Constructing the Evaluation Index System of Skilled Talents' Occupational Ability in the Era of Artificial Intelligence

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Abstract. The scientific development of a vocational ability evaluation index system for skilled talents is the fundamental work for the construction of the skilled talent team. Based on relevant literature on the study of vocational abilities of skilled talents, an improved Delphi method was used to construct an evaluation index system for vocational abilities of skilled talents, including 3 primary indicators and 14 secondary indicators; Using the Analytic Hierarchy Process to determine the weights of evaluation indicators, and based on the research results, proposing relevant suggestions.

Keywords: artificial intelligence, skilled personnel, vocational competence, evaluation indexes

1   Introduction

In October 2022, the General Office of the CPC Central Committee and the General Office of the State Council issued the Opinions on Strengthening the Construction of Highly Skilled Personnel in the New Era, which emphasized the strengthening of the construction of highly skilled personnel above the senior level and put forward the specific objectives of increasing the scale of skilled personnel, steadily improving their quality, optimizing the structure, and steadily increasing their income at the end of the Fourteenth Five-Year Plan period. Stable increase, skilled personnel accounted for more than 30% of the proportion of employed persons, highly skilled personnel accounted for the proportion of skilled personnel to reach 1/3 and other specific objectives, clearly increase the cultivation of highly skilled personnel, including a sound system of training of highly skilled personnel, innovation of training mode of highly skilled personnel and other objectives [1]. 1 percent growth in GDP can create one million jobs, which requires highly skilled personnel 9-10 million people [2]. China's skilled personnel in addition to the shortage of skill reserves, there are also deficiencies in the structure of skills. By the end of 2021, the total number of skilled personnel in China exceeded 200 million, accounting for 26% of the total number of employed people [3]. At present, China's industrial structure is changing from intensive to high-skill, high value-added, and high competitiveness, and the shortage of skills has become a major

constraint on industrial upgrading. Therefore, this paper discusses the proposal of vocational ability evaluation index system of skilled personnel in the era of artificial intelligence, which is of great significance to the development of various industries and even the realization of economic revitalization.

2   Literature Review

Under the impact and influence of the wave of artificial intelligence, the field of talent evaluation is undergoing a deep-level change, and the cross-border integration and development of industrial clusters spawned by artificial intelligence is an important trend in the era of "smart manufacturing", with the main research focusing on the following three aspects:

First, the content of talent evaluation is based on the category of talent competence. Based on the theories of Stephen Robbins, McClelland and Boyatz (i.e., the onion model and the iceberg theory), it mainly assesses a series of elements such as knowledge, skills, attitudes, behaviors and traits of talents based on the work tasks, and focuses on the analysis of the overall condition of talents by combining with the objective environment in which the talents are located as well as the historical period [4]. The standard of talent evaluation in the new era considers moral cultivation as the primary condition, innovation ability as the core element, and professional skills as the basic requirement [5].

Second, artificial intelligence prompts a new change in the connotation of talent evaluation. It changes from simple work task processing to comprehensive vocational ability, from single professional ability to multidisciplinary integration ability, from scale production operation ability to innovation and creativity ability, and from maintenance learning ability to continuous lifelong learning ability [6-7].

Thirdly, artificial intelligence forces the supply side of talent to reconstruct the training system. The reconstruction and integration of the division of labor and the development of artificial intelligence urgently need cross-border integration of skilled talents, which requires talents to have interdisciplinary vision and thinking as well as multi-specialty integration ability. Vocational colleges and universities should establish a comprehensive knowledge and technology structure with multidisciplinary intersection [8-10].

3   Research Methodology

This study was conducted through a literature review to confirm the concept and structure of the study. The research design adopts both qualitative and quantitative research, and is divided into three phases to construct, confirm and analyze the evaluation index system of the vocational competence of skilled personnel. The first stage is to develop the conceptual framework, which mainly aims to explore and develop the conceptual framework and connotation of the vocational competence of skilled personnel in the era of artificial intelligence. The qualitative research was conducted, and the data collection methods included literature analysis and literature review. The results of the

literature analysis and literature review are summarized and analyzed to develop a preliminary conceptual framework and criteria for the vocational competence of skilled personnel. The second stage is to determine the conceptualization and criteria of occupational competence, with the main purpose of revising and confirming the conceptualization and criteria of the occupational competence of skilled personnel in the era of artificial intelligence. In this phase, we will adopt a quantitative research approach by using a modified Delphi method expert questionnaire, analyzing the data using SPSSAU software, and integrating the opinions of experts and scholars in order to filter and confirm the conceptualization of the vocational competencies and criteria that skilled personnel should possess. The third stage is to analyze the weights and priorities of the dimensions and criteria of vocational competence. After confirming the vocational competence evaluation index system for skilled personnel developed by this research, a quantitative research approach is adopted to evaluate the weights of the dimensions and criteria of the vocational competence of skilled personnel by using the Analytic Hierarchy Process to assess the priorities for improvement.

