Research on the Evaluation Index System of Teacher Training Effect in Secondary Vocational Schools in Guizhou, China

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Abstracts

Taking the effect of teacher training in Chinese secondary vocational schools, an evaluation index system based on transformation learning theory was constructed, and studied by in-depth interview, Delphi method, questionnaire survey, AHP level analysis, project analysis, factor analysis and fuzzy evaluation. The results show that the evaluation index system has high feasibility and effectiveness, and can fully reflect the multi-dimensional and hierarchical nature of teacher training effect. This paper provides a scientific evaluation tool and reference basis for improving the quality and level of teacher training in vocational education, and explores an evaluation method suitable for the characteristics and needs of teacher training in Chinese secondary vocational schools, thus making theoretical contributions to promoting the professional development of teachers and the reform of vocational education.

Keyword: China; Secondary Vocational School; Teacher Training; Vocational Education; Evaluation Index

Introduction

Vocational education (Vocational Education and Training, VET) is an indispensable part of national education in China, which plays an important role in ensuring the stable operation of social economy and promoting the employment of talents. In 2019, China's Education Modernization 2035 issued by The State Council in 2019 clearly points out that it will improve the quality standards for vocational education personnel training and formulate diversified standards for higher education personnel training that keep up with the development of The Times, and draw a blueprint for a significant improvement in the level of vocational education services by 2035. At present, China has initially established the world's largest vocational education system, the domestic secondary vocational education education content, talent training direction and social talent demand basically consistent, therefore, expand the scale of secondary vocational school enrollment, strengthen secondary vocational teachers, the development of secondary vocational education, is to ease the outbreak of social employment problems, supplement social shortage of talent.

Research Objective

The key to running vocational education lies in the training of teachers. The quality of secondary vocational teachers determines the skill level of talents cultivated in secondary vocational education. For a long time, however, the government led secondary vocational education teacher training still faces some obvious problems, such as regional training imbalance, talent flow is not smooth, teachers team construction lag, lack of attention to

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teachers' personal development, etc., lead to the effectiveness of teacher training, some training work become a mere formality, the phenomenon such as heavy knowledge and light practice. In this study, the author took Guizhou province, a relatively underdeveloped education level, as the index system framework for the evaluation of secondary vocational schools in Guizhou province according to the specific situation of 154 secondary vocational schools in the province.

Literature Review

1) Constructivism of learning theory

Constructivism learning Theory (Constructivism Learning Theory) is a new cognitive theory that has been developed in nearly 20 years and is widely recognized by the academic and educational circles. This theory is based on the cognitive theory of Swiss psychologist Jean Piaget and American psychologists Lawrence Kohlberg and Robert J. Sternberg Others on the development of cognitive structure theory, emphasize learning as a construction process, is the learners themselves positive, active, selectively to the outside information perception, under the constructivism perspective, teachers are the learners in the process of vocational education training, teachers learning process as the core based on teachers subjective explanation and experience evaluation index system, not only to examine the teachers 'knowledge and skills, but also examine the teacher's learning strategy and learning attitude, and teachers on their learning process and results of reflection and evaluation.

2) Educational evaluation theory

Educational evaluation theory (Educational Assessment Theory), as a clearly oriented educational theory, has formed the fourth generation of evaluation system, emphasizing the purpose and significance of evaluation, putting forward a variety of evaluation methods and tools, and more respect the evaluation subject. For example, the four-level evaluation model of Kirkpatrick emphasizes the four levels of response, learning, behavior and outcome; Stufflebeam CIPP model emphasizes the evaluation of four dimensions: context, input, process and product; CIRO model emphasizes the evaluation of four aspects: context, intervention, feedback and outcome. These evaluation models can provide theoretical support and guidance for the evaluation of the training effect of vocational education teachers, and help the evaluators to evaluate the training effect of teachers comprehensively, objectively and scientifically.

