Research on the Evaluation Model of High-Quality Innovative Knowledge Talents in the Perspective of Labor Education

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Abstract. Labor education is inherently significant in the comprehensive development of individuals in terms of morality, intelligence, physical fitness, aesthetics, and labor skills. It plays a crucial role in cultivating skilled talents. This study employs qualitative research methods to preliminarily identify test items for evaluating the knowledge value of high-quality innovative talents in labor education. Through a comprehensive application of exploratory factor analysis and confirmatory factor analysis, the study examines the test items, leading to the construction of a "Trinity" evaluation model. This model comprises three primary indicators, namely implicit knowledge value, explicit knowledge value, and communicative knowledge value, along with eight secondary indicators and seventeen tertiary indicators. In conjunction with this model, the evaluation of high-quality innovative talents should focus on the following aspects: first, highlighting the evaluation of implicit knowledge value (professional ethics) to correct the previous emphasis on "results first" in talent evaluation; second, reinforcing the evaluation of explicit knowledge value (competence qualities) to change the past practice of "emphasizing education credentials over abilities" and "prioritizing visible abilities over potential"; third, placing importance on the evaluation of communicative knowledge value (performance contribution) to overcome the tendency of "emphasizing seniority over achievements" and "prioritizing titles over contributions".

Keywords: High-quality innovative talents; Competency; Knowledge value; Factor analysis

1 Introduction

High-quality innovative talents engage in long-term scientific and technological innovation activities, possessing noble professional ethics and strong competence qualities. They contribute significantly to scientific and technological development and societal progress, serving as the fundamental guarantee for accelerating China's scientific and innovative development. The evaluation of high-quality innovative talents, as a crucial aspect of the talent development system, plays a vital role in achieving the deep integration of economic and social development with talent development and promoting the construction of an innovative nation [1].

Labor education is an essential component of comprehensive education, emphasizing moral, intellectual, physical, aesthetic, and labor development. It plays a crucial role in nurturing skilled talents[2,3]. Despite notable achievements in the evaluation of high-quality innovative

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talents in recent years, some shortcomings persist. Firstly, evaluation standards often exhibit a one-size-fits-all approach, emphasizing quantity over quality and titles over contributions, while commonly neglecting the assessment of professional ethics. Secondly, the formulation of evaluation indicators is often derived from literature reviews, lacking empirical validation and scientific rigor[4,5]. Thirdly, the basic elements of evaluation model construction mainly focus on qualitative characteristics, with limited consideration for knowledge value.

In this context, this study, amidst the national emphasis on cultivating high-quality artisan talents and advancing labor education, addresses issues identified in teaching practices. Through on-site investigations, literature reviews, and other methods, the study examines the approaches and strategies adopted by vocational colleges both within and outside the province in cultivating artisan talents. It analyzes common problems and shortcomings, focusing on high-quality innovative talents from the perspective of labor, to construct a knowledge value evaluation model. The paper proposes corresponding suggestions to address existing evaluation issues, aiming to provide decision-making references for the selection, cultivation, and evaluation of high-quality innovative talents in China.

2 Research Design

2.1 Collection of Qualitative Characteristics

This study employs a comprehensive approach, integrating literature review, interviews, and questionnaire surveys to gather data on qualitative characteristics, enhancing the credibility of the research results.

Firstly, literature review: Leveraging the China National Knowledge Infrastructure (CNKI) database, keyword searches such as "high-quality innovative talents + evaluation criteria," "high-quality innovative talents + evaluation system," and "high-quality innovative talents + qualitative characteristics" were conducted. Relevant documents released by the government in recent years were also reviewed to collect partial evaluation indicators or qualitative characteristics of high-quality innovative talents [6].

Secondly, in-depth interviews: Using the method of in-depth interviews, statements reflecting the qualitative characteristics of high-quality innovative talents were collected. Twenty high-quality innovative talents were invited for in-depth interviews, including 10 from enterprises, 4 from research institutes, and 6 from universities. Each interview lasted approximately 30 minutes, recorded and transcribed in full. After the interviews, the data was organized, summarized, and the qualitative characteristic statements embedded in the interviews were extracted [7,8].

Thirdly, questionnaire survey: Employing an open-ended questionnaire survey method, 100 individuals from universities, enterprises, and research institutes in the Jiangsu-Zhejiang-Shanghai region were surveyed. Participants were asked to describe the qualitative characteristics that high-quality innovative talents should possess based on their own experiences. One hundred questionnaires were distributed, and 57 valid responses were collected [9]. Based on the survey results, statements on the qualitative characteristics of high-quality innovative talents were compiled.

