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From Skill Training to Competency Generation: Construction and Empirical Validation of a Job Competency Model for Health and Elderly Care Professional Clusters in Higher Vocational Education

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Abstract

The development of the health industry has driven the transformation of talent cultivation in health and elderly care-related professional clusters in higher vocational education from single-skill training toward the generation of composite job competencies. To construct a competency model that meets the demands of emerging health industry occupations, this study develops a three-dimensional job competency model consisting of professional technical competency, comprehensive professional quality, and innovation and digital competency based on competency theory, occupational competency structure theory, and digital competency frameworks. Curriculum matching is introduced as an external validation variable. Empirical tests were conducted using 80 pilot-test samples, 197 exploratory samples, and 199 validation samples. The results indicate that: 1) Health industry job competency can be stably classified into three dimensions: professional technical competency, comprehensive professional quality, and innovation and digital competency; 2) The four-dimensional measurement model comprising PT, CQ, ID, and CM demonstrates satisfactory reliability, convergent validity, and discriminant validity; 3) Curriculum matching significantly and positively affects professional technical competency, comprehensive professional quality, innovation and digital competency, as well as overall job competency, with relatively stronger effects on professional technical competency and comprehensive professional quality. The findings suggest that talent cultivation in health and elderly care professional clusters should shift from a traditional skill-oriented approach toward composite competency generation. Curriculum content, curriculum-cluster coordination, authentic training projects, and alignment with industry demands should serve as key mechanisms for constructing a competency map that addresses the emerging livelihood needs of the health industry.

Keywords

Health Industry, Higher Vocational Education, Health and Elderly Care Professional Clusters, Job Competency, Curriculum Matching, New Livelihood Skills Map

1. Introduction

The rapid development of the health industry is reshaping the competency requirements for talent in health and elderly care-related professional clusters in higher vocational education. Emerging sectors such as elderly care services, health management, smart elderly care, traditional Chinese medicine rehabilitation, and community health services continue to expand, resulting in competency requirements that extend beyond single technical operations and increasingly emphasize the integrated development of professional technical competency, comprehensive professional quality, interdisciplinary collaboration, and digital application capability.

For higher vocational institutions, the key objective of talent cultivation is no longer merely enabling students to "perform operations", but rather equipping them to accomplish tasks, communicate and collaborate, solve problems, and adapt to industrial changes within authentic health service contexts.

Existing studies on vocational talent cultivation have focused primarily on school-enterprise cooperation, curriculum reform, and training-base construction. However, insufficient empirical evidence remains regarding the questions of "what dimensions constitute health-industry job competency" and "how curriculum systems influence competency generation". In particular, under the context of emerging health industry sectors, whether innovation and digital competency have become independent components of job competency and whether curriculum matching can effectively explain students' competency levels require further empirical validation.

Against this background, this study investigates the competency structure underlying talent cultivation in health and elderly care professional clusters. A three-dimensional competency model comprising professional technical competency, comprehensive professional quality, and innovation and digital competency is constructed, and curriculum matching is introduced as an external validation variable. Specifically, this study seeks to answer two research questions:

First, can health-industry job competency be stably identified as a multidimensional structure?

Second, can curriculum matching significantly promote the generation of health-industry job competency?

The findings provide empirical evidence for constructing a new livelihood skills map in the health industry, optimizing curriculum systems within health and elderly care professional clusters, and enhancing the quality of industry-education integrated talent cultivation in higher vocational institutions.

2. Literature Review and Research Hypotheses

Job competency in vocational education is not limited to operational skills but represents a composite construct closely associated with authentic work situations, occupational tasks, and action performance. Antera argued that vocational competency should be understood comprehensively in terms of knowledge, skills, attitudes, and contextualized actions rather than being defined solely through individual skills or professional certifications (Antera, 2021).

Within the health industry, expanding occupational tasks in elderly care services, health management, smart elderly care, and community health services require vocational students not only to master technical operations and health service procedures but also to possess communication, coordination, service awareness, teamwork, and digital tool application capabilities. Therefore, health-industry job competency should be identified as a multidimensional construct.

Research on work-based learning and industry-education collaboration further demonstrates that competency generation depends on authentic work environments and effective connections between schools and workplaces. Nouwen et al. found that work-based learning promotes student engagement by satisfying needs for autonomy, relatedness, and competence (Nouwen et al., 2022). Arinaitwe also emphasized that collaboration between vocational institutions and workplaces requires joint planning, mentor participation, continuous communication, and institutional support (Arinaitwe, 2021). In health professions education, both Nyoni et al. (2021) and Janssens et al. (2024) highlighted that clinical placements and work-integrated learning are important pathways for developing professional competency among health students. These studies indicate that job competency is not a simple accumulation of classroom knowledge but is gradually generated through authentic tasks, practical settings, and multi-stakeholder collaboration.

