Teaching Staff Evaluation in Higher Education Using Fuzzy Comprehensive Evaluation Method Based on Entropy and AHP Methods

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Abstract

It is meaningful for colleges to evaluate teaching staff annually. This paper developed a method to make fuzzy evaluation of teaching staff based on Fuzzy Comprehensive Evaluation Technique (FCE). The main idea is getting experts' opinions for proposed evaluation criteria, calculating the most appropriate weights to the criteria based on combination between AHP and Entropy methods, rating student's answers for lecturers based on the qualified questionnaire, and making rational evaluation for teaching staff based on FCE. This will provide an objective basis for colleges to evaluate lecturers' levels, and provide guidelines for the lecturers to improve their teaching process.

الخلاصة

لأمر ذو أهمية للكليات تقييم كادرها التدريسي بصورة سنوية. هذا البحث طَوَّر طريقة للتقييم المضبب لأعضاء هيئة التدريس بالإعتماد على طريقة التقييم الإستيعابي المضبب. الفكرة الرئيسية هو الحصول على أراء الخبراء لمعايير التقييم المقترحة و حساب الأوزان الملائمة للمعايير بالإعتماد على الدمج بين طريقتي AHP و Entropy للحصول على أفضل الأوزان ومن ثم إستخدام نسب إجابات الطلبة لكل تدريسي حسب الإستبانة المؤهلة وعمل تقييم معقول للكادر التدريسي بالإعتماد على مبدأْ الFCE. هذا التقييم سيجهِّزْ الكليات بأساسْ موضوعي لتقييم مستويات المحاضريين ويكون عوناً للمحاضريين لتحسين طريقة تدريسهم للمقررات.

1. Introduction

Teaching staff evaluation takes an important role in teaching/learning process. Such evaluation can help universities to evaluate a lecturer's ability impersonally, and help lecturer to improve his teaching way. Lecturers may evaluate their teaching according to the test result practically by analyzing test score manually. It is difficult to judge the study effect of one student on all knowledge points, or the study effect of all students on one knowledge point [Kong, 2010].

1.2. Student Ratings of Teaching

Student ratings of teaching or student evaluations are the most commonly used source of data for both summative and formative information. In many academic units they are mandatory, and in several units, they are standardized. For purposes such as tenure and promotion, data should be obtained over time and across courses using a limited number of global or summary type questions. Such data will provide a cumulative record and enable the detection of patterns of teaching development. Information obtained by means of student ratings can also be used by individual instructors to improve the course in future years, and to identify areas of strength and weakness in their teaching by comparison with those teaching similar courses. Longer and more focused questionnaires are also useful in a program of formative evaluation when designed and administered by a lecturer during a course [York, 2002].

Benefits: The use of a mandatory, standardized questionnaire puts all teaching evaluations on a common footing, and facilitates comparisons between teachers, courses and academic units. The data gathered also serve the purpose of assessing whether the educational goals of the unit are being met. Structured questionnaires are particularly appropriate where there are relatively large numbers of students involved, and where there are either several sections of a single course, or several courses with similar teaching objectives using similar teaching approaches [York, 2002].

Limitations: While students' perceptions provide valuable feedback to instructors, recent research has identified specific areas of teaching quality on which students are not able to make informed judgments. These include the appropriateness of course goals, content, design, materials, and evaluation of student work [York, 2002].

2. Analytical Hierarchy Process (AHP)

The AHP was defined as method for formulating and analyzing decisions. It represents a decision support tool that helps in solving complex decision problems with tangible and intangible aspects. AHP offer the decision-makers experience, knowledge and intuition in making decisions. It is a popular Multi-Criteria Decision Making Method (MCDM), where the key ingredient is that all evaluations are made by pair-wise comparisons on a scale 1 to 9 in a matrix A [Saaty, 1980]. As shown in Table 1.