2.2 Coding and Classification Statistics

Initially, employing content analysis, information related to the qualitative characteristics of high-quality innovative talents collected through literature review, in-depth interviews, and questionnaire surveys was organized, simplified, and encoded, resulting in 169 condensed terms. Considering the repetitiveness of words and the issue of questionnaire length, the 169 terms were merged into 56 representative terms. Subsequently, two experts involved in compiling qualitative characteristics conducted a detailed analysis of these 56 representative terms, categorizing them word by word. The results revealed that the classification and summarization of 50 terms (89%) were entirely consistent, while 6 terms (11%) were assigned to different categories by the two experts [10]. Therefore, the consistency between the two experts was relatively high. Direct approval was given to results that were entirely consistent, and for inconsistent results, repeated discussions were conducted until a consensus was reached.

Furthermore, based on the discussion results and the perspective of knowledge value, the 56 terms were categorized into three dimensions: implicit knowledge value, explicit knowledge value, and communicative knowledge value. Through literature review, expert interviews, and coding classification, this study found that although there is a diverse description of the qualitative characteristics of high-quality innovative talents in various sectors, "professional ethics," "competence qualities," and "performance contribution" are common features and primary criteria for assessing high-quality innovative talents. Moreover, there is a corresponding mapping relationship between the three major qualitative characteristics (professional ethics, competence qualities, and performance contribution) and the three categories of knowledge value (implicit knowledge value, explicit knowledge value, and communicative knowledge value). Specifically, "implicit knowledge value" maps to "professional ethics," "explicit knowledge value" maps to "competence qualities," and "communicative knowledge value" maps to "performance contribution."

Based on these findings, this study proceeded to design the preliminary questionnaire.

2.3 Design of the Preliminary Questionnaire

Drawing inspiration from talent characteristic models designed by Feng Tao, Zhang Xiaojuan, and He Jianwen, among others, and considering the knowledge value characteristics and classification results of high-quality innovative talents, this study initially hypothesizes that the knowledge value evaluation model for high-quality innovative talents consists of three dimensions: implicit knowledge value (professional ethics), explicit knowledge value (competence qualities), and communicative knowledge value (performance contribution). In designing the questionnaire, these dimensions were further refined into eight evaluation indicators: professional norms, responsibility and integrity, scientific quality, psychological qualities, knowledge innovation, social practice, performance achievements, and benefits transformation. Utilizing the Delphi method, five experts with extensive talent management experience were invited to make decisions and modifications to the 56 representative terms. After repeated discussions, a consensus was reached, resulting in the formulation of a preliminary questionnaire composed of two parts: basic information and knowledge value evaluation elements. The basic information section includes items such as gender, age, education, nature of employment, professional and technical positions, and research areas. The

knowledge value evaluation elements consist of 25 testing items (refer to Table 1), all rated on a 5-point Likert scale.

Table 1. Preliminary questionnaire test items

Main factor	Index	Key elements
tacit knowledge value (Professional ethics)	professional standards	A1 professional ethics, A2 professional conduct, A3 academic standards
	Responsibility and integrity	A4 social responsibility, A5 integrity commitment
	scientific quality	A6 values, A7 competitiveness, A8 scientific spirit A9 innovative thinking, A10 physical fitness, A11 innovative quality
explicit knowledge value (ability and quality)	psychological quality	B1 psychological behavioral characteristics, B2 willpower
	knowledge innovation	B3 knowledge and skill characteristics, B4 innovation ability, B5 innovative intelligence quality
	social practice	B6 practical ability, B7 social adaptability, B8 management ability
Circulation knowledge value (performance contribution)	performance results	C1 work performance, C2 innovation results, C3 innovation level, C4 innovation influence
	Benefit conversion	C5 economic benefit, C6 social benefit

3 Research Methodology and Process

3.1 Exploratory Factor Analysis

The initial survey primarily targeted experts and talents in the innovation and technology sectors in major cities such as Beijing, Shanghai, Jiangsu, and Zhejiang. The research was conducted through face-to-face interviews and online questionnaire surveys. A total of 300 questionnaires were distributed, with 214 valid responses received, resulting in an effective response rate of 71.33%. Regarding the nature of the workplace, universities accounted for 30%, research institutes for 27%, technology enterprises for 27%, public institutions for 10%, and government agencies for 6%. In terms of education, bachelor's degree holders comprised 7%, master's degree holders 31%, and those with a doctoral degree or above constituted 62%. Regarding professional and technical positions, 41% held intermediate or lower positions, 33% held associate senior positions, 19% held senior positions, and 7% included academicians of the Chinese Academy of Sciences, recipients of the Outstanding Youth Fund, winners of the Yangtze River Scholar Award, and individuals selected for the Hundred Talents Program.