3) Transformed learning theory

Transformation Learning Theory (Transformational Learning Theory) was proposed by Jack Mezirow, an American adult education expert. This theory holds that the ultimate goal of learning is not to acquire knowledge, but to apply this knowledge in practice, and proposes four stages of the learning process: preparation stage, experience stage, reflection stage and application stage.

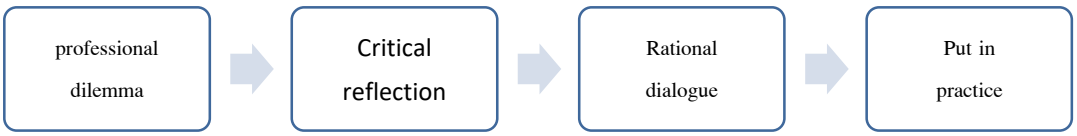
4) Related research on teacher training at home and abroad

According to the different development modes of vocational education, the main directions of research on teacher training in domestic and foreign circles are also different. Wendy (2016 : 33-39) puts forward the performance-based evaluation standard for vocational education teacher training, believing that the core is whether to support the improvement of students' learning effect; Boswell (2018 : 43-47) believes that the teacher training is responsible between the government and schools; Angela (2020) tries to apply the "four-layer evaluation" model to the evaluation of learning response, learning effect and learning behavior in training.

The research on domestic vocational education teacher training mainly focuses on the specific implementation mode of training, including the training path, training status, training evaluation and the countermeasures of related problems. In terms of training path, Bai Bing (2017 : 6-8) summarized four secondary vocational teacher training paths applicable to China. In the analysis of training conditions, Liu Man (2019 : 13-16) and others pointed out some obvious problems in Chinese vocational teacher training, such as lack of funds, incentives and low level of training base construction. In terms of training effect evaluation, Hao Guoqiang (2022 : 87-97) thinks it is necessary to further prepare the training system involving various parties. According to the current development of vocational education in China and the specific national conditions, some scholars offer insights on the way of vocational education and training, Wang Huiting (2021 : 45-47) believed that the evaluation subject should be further expanded to make the evaluation sources more diversified; Yu Xin (2021 : 21-22) pointed out that the evaluation construction of teacher training should focus on new teachers and young teachers to make the training mechanism more flexible. By comparing the research results at home and abroad, it is not difficult to find that Chinese scholars not only absorb the advanced foreign models, but also make scientific suggestions based on the specific domestic educational practices. However, the overall lack of powerful empirical data, and the measures proposed are not operational.

Research Methodology

Pre-stage framework selection based on the evaluation index of teacher training effect, This study intends to adopt a step-by-step research idea, On the basis of sufficient literature collation, In the early stage, we will adopt the in-depth interview method, the Delphi method, On the basis of seeking expert guidance and induction of teachers' opinions, Ensure the reasonable initial structure of the evaluation system; In the middle term, the questionnaire method, hierarchical analysis, Prepare and issue the preliminary test questionnaire according to the preliminary evaluation system, And use the AHP hierarchical analysis method to test whether the weight of the questionnaire is reasonable; In the later stage, the fuzzy evaluation method was used to organize and analyze the formal questionnaire recovery data, The scientific evaluation index system applicable to the effect of teacher training in Guizhou secondary vocational schools is finally confirmed.Put into practice



There are four phased steps summarized based on the transformation learning theory

The study on the effect of vocational education training index system, in 10 public secondary vocational schools 154 (statistics by the end of 2021) by each region 1 as a sample source, according to the school full-time professional teachers scale and the total proportion, refer to Krejcie & Morgan (1970 : 52) Determining Sample Size method to determine the specific sampling number, as shown in table 1.

