Fuzzy Evaluation Method of Teachers’ Informationized Teaching Ability

Shuang Liu*
Center of Education Technology and network, Jilin Engineering Normal University, Changchun, China

*Corresponding author e-mail: lius@jlenu.edu.cn

Abstract. Information education is of great strategic significance to promote educational innovation and improve talent training in higher education. It is a necessary choice to realize the sustainable development of education, and it is the core competence of teachers in the information age. At present, the researches on teachers’ informationized teaching ability mainly focus on the meaning, structure and ability elements, and there are few explorations on the evaluation methods. Through the research of previous literature and related theories as well as Delphi method, this paper analyzes the index composition and weight distribution of teachers’ informatization ability, and constructs the evaluation model of teachers’ informatization ability by using fuzzy evaluation method to realize the qualitative and quantitative evaluation of teachers’ informatization ability. The purpose of this paper is to provide some references for teachers’ ability evaluation and promotion, and also to provide a basis for schools and regions to formulate teacher training plans and school informatization development plans.

Keywords: Information Teaching, Fuzzy Evaluation, Evaluation Index System, Teaching Ability

1. Introduction
With the advent of the information age, the society’s training and demand for talents have changed, requiring talents to have a higher comprehensive quality. Education is the basis of talent training, teachers as the practitioners of education, is the key to high-quality talent training, so the education sector has stepped into the information "lane". In this context, the teacher needs to be advanced technology, concept, teaching mode applied in classroom practice teaching, according to the learner’s personalized characteristic, the learning goals and content as well as the characteristics of information technology teaching attempt and exploration, strengthen their practical ability, and the concept of "information technology teaching ability" arises at the historic moment, and the attention of scholars, by various research has gradually become the hot issue of the informationization teaching research. Reviewing the previous studies, scholars mainly analyzed the connotation, structure and ability factors of teachers’ informationized teaching ability, while the corresponding evaluation system and ability evaluation studies were less concerned.
Establishment of evaluation system and the informationization teaching ability evaluation can provide lessons for teachers’ ability evaluation and improve the method, help to more clearly understand the actual level of the teachers at [1], also can provide the basis for teacher training plan formulation, the selecting talents for the related functional departments, evaluation, teachers pre-service training, etc. To provide the reference [2]. Teachers as the main body of evaluation is, able to carry out self-examination, reference to evaluation system and the results of their current informationization teaching level also have a more objective understanding, find themselves on the shortcomings in the course of informationization teaching, and should take how to improve [3], and can meet the demand of personal development of career planning and teaching plan, improve the capacity eventually realize the common development of teachers and students.

In this paper, preliminary indicators were obtained through literature research, and experts were consulted to classify and merge the indicators. Then, data were obtained through questionnaire survey, and the weight of each corresponding indicator was calculated by factor load after missing value processing. Based on the obtained evaluation system, this paper designs a questionnaire survey, and teachers conduct self-evaluation based on their actual situation of informationized teaching. Based on the obtained data, this paper constructs an evaluation model of teachers’ informationized ability by using fuzzy evaluation method, and makes a comprehensive evaluation of teachers’ informationized ability.

2.Method

2.1 Construction of An Evaluation System for Teachers’ Teaching Informatization Ability

(1) Principles and process of constructing evaluation indicators for teachers’ informationized teaching ability

Information-based teaching ability refers to the ability of teachers to use information technology to support teaching in the context of the information age [4]. The establishment of the teacher information evaluation system is not a collection of all relevant indicators, but a comprehensive and complicated process. It is necessary to form an indicator that can reflect the true level of teachers’ information teaching ability on the basis of observing relevant principles. It is necessary to follow the principles of objectivity, completeness and feasibility, and go through the process of determining evaluation objects and objectives, preliminary proposed evaluation indicators, determining screening evaluation indicators and weights, and revising experiments [5].

