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Using Delphi method and AHP for the research on Kindergarten teachers' comprehensive quality evaluation index weight

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ABSTRACT

The kindergarten teachers' overall quality evaluation index system including three first grade indexes involves professional concept and ethics, professional knowledge, professional ability, nine second grade indexes and twenty-six third grade indexes. This paper uses Delphi technique, AHP method and unweighted pair group method to count the weight of the kindergarten teachers' comprehensive evaluation index.

Key words: Delphi technique; AHP method; the kindergarten teachers' overall quality; evaluation index; weight.

INTRODUCTION

Kindergarten teachers' comprehensive quality is the necessary condition of kindergarten teacher's nursing and teaching job. It's also the precondition of achieving the goals of kindergarten job. Clearing the constituent elements of kindergarten teachers' comprehensive quality is the key to the reasonable evaluation of their comprehensive quality.

Kindergarten teachers' comprehensive quality is composed of multiple first grade indexes which consist of different second grade indexes. Research group adopts method of document, method of interview and questionnaires to build the kindergarten teachers' overall quality evaluation index system. It includes three first grade indexes involves professional concept and ethics, professional knowledge, professional ability and nine second grade indexes and twenty-six third grade indexes.

To scientifically evaluate kindergarten teachers is to lay a foundation for their intensive screening, in-service training and self-development. It is theoretically significant and realistically valuable for good and fast development of China's pre-school education. How to study the pre-school teacher's qualification structure weight, evaluate their comprehensive qualification in a scientific, all-round and accurate manner, and establish scientific, specific and quantitative pre-school teacher comprehensive qualification assessment indicator system has become a problem demanding prompt solution for the present booming pre-school education in the new age.

Different assessment indicators play different roles in evaluating to what extent the evaluated has attained the pre-determined target. To make each indicator effective, they have to be given different weights. Indicator weight is to indicate how important each assessment indicator is in the indicator system and endow it with corresponding numerical value, i.e. the matching weight number, or weight. The process of determining a weight number is called weighting (weighing). In a traditional assessment system, the evaluation of each indicator system are usually implemented in an empirical way, in which deciding an individual weight is not scientific, accurate and representative enough due to man-induced factors.

The Statistical method, an empirical research method, has been used extensively in all fields of education and educational management and provided the theoretical research with verifying proofs to integrate theory with practice.

As the scientific research of pre-school education improves, the educational statistics has become increasingly critical in pre-school educational management. At present, one single method is mostly used in weighing pre-school teacher qualification assessment indicators, such as the empirical way, charrette, statistical analysis, Delphi method and analytical hierarchy process (AHP). Using single methods is less systemic to structurally study the pre-school teacher qualification in rural areas, and more inadequate compared with comprehensively researching country pre-school teacher qualification structure and its weight. The present, with an attempt to comprehensively use Delphi method, in combination with AHP and weighted arithmetic mean method, is to determine the weight of pre-school teacher comprehensive qualification assessment indicator, and make the weight of the country pre-school teacher qualification structure more all-round, scientific and intensive.

1. THE IMPLEMENTATION OF DELPHI METHOD TO DISTRIBUTE WEIGHT NUMBERS TO THE KINDERGARDEN TEACHER COMPREHENSIVE QUALIFICATION ASSESSMENT INDICATOR

1.1. DELPHI METHOD

In Greek mythology, Apollo could foresee the future, after which Delphi was named and the predictive method was called “Delphi Method”. In 1946, Rand Corporation first used this method to make predictions. Improved by Rand, Delphi method, also known as expertise counsel method, was soon put into use extensively.

The advantages of Delphi Method lie in its convenience, feasibility, certain scientificity and certain practicality. The experts can be invited to prediction and their expertise can be fully utilized. Because of anonymity and the back-to-back method, there will be no yes-men for fear of authority, no wrong heads, and no non-disputants unwilling to clash with others’ opinions for the sake of social relationships so that each expert can be independent and free to make his own judgment. Meanwhile, various opinions can be converged in a short time, which can be also easily accepted by the participants, because the opinions, like a consensus of opinion, are objective to some degree.

1.2. IMPLANTATION PROCEDURES OF DELPHI METHOD

(1) Forming a Technical Panel

According to the necessary knowledge scale, the technical panel should be composed of by 18 experts, covering scholars, pre-school leaders and some accomplished teachers, all of whom must be properly representative and authoritative. The survey is greatly supported by the participants, and the prediction is carefully carried out by the experts each time to ensure its effectiveness.