The data were analyzed using SPSS 20.0, conducting the Kaiser-Meyer-Olkin (KMO) test and Bartlett's sphericity test. The results indicated a KMO value of 0.866, and the chi-square value for the sphericity test was 3339.322 ($p < 0.001$), suggesting the suitability for factor analysis. Principal component analysis was applied, utilizing the Kaiser criterion to extract factors with eigenvalues greater than 1. Items A9, B8, and C3, with factor loadings below 0.50, were

excluded. Ultimately, 22 items were retained as preliminary indicators and elements for the evaluation model. Through multiple explorations, 8 common factors were extracted and named as follows: Factor 1 – Professional Norms, Factor 2 – Responsibility and Integrity, Factor 3 – Scientific Quality, Factor 4 – Psychological Qualities, Factor 5 – Knowledge Innovation, Factor 6 – Social Practice, Factor 7 – Performance Achievements, and Factor 8 – Benefits Transformation, aligning with the theoretical concept. The variance contribution rates of these 8 common factors were 20.383%, 15.278%, 14.104%, 6.041%, 4.993%, 4.908%, 4.449%, and 4.383%, with a cumulative variance contribution rate of 74.539%, indicating that the 8 factors can explain most of the variation in the indicator variables.

Furthermore, the Cronbach's α value was calculated to be 0.891 (>0.80), indicating good reliability of the overall questionnaire. Thus, the conceptualization of evaluating high-quality innovative talents based on implicit knowledge value (professional ethics), explicit knowledge value (competence qualities), and communicative knowledge value (performance contribution) received preliminary validation.

3.2 Confirmatory Factor Analysis

The questionnaire consisting of the aforementioned 22 items was distributed for formal investigation to talents from government agencies, research institutes, enterprises, and universities in major cities, including Beijing, Shanghai, Guangzhou, and Jiangsu, Zhejiang, and Anhui provinces. All test items were rated on a 5-point Likert scale. A total of 451 questionnaires were distributed, with 300 valid responses received, resulting in an effective response rate of 66.52%. In terms of research fields, basic research accounted for 36%, applied research for 27%, technology development for 20%, and science and technology management for 17%. Regarding the nature of workplaces, universities comprised 35%, research institutes 14%, technology enterprises 28%, public institutions 18%, and government agencies 5%. In terms of education, bachelor's degree holders constituted 12%, master's degree holders 37%, and those with a doctoral degree or above comprised 51%. Regarding professional and technical positions, 34% held intermediate or lower positions, 37% held associate senior positions, 18% held senior positions, and 11% included academicians of the Chinese Academy of Sciences, recipients of the Outstanding Youth Fund, winners of the Yangtze River Scholar Award, and individuals selected for the Hundred Talents Program.

Based on the sample data, AMOS 21.0 was used to establish a first-order oblique model for confirmatory factor analysis. The results showed that the main fit indices, including x^2/df, RMSEA, NFI, CFI, and IFI, were not ideal. Therefore, further model adjustments were made. After multiple explorations, five items with relatively small factor loadings (A6, A7, A10, B5, and C4) were removed, resulting in the final construction of a first-order oblique model consisting of 17 items and 8 factors (refer to Figure 1).