Table 1: Sample selection status

school	Number of professional teachers	Sample number by questionnaire survey	Number of interviews sampled
Guizhou Provincial Water Conservancy and Electric Power School	146	108	3
Hezhang County Secondary vocational School	185	127	3
Shuicheng District Vocational and Technical School	115	92	3
Tongzi County secondary vocational school	142	108	3
Yuping County secondary vocational school	82	70	0
Anshun Municipal Secondary Vocational School for Nationalities	203	132	0
Weining County Secondary vocational School	400	196	0
Sandu Secondary Vocational School for nationalities	112	86	0
Longli County Secondary vocational School	128	97	3
Guizhou Provincial Tourism School	147	108	0
amount to	1660	1124	15

From the sample schools, 15 teachers from secondary vocational schools who did not participate in the questionnaire survey in the later period were selected as the interviewees. In the 5 sample schools that participated in the same training, 3 teachers were selected from each school to interview face to face (see Table 2 for the interviewees). In this study, we extended the preliminary literature, compiled the interview outline, and took advantage of the opportunity of "Promoting the High-quality Development of Secondary Vocational Education Training Meeting" held by the Department of Education of Guizhou Province to conduct semi-structured interviews with the interviewees. The interview covers the basic information of participating teachers, training expectations, training gains, training results, improvement opinions and free supplement of individual teachers. In the later analysis, according to the answers of the respondents, they coded, recorded and marked the keywords, and classified, summarized and selected the important quantitative indicators that can be used for the initial construction of the evaluation system (Table 2).

Table 2: The in-depth interviews

code name	sex	of school age	specialty
1A	man	21	Construction of water conservancy and hydropower projects
1B	woman	13	Construction project cost
1C	man	24	Power plant and power substation electrical equipment
2A	man	25	animal husbandry and veterinary medicine
2B	woman	7	Pension services
2C	woman	9	Child care
3A	woman	13	Electronic Commerce
3B	woman	4	Urban rail transit operation and management
3C	man	15	numerical control technique
4A	man	10	Automobile use and maintenance
4B	man	7	Animation and game production
4C	woman	5	industrial art
5A	man	13	Computer network technology
5B	woman	14	High-star hotel operation and management
5C	woman	11	Clothing production and production management

Table 3 Analysis table of the encoding frequency of the interview data elements

essential factor	frequency	scale
Training needs	7	46.6%
target location	8	53.3%
Training method	5	33.3%
Training content	11	73.3%
curriculum design	6	40%
persons qualified to teach	7	46.6%
specialized skill	12	80%
Industry experience	7	46.6%
speculative knowledge	9	60%

management of organization	4	26.6%
Exchange discussion	6	40%
practice	8	53.3%

（N=15）

Empirical Results and Analysis

Through the analysis of the results of the pre-test paper and AHP level, it is considered that the preliminary questionnaire is basically reasonable, and only modified the items of some questions according to the feedback, so as to make the questions more suitable to the index content.

Project analysis

The item analysis section includes preliminary descriptive statistics, comparisons of extreme groups, and tests of homogeneity. Organize out the average value, kurtosis and skewness of the questions under each index. According to the preliminary judgment of the statistical data, the mean value, standard deviation, kurtosis and skewness of the questions under the training background "and" training process " show no abnormality, so extreme group comparison and homogeneity test can be carried out. Results of extreme group comparisons and homogeneity tests are shown in Table 4.

Table 4 Summary of analysis of extreme groups comparison and homogeneity test

Level 1 indicators	Question item	t (decision value)	be interrelated	factor loading
Training background	Title 1	8.098**	0.610**	0.601
	Title 2	7.403**	0.648**	0.642
	Title 3	8.796**	0.639**	0.632
	Title 4	7.328**	0.724**	0.73
	Title 5	7.114**	0.609**	0.598
	Title 6	5.612**	0.588**	0.576
	Title 7	8.585**	0.649**	0.645
	Title 8	7.181**	0.708**	0.718
	Title 9	9.081**	0.704**	0.712
	Title 10	7.951**	0.649**	0.657
	Title 11	7.493**	0.622**	0.617
	Title 12	7.045**	0.638**	0.646
	Title 13	7.499**	0.699**	0.709
	Title 14	8.044**	0.612**	0.601
	Title 15	7.657**	0.715**	0.726
The training process	Title 1	5.001**	0.610**	0.604
	Title 2	6.712**	0.635**	0.628
	Title 3	6.406**	0.635**	0.63
	Title 4	7.802**	0.749**	0.756
	Title 5	7.106**	0.664**	0.664
	Title 6	6.554**	0.653**	0.65