(2) Designing the Indicator Weight for Pre-School Comprehensive Qualification Indicator

System (See Tables 1, 2, 3, and 4) and the Instruction Set up the questions to be predicted and corresponding requirements to the experts together with relevant background materials and enquire them about anything else needed as well. The first batch of questionnaire to be hander out to the experts is open-ended without any framework or outline, just putting forward questions to be predicted, according to which, the experts will determine how important every indicator is and finish the questionnaire.

2. USING THE ANALYTIC HIERARCHY PROCESS (AHP) FOR KINDERGARTEN TEACHERS' COMPREHENSIVE QUALITY EVALUATION INDEX WEIGHT DISTRIBUTION

2.1. ANALYTIC HIERARCHY PROCESS

The operational researcher T.L.Saaty introduces Analytic Hierarchy Process to the field of education evaluation, in order to solve the problem of the weight’s determination. The AHP is a multi-objective, more standard system analysis method. It is a flexible and practical method of multi-criteria decision making that use quantitative analysis to analyze quantitative problem. The AHP is mainly through two-two dual comparison to layer the evaluation index, arrange the order of every index according to the priority of importance degree, and then calculate judgment matrix of eigenvectors corresponding to maximum eigenvalue, so as to determine the weight of each index.

2.2. SPECIFIC STEPS

(1) Drawing up the weight questionnaire (see Table 1), send experts to answer.

The questionnaire detailed describes of each investigation index’s meaning and comparative law. Please experts based on the column index, to compare it with the index, if the column index importance more than or equal to the line index importance, then tick "√" in the corresponding Spaces, otherwise blank, the same indicators can not compare.

Table1 The weight questionnaire

	Index1	Index2	Index3	Index4
Index1	1			
Index2	√	1		
Index3		√	1	
Index4	√		√	1

(2) Recycling questionnaire, building matrix A_1 .

(3) The normalization of the number from the results of the comparison between index and the index obtained matrix A_2 , The columns are normalized, matrix A_3 , The value addition, matrices B ; Normalization processing, weighting matrix C .

2.3. RESEARCH DESIGN

(1) Survey elements

The questionnaire of kindergarten teachers' comprehensive quality index system include three first-level indicators, such as the teachers' professional philosophy and ethics, professional knowledge, and the professional ability. Professional philosophy and ethics including professional understanding and knowledge, attitudes and behavior of young children, personal accomplishment and behavior three secondary indexes. Professional knowledge include two two-level index, such as general knowledge, knowledge of child development and care knowledge. Professional capabilities include four two-level index, such as basic teaching ability, observation and understanding abilities of young children, the design and implementation of education activities, and reflection and development.

(2) Investigation object

From two cities of Huaibei and Bengbu, we randomly selected 26 directors conducted a questionnaire survey. Finally, we recovered 24 valid questionnaires, 2 invalid questionnaires. Recovery rate 100%, the rate of valid questionnaire is 92.3%.

2.4. THE DATE PROCESSING

(1) Research on Kindergarten teachers comprehensive quality grade A index system weight

(1-a) The following survey results are kindergarten teachers comprehensive quality grade A index system weight：

Evaluation index	Professional concept and ethics	Professional knowledge	Professional ability
Professional concept and ethics	24	18	17
Professional knowledge	6	24	16
Professional ability	7	13	24

(1-b) Recovery and statistical investigation, one can construct the matrix A_1 .

$$A_1 = \begin{bmatrix} 24 & 18 & 17 \\ 6 & 24 & 16 \\ 7 & 13 & 24 \end{bmatrix}$$

(1-c) The result of index compared with index obtain normalized prossing matrix A_2

$$A_2 = \begin{bmatrix} 1 & 0.75 & 0.71 \\ 0.25 & 1 & 0.67 \\ 0.27 & 0.54 & 1 \end{bmatrix}$$

(1-d) Each column normalized processing, Get the matrix A_3 ..

$$A_3 = \begin{bmatrix} 0.66 & 0.33 & 0.30 \\ 0.16 & 0.44 & 0.28 \\ 0.18 & 0.24 & 0.42 \end{bmatrix}$$

(1-e) Each numerical addition, Get the matrix B.

$$B = \begin{bmatrix} 1.29 \\ 0.88 \\ 0.84 \end{bmatrix}$$

(1-f) Normalized processing , Get the weighting matrix C.

$$C = \begin{bmatrix} 0.43 \\ 0.29 \\ 0.28 \end{bmatrix}$$

Thus, kindergarten teachers' comprehensive quality grade A index system of teachers' professional concept and ethics, professional knowledge, professional ability of the weight is 0.43, 0.29, 0.28, respectively.