Curriculum systems serve as important mechanisms through which industry demands are translated into student competencies. Ferns et al. argued that work-integrated learning should transform workplace experiences into purposeful, supported, and assessed learning processes through curriculum design (Ferns et al., 2024). Boud et al. emphasized that assessment mechanisms influence how students interpret workplace experiences and integrate theory with practice (Boud et al., 2023). Jackson further noted that work-integrated learning requires systematic curriculum design, external partner participation, and quality assurance (Jackson, 2024).

Accordingly, curriculum matching encompasses not only the alignment between curriculum content and job requirements but also curriculum-cluster coordination, authenticity of training projects, coverage of skill demands, and consistency of assessment standards. For health and elderly care professional clusters, higher levels of curriculum matching are expected to facilitate the development of professional technical competency, comprehensive professional quality, and innovation and digital competency.

Digital transformation has also reshaped occupational competency structures. Roll and Ifenthaler proposed that multidisciplinary digital competencies include information processing, digital collaboration, digital security, problem solving, and reflective judgment (Roll & Ifenthaler, 2021). In the health sector, smart elderly care devices, health data management, and digital health services are increasingly integrated into workplace scenarios, making innovation and digital competency a critical competency unit for health professionals. Emrani et al. further demonstrated that service-based learning in authentic community health settings contributes to students' health education competencies (Emrani et al., 2024). Therefore, innovation and digital competency should not be regarded merely as a subsidiary component of professional technical competency but rather as an independent dimension within the health-industry job competency model.

In summary, previous studies provide three major insights. First, job competency is composite and contextualized. Second, authentic work environments and curriculum design are critical conditions for competency generation. Third, digital competency has become an important component of health-service occupations.

Based on these insights, the following hypotheses are proposed:

H1: Health-industry job competency consists of three dimensions: professional technical competency, comprehensive professional quality, and innovation and digital competency.

H2: Curriculum matching positively affects professional technical competency.

H3: Curriculum matching positively affects comprehensive professional quality.

H4: Curriculum matching positively affects innovation and digital competency.

H5: Curriculum matching positively affects overall health-industry job competency.

3. Research Design

3.1. Variable Measurement

A five-point Likert scale was adopted in this study, where 1 represents "strongly disagree" and 5 represents "strongly agree". The questionnaire consisted of four dimensions: professional technical competency, comprehensive professional quality, innovation and digital competency, and curriculum matching, comprising a total of 20 measurement items. Professional technical competency, comprehensive professional quality, and innovation and digital competency jointly constitute health-industry job competency, while curriculum matching serves as an external validation variable. The operational definitions and measurement items of all constructs are presented in **Table 1**.

Table 1. Variables and measurement items.

Variable	Symbol	Item Composition	No. of Items
Professional Technical Competency	PT	Elderly care technical operations, handling complex situations, personalized health planning, equipment utilization, risk identification and emergency response	5
Comprehensive Professional Quality	CQ	Communication and coordination, service awareness, teamwork, professional responsibility, complaint and conflict management	5
Innovation and Digital Competency	ID	Use of information technologies, data analysis, adaptation to emerging sectors, interdisciplinary integration, service process innovation	5
Curriculum Matching	CM	Curriculum content alignment, curriculum-cluster coordination, relevance of practical training courses, coverage of skill requirements, authenticity of training scenarios	5

3.2. Sample Sources and Data Processing

Data analysis was conducted in three stages. The purposes of each sample and the corresponding analytical methods are summarized in Table 2.

Table 2. Sample purposes and analytical methods.

Stage	Sample Size	Purpose	Main Methods
Pilot Test	80	Preliminary examination of scale applicability	Item analysis, reliability analysis, KMO, EFA
Exploratory Sample	197	Finalization of measurement structure	Formal EFA, communality, factor loading, cross-loading examination
Validation Sample	199	Validation of model structure	CFA, CR, AVE, discriminant validity, path analysis

In the first stage, 80 randomly selected pilot-test samples were used to perform preliminary item analysis, reliability testing, and exploratory factor analysis (EFA).

In the second stage, 197 formal exploratory samples were employed to conduct EFA on the 20 items across PT, CQ, ID, and CM and to finalize the measurement structure.