(2) The construction of the theoretical framework of the evaluation index of teachers’ informatization teaching ability

Teachers’ information technology teaching ability based on the teacher’s ability quality structure, ability structure of the existing more than to ability as the research object, all the elements for the various elements of the system analysis is relatively small, so this article by scholars for teachers in the teaching should have the ability to analysis, on the basis of its ability to structure model, summarizes various elements, and based on constructing evaluation index system of [6]. In addition, informatization teaching ability includes 5 dimensions: professional basis, informatization teaching design ability, informatization teaching implementation and monitoring ability, informatization teaching evaluation ability and informatization teaching research ability, as well as 22 secondary indicators and 74 observation indicators.

(3) Selection of evaluation indexes of information-based teaching ability based on Delphi method

Through the analysis of literature and related theories, this paper initially extracted the evaluation indicators, but the number of them is large and the meaning is similar, so appropriate measures should be taken for scientific classification and screening [7]. The Delphi method, in which experts are consulted anonymously, is by far the most widely used. Two expert consultations were conducted in this paper. Based on the indicators initially extracted, the first expert opinion questionnaire was designed in this paper. Experts were invited to evaluate the evaluation indicators and their suitability. On the basis of the expert opinions and the indicators suggested to be modified, the second
questionnaire of expert opinions was organized and designed. Based on the statistical analysis of two rounds of expert consultation, 5 dimensions, 17 secondary indicators and 56 observation indicators were finally obtained.

(4) Determine the weight of the evaluation index of teachers’ informatization teaching ability

The weight indicates the importance of the index in the evaluation system. The determination of the weight should be based on certain scientific principles, so as to improve its accuracy and applicability in specific application evaluation [8-9]. Based on the high-order confirmatory factor analysis of structural equation model, the factor load of each dimension and index is obtained and the weight of evaluation index is determined by standardization. In this paper, the evaluation grade of each observation index is set as "excellent", "good", "average", "poor" and "poor", and the value is assigned 5 points, 4 points, 3 points, 2 points and 1 point respectively, and the final evaluation index system is obtained.

2.2 Fuzzy Evaluation Method

Evaluation method of fuzzy evaluation method is the use of fuzzy mathematics, is a kind of things is affected by many factors for the effective way of comprehensive evaluation, namely according to certain criteria, to give something to get the possibility of a comment, the evaluation result is not absolute affirmation and negation, and the use of a fuzzy set said [10]. The fuzzy evaluation method has been widely used in many fields, and also gained the attention of the education circle, such as course teaching quality evaluation, teacher evaluation and so on. In addition, some other fields of education also have the characteristics of vagueness, among which the evaluation of teachers’ informationized teaching ability is one of them.

3. Experiment

3.1 Questionnaire Design

According to the obtained evaluation index system, this paper needs to form a new questionnaire. Teachers conduct self-evaluation based on their actual situation of informationized teaching, thus forming the main data of this paper. The questionnaire consists of two parts. The first part is the description of the questionnaire and the relevant background information of the test objects. The second part is the scale of teachers’ informationized teaching ability, which takes the observation index of the evaluation system constructed above as the topic item, with a total of 57 items. All the questions adopted the 5-level Likert scale, specifically: excellent, good, general, poor, poor, and each was assigned a value of 5, 4, 3, 2, 1, forming the final assessment questionnaire.

In this paper, 90 samples of data were collected by online and on-site methods. Re-screening was conducted according to the following principles: 1) Random questionnaires; 2) Less than 120 seconds (within 120-160 seconds according to the test); After eliminating 6 irrelevant questionnaires, 84 valid data were obtained, with a recovery rate of 93.3%.