Table 1 Importance (preferences) points and its meaning of AHP

Importance	Meaning	Explanation
1	Equally important	Two elements contribute equally
3	Slightly important	Experience and judgment prefer one element over another
5	Quite important	An element is strongly Preferred
7	Very important	An element is very strongly dominant
9	Extremely important	An element is preferred by at least an order of magnitude
2,4,6,8	Intermediate values	Used to compromise between two judgments
$\frac{1}{3},\frac{1}{5},\frac{1}{7},\frac{1}{9}$	a_{ij}x a_{ji}	Reciprocal in importance

2.1.AHP Steps

To perform a complete AHP analysis, the following steps must be followed [T. L. Saaty, 1980]:

Step 1: The structure of the AHP model must be determined. One of the ways to do this step is by interviewing with domain experts.

Step 2: Suitable questionnaire must be designed. The questionnaire is specially designed to perform all of possible pair-wise comparisons among input factors (or dimensions). A nine-point scale is usually utilized to indicate the importance ratio of one factor to another. Table 1 shows a nine-point scale used for AHP.

AHP helps in the conversion of qualitative judgments into cardinal values. Table 2 demonstrates a simple AHP questionnaire with three factors: factors A, B, and C. In the table, the first row shows two factors for comparison (the leftmost cell and the rightmost cell) and the values of comparison result of the two factors. It is important to note that the values shown in the first row are symmetrical. People use values in the left side if the factor in the leftmost cell is more important than the factor in the rightmost cell. The rest of rows indicate the pair-wise comparisons of importance among any pairs of two factors. For example, assume factor A is three times importance than factor B. We then mark "V" in the cell associated with 3 (close to factor A which is located in the left side) in the second row. The ratio of factor A to factor B is 3:1.

Similarly, the importance ratio of factor A to factor C is 4: 1, and the importance ratio of factor B to factor C is 1:7.

Table 2: Example of questionnaire

Factor	9	8	7	6	5	4	3	2	1	2	3	4	5	6	7	8	9	Factor
A							V											B
A						V												C
B															V			C

Step 3: Use the questionnaire to collect the experts' opinions on the importance ratios among the factors and to build importance matrix.

Step4: Calculate the weights;

A: The weight of every level can be calculated as:

$$\bar{w}_i = \sqrt[n]{\prod_{j=1}^{n} a_{ij}} \;...(1)$$

B: This weight must be standardized:

$$w_i = \frac{\bar{w}_i}{\sum_{i=1}^{n} \bar{w}_i} \;...(2)$$

C: Find the largest Eigenvalue as:

$$\lambda_{max} = \sum_{i=1}^{n} \frac{\sum_{j=1}^{n} a_{ij} * w_j}{n * w_i} \;...(3)$$

Step 5: A constituency test must be performed.

A: Consistency Index (CI) must be computed using the following formula:

$$CI = \frac{\lambda_{max} - n}{n - 1} \;...(4)$$

Where n is the number of factors, λ_{max} is the maximum eigenvalue of the importance matrix.

B: Constituency Ratio (CR) is used to determine if a questionnaire passes the consistency test.

$$CR = \frac{CI}{RI} \;...(5)$$

Where RI (Random Index) is defined in Table 3 below. If CR is less than or equal to 0.1, the questionnaire passes the consistence test. The weights in an AHP model are the elements of the normalized eigenvector associated with λmax.

Table 3 Random Index [T. L. Saaty,1977]

N	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
R.I	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.48	1.56	1.57	1.59

Remark: n is the number of factors

If CR is greater than 0.1, the questionnaire fails.

3. Entropy method

The entropy method is an object empowerment approach, in which the weight values of individual indicators are determined by calculating the entropy and entropy weight. The greater the entropy is, the smaller the corresponding entropy weight will be [Lin, et al., 2009].

The amount of useful information that the target provides to the decision-maker is reduced. If the entropy weight is zero, it provides no useful information to the decision-maker, and this indicator may be removed [Jing et al., 2009].

The main steps of the entropy weight method include: the formation of the evaluation matrix; the standardization of the evaluation matrix; the calculation of the entropy and the entropy weight [Yuguo et.al, 2010].