In the third stage, 199 independent validation samples were used to conduct confirmatory factor analysis (CFA), convergent validity testing, discriminant validity testing, and examination of the effects of curriculum matching.

3.3. Analytical Methods

This study employed a combination of exploratory factor analysis and confirmatory factor analysis.

First, the quality of the measurement scale was assessed using the 80 pilot-test samples.

Second, the 197 exploratory samples were used to conduct formal EFA to verify the proposed four-dimensional structure.

Third, the 199 validation samples were employed to perform CFA and evaluate model fit, standardized factor loadings, composite reliability (CR), average variance extracted (AVE), and discriminant validity.

Finally, the effects of curriculum matching on professional technical competency, comprehensive professional quality, innovation and digital competency, and overall job competency were examined.

4. Empirical Results

4.1. Pilot Test Results

Results from the 80 pilot-test samples showed that Cronbach's α coefficients for PT, CQ, ID, and CM were 0.885, 0.904, 0.887, and 0.885, respectively, while the overall scale achieved a Cronbach's α of 0.928, indicating satisfactory reliability.

The KMO value was 0.892, and Bartlett's test of sphericity was significant, indicating that the data were suitable for factor analysis.

The EFA results revealed four factors with eigenvalues greater than 1, which were consistent with the theoretically proposed four-dimensional structure consisting of professional technical competency, comprehensive professional quality, innovation and digital competency, and curriculum matching. The cumulative explained variance reached 71.57%.

Most items exhibited primary loadings above 0.50 and communalities above 0.40. Although ID3 demonstrated a relatively lower loading in the pilot test, its corrected item-total correlation (CITC) and communality met the minimum retention criteria. Therefore, no item was removed during the pilot stage, and ID3 was identified as a key item for further observation in the formal sample.

4.2. Exploratory Factor Analysis

Results from the 197 exploratory samples indicated that the overall Cronbach's α of the scale was 0.919. The reliability statistics and exploratory factor analysis results are reported in Table 3. Cronbach's α coefficients for PT, CQ, ID, and CM were 0.831, 0.885, 0.837, and 0.864, respectively, demonstrating satisfactory reliability.

The KMO value reached 0.912, and Bartlett's test of sphericity was significant, confirming the suitability of the data for exploratory factor analysis.

Table 3. Reliability and EFA results of the exploratory sample.

Indicator	Result
Overall Cronbach's α	0.919
PT Cronbach's α	0.831
CQ Cronbach's α	0.885
ID Cronbach's α	0.837
CM Cronbach's α	0.864
KMO	0.912

Continued

Bartlett χ^2	1945.462
Bartlett df	190
Bartlett p	<0.001
Number of Factors with Eigenvalues > 1	4
Cumulative Explained Variance	64.39%

The EFA results showed that all 20 items loaded onto their theoretically assigned factors. Primary factor loadings exceeded 0.50, communalities exceeded 0.40, and no substantial cross-loadings were observed.

The loading of ID3 increased to 0.720 in the formal exploratory sample, indicating satisfactory performance. Consequently, no item was removed, and all 20 items were retained for CFA. Table 4 presents the primary factor loadings and communalities of all retained items.

Table 4. Primary loadings and communalities of the exploratory sample.

Dimension	Items	Loading Range	Communality Range	Decision
PT	PT1-PT5	0.522 - 0.624	0.479 - 0.578	Retained
CQ	CQ1-CQ5	0.639 - 0.783	0.546 - 0.701	Retained
ID	ID1-ID5	0.581 - 0.731	0.473 - 0.590	Retained
CM	CM1-CM5	0.651 - 0.736	0.492 - 0.652	Retained

4.3. Confirmatory Factor Analysis and Convergent Validity

Based on the finalized 20-item structure, CFA was conducted using the 199 validation samples. The results demonstrated satisfactory model fit. The detailed model fit indices are presented in Table 5.

Table 5. CFA model fit results.

Indicator	Result	Assessment
χ^2/df	1.027	Acceptable
CFI	0.998	Acceptable
TLI	0.998	Acceptable
RMSEA	0.012	Acceptable
SRMR	0.040	Acceptable

All fit indices met commonly accepted thresholds, indicating strong support for the four-dimensional measurement model.

Standardized factor loadings exceeded 0.50, with the minimum loading being 0.690.

The loading ranges were: PT: 0.744 - 0.800, CQ: 0.771 - 0.851, ID: 0.690 - 0.844, CM: 0.743 - 0.802. The loading of ID3 reached 0.747, satisfying retention criteria. Table 6 reports the reliability and convergent validity results for all constructs.

