July-August 2020
ISSN: 0193-4120 Page No. 3755 - 3764

Research on the Evaluation Index System of Teacher Training Effect in Preschool Education College Based on AHP

YanzhouRen, Yonghong Chen*
Anyang Preschool Education College, Anyang, Henan, 456150, China
*Corrosponding author:Yonghong Chen

Article Info
Volume 83
Page Number: 3755 – 3764
Publication Issue:
July - August 2020

Article History
Article Received*: 06 June 2020*
Revised*: 29 June 2020*
Accepted*: 14 July 2020*
Publication*: 25 July 2020*

Abstract

Construting a scientific and rational evaluation index system of teacher training effect for higher preschool education college, which has important significance in enhancing quality of teacher training.Based on Kirkpatrick Model,and in conjunction with expert opinion modification, the author established a evaluation index system of teacher training effect of higher preschool education college. On this basis, it estabilished questionaire to examine the reliability and validity of survey results, and that further determine the weight of evaluation index , get the effective training effect evaluation index system and evaluation scale. The system and scale are of practical guiding significance for improving the quality and effect of training.

Keywords:*Teachers of Higher Preschool Education College, training results,AHP.*

I. INTRODUCTION

The evaluation of the effect of teacher training in higher preschool education college is the guarantee for the realization of the teacher training policy and training objectives of higher preschool education college and the key to improving the quality of training. Training effect refers to the actual effect of improving the knowledge or skills of the trainee through certain special training. The effect of teacher training in higher preschool education college refers to the actual effect of improving the professional and teaching abilities of teachers in higher preschool eduacation colleges through professional training of teachers in higher preschool education colleges. The evaluation index system of teacher training effect of higher preschool education colleges is an effective tool to evaluate the effect of teacher training of higher preschooleducation colleges.Therefore, constructing a scientific and reasonable index system for evaluating the effectiveness of teacher training in higher preschool education colleges is of great significance for improving the quality and effectiveness of their teacher training. To ensure the rigor and scientific nature of the index system, the evaluation index system constructed in this study has been revised and adjusted twice based on the expert opinion consultation results and validity test results of the Delphi method, and it has undergone three expert evaluations. For the first time, the Delphi method was used to conduct three rounds of anonymous expert's opinion consultation, then the initial indicator system was revised; the second time the experts put forward suggestions for

July-August 2020
ISSN: 0193-4120 Page No. 3755 - 3764

amendments to the evaluation questionnaires;the third time the experts score the importance of the evaluation indicators, construct a judgment matrix, and lay the foundation for the assignment of indicator weights.

II. SELECTION OF INITIAL ESTABLISHMENT OF EVALUATION INDICATORS

The theoretical source of this research is Kirkpatrick Model, adopt Delphi method to consult experts and revise evaluation indicators.

General Index Selection Based on Kirkpatrick Model

As the subject of training activities, teachers of higher preschool education college are the most direct experiencers and presenters of training effects. Therefore, this study selects the Kirkpatrick model with learners as the main body of evaluation as the theoretical basis of the index system. Among the current mainstream training results analysis and evaluation models, the Kirkpatrick Model proposed by the American scholar Donald. L. Kirkpatrick is a classic evaluation model that is widely used and far-reaching at home and abroad [2]. The Kirkpatrick model divides the evaluation into four levels according to the participants' depth of learning level: the first level is the response level, which examines the participants' views on the training project (such as satisfaction); the second level is the learning level, which evaluates the participants' improvement in knowledge, skills or experience; the third level is the behavior level, which examines whether the trainees can apply what they have learned in the training; the fourth level is the result level, which evaluates positive effect of the organizational performance brought about by training activities.

Use Delphi Method to Further Modify the Evaluation Index

In order to further test the teacher training effect evaluation indicators of higher preschool education colleges, this study uses the Delphi method and uses the Likert five-level scale to design the three-level indicators of the preliminary evaluation system into an expert opinion consultation form and conduct a questionnaire survey. The author hired 15 experts and scholars to participate in the questionnaire survey. Based on the scoring results and open-ended suggestions of 15 experts in three rounds, this study processed the questionnaires of experts and scholars, and initially revised the original indicators. The preliminary revised first-level indicators are determined to be "training background", "training response" and "training gains". The corresponding second and third-level indicators have also been adjusted and merged.