3.2 Basic Flow of Fuzzy Evaluation Method

The fuzzy evaluation model is used to analyze and evaluate teachers’ informatization ability. The basic steps of fuzzy comprehensive evaluation model are as follows: firstly, determine the factor (index) set U and factor weight set W of the evaluation object, then construct the evaluation set V and single factor evaluation matrix R, and finally realize the fuzzy transformation from factor set U to evaluation set V, that is, realize the synthetic operation of weight vector W and evaluation matrix R. According to this principle, the fuzzy evaluation process of teachers’ informatization ability can be shown in figure 1.
First, the evaluation object of this paper is teachers’ informatization ability, whose factor set is the evaluation index system obtained above. Second, the evaluation set of informatization teaching ability adopts grade 5 evaluation, that is, the evaluation set is: poor, poor, general, good, excellent. Thirdly, this paper mainly distributes questionnaires to teachers in a certain place, adopts the self-evaluation method, and gives the evaluation results according to the set five grades, and obtains the corresponding fuzzy evaluation matrix. In this study, the specific gravity method was used to calculate the membership of each observation index based on the recovered data, and the fuzzy relation matrix of each evaluation factor was established. Fourthly, firstly, evaluate each three-level index and calculate the evaluation value of each one, that is, the first-level fuzzy comprehensive evaluation. Secondly, each secondary index is evaluated and the evaluation value of each index is obtained, that is, the secondary fuzzy comprehensive evaluation. In the same way, the five dimensions of teachers’ informatization ability are evaluated, namely the three-level fuzzy comprehensive evaluation.

4. Discuss

4.1 Fuzzy Comprehensive Evaluation and Analysis of Teachers’ Informatization Teaching Ability

Based on two rounds of statistical analysis, this paper finally obtained 5 dimensions, 17 secondary indicators and 56 observation indicators, as shown in figure 2. On the basis of the evaluation index system, this paper designs the questionnaire, obtains the effective data by the way of teachers’ self-evaluation, and carries on the fuzzy evaluation of teachers’ informatization teaching ability.

Through the fuzzy evaluation of teachers’ informatization teaching ability, the comprehensive evaluation results are obtained in this paper, as shown in table 1. The proportion of teachers’ evaluation on informatization teaching ability in each grade is: poor 0.5% , poor 5.7% , generally 35.3% , good 53.1% , excellent 5.3% , between the good level and the general level, and relatively inclined to the good level. If judged according to the principle of maximum membership, the overall level of middle school teachers in this area is good. If 0.7 is set according to the principle of
confidence, it is a good level; If calculated on a weighted average basis and assigned 1,2,3,4,5 points in turn, the overall proficiency score of middle school teachers is 3.57 points, which is between "good" level and "average" level, and relatively inclined to "good" level. From the comprehensive evaluation results of all dimensions, according to the weighted average calculation, the highest score of the informatization teaching major is 3.81. The second is the research ability of information teaching, with a score of 3.66. The score of the dimension of informatization teaching evaluation ability is 3.57. The score of the dimension of informatization teaching implementation and monitoring ability is 3.46. The lowest dimension of the evaluation results was the ability of informationized instructional design, scoring only 3.44 points, which was significantly lower than other dimensions. To sum up, it shows that the overall level of teachers' informatization teaching ability is not high. Among them, the professional foundation of informatization teaching is good, but the ability to design, implement and monitor with the corresponding professional foundation still needs to be strengthened.

**Table 1. The Comprehensive Evaluation Results Of Informationization Teaching Ability**

| Dimensions                          | Bad | Average | Good | Excellent | Evaluation value |
|-------------------------------------|-----|---------|------|-----------|------------------|
| Information Teaching Professional Basis | 0.00 | 0.38    | 0.48 | 0.09      | 3.81             |
| Information Teaching Design Ability | 0.01 | 0.42    | 0.45 | 0.04      | 3.44             |
| Information Teaching Evaluation Ability | 0.01 | 0.34    | 0.57 | 0.03      | 3.57             |
| Information Teaching Research Ability | 0.00 | 0.34    | 0.57 | 0.06      | 3.66             |
| Information Teaching Ability        | 0.005 | 0.353   | 0.53 | 0.053     | 3.57             |