Table 6. Reliability and convergent validity.

Dimension	Cronbach's α	CR	AVE	Assessment
PT	0.882	0.884	0.603	Acceptable
CQ	0.914	0.915	0.682	Acceptable
ID	0.876	0.877	0.589	Acceptable
CM	0.880	0.880	0.596	Acceptable

All CR values exceeded 0.70 and all AVE values exceeded 0.50, indicating satisfactory composite reliability and convergent validity.

4.4. Discriminant Validity

The discriminant validity results showed that correlations among PT, CQ, ID, and CM were all lower than the square roots of their corresponding AVE values. The detailed discriminant validity statistics are reported in Table 7. In addition, all HTMT values were below 0.85, indicating adequate discriminant validity.

Table 7. Discriminant validity results.

Dimension Relationship	Correlation	HTMT	Assessment
PT-CQ	0.655	0.658	Passed
PT-ID	0.573	0.580	Passed
PT-CM	0.606	0.603	Passed
CQ-ID	0.507	0.514	Passed
CQ-CM	0.574	0.575	Passed
ID-CM	0.541	0.543	Passed

These findings indicate that professional technical competency, comprehensive professional quality, innovation and digital competency, and curriculum matching can be treated as correlated yet structurally distinct latent variables.

4.5. Effects of Curriculum Matching on Job Competency

After the measurement model was validated, the effects of curriculum matching on job competency were further examined. The results indicate that curriculum matching has significant positive effects on professional technical competency, comprehensive professional quality, innovation and digital competency, as well as overall health-industry job competency. The path coefficients and explanatory power are presented in Table 8.

Table 8. Effects of curriculum matching on job competency.

Path	Standardized Coefficient (β)	*p*-value	R^2	Result
CM → PT	0.531	<0.001	0.282	Supported
CM → CQ	0.515	<0.001	0.265	Supported
CM → ID	0.477	<0.001	0.228	Supported
CM → AC	0.615	<0.001	0.378	Supported

Figure 1 presents the structural relationships between curriculum matching and health-industry job competency.

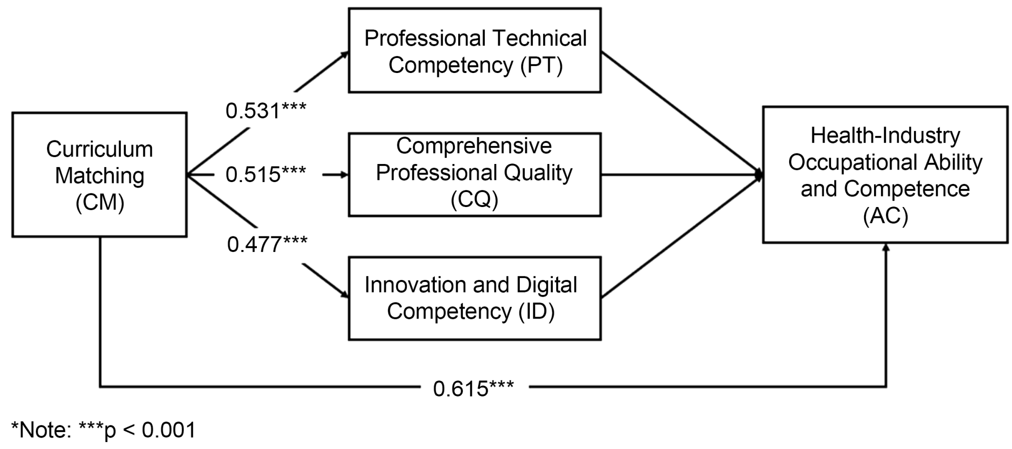

Figure 1. Path model of curriculum matching promoting the generation of health-industry job competency.

As illustrated in Figure 1, curriculum matching exerts significant positive effects on professional technical competency, comprehensive professional quality, innovation and digital competency, as well as overall health-industry job competency. Among these relationships, curriculum matching exerts the strongest effect on professional technical competency and a relatively weaker effect on innovation and digital competency. This finding suggests that the current curriculum system provides stronger support for traditional technical skills and service-oriented professional qualities, while curricular support for competencies related to digital health, smart elderly care, health data analytics, and service process innovation remains insufficient and requires further enhancement.

5. Discussion

5.1. Health-Industry Job Competency Exhibits a Composite Competency Structure

The findings indicate that health-industry job competency can be stably classified into three dimensions: professional technical competency, comprehensive professional quality, and innovation and digital competency. This suggests that talent cultivation within health and elderly care-related professional clusters in higher vocational education should no longer remain at the level of isolated skill training but should instead focus on the generation of composite job competencies.