The Construction of Teacher Training Evaluation Index System of Higher Preschool Education College

Based on the general indicators of the Kirkpatrick Model, this research has initially constructed a teacher training effect evaluation indicator system for higher preschool education colleges through the revision of relevant experts. There are 3 primary indicators, 10 secondary indicators, and 22 tertiary indicators. See Table 1 for details.

Table 1. Construction of Index System

LevelIindictors	**LevelIIindictors**	**Level III indictors**
Training Background	Training Objectives	Effectiveness of training objectives
		Feasibility of training objectives
	Training Programs	Course design
		Training equipment
	Training Needs	Career and job needs (*Quandary)
		Learning needs (* active learning)
		Personal

July-August 2020
ISSN: 0193-4120 Page No. 3755 - 3764

		development (* Action Plan)
Training Response	Training Content	Compatibility with the teacher training characteristics of higner preschool education college
		The training content matches the actual needs of the trainees
		Reflect professional development trends
	Training Method	Fit with training content
		Promote communication
	Training Teachers	Professional knowledge
		Professionalism
Training Gains	Education Concept	Update educational concepts (* Solve puzzles or get rid of difficulties)
		Enhance sense of responsibility
	Knowledge and Skills	Professional knowledge (* Acquisition of new knowledge)
		Professional skill
	Teaching Implementation	Classroom teaching
		Student behavior
	Research Innovation	Scientific research achievements
		Organizational contribution

III. CONSTRUCTION OF TRAINING EFFECT EVALUATION INDEX SYSTEM BASED ON AHP

Based on the preliminary formed index system of teacher training effect of higer preshcool education college, a questionnaire was compiled for testing, the validity and reliability of the questionnaire results were tested, and the index system was reconstructed using AHP to obtain the final higer preshcool education College's teacher training effect evaluation index system and evaluation scale.

Questionnaire Preparation and Testing Situation

The respondents of the questionnaire are teachers from higer preshcool Education College who have participated inrelevant training. The questionnaire design consists of two parts: the first part is the basic information of the interviewee, and the questions are answered in the form of multiple choice questions; the second part is the evaluation of the effect of teacher training in higer preshcool education college, based on the 22 third-level indicators of the preliminary indicator system .The indicator is set with 66 questions, and respondents are required to answer according to the degree of conformity with the teacher training effect of higer preshcool education college. This study tested the preliminary questionnaire using the expert opinion method. By inviting 4 experts in education management, 4 cadres at or above the middle-levelfrom higer preshcool education college, a total of 8 people conducted in-depth expert opinion consultation, and questions of higer preshcool education college of teacher training effect evaluation was reduced to 60, and the problem expression was sorted and simplified, and the final "higer preshcool education college teacher training effect evaluation questionnaire" was obtained. This study selected 5 higer preshcool education colleges in Henan for research. A total of 260 questionnaires were issued to teachers of higer preshcool education colleges, and 223 questionnaires were returned, with a recovery rate of 86%.

The Structural Validity of the Questionnaire

Based on the statistical results of the questionnaire, this study uses the KMO test and Bartlett's Test of Sphericity to perform structural validity analysis to

July-August 2020
ISSN: 0193-4120 Page No. 3755 - 3764

determine whether the variables can be used for factor analysis. The KMO test judges the correlation between variables by comparing the magnitude of the simple correlation coefficient and the partial correlation coefficient between the variables, and the value is between 0 and 1. The closer the KMO value is to 1, the stronger the correlation between variables and the more suitable for factor analysis. Bartlett's Test of Sphericity is used to test whether the correlation coefficient matrix is an identity matrix, that is, whether each variable is independent. When the SPSS test result shows Sig.<0.05 (that is, p-value<0.05), it indicates that the variables are correlated and suitable for factor analysis. It can be seen from Table 2 that the KMO result of the "training background" in the initially constructed first-level indicator system is 0.941 (close to 1), indicating that the various items of the test scale contain common factors, which are in line with the conditions of factor analysis. In Bartlett's Test of Sphericity, the significance probability value of the scale is 0.000 (p value<0.05). This result shows that the net correlation matrix is recognized as a unit matrix and can be used for factor analysis. After calculation, the "training background" scale has no deleted questions, and two common factors are extracted. The first two factors can explain 70.86% of the original variables.