3.1. Entropy method steps

The following are the main Entropy method steps [Lin Z.Z. and Wen F.S., 2009]:

Under evaluate factors, select m targets and n level, xij for the evaluation of the metric value of the j level in the i target (i=1, 2, …, m ; j=1, , 2, …, n).

Compute the ratio of the metric value of the i target in the j metric to this metric value, then

$$p_{ij} = \frac{x_{ij}}{\sum_{i=1}^{m} x_{ij}}, i = 1,2, \ldots, m; j = 1,2, \ldots, n. \ldots (6)$$

Compute the entropy value of the j metric, then

$$e_j = -k \sum_{i=1}^{m} p_{ij} . \ln(p_{ij}) \ldots (7)$$

In formula (7), $k > 0, k = 1/ln(m), e_j \geq 0.$

Compute the different coefficient of the j metric, as for the j metric, the greater the difference between metric values, the greater influence it has on the evaluation of the system, hence the less the entropy value becomes. Define difference coefficient as follows:

$$g_j = \frac{1 - e_j}{n - E_e} \ldots (8)$$

In formula (8), $E_e = \sum_{j=1}^{n} e_j, 0 \leq g_j \leq 1, \sum_{j=1}^{n} g_j = 1.$

Computation of the synthesized value for each target

$$s_i = \sum_{j=1}^{n} g_j p_{ij}, i = 1, 2, \ldots, m \ldots (9)$$

4. Fuzzy Comprehensive Evaluation Method (FCEM)

Statistics tools are an effective method to evaluate and analyze risks when a large quantity of survey data was collected. In addition to statistics there are some methods such as the application of fuzzy mathematics (Fuzzy comprehensive evaluation and fuzzy information processing (including information distribution and information diffusion)) and so called 'hybrid technique' [Huang and Shi, 2002]. These new methods perform well and play an important role in the case of insufficient statistical data and small sample problem.

4.1. Basic Concepts and Process

The teaching and learning often need to be evaluated in various purposes, such as the experience of the students as partners in the evaluation process(their experience of what is provided and of the providers their motivation and approach to learning), the performance of the provider(s) (the academic staff, tutors, supports staff, involved in the delivery of this program/ course / class), the quality of the educational provision which could be the whole program, a course (module), a class (lecture, seminar, laboratory, etc.), etc..

The fuzzy comprehensive evaluation is also known as the fuzzy synthetic decision-making [Li etal., 2006]. The key to the method is to determine the weight set. The weight can be determined by several methods, e.g., the subjective method using the analytic hierarchy process [Zhao etal., 2004], the objective method such as the comprehensive exponential method [Guoetal., 2009]. The entropy weight method can establish a quantifiable bridge between the subjective and objective methods, and represents a good way to determine weights [Yuguoetal., 2010].

Usually there is more than one factor that initiates the evaluation for such purpose. To evaluate performance of the lecturer(s) must be considered multiple relative factors and make a comprehensive decision, a process called comprehensive evaluation. When referred to fuzzy factors, it called fuzzy comprehensive evaluation. The main steps of fuzzy comprehensive evaluation are as follows [Zhang, Lu and Zhu, 1991].

4.2. Construct Factor Set

The main factor set U that influence the results of evaluation is an ordinary set and; $U = \{u_1, u_2, \cdots, u_m\}$ while $u_i(i = 1, 2, \cdots, m)$ stands for each factor, which can be fuzzy or not. The relationship between these two sets (u_i and U) is either u_i belong to U or not. ($u_i \in U$, $u_i \notin U$), and only one of these two relation must be satisfied.

4.3. Construct Weight Set

In general, the different factors have different importance. One set a weight $a_i(i = 1, 2, \cdots, m)$ to each u_i to reflect its importance. So the set $A = \{a_1, a_2, \cdots, a_m\}$ will represents a factor weight set or weight set.