(2) Research on the kindergarten teachers professional concept and ethics weights

(2-a) The following survey results are kindergarten teachers professional concept and ethics

Evaluation index	Understand and knowledge of profession	Attitude and behaviour to children	Personal accomplishment and behaviour
Understand and knowledge of profession	24	5	17
Attitude and behaviour to children	20	24	12
Personal accomplishment and behaviour	12	13	24

(2-b) Recovery and statistical investigation, one can construct the matrix A_1 .

$$A_1 = \begin{bmatrix} 24 & 5 & 17 \\ 20 & 24 & 12 \\ 12 & 13 & 24 \end{bmatrix}$$

(2-c) The result of index compared with index obtain normalized prossing matrix A_2

$$A_2 = \begin{bmatrix} 1 & 0.21 & 0.71 \\ 0.83 & 1 & 0.50 \\ 0.50 & 0.54 & 1 \end{bmatrix}$$

(2-d) Each column normalized processing, Get the matrix A_3 ..

$$A_3 = \begin{bmatrix} 0.43 & 0.12 & 0.32 \\ 0.36 & 0.57 & 0.23 \\ 0.21 & 0.31 & 0.45 \end{bmatrix}$$

(2-e) Each numerical addition, Get the matrix B.

$$B = \begin{bmatrix} 0.87 \\ 1.16 \\ 0.97 \end{bmatrix}$$

(2-f) Normalized processing , Get the weighting matrix C .

$$C = \begin{bmatrix} 0.29 \\ 0.39 \\ 0.32 \end{bmatrix}$$

Thus, kindergarten teachers professional concept and the ethics index system of the understanding and knowing of the teacher professional, the attitude and behavior to child, the personal accomplishment and behavior of weight is 0.29 0.39 0.32, respectively.

(3) Research on the kindergarten teachers professional knowledge

(3-a) The survey results of researching on the kindergarten teachers professional knowledge

Evaluation index	General knowledge	Early childhood development and wang knowledge
General knowledge	24	6
Early childhood development and wang knowledge	18	24

(3-b) Recovery and statistical investigation, one can construct the matrix A_1 .

$$A_1 = \begin{bmatrix} 24 & 6 \\ 18 & 24 \end{bmatrix}$$

(3-c) The result of index compared with index obtain normalized prossing matrix A_2

$$A_2 = \begin{bmatrix} 1 & 0.25 \\ 0.75 & 1 \end{bmatrix}$$

(3-d) Each column normalized processing, get the matrix A_3 ..

$$A_3 = \begin{bmatrix} 0.57 & 0.20 \\ 0.43 & 0.80 \end{bmatrix}$$

(3-e) Each numerical addition, get the matrix B .

$$B = \begin{bmatrix} 0.77 \\ 1.23 \end{bmatrix}$$

(3-f) Normalized processing , get the weighting matrix C .

$$C = \begin{bmatrix} 0.39 \\ 0.61 \end{bmatrix}$$

Thus, Kindergarten teachers professional knowledge index system of teachers general knowledge, Early childhood development, protection and education knowledge of weight is 0.39 0.61 respectively.

(4) Research on the weight of kindergarten teachers professional ability
(4-a) The following survey results are kindergarten teachers professional ability

	Evaluation index	Basic teaching ability	To observe and understand young children's ability	The design of education activities and conduct ability	Reflection and development
Professional ability	Basic teaching ability	24	7	10	8
	To observe and understand young children's ability	17	24	6	15
	The design of education activities and conduct ability	17	18	24	11
	Reflection and development	14	11	16	24

(4-b) Recovery and statistical investigation, one can construct the matrix A_1 .

$$A_1 = \begin{bmatrix} 24 & 7 & 10 & 8 \\ 17 & 24 & 6 & 15 \\ 17 & 18 & 24 & 11 \\ 14 & 11 & 16 & 24 \end{bmatrix}$$

(4-c) The result of index compared with index obtain normalized prossing matrix A_2

$$A_2 = \begin{bmatrix} 1 & 0.27 & 0.42 & 0.33 \\ 0.71 & 1 & 0.25 & 0.63 \\ 0.71 & 0.75 & 1 & 0.46 \\ 0.58 & 0.46 & 0.67 & 1 \end{bmatrix}$$

(4-d) Each column normalized processing, get the matrix A_3 ..

