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Evaluation Model of Comprehensive Ability of Accounting Talents in Higher Vocational Colleges that Uses Big Data Calculation

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Abstract: *The rapid development of new technologies such as big data, artificial intelligence, mobile Internet, cloud computing, and blockchain has exerted a multi-dimensional impact on the accounting industry, and the needs of enterprises have changed accordingly. The demand for compound talents with a solid financial foundation and big data application ability is surging, but there is no corresponding standard for evaluating the comprehensive ability of those talents. Based on the needs of enterprises, we construct the comprehensive ability evaluation framework for higher vocational accounting talents, including four middle-level indicators such as professional quality, professional ability, management communication, and data processing with 20 specific indicators. The AHP method is used to determine the weight, and the fuzzy comprehensive evaluation method is used to empirically evaluate the accounting talents in higher vocational colleges. The result is used to realize the accurate and effective evaluation of the comprehensive ability of accounting talents in higher vocational colleges under the background of big data.*

Keywords: *big data computing, higher vocational accounting talents, comprehensive capability assessment*

1. Introduction

In recent years, global market leaders such as Meta, Google, Amazon, and Microsoft have laid out artificial intelligence strategies, and Chinese leading enterprises such as Alibaba and Tencent have also vigorously promoted the development of the artificial intelligence industry [1]. On March 10, 2016, Deloitte announced the introduction of artificial intelligence into accounting and auditing. Subsequently, KPMG, PWC, E&Y, and other accounting firms launched their financial robot products. New technologies appear as a tidal wave with a fierce momentum [2]. New technologies represented by big data have influenced methods and processes of financial work and exerted a multi-dimensional influence on the accounting industry [3]. The demand of enterprises has also changed accordingly a large number of low-end repetitive and mechanical simple labor are replaced by artificial intelligence, and "machine replacement" has become a reality. The field of finance and accounting is facing great challenges from the reform of the manufacturing, retail and financial industries. The gap in demand for applied talents of technology in the future is growing, and the training and construction of intelligent accounting talents are imminent. In the era of big data, the comprehensive ability evaluation of accounting talents is an important standard for talent training, which is of great significance to improve the comprehensive quality and ability of accounting practitioners and the service quality of the accounting industry.

2. Literature Review

Under the background of big data, accounting is gradually developing towards value-added accounting with deep integration of business and finance [4]. Accounting staff needs to transform into operational accounting and strategic accounting, and constantly improve in terms of concepts, knowledge, and ability to adapt to changes in the macro environment [5]. Zhao (2017) proposed that accounting majors in higher vocational colleges must be timely adjusted according to changes in the social environment and cultivate innovative talents driven by innovation, intelligent talents under intelligent environment, and ecological talents under green conditions [6]. Yuan et al. (2018) believe that the training objectives of higher vocational accounting talents need to be reconstructed from the perspectives of professional, innovative, and strategic talents [7]. Zhang et al. (2020) constructed the training system

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of "Big data + Finance" management accounting talents under the concept of OBE from the aspects of ability framework, curriculum system1, and assessment methods, and evaluated the results of the undergraduate training program of management accounting [8]. Wang (2019) constructed an indicator system from three aspects of development ability, professional ethics, and knowledge to evaluate the comprehensive ability of accounting talents in colleges and universities in the era of big data [9]. Zhang (2020) constructed an indicator system to evaluate the quality of postgraduate education based on AHP and fuzzy comprehensive evaluation [10].

Current literature presents that the academic research on the demand for intelligent accounting talents mainly focuses on teaching at the undergraduate level or even the postgraduate level (MPACC), while education research at the higher vocational level is scarce. With the rapid development of big data technology in recent years, the shared accounting cloud platform which provides shared accounting services for small and medium-sized enterprises has emerged. More small and medium-sized enterprises migrate their accounting systems to the shared accounting cloud platform. How to cultivate and evaluate intelligent accounting talents at a higher vocational level has important practical significance.