	Title 7	7.576**	0.739**	0.745
	Title 8	8.987**	0.715**	0.717
	Title 9	7.871**	0.696**	0.7
	Title 10	6.130**	0.641**	0.639
	Title 11	7.489**	0.639**	0.634
	Title 12	7.219**	0.641**	0.642
	Title 13	8.114**	0.701**	0.709
	Title 14	7.374**	0.634**	0.63
	Title 15	6.022**	0.633**	0.628
	Title 16	8.412**	0.696**	0.703
	Title 17	8.775**	0.715**	0.722
	Title 18	6.966**	0.621**	0.614
Training harvest	Title 1	8.428**	0.636**	0.635
	Title 2	6.231**	0.603**	0.598
	Title 3	7.724**	0.713**	0.725
	Title 4	7.128**	0.670**	0.679
	Title 5	4.617**	0.544**	0.535
	Title 6	6.138**	0.608**	0.603
	Title 7	7.988**	0.700**	0.706
	Title 8	6.632**	0.619**	0.616
	Title 9	8.290**	0.648**	0.651
	Title 10	7.554**	0.600**	0.6
	Title 11	7.115**	0.607**	0.601
	Title 12	6.889**	0.656**	0.656
	Title 13	8.315**	0.579**	0.567
	Title 14	6.212**	0.662**	0.666
	Title 15	6.458**	0.650**	0.654

(Note: N=243 * * p <0.01)

As shown in the figure, a total of 48 questions under the three indicators are set scientifically, which meet the retention conditions.

Factor analysis

Use factor analysis to test the validity of the questionnaire. The validity is the correctness of the test score, that is, the degree to which a test can measure the characteristics it wants to measure. The collation is shown in Table 5.

Table 5 Summary of the extraction and analysis of the secondary index factors

Level 1 indicators	First-level index, KMO	bedding	Secondary index, KMO	eigenvalue	Explaining variants in the number of polyps
Training background	0.941	Training objectives	0.842	2.86	47.67%
		training scheme	0.807	2.65	53.00%
		Training needs	0.76	2.219	55.47%
		Training content	0.888	3.519	50.27%
		Training method	0.663	1.846	61.54%
The training process	0.957	Training teachers	0.654	1.801	60.04%
		Learning reaction	0.815	2.604	52.08%
		Knowledge reconstruction	0.5	1.318	65.91%
		educational idea	0.798	2.529	50.58%
Training harvest	0.931	Teaching implementation	0.707	2.001	50.03%
		Innovation and service	0.739	2.104	52.59%

In general, the KMO values at all levels of this study were above 0.50, reaching a significant level, indicating that they all meet the expectations of factor analysis, and the index design is reasonable.

Reliability verification

The Cronbach's α reliability analysis was performed for each questionnaire question, and the results are shown in Table 6.

Table 6 Results of Cronbach's α reliability analysis of different question items of the questionnaire

Level 1 indicators	Question item	Item deleted α coefficient	Cronbach's α
Training background	Title 1	0.9	0.904
	Title 2	0.898	
	Title 3	0.899	
	Title 4	0.895	
	Title 5	0.9	
	Title 6	0.901	
	Title 7	0.898	
	Title 8	0.896	
	Title 9	0.896	
	Title 10	0.898	
	Title 11	0.899	
	Title 12	0.898	
	Title 13	0.896	
	Title 14	0.9	
	Title 15	0.895	