Professional technical competency serves as the foundation for completing elderly care and health management tasks. Comprehensive professional quality reflects the service-oriented nature of health-industry occupations. Innovation and digital competency address the practical demands arising from smart elderly care, health data management, and the development of emerging health-service sectors.

5.2. Innovation and Digital Competency Possesses an Independent Structural Position

Although Item ID3 exhibited potential concerns during the pilot-testing stage, the overall structure of the ID dimension remained stable in both the exploratory sample (n = 197) and the validation sample (n = 199), and ID3 ultimately met the retention criteria.

This finding suggests that "adapting to the development needs of emerging health-industry sectors" is not a vague capability but an important component of innovation and digital competency. Therefore, innovation and digital competency should no longer be viewed as a subsidiary element of professional technical competency but rather as an independent dimension within the health-industry job competency model.

5.3. Comprehensive Professional Quality Is a Critical Support for Health-Industry Job Competency

The CQ dimension demonstrated stable performance across all three stages of analysis, indicating that communication and coordination, service awareness, teamwork, professional responsibility, and conflict management are essential components of competency in health-industry occupations.

Health services frequently involve elderly individuals, patients with chronic diseases, rehabilitation populations, and community health service recipients. Consequently, occupational tasks require students not only to master technical procedures but also to possess strong interpersonal communication skills and service-oriented competencies. Therefore, talent cultivation in health and elderly care programs should avoid an excessive emphasis on technical skills at the expense of service capabilities.

5.4. Curriculum Matching Is an Important Mechanism for Competency Generation

The path analysis reveals that curriculum matching exerts a significant positive influence on overall health-industry job competency.

This finding suggests that job competency is not a naturally occurring personal attribute but is systematically generated through the alignment of curriculum content, practical training projects, curriculum-cluster coordination, and industry demands.

The relatively stronger effects of curriculum matching on professional technical competency and comprehensive professional quality, compared with innovation and digital competency, indicate that current curriculum systems should further strengthen content related to smart elderly care, digital health technologies, health data analytics, and service process innovation.

6. Conclusions and Recommendations

Based on 80 pilot-test samples, 197 exploratory samples, and 199 validation samples, this study constructed and validated a health-industry job competency model for health and elderly care professional clusters in higher vocational education.

The findings indicate that:

First, health-industry job competency consists of three dimensions: professional technical competency, comprehensive professional quality, and innovation and digital competency.

Second, the four-dimensional measurement model comprising PT, CQ, ID, and CM demonstrates satisfactory reliability, convergent validity, and discriminant validity.

Third, curriculum matching significantly and positively affects professional technical competency, comprehensive professional quality, innovation and digital competency, as well as overall job competency.

Fourth, the influence of curriculum matching on innovation and digital competency is relatively weaker, indicating that curriculum development in digital health-related areas still requires further strengthening.

Based on these findings, the following recommendations are proposed.

First, construct a three-dimensional integrated new livelihood skills map for the health industry.

Health and elderly care professional clusters in higher vocational education should incorporate professional technical competency, comprehensive professional quality, and innovation and digital competency into an integrated competency framework, thereby avoiding the reduction of talent cultivation to purely technical training.

Second, reconstruct curriculum systems around occupational tasks.

Curriculum content should be aligned with typical occupational tasks in elderly care services, health management, traditional Chinese medicine rehabilitation, community health services, and smart elderly care. Industry requirements should be translated into curriculum projects, practical training tasks, and assessment standards.

Third, strengthen the cultivation of innovation and digital competency.

Higher vocational institutions should further increase curricular content related to health data analytics, smart elderly care technologies, digital health management tools, and service process optimization in order to enhance students' ability to adapt to emerging developments in the health industry.

Fourth, enhance coordination among curriculum clusters.

Health-industry job competency cannot be generated through a single course in isolation. Instead, it requires coordinated support among foundational professional courses, core skills courses, practical training courses, and interdisciplinary courses.

Overall, talent cultivation within health and elderly care professional clusters should move: from **skill training** to **competency generation**; from **curriculum provision** to **job matching**; from **isolated disciplinary development** to **the construction of a new livelihood skills map**.

Only when curriculum systems maintain continuous alignment with the actual competency requirements of health-industry occupations can students' professional technical competency, comprehensive professional quality, and innovation and digital competency be systematically enhanced.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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