Then, $a_i$shave unitary and non-negative properties:

$$\sum_{i=1}^{m} a_i = 1, a_i \geq 0, i = 1,2,\dots,m. \dots(10)$$

a_i can be considered as the membership grade of importance, the weight set is a fuzzy subset on the factor set and can be expressed as

$$A = \frac{a_1}{u_1} + \frac{a_2}{u_2} + \cdots + \frac{a_m}{u_m}. \dots(11)$$

4.4. Construct Evaluation Set

The various possible results of final evaluation for an object of study consist of an evaluation set V: $V = \{v_1, v_2, \cdots, v_n\}$, where V_i $(i = 1, 2, \cdots, n)$ denotes each possible final evaluation result. The purpose of fuzzy comprehensive evaluation is to find out the best evaluation result based on all influence factors.

4.5. Single Factor Fuzzy Evaluation

When we evaluate the membership grade for an object of study based on one factor, we call it single factor fuzzy evaluation. Suppose the evaluation is based on the i^{th} factor U_i. The membership grade to the j^{th} element V_j of the evaluation set is r_{ij}. The evaluation result for the i^{th} factor u_i is the fuzzy set $R_i = \frac{ri1}{v1} + \frac{ri2}{v2} + \cdots + \frac{rin}{vn}$, called single factor evaluation set. In fact R_i is also a fuzzy subset of evaluation set V, denoted by $R_i = (r_{i1}, r_{i2}, \cdots, r_{in})$.

In this way, we get a series of single factor evaluation set as follows:

$$R_1 = (r_{11}, r_{12}, \ldots, r_{1n}),$$
$$R_2 = (r_{21}, r_{22}, \ldots, r_{2n}),$$
$$\vdots$$
$$R_m = (r_{m1}, r_{m2}, \ldots, r_{mn}).$$

Let single factor evaluation set $R_i$be the row of R, which is called single factor evaluation matrix, then

$$R = \begin{pmatrix} r_{11}, r_{12}, \cdots, r_{1n} \\ r_{21}, r_{22}, \cdots, r_{2n} \\ \cdots \cdots \cdots \cdots \cdots \\ r_{m1}, r_{m2}, \cdots, r_{mn} \end{pmatrix}.$$

4.6. Fuzzy Comprehensive Evaluation

The fuzzy comprehensive evaluation based on all factors. From single factor evaluation matrix R, the i^{th} row reflects the influence of the i^{th} factor to each element of evaluation set and the j^{th} column reflects the influence of the each factor to the j^{th} element of evaluation set. Therefore the sum $\tilde{R}_j = \sum_{i=1}^{m} r_{ij}$ (j = 1, 2, • • •, n) may be regarded as the total influence of all factors to the j^{th} element. However, $\tilde{R}_j$ doesn't take the importance of various factors into account. To reflect the comprehensive influence of all factors, we may multiply $r_{ij}$with the weight a_i (i = 1, 2, • • •, m). Thus we obtain the fuzzy comprehensive evaluation as follows:

$$B = (a_1 a_2 \ldots a_m) \text{ o } \begin{pmatrix} r_{11}, r_{12}, \cdots, r_{1n} \\ r_{21}, r_{22}, \cdots, r_{2n} \\ \cdots \cdots \cdots \cdots \cdots \cdots \\ r_{m1}, r_{m2}, \cdots, r_{mn} \end{pmatrix} = (b_1 b_2 \ldots b_n) \ldots (12).$$

Where o is a synthetic operator that can be explained in various ways and B is fuzzy comprehensive evaluation set [Shang, 2006].

5. The Proposed Method

The qualified criteria can be shown in Table 4.We can illustrate the proposed method using the algorithm (1)

Algorithm (1) Fuzzy Comprehensive Evaluation Method

Inputs: The weights for each criterion resulted from combination between AHP and Entropy methods (A), rating of students for each lecturer (R).

Output: The evaluation for each main criterion for each lecturer Ev(C, L) and total evaluation for each lecturer T(L).