The training process	Title 1	0.924	0.9274
	Title 2	0.924	
	Title 3	0.923	
	Title 4	0.92	
	Title 5	0.923	
	Title 6	0.923	
	Title 7	0.921	
	Title 8	0.921	
	Title 9	0.922	
	Title 10	0.923	
	Title 11	0.923	
	Title 12	0.923	
	Title 13	0.922	
	Title 14	0.924	
	Title 15	0.923	
	Title 16	0.922	
	Title 17	0.921	
	Title 18	0.924	
Training harvest	Title 1	0.886	0.893
	Title 2	0.887	
	Title 3	0.882	
	Title 4	0.884	
	Title 5	0.89	
	Title 6	0.887	
	Title 7	0.883	
	Title 8	0.887	
	Title 9	0.885	
	Title 10	0.887	
	Title 11	0.888	
	Title 12	0.885	
	Title 13	0.889	
	Title 14	0.885	
	Title 15	0.885	

According to Table 6, the reliability analysis results of the "training background", "training process" and "Training Harvest" questionnaires had a Cronbach's α coefficient of 0.904,0.927 and 0.893, respectively, indicating the high reliability of the questionnaire.

Determine the evaluation fuzzy set

The evaluation set is taken as X= (X1, X2, X3, X4, X5), which respectively indicates the grade of the index layer: excellent, good, qualified, poor and very poor. The evaluation index system of training effect evaluation is excellent, good, qualified, poor and very poor, and the fuzzy values are 90,70,50,30 and 10 respectively. The summary results are summarized and normalized, so as to obtain the membership matrix. Take the status of the effectiveness of training effect evaluation as an example, the number of excellent, good, good, general, poor, poor, very poor score is 32,36,39,51,43, respectively, its membership is [0.1592 0.1791 0.1940 0.2537 0.2139], so on the training effect evaluation research index system membership matrix

table, then the weight matrix and membership matrix together, finally get the fuzzy comprehensive evaluation matrix of the index layer, as shown in Table 7.

Table 7 Fuzzy comprehensive evaluation of the three-level indicators in the training effect evaluation system

metric	degree of membership					grade	grade
	very bad	range	qualified	good	outstanding		
Effectiveness of the intended objectives	0.1592	0.1791	0.1940	0.2537	0.2139	53.6816	qualified
Feasibility of the expected objectives	0.0647	0.0746	0.2836	0.3035	0.2736	62.9353	good
Training course arrangement	0.0697	0.0647	0.2438	0.2985	0.3234	64.8259	good
Training equipped with	0.0547	0.0547	0.3433	0.2438	0.3035	63.7313	good
Job skills improvement skills (* confused)	0.0796	0.0647	0.3234	0.2687	0.2637	61.4428	good
Requirements for professional knowledge learning (* active learning)	0.0498	0.0697	0.2836	0.3085	0.2886	64.3284	good
Personal Development (* Action Plan)	0.0896	0.0896	0.2289	0.3134	0.2786	62.0398	good
Reflect the professional development trend	0.0746	0.0498	0.2637	0.3632	0.2488	63.2338	good
Vocational skills improvement needs	0.0647	0.0647	0.2836	0.2736	0.3134	64.1294	good
School-based research and study, enterprise practice, etc	0.0597	0.0597	0.2886	0.3284	0.2637	63.5323	good
Lecturer industry experience	0.0647	0.0945	0.2985	0.2388	0.3035	62.4378	good
Lecturer's professional ability	0.0547	0.0647	0.3234	0.2537	0.3035	63.7313	good
* communication	0.0299	0.0896	0.2488	0.3134	0.3184	66.0199	good
teamwork	0.0498	0.0697	0.2886	0.3433	0.2488	63.4328	good
* Critical reflection	0.0697	0.0945	0.3134	0.2736	0.2488	60.7463	good
* Solve confusion	0.0647	0.0547	0.3134	0.2587	0.3085	63.8308	good
Cutting-edge knowledge (* new knowledge)	0.0547	0.0597	0.3085	0.2687	0.3085	64.3284	good
Professional technical skills (* learning of new knowledge)	0.0498	0.0796	0.2488	0.2836	0.3383	65.6219	good

Guide students to practice	0.0547	0.0498	0.2836	0.2935	0.3184	65.4229	good
Innovation ability and other social service ability	0.0547	0.0697	0.3134	0.2537	0.3085	63.8308	good

It can be seen that the 20 three-level indicators have all been qualified above the fuzzy evaluation, indicating that the subdivided indicators are set reasonably. According to the membership data of the three-level index layer and the fuzzy matrix:

$R = Z * W$

The fuzzy comprehensive evaluation of the secondary index layer is shown in Table 14.