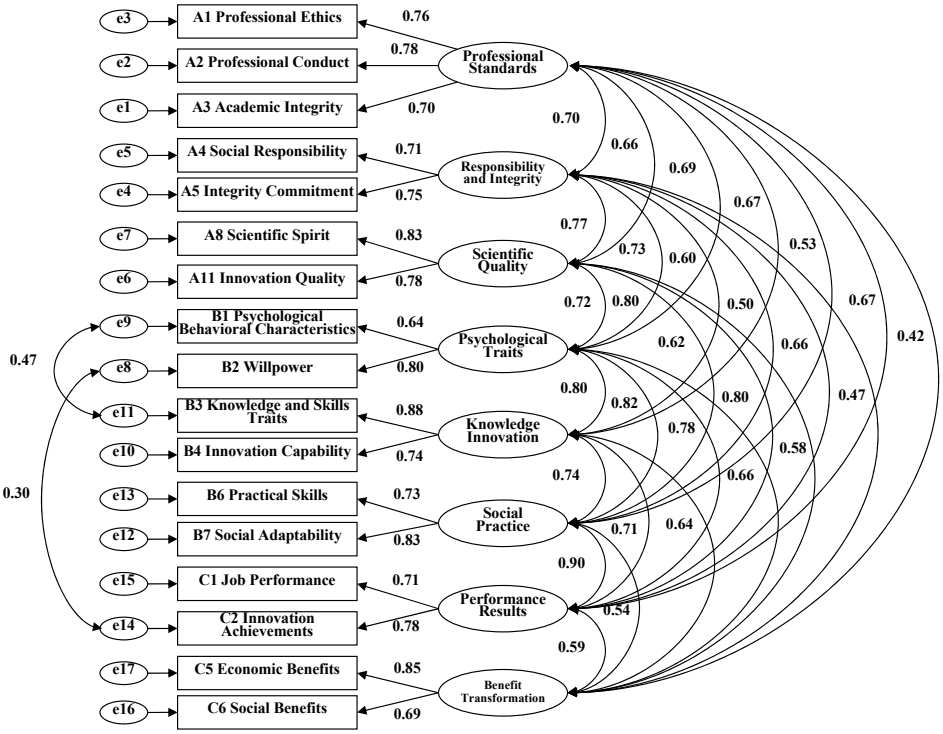

Fig. 1. First-Order Model Diagram

After the revision, the main fit indices approached the ideal benchmarks, with $x^2/df = 2.110$ (less than 3), RMSEA = 0.061 (less than 0.08), RMR = 0.041 (less than 0.05), RFI = 0.903, CFI = 0.965, NFI = 0.937, IFI = 0.966, TLI = 0.947, all exceeding 0.9. All factor loadings were greater than 0.6, indicating a good fit for the model.

The first-order confirmatory factor analysis confirmed the good fit between the 17 items in the scale and the 8 factors in the model. To verify whether these 8 factors belong to a higher-order factor, this study conducted a higher-order confirmatory factor analysis. The results indicated that the 8 first-order factors belonged to a higher-order factor, specifically, implicit knowledge value (professional ethics), explicit knowledge value (competence qualities), and communicative knowledge value (performance contribution), forming three higher-order factors. Furthermore, these three higher-order factors were subsumed under the concept of "knowledge value evaluation of high-quality innovative talents" (see Figure 2).