3. Evaluation Model

3.1. Hierarchy

The analytic hierarchy process (AHP) is a systematic analysis method combining qualitative and quantitative analysis. Its basic principle is to dissolve the tedious problems to be studied into simple factors and arrange them into several levels from high to low according to the membership relationship between these factors. Then, experts, scholars, and authorities are invited to compare the importance of each factor pairwise, and mathematical methods are used to rank each factor hierarchy by hierarchy and calculate the weight to assist evaluation and decision making. The analytic hierarchy process divides the decision-making goal into target hierarchy, scheme hierarchy, and criterion hierarchy to draw the hierarchical structure diagram. Based on the existing literature. The comprehensive ability of accounting talents is decomposed into three levels as shown in Table 1 in this study.

3.2. Judgment matrix

When determining the weight of each level between various factors, we need to transform the qualitative results into quantitative results. Since it is difficult to compare all indicators simultaneously, the indicators are compared pairwise to improve the accuracy. Pairwise comparison of indicators can reduce the difficulty of comparing factors with different properties as much as possible. The relative scale is the comparison result of the importance of factors i and j, and the matrix formed by the pairwise comparison result is called the judgment matrix. For example, there are N indicators under criterion hierarchy A_1, we compare all the factors pairwise. If factor A_{1i} is compared with factor A_{1j} to obtain a relative scale A_{ij}, an n×n judgment matrix $A=(a_{ij})_{n\times n}$ can be obtained.

3.3. Indicator weight and consistency test

For matrix A, its largest eigenvalue λ is calculated first, and then its corresponding eigenvector is found. Denoted as W after normalization, the weight of N factors is at the same level. Next, the consistency test is required. The consistency test refers to the determination of the allowable range of inconsistency for A, and the consistency indicator is calculated by CI. The greater the CI, the greater the inconsistency.CI=0, perfect consistency; CI is close to 0, with satisfactory consistency.

$$CI = \frac{\lambda - n}{n-1} \tag{1}$$

where λ is the largest characteristic root of judgment matrix A, and n is the order of judgment matrix A.

3.4. Fuzzy comprehensive evaluation

The fuzzy comprehensive evaluation method uses fuzzy mathematics to make an overall evaluation of things or objects restricted by many factors, the following are the specific steps of the fuzzy evaluation method:

Firstly, the factor and evaluation sets are determined. Factor sets are set according to the indicator

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system constructed by the analytic hierarchy process, which is presented as $U=\{U_1, U_2, \ldots, U_n\}$. Assuming that the evaluation grade of the indicators by experts is divided into five levels, namely, excellent, good, general, pass, and poor, which are respectively represented by V_1, V_2, V_3, V_4 and V_5, then the comment set $V= \{ V_1, V_2, V_3, V_4, V_5\}$ is generated.

Secondly, the fuzzy matrix is constructed. Through expert scoring or evaluation, the membership degree of each indicator is determined to obtain the single factor evaluation matrix R. After determining the membership degree of each indicator, the fuzzy comprehensive evaluation matrix $R=(R_{ij})$ is constructed where R_{ij} represents the membership relationship of indicator i and the comment j.

Finally, the fuzzy evaluation set is calculated. According to the fuzzy comprehensive evaluation matrix R and the weight W of the analytic hierarchy process, the fuzzy evaluation set F=W*R is calculated, and the evaluation is made according to the principle of maximum membership degree.

4. Empirical Research

4.1. Weight of indicator by AHP

According to the above evaluation system, we construct the AHP questionnaire. The respondents of the questionnaire include the director of the accounting department in higher vocational colleges, accounting enterprise mentors, financial managers, and directors of enterprises. The respondents all have more than 10 years of work or research experience in the accounting industry. A total of 20 valid questionnaires were obtained in this study. According to the above analytic hierarchy process, the indicator weights were obtained as shown in Table 1.