Repeat the above operation, the fuzzy comprehensive evaluation of the primary index layer (criterion layer) is obtained as shown in Table 8.

Table 8 Fuzzy comprehensive evaluation of the secondary indicators in the training effect evaluation system

Secondary indicators	degree of membership					grade	grade
	very bad	range	qualified	good	outstanding		
Training objectives	0.0867	0.0990	0.2627	0.2919	0.2597	60.7764	good
training scheme	0.0660	0.0623	0.2679	0.2853	0.3186	64.5607	good
Training needs	0.0681	0.0708	0.2911	0.2932	0.2769	62.8030	good
Training content	0.0678	0.0599	0.2773	0.3020	0.2929	63.8457	good
Training method	0.0597	0.0597	0.2886	0.3284	0.2637	63.5323	good
Training teachers	0.0597	0.0796	0.3109	0.2463	0.3035	63.0846	good
Learning reaction	0.0553	0.0873	0.2919	0.3000	0.2655	62.6599	good
Knowledge reconstruction	0.0647	0.0547	0.3134	0.2587	0.3085	63.8309	good
educational idea	0.0510	0.0747	0.2635	0.2799	0.3309	65.3027	good
Teaching implementation	0.0547	0.0498	0.2836	0.2935	0.3184	65.4229	good
Innovation and service	0.0547	0.0697	0.3134	0.2537	0.3085	63.8309	good

Table 9 Fuzzy comprehensive evaluation of the first-level indicators in the training effect evaluation system

Level 1 indicators	degree of membership					grade	grade
	very bad	range	qualified	good	outstanding		
Training background	0.0695	0.0699	0.2741	0.2885	0.2980	63.5096	good
The training process	0.0594	0.0737	0.2947	0.2929	0.2793	63.1822	good
Training harvest	0.0547	0.0628	0.2849	0.2775	0.3201	64.9101	good

It can be seen from Table 14 and 15 that in the evaluation index system of the training effect of teachers in secondary vocational schools constructed in this study, the primary and secondary indicators all obtained good scores, which can fully evaluate and reflect the training effect of vocational teachers (Table 10).

Table 10 Comprehensive evaluation of target layer

Target layer	very bad	range	qualified	good	outstanding	grade	grade
Training effect	0.0580	0.0669	0.2864	0.2834	0.3052	64.2192	good

Conclusion and Recommendations

This study aims to construct a complete evaluation index system for the training effectiveness of vocational education teachers, and to conduct an empirical study on secondary vocational schools in Guizhou Province as an example. Through in-depth interviews, Delphi method and questionnaire survey, the following preliminary conclusions were obtained in this study:

(1) Based on the constructivism learning theory, education evaluation theory and transformation learning theory, a relatively complete evaluation system of vocational education teacher training effect can be constructed.

(2) The four-level evaluation model of Kirkpatrick is a widely used evaluation model in the world, but its applicability in the field of vocational education has some limitations. This study combines the translational learning theory and proposed a more suitable for the training evaluation of vocational education teachers.

(3) Based on the empirical analysis, this study constructed a relatively complete evaluation index system of the training effect of vocational education teachers, and the weight reflected in the study shows that teachers pay more attention to "training harvest".

Based on the above research conclusions, the author believes that the designers of vocational education teacher training should pay attention to the evaluation and improvement of the training process, establish diversified training methods and training teachers, and improve the effectiveness and pertinence of the training. Individual teachers should strengthen their own career development planning, improve their vocational education quality through educational background and work experience, actively participate in various training, and apply the knowledge to the actual teaching work.

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