Research on Influencing Factors of Teachers' Practical Teaching Competence in Higher Vocational Colleges

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Abstract: From the perspective of type education, vocational education is as important as general education, and its development is related to the integrity of the education system and the diversification of talent cultivation. In order to improve the practical teaching ability of teachers in Higher Vocational Colleges from the perspective of type education, through literature analysis and interviews, this paper identifies six core dimensions and 31 influencing factors, including teachers' own operation ability, practical teaching design ability, practical teaching implementation ability, practical teaching research and innovation ability, practical teaching reflection and evaluation ability, and practical teaching development ability. Social network analysis is used to construct the adjacency matrix and calculate the centrality index. The results show that seven key factors, such as the ability to control the practice teaching process and the ability to connect the development of industrial demand, exist problems such as lack of coordination and lag in updating. Based on this, this paper puts forward some optimization countermeasures, such as digital management and control, school enterprise cooperation, etc., to provide reference for the improvement of teachers' ability in higher vocational colleges.

Keywords: Type Education; Higher Vocational Colleges; Practical Teaching Competence; Influencing Factors; Social Network Analysis

1. Introduction

In recent years, the orientation of vocational education as a type of education has been continuously clarified and strengthened. It plays an irreplaceable role in serving the national economic and social development and cultivating high-quality technical and skilled talents. As the higher level of the vocational education system, higher vocational colleges are the main front for the cultivation of technical and skilled talents. The quality of education directly determines the effectiveness of talent cultivation, and teachers' practical teaching ability is the key factor affecting the quality of higher vocational education[1-2]. At present, the research on Teachers' practical teaching ability in higher vocational colleges has achieved some results, but the systematic research on the evaluation of teachers' practical teaching ability is still insufficient. The existing evaluation system fails to fully reflect the type characteristics of vocational education, and it is difficult to accurately measure the consistency between teachers' practical teaching ability and the type education of higher vocational education, which restricts the improvement of teachers' practical teaching ability in Higher Vocational Colleges and the high-quality development of vocational education.

Therefore, the research on the influencing factors of teachers' practical teaching ability in Higher Vocational Colleges from the perspective of type education has important theoretical and practical significance: at the theoretical level, it can break through the existing research's lack of attention to the "type attribute" of vocational education, build a theoretical framework of practical teaching ability that fits the characteristics of higher vocational education, make up for the defects of the traditional evaluation system that ignores the core dimensions of "industry education collaboration", "industry adaptation" and "achievement transformation", and enrich the theoretical system of vocational education teachers' ability research[3-5]. At the practical level, it can accurately identify the key variables that affect the improvement of teachers' practical teaching ability, such as the depth of school enterprise

cooperation, the docking mechanism of industrial demand, the supply of practical teaching resources, and teachers' experience in enterprises, so as to provide empirical basis for higher vocational colleges to formulate plans for improving teachers' ability, and then promote the precise matching of teachers' practical teaching ability with industrial technology development and talent training objectives, and ultimately help the positioning of vocational education types, so as to cultivate more high-quality technical and skilled talents to meet the needs of economic and social development for the country.

2. Identification of Influencing Factors

The key words "type education", "higher vocational colleges", "teachers' practical teaching ability" and "influencing factors (elements)" were retrieved from CNKI, Wanfang, VIP and other databases. At the same time, the key words were extended to "integration of industry and education", "school enterprise cooperation", "practical teaching", "technical and skilled personnel training" and other key words. The retrieval time was determined to be 2013-2024. The core literature was selected according to the correlation between the literature title, abstract and the research topic. The six core dimensions of teachers' practical teaching ability in higher vocational colleges are preliminarily established, which are practical teaching cognitive ability, teachers' own operation ability, practical teaching design ability, practical teaching implementation ability, practical teaching research and innovation ability, and practical teaching reflection and evaluation ability. Under each core dimension, further comb out the specific key ability elements: Teachers' own operation ability: the literature generally emphasizes the "practical equipment operation ability" (42 times) and "practical technology application ability" (39 times) [4-8], and some literatures put forward the "enterprise scene transformation ability" (21 times) [9-11], believing that teachers need to transform the enterprise production practice experience into teaching resources, which corresponds to the "integration of production and education" requirements of type education; Another 17 times referred to "safety prevention and control ability", highlighting the importance of practical teaching safety.