The quantitative statistics part of the modified Delphi method questionnaire adopts the judgment criteria of appropriateness analysis, consistency analysis and stability analysis. In this study, in order to achieve a moderate number of indicators, specific and appropriate indicator content, and clear and non-repetitive meaning of the indicators, we gradually reached a consensus among the expert panel by retaining, modifying, and deleting the mean, standard deviation, and quadratic deviation based on the values of the mean, standard deviation, and quadratic deviation, as well as the opinions of the expert panel members.

The Analytic Hierarchy Process first transforms the indicator system for evaluating the vocational ability of skilled personnel into questionnaire, which utilizes a two-by-two comparison of factors to assess each expert's perception of the degree of influence of each factor, and then establishes a pair-wise comparison matrix based on the results obtained from the questionnaires returned to the expert panel, in order to make pair-wise comparisons of the relative importance of the two factors. The eigenvectors and eigenvalues are then calculated to find the relative weights of the factors, and finally a consistency check is performed.

4   Results and Discussion

4.1   Establishment of Initial System of Evaluation Indicators for Skilled Personnel's Occupational Ability in the Age of Artificial Intelligence

Based on the literature survey, the framework of occupational competence proposed by Kang Dae-won is firstly used as the first level indicator, i.e., professional competence, methodological competence and social competence [11]. Professional competence refers to possessing specialized skills and professional knowledge required for engaging in occupational activities, and focusing on acquiring skills and mastering knowledge in order to obtain a reasonable structure of knowledge and abilities. Methodological competence refers to having the working methods and learning methods required for engaging in vocational activities, focusing on learning to learn and learning to work in

order to develop scientific habits of mind. Social competence refers to the behavioral norms and values required for engaging in vocational activities, focusing on learning to live together and learning to be a human being in order to establish a positive attitude towards life. Secondly, combined with the new requirements for skilled personnel in the era of artificial intelligence, the indicators related to AI literacy are categorized according to the connotation scope of the first-level indicators. Finally, the organized secondary indicators are grouped into the corresponding first-level indicators, as shown in Table 1.

Table 1. Summary of indicators

author / Indicator	Wang [12]	Zhou [13]	Sun [14]	Wang [15]	Gong [16]	Lv [17]	Liu [18]	Liu [19]	Zhang [20]	Zheng [21]	Yang [22]	Wu [23]	Zhong [24]	Guo [25]	Wong [26]	Kim [27]	Su [28]
Artificial intelligence knowledge				✔					✔	✔		✔	✔		✔	✔	✔
General knowledge	✔		✔	✔	✔	✔	✔	✔									✔
professional knowledge	✔		✔	✔	✔	✔	✔	✔						✔			✔
Artificial Intelligence Skills				✔					✔	✔		✔	✔	✔	✔	✔	✔
General skills	✔	✔	✔	✔	✔	✔				✔	✔		✔	✔			✔
Professional skills	✔	✔	✔	✔	✔	✔				✔	✔		✔	✔			✔
Artificial Intelligence Thinking				✔						✔	✔	✔	✔				✔
Management ability	✔	✔	✔	✔	✔	✔	✔	✔				✔	✔	✔			
creative thinking					✔	✔	✔	✔			✔						
Innovative Learning		✔			✔		✔	✔						✔			
Continuous learning		✔				✔	✔	✔						✔			
Artificial intelligence emotion									✔	✔		✔	✔		✔	✔	✔
Ethics and morality		✔	✔	✔				✔			✔						
Psychological resilience					✔												
Craftsmanship spirit	✔	✔				✔	✔										
Professional attitude						✔	✔				✔	✔					
Comply with laws and regulations	✔					✔		✔									

4.2   Validation of Skilled Personnel Occupational Ability Evaluation Index System in the Age of Artificial Intelligence

In the course of the Delphi survey, the expert group mainly proposed the following adjustments: first, it is suggested that "innovative learning" and "continuous learning" be combined into one indicator, with its meaning fully explained in the definition; second, it is suggested that "creative thinking" be adjusted to "creative ability"; third, it is suggested that "compliance" be included in "AI emotion" and "AI emotion"; and third, it is suggested that "compliance" be included in "AI emotion" and "AI emotion". creative thinking" to "innovation ability"; third, it is suggested that "law-abiding" be included in "AI emotion" and "ethics"; and third, it is suggested that "law-abiding" be

included in "AI emotion" and "ethics". Third, it is proposed to include "law-abiding" in the definition of "AI emotion" and "ethics".

After several rounds of questionnaire surveys, the scores of each index were all greater than 3.75; the standard deviation was less than 1; the overall index passing rate was 94.73%; and the expert group's opinions were generally agreed. Finally, a indicator system for evaluating the vocational competence of skilled personnel was formed, consisting of 3 first-level indicators and 14 second-level indicators, such as "professional competence, methodological competence and social competence", as shown in Table 2.

