to acquire knowledge through the observation and research of real things and phenomena
	Field teaching method	The teaching method takes the field as the center, the field practice as the object, and the student activity as the main body
Practical teaching	Practice hardware facilities	Modern computer room, multi-function speech classroom, high configuration of practical training laboratory, projector, display, and so on
	Proportion of double-qualified teachers	Teachers are required to have both the quality of theoretical teaching and the quality of practical teaching
	Industry seminars	Invite industry experts and industry elites to popularize industry-forward knowledge and experience for students on a regular basis to help students understand industry-forward development
	Job skills training	To enable students to acquire the knowledge, skills, attitudes, and experience necessary to perform professional work at a high level, and to improve their match with industry requirements
	University–industry cooperation	To promote the combination of teaching and research and the transformation of research achievements into productive forces, so as to achieve the goals of personnel training, research development, and management benefits
Examination and evaluation system	Time of assessment	The evaluation of students is not only concentrated in the mid-term or at finals, but throughout the whole process of learning, so as to stimulate students' interest and enthusiasm in learning
	Content of examination	The content of assessment is not limited to the form of final exams or course papers, but also includes class presentation, group discussion, class speech, after-class practice, and so on
	Evaluation mode	Diversified assessment methods, combining online and offline, combining traditional assessment methods with innovative assessment methods
	Participation in the assessment process	In the assessment process, students' sense of participation is emphasized, and students' enthusiasm is improved, realizing a process transformation from passive assessment to active participation
	Degree of teacher–student communication in the assessment process	Assessment is not only for students to unilaterally complete the tasks assigned by teachers, but also for teachers to participate and interact in the assessment. In the process of assessment, students should take the initiative to communicate and discuss with teachers

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