The interview method was used to supplement and improve the influencing factors of literature identification. The interviewees were selected by "stratified sampling", including 9 front-line teachers, 3 enterprise personnel and 3 education managers. The interview outline is designed around three core questions: whether the ability evaluation indicators preliminarily extracted from the literature analysis are complete, whether they meet the actual needs, and whether new elements need to be added. Combined with the results of literature analysis and interviews, we supplemented and improved the content, removed the cognitive ability of practical teaching, added the developmental ability of practical teaching, and finally formed the influencing factors including 6 core dimensions and 31 specific abilities (Table 1).

3. Network Analysis of Influencing Factors

The identified influencing factors of teachers' practical teaching ability in higher vocational colleges are related to each other. The social network analysis method focuses on how the relationship form composed of multi-dimensional factors jointly affects the behavior of network members, and pays attention to the relationship between individual factors and overall factors, which can better grasp the relationship between factors and teachers' practical teaching ability in higher vocational colleges.

3.1 Scale Design and Data Collection

The adjacency matrix of the influencing factors network of teachers' practical teaching ability in higher vocational colleges is constructed by factor pairwise comparison. Risk adjacency matrix RA and Ma are different positions of the same risk factor, RA is the factor affecting other risks, and Ma is the factor affected by other risk factors. If the risk factor RA affects Ma, it will be quantified as "1", and if there is no impact, it will be quantified as "0". The same factor has no mutual influence and will not be quantified, which is expressed as "-". In order to make the survey convenient and efficient, this survey divides the entire adjacency matrix into several small matrices for separate surveys, using offline paper version and online electronic version. Online electronic documents are distributed through questionnaire star and credamo questionnaire platform. This survey has issued 38 questionnaires, and 38 questionnaires were recovered. After analysis, 32 questionnaires

were finally determined to be valid, and the adjacency matrix shown in Figure 1 was obtained by adopting the principle of simple minority obeying majority.

Table 1. Influence Factor

Classification	Specific Capabilities
Teachers' operation ability	Practical operation core equipment precision operation ability (A01)
	Comprehensive application ability of key technologies in practical operation (A02)
	Transformation ability of enterprise practice scene teaching (A03)
	Practice equipment fault diagnosis capability (A04)
	Practical teaching safety prevention and control ability (A05)
Practical teaching design ability	Practical teaching goal design ability (A06)
	Practical teaching content construction ability (A07)
	Practical teaching method design ability (A08)
	Practical teaching resource development ability (A09)
	Practice teaching implementation and evaluation design ability (A10)
	Innovative design ability of practical teaching (A11)
Practical teaching implementation ability	Ability to integrate ideological and political education into curriculum design and Implementation (A12)
	Practice teaching implementation preparation ability(A13)
	Practical teaching process control ability(A14)
	Differentiated implementation ability of practical teaching(A15)
	Practical teaching emergency handling ability(A16)
	Transformation ability of practical teaching achievements(A17)
Practice teaching research and scientific research innovation ability	Implementation ability of school enterprise cooperation resources integration(A18)
	Practical teaching research topic selection and design ability(A19)
	Innovation and transformation ability of practical teaching and research achievements(A20)
	Research and development ability of practical scientific research projects(A21)
	Ability to promote and exchange practical teaching and research achievements(A22)
Practical teaching reflection and evaluation ability	Practice teaching self reflection ability(A23)
	Construction and implementation ability of practical teaching evaluation system(A24)
	Practical teaching evaluation implementation and result application ability(A25)
	Continuous improvement ability based on reflection and evaluation(A26)
	Self development ability of practical teaching(A27)
Practical teaching developmental ability	Industrial demand docking development capacity(A28)
	Practice teaching guidance and radiation ability(A29)
	Practical teaching resources upgrading and development ability(A30)
	Cross border collaborative development capacity(A31)