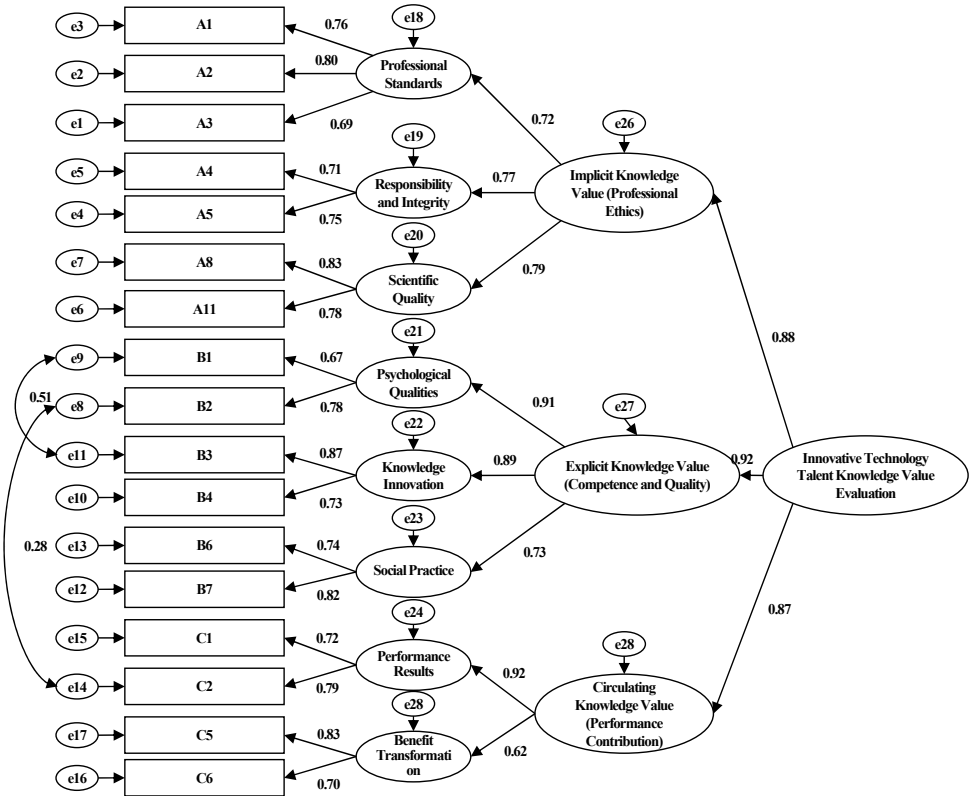

Fig. 2. Higher-Order Model Diagram

The test results indicate that the main fit indices are close to the ideal benchmarks, with x^2/df = 2.142 (less than 3), RMSEA = 0.062 (less than 0.08), RMR = 0.047 (less than 0.05), RFI = 0.902, CFI = 0.958, NFI = 0.925, IFI = 0.959, TLI = 0.945, all exceeding 0.9. The factor loadings for each item were all greater than 0.6, indicating a good overall fit for the model. Therefore, the conceptualization of evaluating high-quality innovative talents based on implicit knowledge value (professional ethics), explicit knowledge value (competence qualities), and communicative knowledge value (performance contribution) received further validation.

4 Conclusions

High-quality innovative talents are a key variable driving economic and social development and the construction of an innovative nation. The construction of a knowledge value evaluation model for high-quality innovative talents is a fundamental and essential task for objectively, scientifically, and fairly assessing the value created by talents. Based on the competency model theory and knowledge value theory, this study has constructed a "Three-in-One" knowledge value evaluation model for high-quality innovative talents (see Figure 3).

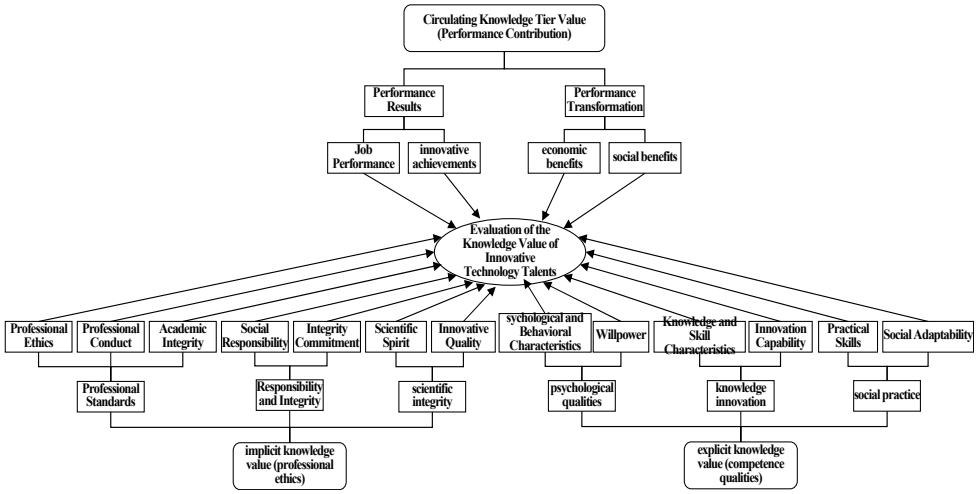

Fig. 3. Tripartite Evaluation Model

Based on the empirical analysis results, the following conclusions can be drawn:

Firstly, in the dimension of implicit knowledge value (professional ethics), which includes professional norms, responsibility and integrity, and scientific qualities. It is manifested as follows: High-quality innovative talents should have a strong sense of professional ethics and adherence to industry norms, a love for the country, a pursuit of truth, and rigorous dedication to academic research. They should possess a strong sense of social responsibility and integrity, avoiding deception and conducting research that is beneficial to society. High-quality innovative talents should excel in breaking conventions, embodying a scientific spirit that continually pursues innovative knowledge, daring to be unconventional, and questioning authority.

Secondly, in the dimension of explicit knowledge value (competence qualities), which includes psychological qualities, knowledge innovation, and social practices. It is manifested as follows: High-quality innovative talents should demonstrate a strong passion for scientific research, high independence, and resilience under pressure. They should possess a solid foundation of professional knowledge and keen insight, consistently approaching problem analysis and resolution from an innovative perspective, offering creative insights. High-quality innovative talents should have strong practical abilities, applying foundational knowledge and professional skills to solve problems, adapting quickly to changes in the research environment and being flexible in responding to challenges.

Thirdly, in the dimension of communicative knowledge value (performance contribution), which includes performance results and benefit transformation. It is manifested as follows: High-quality innovative talents should be able to achieve high performance and innovative results in a particular field, with significant value and far-reaching impact. The scientific achievements obtained by high-quality innovative talents should provide dual benefits, enhancing economic competitiveness, promoting economic development, and simultaneously contributing to societal welfare, driving sustainable social development, and making tangible contributions to the construction of an innovative nation.

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