Begin of Algorithm

- Find evaluation set function

$$\aleph_i = \frac{\lambda_i - \min}{\max - \min} * (new_{max} - new_{min}) + new_{min} \ldots (13)$$

$$\lambda_i = \frac{\sum_{i=1}^{m} x_i f_i}{\sum_{i=1}^{m} f_i} \dots (14)$$

- Find the fuzzy comprehensive evaluation vectors

$$B_j = \sum_{i=1}^{v} A_i \cdot R_{ij} \dots (15)$$

- Find Final Evaluation for each lecturer.

$$Final\ Evaluation\ \bar{B} = A.B_j \dots (16)$$

- Find The Fuzzy Comprehensive Evaluation for the main criteria.

$$EV(C,L) = F = \sum_{i=1}^{v} B_i.\aleph_i \dots (17)$$

- Find The Total Fuzzy Comprehensive Evaluation

$$T(L) = \bar{F} = \bar{B}.\aleph_i \dots (18)$$

End of Algorithm

Table 4.Qualified Criteria

E1-1-Teaching Content	E1 - Lecturer presented his/her subject plan quarterly (or annual) in the first lecture.
	E2 – The entire subject's curriculum was studied.
	E3 – Lecturer's exams covered the subject curriculum.
E-2-2-Teaching Method	E4 – Lecturer was commitment in time of beginning and ending of the lecture and time table of lectures subject.
	E5 – Lecturer viewed his/her lecture using scientific techniques in clear and understandable manners.
	E6 – Lecturer welcomed scientific dialogue during the lecture.
	E7 – Lecturer cared to make sure that all the students understand the lecture.
	E8 – Lecturer used a variety of teaching/learning aids in discussing his/her subject.
	E9 – Lecturer was able to present his/her arguments and points of view.
	E10 –Lectures of lecturer characterized by novelty and modernity.
	E11 –Lecturer was adopting dialogue and discussing in teaching subject.
	E12 –Lecturer involved students in the events of the subject.
	E13 –Lecturer was master in broach questions during the lectures.
	E14 - Lecturer was master in answer to questions from the students.
	E15 – Lecturer was accurate in presentation of the subject.
E-3-3-Teaching Attitude	E16 – Lecturer welcomed inquiries from students inside and outside the lecture hall.
	E17 – Lecturer respected the views of students and interacted with them.
	E18 – Lecturer equalized among students in dealing.
E4-4-Teaching effectiveness	E19 – Lecturer charged students to conduct research and/or write articles and/or solving exercises related to the curriculum subject.
	E20 – Lecturer concerned for students' use of external scientific sources (library and the Internet ...).
	E21 – Students benefitted from the duties given to them to improve activity in their specialist.
	E22 – Lecturer utilized the time allocated for teaching and learning process.
	E23 – Lecturer characterized by ability to manage the class.
	E24 – Lecturer gave duties in the base of the objectives of the subject.
	E25 – Lecturer's exams questions characterized by clarity.
	E26 – Lecturer used appropriate and variety methods for students' assessment.
	E27 – Lecturer discussed the students' answers in the exams and assignments.
	E28 – Lecturer was adopting in his/her questions on understanding and trialing.
	E29 – Lecturer's questions was appropriate for the exam time.

6.Case Study

The combination weight set resulted from AHP and Entropy method to the main criteria E1-1, E2-2, E3-3, E4-4 were

A= [0.14344346, 0.46618965, 0.14536662, 0.24500031].

The combination weight set resulted from AHP and Entropy method to the sub criteria for each main criterion was

A1= [0.19458846, 0.49986302, 0.30554854].

A2= [0.060759712, 0.080987043, 0.074940875, 0.10138575, 0.0580623, 0.08432576, 0.0706779, 0.084396027, 0.085311353, 0.09486602, 0.10903819, 0.09524887].

A3= [0.29611438, 0.32569935, 0.37818622].

A4= [0.08816789, 0.094546563, 0.11602765, 0.096842244, 0.14276397, 0.0926118, 0.086161181, 0.059868045, 0.070723921, 0.084167167, 0.068119436].

The lecturer No. 13 was chosen to clarify the method and the crisp data was used for rating in this case study. The membership degree for each criterion to the lecturer No. 13 depends on student answers as shown in table 5.