	A01	A02	A03	A04	A05	A06	A07	A08	A09	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19	A20	A21	A22	A23	A24	A25	A26	A27	A28	A29	A30	A31
A01	—	1	1	1	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	1	0	1	0	1	1	0	0	0
A02	1	—	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
A03	0	1	1	0	0	1	1	1	0	0	1	0	1	0	0	0	0	1	1	1	1	1	0	0	0	0	—	1	1	0	0
A04	1	1	1	—	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
A05	0	0	0	1	—	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A06	0	0	1	0	0	—	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
A07	0	0	1	0	0	1	—	0	0	1	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
A08	0	0	0	0	0	0	1	—	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
A09	0	0	0	0	0	1	1	0	—	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
A10	0	0	0	0	0	1	1	1	0	—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1
A11	0	0	0	0	0	0	0	0	0	0	—	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	1	0	0	1	0
A12	0	0	0	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
A13	0	0	0	0	1	0	0	0	0	0	0	0	—	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A14	0	1	1	0	1	1	1	1	1	1	1	0	1	—	1	1	1	0	0	1	1	0	0	1	1	1	1	0	1	0	1
A15	0	1	1	0	0	1	1	1	1	0	1	0	0	1	—	0	1	1	1	1	1	0	0	0	0	0	1	0	0	1	0
A16	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	—	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
A17	0	0	1	0	0	1	1	1	1	0	1	0	0	0	0	0	—	1	1	1	0	1	1	0	0	1	1	0	0	0	0
A18	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1	—	0	1	0	0	0	0	0	0	0	0	0	0	0
A19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	—	1	0	0	0	0	0	0	1	0	0	0	0
A20	0	0	1	0	0	1	1	0	1	0	1	0	0	0	1	0	1	0	0	—	1	1	0	0	0	0	1	1	1	0	0
A21	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	—	1	1	0	0	0	0	0	0	0	0
A22	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	—	1	0	0	0	0	0	0	0	0
A23	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	1	—	0	0	0	0	0	0	0	0
A24	0	0	1	0	0	1	1	1	0	1	1	0	1	1	1	0	1	0	0	0	0	1	1	—	1	0	1	0	1	1	0
A25	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	—	1	0	0	0	0	0
A26	0	0	1	0	0	1	0	1	0	0	1	0	1	0	0	0	1	0	0	0	0	0	1	—	—	0	1	0	1	1	0
A27	0	—	0	1	1	1	1	1	1	1	0	0	0	1	0	0	1	0	0	0	1	0	0	0	0	0	0	0	1	0	
A28	1	1	1	0	0	1	1	0	1	0	0	0	0	0	0	0	1	1	0	1	1	1	0	1	1	1	1	—	1	1	1
A29	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	1	0	0	0	0	0	0	0	1	1	—	1	0
A30	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	—	0
A31	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	—

Figure 1. Adjacency Matrix of Influencing Factors of Teachers' Practical Peaching Ability in Higher Vocational Colleges

3.2 Network Model Construction

According to the results of the questionnaire, the adjacency matrix of the influencing factors network of teachers' practical teaching ability in higher vocational colleges is formed (Figure 1), which is imported into gephi to draw the network diagram (Figure 2).

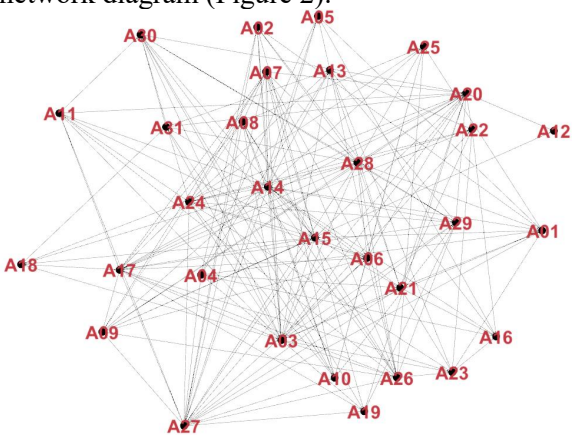

Figure 2. Network Model of Influencing Factors of Teachers' Practical Teaching Ability in Higher Vocational Colleges

