The Journal of Academic Social Science Studies

International Journal of Social Science
Doi number:http://dx.doi.org/10.9761/JASSS2242
Number: 23 , p. 465-475, Spring 2014

GRİ İLİŞKİ ANALİZİ YÖNTEMİYLE ÖĞRETİM ELEMANI PERFORMANS DEĞERLENDİRMESİ*

PERFORMANCE EVALUATION OF INSTRUCTORS THROUGH GREY RELATIONAL ANALYSIS METHOD

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Özet

Bu çalışma, öğretim elemanının performansının değerlendirilmesi için geleneksel yöntemlerden farklı olarak Gri İlişki Analizi yöntemi kullanılan ilk çalışmalardandır. Yükseköğretim kurumlarının öğretim elemanı niteliği, eğitimin kalitesini doğrudan etkileyen faktörlerin başında gelmekte ve öğretim elemanlarının performanslarının değerlendirilmesi, kalite kontrol güvencelerinin en önemli göstergelerinden biri olarak görülmektedir. Öğretim elemanının performansı, benzer çalışmalarda, öğretim performansı ve danışmanlık performansı olarak ayrı ayrı ele alınmasına rağmen, bu çalışmada birlikte ele alınarak öğretim elemanının performansı olarak adlandırılmıştır. Öğretim elemanının performansının değerlendirilmesi amacıyla Marmara Üniversitesi Teknik Bilimler Meslek Yüksekokulu Endüstriyel Elektronik Bölümünde öğrenim gören öğrencilere anket uygulaması yapılmıştır. Yapılan ankette öğrencilere; demografik sorularının yanı sıra öğretim elemanının performansı ile ilgili sorular yönetilmiştir. Anketin değerlendirilmesinde kullanılan Gri ilişki analizinde; cevapların frekanslarından ziyade öğrencilerin ifadelere verdikleri yanıtlar kullanılmaktadır. Veri kümesinin kısıtlı ve az sayıda olması, değişkenlerin kesikli ve sürekli rasgele değişkenlerden oluşması, herhangi bir olasılık dağılımına sahip olma şartı aranmaksızın belirsiz durumlara uygulanabilir olması, fonksiyonel bir dizi işlemlerin yerine basit, belirli ve net hesaplama adımlarıyla birlikte veriler arasındaki birebir ilişki

*Bu makale Crosscheck sistemi tarafından taranmış ve bu sistem sonuçlarına göre orijinal bir makale olduğu tespit edilmiştir.

derecesini sayısal olarak analiz edebiliyor olması, varsayımlarının olmaması, kolay, pratik ve kullanışlı olması gibi özellikler, Gri ilişki analizini diğer yöntemlerden ayıran ve üstün kılan özelliklerdir. Bu nedenle, anket sonucunda elde edilen veriler yeni bir istatistik yöntem olan Gri İlişki Analizi yöntemi ile değerlendirilmiş ve sonuçları bu doğrultuda yorumlanmıştır.

Anahtar kelimeler: Gri ilişki analizi, öğretim elemanı performansı, performans değerlendirme

Abstract

As opposed to traditional methods, this study is among the first ones that use Grey Relational Analysis method for evaluation of instructors' performances. The qualifications of an instructor in a higher educational institution is one of the top factors that directly affect the quality of education, and hence, the evaluation of instructors' performances is among the most significant indicators of quality control assurance. Even though the performance of an instructor is evaluated separately in similar studies as teaching performance and advising performance, this study handles these two together and calls it the performance of an instructor. To be able to evaluate the performance of the instructor, students of Marmara University Technical Sciences Vocational School Industrial Electronics department are surveyed. In the survey implemented, students are asked demographic questions in addition to the questions related to the performance of the instructor. In Grey relational analysis applied for assessment of the survey, the responses of the students are used instead of the frequency of the responses. The fact that its data set is limited and low in number; the variables are intermittent and composed of continuous random variables; can be applied in uncertain situations without necessitating a probability distribution; provides an ability to analyze one-to-one interrelations of data in a numerical manner with simple, specific and net calculation steps instead of a number of functional processes; contains no assumptions, and is easy to use and practical makes Grey relational analysis a method superior to others. Therefore, the data obtained as a result of the survey are assessed and the outcomes are interpreted with this new statistical method called Grey Relational Analysis.

Key words: Grey Relational Analysis, instructor performance, performance evaluation

Introduction

As institutions providing higher education, universities need a universal level of quality necessitated by the modern era and effective evaluation systems to be able to renovate themselves. The qualifications of an instructor in a higher educational institution is one of the top factors that directly affect the quality of education, and hence, the evaluation of instructors' performances is among the most significant indicators of quality control assurance.

This qualification can only become meaningful by evaluating the instructor's performance both within and outside the classroom. While the in-class effectiveness of an instructor is determined by factors like having a good command of the course, the way subjects are taught, reassuring the students, knowledge-based authority in the class, the ability to establish a dialogue with the students, and sincerity towards the students, effectiveness outside the classroom is determined by the help and guidance the instructor provides to the advisee students about the level of knowledge on the higher education institution they attend, learning its rules, adaptation to its social and academic environment, personal development, awareness, self-confidence, preferences and launching their careers equipped with necessary knowledge.

Performance Evaluation

Performance evaluation is the systematic identification of strengths and weaknesses of an individual or a group in a given task (Kepir-Sinangil,H. 1998). Barutçugil (2002) defines performance evaluation as a planned tool that completes the success of an individual in a given task, his/her attitude and behavior, morality and qualifications in the job and assesses the contribution of the individual to the success of an organization.