Table 5: Students' answers to evaluate lecturer 13

	Evaluation No.	Excellent	Very good	Good	Middle	Poor	Very poor
	E1	0.7058	0.1176	0.1764	0	0	0
R_1	E2	0.647	0.294	0.05882	0	0	0
	E3	0.823	0.176	0	0	0	0
	E4	0.764	0.176	0.0588	0	0	0
	E5	0.705	0.176	0.117	0	0	0
	E6	0.529	0.294	0.0588	0.05882	0	0
	E7	0.529	0.294	0.0588	0.05882	0.05882	0
	E8	0.647	0.294	0.0588	0	0	0
R_2	E9	0.588	0.117	0.176	0.1176	0	0
	E10	0.176	0.588	0	0	0	0
	E11	0.588	0.352	0.0588	0	0	0
	E12	0.411	0.176	0.294	0.1176	0	0
	E13	0.529	0.352	0.0588	0.05882	0	0
	E14	0.529	0.235	0.176	0.05882	0	0
	E15	0.470	0.235	0.176	0.1176	0	0
	E16	0.529	0.352	0.117	0	0	0
R_3	E17	0.705	0.117	0.176	0	0	0
	E18	0.588	0.235	0.0588	0.1176	0	0
	E19	0.529	0.352	0.117	0	0	0
	E20	0.588	0.294	0.0588	0.05882	0	0
	E21	0.352	0.470	0.117	0.05882	0	0
	E22	0.647	0.352	0	0	0	0
	E23	0.588	0.235	0.117	0	0	0
R_4	E24	0.470	0.470	0.0588	0	0	0
	E25	0.235	0.411	0.294	0.05882	0	0
	E26	0.352	0.411	0.235	0	0	0
	E27	0.411	0.235	0.294	0.05882	0	0
	E28	0.470	0.235	0.176	0.1176	0	0
	E29	0.294	0.411	0.235	0.05882	0	0

Depending on equation (12) the product sum $\mathbf{m}(\bullet,+)$used as a synthetic operator as show in the equation (15), the fuzzy comprehensive evaluation vectors of the main criteria for lecturer No. 13 were:

B_1= [0.3334084, 0.442744, 0.1062329, 0, 0, 0].

B_2= [0.6194634, 0.269417, 0.08080017, 0.03031935, 0, 0].

B_3= [0.5646418, 0.30338, 0.0971411, 0.01741849, 0, 0].

B_4= [0.449, 0.302, 0.177946, 0.06566686, 0.005186346, 0].

The fuzzy comprehensive evaluation for this lecturer was calculated overall depends on the equation (16).

where B_j= [B_1, B_2, B_3, B_4]

$$B_j \left\{ \begin{bmatrix} 0.3334084, 0.442744, 0.1062329, 0, 0, 0 \\ 0.6194634, 0.269417, 0.08080017, 0.03031935, 0, 0 \\ 0.5646418, 0.30338, 0.0971411, 0.01741849, 0, 0 \\ 0.449, 0.302, 0.177946, 0.06566686, 0.005186346, 0 \end{bmatrix} \right\}$$

$\bar{B}$= [0.5287, 0.3072, 0.1106, 0.03275, 0.00127, and 0].

The evaluation set $\aleph$ for lecturer 13 depends on equation (13 and 14)was:-

$\aleph$ = [95.3144, 82.92089, 71.23732, 60.3854, 40.04057, and 0].

Final fuzzy comprehensive evaluation for the main criteria was calculated by the equation (17)

The F for E1-1 = 76.05909

The F for E2-2 = 88.97092

The F for E3-3 = 86.94693

The F for E4-4 = 84.70448

The $\bar{F}$ for overall evaluation for that lecturer was calculated by the equation (18) = 85.77931.

Results

The percentages of distribute lecturers in Computer Science Department at Babylon university among five intervals were shown in table 6.