Table 2. KMO and Bartlett's sphericity test

The Kaiser-Meyer-Olkin measure of sample adequacy.		.941
Bartlett's sphericity test	Approximate chi-square	4256.358
	df	190
	Sig.	.000

Note: KMO=0.941, P=0.000

Using the same method, this study successively tested the validity of "training response" and "training gains", and carried out factor extraction and naming based on this, and readjusted internal indicators. Through the validity test, the 20 questions under the "training background" of the first-level indicator were transformed into 2 factor component groups, and no problems were deleted. After analysis, the three secondary indicators in the preliminary draft table under this indicator were changed to two secondary indicators of "training design" and "training demand". The 21 questions under the first-level indicator "Training Response" were transformed into 2 factor component groups. One question was deleted in the first round of testing, and no problems were deleted in the second round of testing. The three secondary indicators in the preliminary table under this indicator have been changed to two secondary indicators of "training content and methods" and "training teachers and professional level". The 20 questions under the first-level indicator "training gains" were transformed into 2 factor component groups, and no problems were deleted. The 4 secondary indicators in the preliminary table under this indicator are changed to 2 secondary indicators of "learning effect" and "behavior transformation". After the internal indicators are adjusted, 3 first-level indicators, 6 second-level indicators, and 21 third-level indicators are finally determined (see Table 5 for the final indicator system).

Reliability test of the questionnaire

The purpose of testing the reliability of the questionnaire is to understand whether the scale is reliable and stable. In order to test whether the relevant topics in the scale can reflect the researcher's research intention on the same question or content, this study conducted an internal consistency reliability test. The standard of reliability measurement is usually expressed by Cronbach Alpha coefficient [10]. The level of the Alpha coefficient reflects the degree of correlation between internal questions. The higher the number, the higher the correlation and the better the reliability of the scale. Table 3 shows the reliability test results of the scale "training background", "training response" and "training gains".

July-August 2020
ISSN: 0193-4120 Page No. 3755 - 3764

Table 3. Reliability Test Results

	Cronbach's Alpha	Cronbach's Alpha based on standardized terms	Number of items
Training Background	0.970	0.970	20
Training Response	0.974	0.974	20
Training Gains	0.980	0.980	22

According to the data in Table 3, the Alpha coefficients of the scales "Training Background", "Training Response" and "Training Gains" are 0.970, 0.974, and 0.980 respectively, indicating that the reliability of the three scales is good, which can ensure the accuracy and scientificity of the questionnaire in this study.

IV. WEIGHT ASSIGNMENT OF EVALUATION INDICATORS

This study uses AHP to determine the weights of evaluation indicators to ensure the objectivity and accuracy of weight distribution.

Divide the hierarchy

The teacher training effect evaluation index system of higher preschool education college is divided into four levels: The first level is the predetermined goal (A), which is the goal of teacher training effect evaluation of higher preshool education college; the second level is the first level indicator, including the training background (B1), training response (B2) and training gains (B3); the third level is the second-level index, which is a number of sub-indicators under the first-level index, a total of 6 items, including training design (C1), training requirements (C2), Training content and method (C3), trainer and professional level (C4), learning effect (C5) and behavior transformation (C6); the fourth level is the third-level index, which is a number of sub-index items under the second-level index, a total of 21 items are represented by Cij respectively. Then the overall structure of the teacher training effect evaluation index system of higher preschool education college is that the target layer is the teacher training effect evaluation index system of higher preshool Education College. The first level of criteria includes three indicators such as training background, and the second level of sub-criteria includes Training Design and other 6 indicators, the third level of the program layer contains 21 indicators.

Construct a comparison judgment matrix

Based on the hierarchical evaluation structure, this study constructs a judgment matrix through the expert scoring method, and compares the relative importance of indicators at each level to a criterion at the previous level. The author hired 18 experts from higher preshool education colleges and related universities to score the index values in the judgment matrix V. According to the scoring results of experts, the study takes values of the importance of the evaluation indicators of each level of teacher training in higher preshool Education College, constructs a judgment matrix, and then calculates the eigenvector and the largest eigenroot of the matrix. (See Table 4)

Table 4.Judgment matrix of first level index

Teacher training performance of higher preshool education college	**Training Background**	**Training Response**	**Training Gains**
Training Background	1	5/7	5/8
Training Response	7/5	1	7/8
Training Gains	8/5	8/7	1

July-August 2020
ISSN: 0193-4120 Page No. 3755 - 3764

Note: The study uses the scale method of 1-9 and its reciprocal to express the relative importance of two elements.