3.3 Centrality Analysis

Accurately calculate the total degree, intermediary centrality and proximity centrality based on adjacency matrix through social network analysis. The total degree of nodes reflects the breadth of direct correlation between nodes and other capabilities, and counts the "1" number of rows corresponding to each node in the matrix. The intermediate centrality reflects the "bridge hub function" of nodes, and counts the number of times each node is located on the "shortest path of node pair". The proximity centrality reflects the indirect connection efficiency of the node. First, calculate the shortest path from the node to all other nodes, sum the total distance, and then take the reciprocal of the total distance. The smaller the total distance, the higher the proximity centrality. Result analysis: the nodes of A14 (14), A28 (13), A03/A15/A24 (11) and other factors are the core connection points of the network system, which directly link multiple capability areas. A14 (0.31), A28 (0.28), A24 (0.24) and other factors have a high degree of intermediary centrality, indicating that these nodes are the key to cross domain convergence and can promote the collaboration of sub networks with different capabilities. A14 (0.92), A28 (0.89), A24 (0.85) and other factors have a high degree of proximity to the center, indicating that such nodes can quickly transfer information and are the core of information flow in the system.

For the sake of overall intuitive statistics, the paper weighted the total node degree, intermediate centrality and proximity centrality by 0.4/0.3/0.3 respectively, and calculated the overall centrality. The results are shown in Table 2.

Table 2. Centrality Analysis

Factor	Total degree	Intermediary centrality	Near centrality	Whole	Ranking
A14	14	0.31	0.92	5.969	1
A28	13	0.28	0.89	5.551	2
A24	11	0.24	0.85	4.727	3
A15	11	0.23	0.84	4.721	4
A03	11	0.22	0.83	4.715	5
A20	10	0.21	0.82	4.309	6
A17	10	0.2	0.81	4.303	7
A27	9	0.14	0.75	3.867	8
A01	9	0.13	0.73	3.858	9
A26	8	0.15	0.76	3.473	10
A04	7	0.09	0.7	3.037	11
A10	6	0.09	0.69	2.634	12
A02	6	0.08	0.68	2.628	13
A29	5	0.09	0.68	2.231	14
A23	5	0.08	0.67	2.225	15
A22	5	0.08	0.67	2.225	16
A09	5	0.08	0.67	2.225	17
A07	5	0.08	0.67	2.225	18
A31	4	0.07	0.66	1.819	19

A30	4	0.07	0.66	1.819	20
A18	4	0.07	0.66	1.819	21
A06	4	0.07	0.66	1.819	22
A21	4	0.06	0.65	1.813	23
A11	4	0.06	0.65	1.813	24
A05	4	0.06	0.65	1.813	25
A25	3	0.05	0.63	1.404	26
A08	3	0.05	0.63	1.404	27
A19	2	0.04	0.62	0.998	28
A16	2	0.03	0.61	0.992	29
A13	2	0.03	0.61	0.992	30
A12	1	0.01	0.58	0.577	31

The results show that the practice teaching process takes the control ability (A14) as the overall controller of the whole process. Although the linkage link is the widest, the coordination of safety prevention and control and ideological and political integration is insufficient, and the digital monitoring needs to be strengthened; The industry demand docking development capability (A28) plays the role of external industry interface and can connect industry demand and teaching output, but it has shortcomings in the transformation and connection of scientific research achievements and the timeliness of demand research; The construction and implementation ability of practical teaching evaluation system (A24) is the quality feedback center, which can connect teaching implementation and continuous improvement. However, the evaluation dimension is single, focusing on skills rather than ideological and political and industrial adaptability, and the application of the results lags behind; As the core of personalized adaptation, the differentiated implementation ability of practical teaching (A15) can meet the needs of different students, but it lacks the support of students' ability portrait, and the coordination of hierarchical resources and methods is insufficient; The teaching transformation ability of enterprise practice scene (A03) is the link of production and education transformation, which can transform the enterprise scene into teaching resources, but it faces the problem that the scene update lags behind the industrial technology and the virtual scene development is insufficient; The innovation and transformation ability of practical teaching and research achievements (A20) is the landing engine of teaching and research, which can connect topic selection and application, but there is a disconnect between teaching and research topic selection and teaching needs, and the promotion scope of achievements is narrow; Practical teaching achievements transformation ability (A17), as the output hub of achievements, can realize the value landing, but the types of achievements are single, most of them are course assignment type, few are industrial application type, and the transformation channels are limited.