Table 6: The percentages of lecturers' distribution

Lecturer's Criteria	Excellent %	V. Good %	Good %	Middle %	Poor %
Teaching Content	0	٦.٠٦٠٦٠٦	٢٤.٢٤٢٤٢	٢٧.٢٧٢٧٣	٤٢.٤٢٤٢٤
Teaching Attitude	0	٤٢.٤٢٤٢٤	٣٣.٣٣٣٣٤	٢١.٢١٢١٢	٣.٠٣٠٣٠٣
Teaching Effectiveness	0	٣٩.٣٩٣٩٤	٣٠.٣٠٣٠٣	٢٧.٢٧٢٧٣	٣.٠٣٠٣٠٣
Teaching Method	0	١٢.١٢١٢١	٤٨.٤٨٤٨٥	٣٣.٣٣٣٣٤	٦.٠٦٠٦٠٦
Total final evaluation	0	٣٠.٣٠٣٠٣	٣٣.٣٣٣٣٤	٣٠.٣٠٣٠٣	٦.٠٦٠٦٠٦

Table7 show the evaluation results for all lecturers were voted by students.

Table7: Evaluation of Lecturers

Lecturer No.	Teaching Content	Teaching Attitude	Teaching Effectiveness	Teaching Method	Total Final Evaluation
2	58.11535	74.6548	73.20932	73.37619	71.75894
3	45.24128	71.9052	72.95472	69.2672	67.58673
7	59.28516	87.38751	84.63394	77.93162	80.63944
8	45.27104	75.59276	72.4307	69.0979	69.19242
11	38.7198	63.86087	67.2444	58.87421	59.52468
13	76.05908	88.9709	86.94692	84.70447	85.77931
14	74.6654	82.7104	82.5633	83.69911	81.77727
15	62.055496	81.096412	86.0322036	77.90756	78.30135
16	57.753627	87.371696	85.7355804	83.36098	81.90270
19	57.140331	86.772285	89.4417037	81.67572	81.66116
20	59.497192	79.896980	83.6289520	70.52883	75.21807
21	48.980323	67.238548	69.8926467	63.10671	63.99304
22	68.354461	70.028350	76.5500869	73.91699	71.68901
31	44.934234	80.141738	83.5511856	72.99793	73.83684
32	67.511322	70.323417	68.3519210	68.81857	69.26477
34	60.241863	67.179336	68.3224105	63.86159	65.53752
37	66.029579	81.547523	74.59268	76.20394	77.00139
39	72.000541	75.785049	75.9025115	70.51412	73.96788
40	69.583312	74.250236	68.6811599	67.59294	71.14020
41	57.480613	65.584701	65.0389480	61.80122	63.41594
44	66.877334	68.890190	72.1634140	61.39327	67.24053
45	68.042533	70.193267	64.0521926	70.32241	69.02369
46	74.256156	85.065032	85.9591598	78.3916	82.00955
51	79.749649	82.888946	85.313949	78.95433	81.82717
52	73.995841	82.8044	81.033065	78.53911	80.2384
53	80.37723	75.36235	73.146774	73.89217	75.39944
59	75.05368	70.213829	74.5287551	68.58164	71.12595
60	36.704734	64.94868	69.8674	65.37484	61.71671
61	79.69829	82.01197	80.2389	79.8128	80.88358
62	37.40301	55.07541	44.470069	47.5929	49.16555
63	58.937374	66.695655	66.95755	63.20029	64.76449
64	80.533424	89.215652	82.47295	76.94559	83.98391
65	68.463195	82.601226	79.6877822	76.29145	78.60381

8. Conclusions

Depending on the findings through on research, we can conclude:

The Evaluation model can gain objective and efficient results in evaluating of lecturers in higher education.

The combination between AHP method and Entropy method produce more valuable and rational results in evaluation.

There are more difficulties of getting a response from students either in online questionnaires or in paper questionnaires.

FCE technique provides more effective methodology in final agglomerative results.

Choice of synthetic operator plays an important function in FCE method accuracy.

The distribution of student’s answer is variable and it’s hard to employ it in evaluation.

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تقييم أعضاء هيئة التدريس في التعليم العالي بإستخدام طريقة التقييم الإستيعابي المضبب إعتماداً على طريقة الانتروبي والAHP