Scale 1 means that element i and element j have the same importance to the previous level factor; 3 means element i is slightly more important than j; 5 means element i is more important than j; 7 means element i is more important than j; 9 means element i It is extremely important than j; while the scales 2, 4, 6, 8 represent the median value of adjacent judgments 1~3, 3~5, 5~7, and 7~9. For example, the scale of 8/5 in Table 4 indicates that the importance of the element "training gain" is 8/5 than the element "training background", and so on.

All levels of ranking and consistency check

Single-level sorting is to sort all elements of this level according to their relative importance to a certain element associated with the previous level. This sorting is represented by the calculated numerical value, and the weight distribution is made by calculating the characteristic root and the characteristic vector of the judgment matrix. At the same time, it is also necessary to check the consistency of the judgment coefficient matrix, that is, to calculate the consistency index CI{CI=(λmax-n)/(n-1)}. A large CI value indicates that the judgment matrix deviates greatly from the consistency, while a small value indicates a better consistency. The deviation of the judgment matrix from consistency may be caused by random reasons, so the test coefficient CR is introduced, that is, CI is compared with the average random consistency index RI. When CR=CI/RI≤0.10, it can be said that the judgment matrix has passed the consistency test, otherwise the judgment matrix needs to be adjusted. According to the existing higher preschool education college teacher training effect evaluation of judgment of first-level indicator expert matrix, the Matlab software eig program is used to calculate its eigenvector W=[0.25, 0.35, 0.40]T and the maximum eigenvalue λmax=3. The consistency of the judgment matrix is tested, and the result shows that the consistency index CI is 0, and the consistency ratio CR=0<0.10. According to the calculation results, the expert comprehensive judgment matrix of this research passed the consistency test. The feature vector calculated from this is the weight value of the first-level indicator of teacher training effect evaluation of higher preschool education college. The weight of training gain is 0.40, which is the largest proportion; the weight of training response is 0.35, which is the middle proportion; the training background is 0.25, which is the smallest proportion. The weights of the secondary indicators to which the primary indicators belong are also calculated in the same way, so I won't repeat them here.

Overall weight assignment

On the basis of the single-level ranking weight results, the overall ranking of the indicators can be calculated, that is, the overall weight assignment of the indicator system, the calculation formula is Wij = WA-B×WBi-Cj×WCi-CIj. Table 5 is the weight assignment result of the teacher training effect evaluation index system of higher preschool education college, and it is also the final evaluation index system constructed by this research.

Table 5. Evaluation index system

Level Iindictors	LevelIIindictors	Weights	Weights	Level IIIindictors	Weights	Weight in the whole
Training Background	0.25	Training Design	0.60	Effectiveness of Training Objectives	0.20	0.03
				Feasibility of training	0.25	0.04

				objectives		
				Course Design	0.35	0.05
				Training equipment	0.20	0.03
		Training Demand	0.40	Learning needs	0.50	0.05
				Career and personal development needs	0.50	0.05
Training Response	0.35	Training Content and Method	0.50	The content matches with the teacher training characteristics of higer preschool education college	0.25	0.04
				The content meets the actual needs of the students	0.25	0.04
				The fit of training method and content	0.25	0.04
				Promote communication	0.25	0.04
		Training teachers and professional level	0.50	Lecturer Major	0.30	0.05
				Knowledge display, communication and sharing	0.35	0.06
				Lecturer professionalism	0.35	0.06
Training Gains	0.40	learning result	0.50	Update education concept	0.20	0.04

				Enhance sense of responsibility	0.20	0.04
				Professional knowledge	0.30	0.06
				professional skill	0.30	0.06
		Behavior transformation	0.50	Classroom teaching	0.30	0.06
				Student behavior	0.25	0.05
				Scientific research results	0.25	0.05
				Organizational contribution	0.20	0.04

It can be seen from Table 5 that the evaluation of training gains occupies the most important position in the overall evaluation, which indicates that the evaluation of teacher training effects of higher preschool education colleges should focus on evaluating teachers' learning gains and practical application levels after participating in the training; The response is ranked after the training gains, indicating that the teachers participating in the training's views and feedback on the training project are more important; the importance of training background is ranked after the training gains and training response, because it evaluates the rationality and feasibility of the entire training project design .To a certain extent, the training requirements and training requirements reflect the achievement of training goals and requirements, but the obvious impact on the overall training effect is not prominent, so the training background has the lowest weight. In the evaluation of teacher training effects in higher preschool education colleges, the weights of training background, training response, and training gains.Evaluations gradually increase, which are in line with the four evaluation levels proposed by Kirkpatrick's theory: response level, learning level, behavior level, and result level. It is consistent with the concept of comprehensively measuring the training effect.