Table 2. Summary of final data statistics on indicators

norm	mean value	(statistics) standard deviation	four-point spread
professional capacity	4.5	0.527	0.5
methodological capacity	4.3	0.483	0.5
social capacity	4.2	0.632	0.5
Artificial Intelligence Knowledge	4.2	0.421	0.125
general knowledge	4.3	0.674	0.5
specialized knowledge	5	0	0
artificial intelligence (AI) skill	4.5	0.527	0.5
generic skill	4.3	0.674	0.5
specialized skill	5	0	0
management capacity	4.5	0.707	0.5
innovation capacity	4.7	0.483	0.5
continuous learning	4.4	0.699	0.5
Artificial Intelligence Emotion	4.2	0.421	0.125
ethics	4.3	0.674	0.5
psychological quality (in ideological education)	3.9	0.567	0.125
craftsmanship	4.7	0.483	0.5
professional attitude	4.6	0.516	0.5

Description[29]: Retention condition: $M \geq 3.75$, $SD < 1$ and $QD \leq 0.5$. Modification condition: $M < 3.75$ or $SD \geq 1$ or $0.5 < QD < 1$, or the first round of the Delphi Method questionnaire survey, the panelists suggested to amend or merge the rubrics. Deletion condition: $M < 3.75$, $SD \geq 1$, and $QD \geq 1$, or the first round of the Delphi method questionnaire, more than one-half (≥ 13) of the panelists suggested deletion of the rubrics. Stopping the survey: When the average value of stability of all items in the questionnaire is greater than or equal to 70% , the Delphi Method survey can be stopped.

4.3   Weighting Analysis of Evaluation Indexes of Vocational Ability of Skilled Personnel in the Era of Artificial Intelligence

On the basis of the adoption of the above evaluation index system, the Analytic Hierarchy Process was adopted, and the same group of experts was invited to assign weights to each index, and the following results were obtained,   as shown in Table 3: among the first-level indexes, professional competence has the greatest weight, followed by methodological competence, and social competence has the least weight. Among the professional competencies, the weight of professional knowledge is the largest,

highlighting the fundamental role of knowledge in professional competencies. Among the methodological competencies, management competency has the highest weight, emphasizing that the purpose of management is to improve the efficiency and effectiveness of work. Among the social competencies, craftsmanship has the highest weight, highlighting the important role of spiritual leadership.

Table 3. Analytic Hierarchy Process Data Statistics

norm	eigenvector (math.)	weighting	Maximum characteristic root	CI value	RI value	CR value
professional capacity	1.959	65.304%				
methodological capacity	0.705	23.513%	3.029	0.015	0.52	0.028
social capacity	0.335	11.183%				
Artificial Intelligence Knowledge	0.698	11.636%				
general knowledge	1.061	17.686%				
specialized knowledge	2.587	43.114%	6.319	0.064	1.26	0.051
artificial intelligence (AI) skill	0.425	7.083%				
generic skill	0.32	5.331%				
specialized skill	0.909	15.150%				
management capacity	1.717	57.236%				
innovation capacity	0.858	28.585%	3.044	0.022	0.52	0.043
continuous learning	0.425	14.179%				
Artificial Intelligence Emotion	0.656	13.114%				
ethics	1.231	24.610%				
psychological quality (in ideological education)	0.447	8.938%	5.184	0.046	1.12	0.041
craftsmanship	2.346	46.915%				
professional attitude	0.321	6.423%				

5   Conclusions

This study lays a solid theoretical foundation for the evaluation index system of vocational ability of skilled talents by comprehensively collecting and organizing the literature, and collates the initial elements of the evaluation indexes of vocational ability of skilled talents, including 3 first-level indexes and 16 second-level indexes. And then through the revision of the formal Delphi method of scientific screening, reasonable judgment, and timely supplementation of the corresponding indicator elements, to establish an evaluation system containing 3 first-level indicators and 14 second-level indicators. In order to make the establishment of the indicator system more scientific, the Analytic Hierarchy Process is used to assign weights to each indicator and prioritize them, and it is found that the most important first-level indicator is "professional competence", and the most important second-level indicators include "professional knowledge", "management competence", "management ability" and "professionalism". The most important secondary indicators include "professional knowledge", "management ability" and "craftsmanship." So far, the evaluation index system of professional ability of skilled personnel has been established. However, due to the differences in practice of different industries, the ways of measurement, evaluation and assessment

are also different. Therefore, we would like to provide directional suggestions from the three aspects of "selecting, employing and educating": (1) Use the indicator system as a recruitment outline, and set up assessment methods according to the contents of different modules, such as written tests, interviews or practical exercises. (2) Further refine the indicator system into the content of the employee assessment, and conduct a comprehensive evaluation of the employee's professional ability. (3) Based on the assessment results, target training to the part of the employee that is lacking against the evaluation index.

Acknowledgments

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