Table 1: Weight of comprehensive ability evaluation indicator of higher vocational accounting talents

Target Hierarchy	Scheme Hierarchy	Weights	Criterion Hierarchy	Weights	Final Weights
Comprehensive Ability of Higher Vocational Accounting Talents A	Professional Quality A1	0.3619	Professional Ethics A11	0.508	0.184
			Learning Ability A12	0.169	0.114
			Innovation Ability A13	0.104	0.111
			Responsibility A14	0.220	0.080
	Professional Competence A2	0.2722	Report Preparation and Analysis A21	0.082	0.067
			Cost Accounting A22	0.097	0.065
			Risk Management and Internal Control A23	0.124	0.061
			Tax Declaration and Planning A24	0.408	0.042
			Financial Management and Management Accounting A25	0.238	0.037
			Accounting Records A26	0.050	0.034
	Management Communication A3	0.1109	Negotiation and Communication A31	0.127	0.034
			Decision Making A32	0.062	0.034
			Team Cooperation A33	0.310	0.026
			Environmental Suitability A34	0.378	0.024
			Leadership A35	0.123	0.022
	Data Processing A4	0.2550	Data Acquisition and Processing A41	0.094	0.016
			Intelligent Accounting and Tax A42	0.261	0.014
			Big Data Financial Analysis A43	0.448	0.014
			Data Visualization A44	0.133	0.014
			Data Modeling A45	0.064	0.007

According to the weight calculation results, the most important comprehensive ability of higher vocational accounting talents is professional quality, accounting for 36.3%. Among the professional quality sub-abilities, the most important was professional ethics, accounting for 50.6%. It shows that honesty and trustworthiness are the basic qualities of an accountant and the requirements for his comprehensive ability. The second important comprehensive ability is professional competence, accounting for 27.22%. Among the professional competence sub-abilities. Tax declaration and planning are most important, followed by financial management and management accounting. The least important factor is accounting records. In the era of big data, the demand for financial talents' professional competence is transforming from traditional accounting to management accounting.

The third most important comprehensive ability is data processing, accounting for 25.5% close to professional competence, which is the second most important ability. In the era of big data, the data processing ability of accounting talents is becoming more important. Among the data processing sub-

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capabilities, big data financial analysis is the most important. The last important comprehensive ability is management communication, in which the most important is the ability of team cooperation and environmental suitability.

4.2. Comprehensive ability evaluation based on fuzzy method

The evaluation object of this study is the accounting talents of higher vocational colleges. Here, we demonstrate the evaluation process of a student named Zhang. We invited 20 experts to grade Zhang. The expert scores are based on the data provided by the educational administration management system, student management system, school-enterprise cooperation management system, and other smart campus platforms, as well as Zhang's interview performance. The evaluation set V={V_1 excellent, V_2 good, V_3 average, V_4 pass, and V_5 poor} is used in this fuzzy comprehensive evaluation. The evaluation interval of V_1 is (90,100), V_2 is (80,90), V_3 is (70,80), V_4 is (50,70), and V_5 is (0,50).

According to the evaluation results of experts, we obtain the membership vector of the criterion hierarchy indicators of professional quality.

$$R_1 = \begin{bmatrix} 0.7 & 0.2 & 0.1 & 0 & 0 \\ 0.3 & 0.6 & 0.1 & 0 & 0 \\ 0.1 & 0.2 & 0.4 & 0.3 & 0 \\ 0.3 & 0.4 & 0.3 & 0 & 0 \end{bmatrix} \tag{2}$$

Combined with the weight of the indicators calculated by the analytic hierarchy process, the membership vector of the scheme hierarchy indicators of professional quality can be calculated as

$$A_1 = W_1 * R_1 = [0.508\ 0.169\ 0.104\ 0.220] \begin{bmatrix} 0.7 & 0.2 & 0.1 & 0 & 0 \\ 0.3 & 0.6 & 0.1 & 0 & 0 \\ 0.1 & 0.2 & 0.4 & 0.3 & 0 \\ 0.3 & 0.4 & 0.3 & 0 & 0 \end{bmatrix}$$

$$= [0.482\ \ 0.312\ \ 0.175\ \ 0.031\ \ 0] \tag{3}$$

Similarly, the membership vectors of professional competence, management communication, and data analysis can be obtained as follows.

$$\begin{aligned} A_2 &= [0.117\ 0.306\ 0.447\ 0.103\ 0.027] \\ A_3 &= [0.357\ 0.156\ 0.339\ 0.668\ 0.080] \\ A_4 &= [0.049\ 0.288\ 0.435\ 0.221\ 0.006] \end{aligned} \tag{4}$$