Among the secondary indicators in the context of training, training design has a higher weight of 0.6, followed by training needs, which highlights the importance of training design evaluation in measuring training effects. The training response and training gains have the same weights for the secondary indicators. Therefore, in the actual evaluation operation, the indicators should be evaluated in a comprehensive and balanced manner. In the entire third-level indicators, the evaluation elements extracted based on the key features of transformative learning, such as learning needs, professional and personal development needs, display exchange sharing, professional knowledge, professional skills, classroom teaching, etc.All these key features occupy a higher weight and are adequate It shows that the evaluation of the learning process, behavior and psychological changes of the participating teachers can affect the training effect to a certain extent.

V. CONCLUSION

July-August 2020
ISSN: 0193-4120 Page No. 1 - 08

The teacher training effect evaluation of higher preschool education college is an important part of teacher training in higher preschool education college. The significance of the construction of the training effect evaluation index system is not only to provide a scientific reference for training evaluation, but also to urge the implementation of the training results through the evaluation results, therefore teachers will be able to apply what the training has learned to education and teaching practice. The final evaluation index system constructed in this study evaluates the effects from three dimensions including training background, training response and training gains, which assigns the results based on the weights of indicators at each level. This study draws the following important conclusions. First, it is clear that the departure point of the training program should be guided by the needs of teachers'professional development, combined with the country's requirements for the development of "dual-qualifiedteachers" and the development direction of institutions, and designs the training courses that meet the characteristics of teachers of different subjects and levels,and the training courses are practical and feasible. Second, pay attention to the feedback of participating teachers on training projects. In the actual training evaluation work, in addition to paying attention to understanding the harvest of teachers participating in the training, the entire process of the training of participating teachers should also be incorporated into the training evaluation system. Understanding the trainees' views on training contents, training teachers, training methods, etc. Especially whether teachers have realized the transformation of learning content through communication and reflection in training, which has an important impact on the consideration and presentation of training effects. Third, adopting a variety of effect evaluation methods for training evaluation to promote teacher training migration. The survey questionnaires about satisfaction can be used to understand the trainee's feedback and opinions on the training project, and the written or online test can be used to understand the level of the trainee's mastery of the training content. Through interviews and discussion with the trainee's superiors, subordinates,colleagues,students communicate with themselves, the way that can evaluate their learning gains and behavior changes from participating in the training, and also it can use observation methods to evaluate the application of the skills and methods learned by the participating teachers in teaching.

REFERENCES

[1] Ministry of Education of the People's Republic of China. List of National Colleges and Universities.List of national colleges and Universities[EB/OL].(2017-6-14)[2018-9-6]http://www.moe.edu.cn/srcsite/A03/moe_634/201706/t20170614_306900.html.

[2] Zhang Xuemei, Zhang Jinbao, Song Yuan(2006) Evaluation of teacher training in primary and secondary schools in China. Teacher training in primary and secondary schools, 12.

[3] Shi Dawei (2012) Study on the effect evaluation of teacher training program. Lanzhou: Northwest Normal University.

[4] Wu Lizhi (2014) Construction of evaluation index system of teacher distance training effect--Research Based on Delphi method. Open education research, 5.

[5] Lu Shaoying (2013) Research on the evaluation model of teacher training based on Kirschner model. Journal of Ningbo Institute of education, 6.

[6] MEZIROW J (2000) Learning as transformation: Critical perspectives on a theory in progress. San Francisco, CA:Jossey-Bass, 7.

[7] Tao Wei,Gu Peiya (2015) A Review of Foreign Teachers' Transformative Learning Research. Foreign Educational Research,1.

[8] CARRACELAS-JUNCA C, BOSSALLER J,YAOYUNEYONG G (2009) Integrating service-learning pedagogy:A faculty reflective process. Insight: A Journal ofScholarly Teaching, 4(1): 28-44.

[9] LiuFengyue (2013)Understanding teachers' transformational learning in Vocational Schools:

a case-based analysis. Tianjin: Tianjin University.

[10] Fan bainai, LAN Zhiyong (2009) Public management research and quantitative analysis method. Beijing: Science Press, 44