$$A_3 = \begin{bmatrix} 0.33 & 0.11 & 0.18 & 0.14 \\ 0.24 & 0.40 & 0.11 & 0.26 \\ 0.24 & 0.30 & 0.43 & 0.19 \\ 0.19 & 0.19 & 0.29 & 0.41 \end{bmatrix}$$

(4-e) Each numerical addition, get the matrix B .

$$B = \begin{bmatrix} 0.76 \\ 1.01 \\ 1.16 \\ 1.08 \end{bmatrix}$$

(4-f) Normalized processing , Get the weighting matrix C .

$$C = \begin{bmatrix} 0.19 \\ 0.25 \\ 0.29 \\ 0.27 \end{bmatrix}$$

Thus, Kindergarten teachers professional ability index system of teachers basic teaching ability ,to observe and understand young children's ability the design of education activities and conduct ability, reflection and development ability of weight is 0.19, 0.25, 0.29, 0.27 respectively.

3. USING AVERAGE WEIGHTING FOR THE COMPREHENSIVE QUALITY OF KINDERGARTEN TEACHERS EVALUATION INDEX WEIGHT DISTRIBUTION

After using the experts consultation method and the analytic hierarchy process, the method of using weighted average have a final weight of kindergarten teachers' complex qualities evaluation index. Average is a quotient that the observation times are divisible by the sum total of observed value. The formula is as follows:

On the assumption that $x_1, x_2, \cdots, x_n$ as the observed value and X as the observation times, so,

$$\overline{X} = \frac{X_1 + X_2 + X_3 + \ldots + X_n}{N}$$

3.1. Research on the weight of kindergarten teachers' A index system of comprehensive qualities

$$\overline{X}_{\text{Professional concept and ethics}} = \frac{0.43+0.37}{2} = 0.40$$

$$\overline{X}_{\text{Professional knowledge}} = \frac{0.29+0.30}{2} = 0.30$$

$$\overline{X}_{\text{Professional ability}} = \frac{0.28+0.33}{2} = 0.30$$

3.2. Research on the weight of kindergarten teachers' Professional concept and ethics

$$\overline{X}_{\text{Understand and knowledge of profession}} = \frac{0.29+0.30}{2} = 0.30$$

$$\overline{X}_{\text{Attitude and behaviour to children}} = \frac{0.39+0.40}{2} = 0.40$$

$$\overline{X}_{\text{Personal accomplishment and behaviour}} = \frac{0.32+0.30}{2} = 0.30$$

3.3 Research on the weight of kindergarten teachers' professional knowledge

$$\overline{X}_{\text{General knowledge}} = \frac{0.39+0.44}{2} = 0.42$$

$$\overline{X}_{\text{Early childhood development and wang knowledge}} = \frac{0.61+0.56}{2} = 0.58$$

3.4 Research on the weight of kindergarten teachers' professional ability

$$\overline{X}_{\text{Basic teaching ability}} = \frac{0.19+0.23}{2} = 0.21$$

$$\overline{X}_{\text{To observe and understand young children's ability}} = \frac{0.25+0.27}{2} = 0.26$$

$$\overline{X}_{\text{The design of education activities and conduct ability}} = \frac{0.29+0.30}{2} = 0.30$$

$$\overline{X}_{\text{Reflection and development}} = \frac{0.27+0.20}{2} = 0.23$$

CONCLUSION

Researches show that in the kindergarten teachers' evaluation indexes system of complex qualities, the weight of Professional concept and ethics、professional knowledge and profession ability are not uniform size. The weight of Professional concept and ethics is 0.40, which have a large proportion in the first grade assessment indicator, it is show clearly that the kindergarten teachers' Professional concept and ethics should have a improvement. Secondly, the weight of kindergarten teachers' professional knowledge is 0.30, and professional ability is 0.3, which are also important that evaluate the kindergarten teachers' complex equalities.

In kindergarten teachers' comprehensive quality evaluation index system, the weight of each secondary index also have bigger difference. In the evaluation index system of Professional concept and ethics, kindergarten teachers' professional understanding and knowledge of the weight of 0.30, for young children's attitude and behaviour of the weight is 0.40, the weight of individual accomplishment and behaviour for 0.30. This shows that early childhood teachers are very important to young children's attitude and behaviour.

In the evaluation index system of professional knowledge, the weight of general knowledge of kindergarten teachers is 0.42, the weight of early childhood development and wang knowledge of 0.58.

In the professional ability evaluation index system, the weight of basic teaching ability of kindergarten teachers is

0.21, ability to observe and understand young children's weight is 0.26, the weight of the design and implementation of education activities is 0.30, reflection and development ability of the weight of 0.23.

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