Finally, the membership vector of the target hierarchy indicator is calculated:

$$A = W * [A_1\ A_2\ A_3\ A_4] = [0.362\ 0.272\ 0.111\ 0.255] \begin{bmatrix} 0.482 & 0.312 & 0.175 & 0.031 & 0 \\ 0.117 & 0.306 & 0.447 & 0.103 & 0.027 \\ 0.357 & 0.156 & 0.339 & 0.668 & 0.080 \\ 0.049 & 0.288 & 0.435 & 0.221 & 0.006 \end{bmatrix} \tag{5}$$

$$= [0.259\ \ 0.287\ \ 0.334\ \ 0.103\ \ 0.018]$$

In order to obtain a specific score to accurately evaluate the student's ability in all aspects, the median vector was introduced as D=[95 85 75 60 25]. The student's score is calculated as

$$95 \times 0.259 + 85 \times 0.286 + 75 \times 0.334 + 60 \times 0.103 + 25 \times 0.018 = 80.595$$

The above steps are repeated to ontain Zhang's score in each indicator as shown in Table 2.

According to the evaluation results, Zhang's comprehensive score is 80.595, reaching a good level. His professional quality is good, with a score of 87.3. However, his professional competence, management communication ability, and data processing ability are relatively average. The student needs to further improve his data processing ability to better adapt to the requirements of accounting talents in the era of big data.

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Table 2: Scores of the evaluation objects in each indicator

Target Hierarchy	Scheme Hierarchy	Score	Criterion Hierarchy	Score
Comprehensive Ability of Higher Vocational Accounting Talents A	Professional Quality A_1	87.297	Professional Ethics A_{11}	91
			Learning Ability A_{12}	87
			Innovation Ability A_{13}	74.5
			Responsibility A_{14}	85
	Professional Competence A_2	77.515	Report Preparation and Analysis A_{21}	83.5
			Cost Accounting A_{22}	80
			Risk Management and Internal Control A_{23}	71
			Tax Declaration and Planning A_{24}	75.5
			Financial Management and Management Accounting A_{25}	81.5
			Accounting Records A_{26}	76.5
	Management Communication A_3	78.287	Negotiation and Communication A_{31}	71
			Decision Making A_{32}	69.5
			Team Cooperation A_{33}	84
			Environmental Suitability A_{34}	86
			Leadership A_{35}	52
	Data Processing A_4	74.765	Data Acquisition and Processing A_{41}	81.5
			Intelligent Accounting and Tax A_{42}	76
			Big Data Financial Analysis A_{43}	73
			Data Visualization A_{44}	78
			Data Modeling A_{45}	65.5

5. Conclusions

In the era of big data, accounting talents not only need to have a solid foundation in accounting and finance but also need to be equipped with the theoretical basis and application ability of artificial intelligence, information technology, data science, and big data technology. Based on the needs of enterprises, the comprehensive ability framework of higher vocational accounting talents is constructed, including 4 scheme hierarchy indicators such as professional quality, professional competence, management communication, data processing, and 20 criterion hierarchy indicators. The AHP method is used to determine the indicator weight, and the fuzzy comprehensive evaluation method is used for empirical study. In the era of big data, professional quality, especially professional ethics, is an essential requirement for an accounting talent. The era of big data puts forward higher data processing ability for accounting talents. The market demand for the professional ability of higher vocational accounting talents has shifted from traditional accounting to management accounting.

The hierarchical analysis fuzzy comprehensive evaluation model constructed in this study provides a basis for scientifically measuring the comprehensive ability of higher vocational accounting talents. Enterprises can refer to this model for comprehensive evaluation of accounting talents, and colleges and universities can also refer to this model to determine the talent training method. Because the AHP fuzzy comprehensive evaluation is based on the subjective judgment of experts, the weight of the indicator changes with the number of questionnaires and the opinions of experts. Although the consistency test is adopted in this study, the deviation between subjective judgment and objective reality is still unavoidable. It is necessary to further explore the mode to make full use of the data of the educational administration management system and other digital platforms to objectively evaluate and score students' ability, which is also the direction of future research.

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