4. Countermeasure Analysis

4.1 Optimization of Control Ability in Practice Teaching Process

Strengthen the whole process collaboration and digital control. On the one hand, set up a safety ideological and political double verification mechanism in the teaching process, carry out equipment safety verification before operation, and integrate professional quality guidance into the case explanation to avoid disconnection from key support capabilities; On the other hand, a digital monitoring platform is built to collect teaching, operation and equipment data in real time, automatically warn the process deviation and synchronously push it to the implementation design and evaluation module, so as to realize the real-time linkage of control adjustment evaluation.

4.2 Industrial Demand Docking and Development Capacity Optimization

To improve the internal and external linkage and demand response mechanism, first, set up an industrial demand research group, visit enterprises quarterly to collect job standards and technical trends, and form a demand report to guide the updating of teaching scenarios and target adjustment; The second is to build a docking platform for the transformation of achievements, classify and archive scientific and technological achievements and teaching and

research plans, screen landing projects by joint enterprises, promote the transformation of achievements to industrial applications, and build a closed loop of demand research and development teaching application.

4.3 Construction of Practical Teaching Evaluation System and Optimization of Implementation Ability

Expand the application of evaluation dimensions and results, build a three-dimensional evaluation framework of skills compliance, industrial adaptation, and ideological and political literacy, and introduce indicators such as corporate mentor scores and professional ethics performance to break the limitation of skill only evaluation; At the same time, an application list of evaluation results is established to link the evaluation data to the continuous improvement link, push special training for the lack of skills, adjust the teaching scene for the low adaptability of the industry, and shorten the improvement cycle.

4.4 Optimization of Differentiated Implementation Ability in Practical Teaching

Accurately match the needs and hierarchical support, establish a database of students' ability portraits, integrate the test and learning data, and divide the basic, advanced and innovative levels to provide the basis for teaching objectives and content design; Jointly develop layered resource packs to provide operating videos, case libraries and other resources for students at different levels, and ensure adequate support for differentiated implementation.

4.5 Optimization of Enterprise Practice Scene Teaching Transformation Ability

Accelerate scene updating and technology empowerment, set up a school enterprise scene development team, update the industrial frontier scene library every six months and disassemble it into three-level teaching tasks; Introduce vr/ar technology to develop virtual training content for high-risk and high-cost scenes, solve the problem of scene access, and improve teaching security and repeatability.

4.6 Innovation and Transformation Ability Optimization of Practical Teaching and Research Achievements

Focusing on demand orientation and achievement promotion, the list of pain points in practical teaching was released at the beginning of the year, requiring the docking of teaching and research topics; Build a school level achievement sharing platform, classify and mark outstanding achievements, and improve the reuse rate and radiation range of achievements through inter school cooperation and teacher training and promotion.

4.7 Optimization of Transformation Ability of Practical Teaching Achievements

Enrich the types and transformation channels of achievements, guide the transformation of achievements from Operation Oriented to industrial application-oriented, and jointly screen valuable achievements to push them to enterprise pilot projects; Organize students to participate in skills competition and innovation and entrepreneurship competition, connect enterprise resources, promote the transformation of award-winning achievements to marketization and industrialization, and build a teaching competition industry progressive transformation chain.

5. Conclusion

Focusing on the orientation of type education, this paper systematically carries out the research on the influencing factors of teachers' practical teaching ability in higher vocational colleges, and draws the following conclusions: first, it defines the network structure of 31 influencing factors. The core of the network is the ability to control the practical teaching process, the ability to meet the needs of the industry, and the ability to build and implement the practical teaching evaluation system, which is the key to promote the improvement of teachers' practical teaching ability; Second, the core factors have some common problems, such as the lack of coordination in the whole process, the weak adaptability of the industry, and the single evaluation dimension, which reflect the gap between the current teacher ability system and the requirements of "integration of industry and education, and precise education" of type education; Third, the proposed digital management and control, school enterprise scene development, three-dimensional evaluation and other countermeasures can effectively solve the core problems, provide empirical basis and practical path for higher vocational colleges to formulate plans to improve teachers' ability and implement the type positioning of vocational

education, and help cultivate high-quality technical and skilled talents suitable for industrial needs.

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