4.2 Analysis on The Difference of Teachers’ Informatization Teaching Ability

Section in this paper, the information technology teachers teaching ability has carried on the fuzzy comprehensive evaluation, in order to further research, this paper take One - Way ANOVA method, sample teachers of different background variables on the information-based teaching ability is the total score of each dimension difference analysis of teachers' background variables including gender, job title, teaching age, position, area. According to the results of variance analysis, this paper finds that: the background variables will make the scores of each dimension of teachers' informationized teaching ability vary. Teachers of different teaching ages and regions have different levels in each dimension of informatization teaching ability, teachers of different positions have significant differences in the basic dimension of informatization teaching major, and teachers of different titles have significant differences in the dimension of informatization teaching evaluation ability.

5.Conclusion

With the advent of the information age, the evaluation of teachers' informatization teaching ability has drawn more and more attention. It can not only provide referential methods for the evaluation and improvement of teachers' ability, but also provide references for the selection and assessment of classroom talents in relevant functional departments and the pre-job training of normal university students. In this paper, the fuzzy evaluation method is used to evaluate teachers' informatization teaching ability, and the results show that the overall level of teachers' informatization teaching ability
is not high, only the basic dimension of informatization teaching specialty is good, but the other dimensions are weak. According to the results of variance analysis, teachers of different teaching ages and regions have different levels in each dimension of informatization teaching ability, teachers of different positions have significant differences in the basic dimension of informatization teaching major, and teachers of different titles have significant differences in the dimension of informatization teaching evaluation ability.

References
[1] Du Yan-xia. Research on College English Teachers’ Information Literacy in Information Environment[J]. English Language Teaching, 2017, 10(11):37.
[2] Alice M. Blazeck, Elizabeth Katrancha, Dawn Drahnak. Using Interactive Video-Based Teaching to Improve Nursing Students’ Ability to Provide Patient-Centered Discharge Teaching[J]. Journal of Nursing Education, 2016, 55(5):296-299.
[3] Muneeerah S. Al-Subaiei. Challenges in Mixed Ability Classes and Strategies Utilized by ELI Teachers to Cope with Them[J]. English Language Teaching, 2017, 10(6):182.
[4] Zhen Z, Zhen Z. Investigation and Analysis of the Status Quo of the Practical Teaching Ability of English Normal Students in the Higher Vocational College in China[J]. 2017, 10(11):15.
[5] Hsueh-Yun Chi, Fong-Ching Chang, Li-Jung Huang. Enhancing teachers’ medication literacy and teaching through school–pharmacist partnership in Taiwan[J]. Drugs Education Prevention & Policy, 2017, 25(6):1-9.
[6] FATEMEH BAMBAEEROO, NASRIN SHOKRPOUR. The impact of the teachers’ non-verbal communication on success in teaching[J]. Journal of Advances in Medical Education & Professionalism, 2017, 5(2):51-59.
[7] Hsueh-Yun Chi, Fong-Ching Chang, Li-Jung Huang. Enhancing teachers’ medication literacy and teaching through school–pharmacist partnership in Taiwan[J]. Drugs Education Prevention & Policy, 2017, 25(6):1-9.
[8] X. Zhang, J. Li, J. Liu. Stability evaluation of soft rock supporting system of inclined shaft based on fuzzy comprehensive evaluation method[J]. Liaoning Gongcheng Jishu Daxue Xuebao (Ziran Kexue Ban)/Journal of Liaoning Technical University (Natural Science Edition), 2018, 37(3):476-481.
[9] Guichao Fan, Denghua Zhong, Fugen Yan. A hybrid fuzzy evaluation method for curtain grouting efficiency assessment based on an AHP method extended by D numbers[J]. Expert Systems with Applications, 2016, 44(C):289-303.
[10] Baiyu Jiang, Junfu Lu, Yu Yu. Reliability Evaluation Method of Supporting Structure of Subsea Tunnel Based on Fuzzy Probability[J]. Journal of Computational and Theoretical Nanoscience, 2016, 13(2):1442-1449.