As a tool used extensively in many organizations, performance evaluation is now being widely used in educational institutions as well. University is an educational institution that provides higher level of education, training and scientific research. Composed of academic and administrative personnel and students, a university exhibits a heterogeneous structure in terms of its components (Basbug & Unsal, 2009). The existence of different groups within a university necessitates consideration of interest and requirements of all these groups by the administration. Especially in terms of the performance evaluation of the university's academic personnel, the purpose of the evaluation, what should be evaluated and who will be responsible are significant issues that need to be addressed (Rutheiford, 1988). The fact that universities are knowledge-based organizations indicates that performance evaluations in these institutions should be handled with special care (Simmons, 2002; Basbug & Unsal, 2009)

This is why the evaluation method that compensates shortcomings and aims development by identifying the level of teaching performance of the academicians is called formative evaluation. In formative evaluation, the instructor and the course are evaluated with data obtained from different sources. Summative evaluation on the other hand is the evaluation of the instructor and the course for the purposes of determination of the level and decision making based on data obtained from various sources. The methods used in evaluating the teaching performances of the academicians are examined under ten headings (Kalaycı, 2009). These methods are student assessment survey, evaluation performed by experienced colleagues within the

faculty or department, self-evaluation, evaluation by administrators, specialist evaluation from outside the university, evaluation by graduated students, awards given to most successful instructors, video shoots, the views of employers on graduates and the level of students' learning.

In evaluating the teaching performance of the instructors, having a good command of the course, the way subjects are taught, reassuring the students, knowledge-based authority in the class, the ability to establish a dialogue with the students, and the sincerity towards the students in addition to the activities outside the classroom called academic advising as one of the tasks of a lecturer are among the significant factors that influence the success of the students. Academic advising contains providing help and guidance to the students in learning about the higher education institution they attend, learning its rules, adaptation to its social and academic environment, personal development, awareness, self-confidence, preferences and launching their careers equipped with necessary knowledge. In evaluating the performances of instructors, no method is adequate by itself. However, these methods may provide valid and reliable outcomes when assessed together (Kalaycı, & Çimen, 2011)

This study, as opposed to the traditional methods of performance evaluation, uses grey relational analysis that has been gaining significance in recent years.

Grey Relation Analysis

The validity of traditional statistical analysis techniques is based on assumptions such as the distribution of population and variances of samples. Nevertheless sample size will also affect the reliability and precision of the results produced by traditional statistical analysis techniques. J. Deng argued that many decision situations in real life do not conform to those assumptions, and may not be financially or pragmatically justified for the required sample size. Making decisions under uncertainty and with insufficient or limited data available for analysis is actually a norm for managers in either public or private sectors (Deng, 1982; Deng, 1989). To address this problem, J. Deng developed the grey system theory, which has been widely adopted for data analysis in various fields. The Grey Relational Analysis introduced in the following is a method in Grey System Theory for analyzing discrete data series. A procedure for the Grey Relational Analysis, which is appropriate for Likert scale data analysis, consists of the following steps.

1. Generate reference data series x_0.

$x_0 = (d_{01}, d_{02}, ..., d_{0m})$

where m is the number of respondents. In general, the x_0 reference data series consists of m values representing the most favoured responses.

2. Generate comparison data series x_i.

$x_i = (d_{i1}, d_{i2}, ..., d_{im})$

where i = 1, ..., k. k is the number of scale items. So there will be k comparison data series and each comparison data series contains m values.

3. Compute the difference data series Δ_i.

$\Delta_i=(|d_{01} - d_{i1}| , |d_{02} - d_{i2}| , ..., |d_{0m} - d_{im}|)$

4. Find the global maximum value Δmax and minimum value Δmin in the difference data series.

$$\Delta_{\max} = \max_{\forall_i}\left(\max \Delta_i\right)$$

$$\Delta_{\min} = \min_{\forall_i}\left(\min \Delta_i\right)$$

5. Transform each data point in each difference data series to grey relational coefficient. Let $\gamma_{i(j)}$ represents the grey relational coefficient of the j_{th} data point in the i_{th} difference data series, then

$$\gamma_i(j) = \frac{\Delta_{\min} + \varsigma\Delta_{\max}}{\Delta_i(j) + \varsigma\Delta_{\max}}$$

where $\Delta_{i(j)}$ is the jth value in Δ_i difference data series. ς is a value between 0 and 1. The coefficient ς is used to compensate the effect of Δmax should Δ_{max} be an extreme value in the data series. In general the value of ς can be set to 0.5.

6. Compute grey relational grade for each difference data series. Let Γi represent the grey relational grade for the i_{th} scale item and assume that data points in the series are of the same weights 1, then

$$\Gamma_i = \frac{1}{m}\sum_{n=1}^{m}\gamma_i(n)$$

The magnitude of Γ_i reflects the overall degree of standardized deviance of the i_{th} original data series from the reference data series. In general, a scale item with a high value of Γ indicates that the respondents, as a whole, have a high degree of favoured consensus on the particular item.

7. Sort Γ values into either descending or ascending order to facilitate the managerial interpretation of the results (Chien-Ho Wu, 2007)

Methods and Findings

The universe of the study is composed of associate degree students attending to Marmara University in 2011-2012 term. The sampling frame of the study is composed of students attending to Marmara University Technical Sciences Vocational School Industrial Electronics department. Convenience sampling is used as the method of sampling.

Method of Data Collection

Surveying is chosen as the tool for data collection and the data are collected either through face to face interviews or in paper form distributed in classrooms. A total of 178 surveys are completed, and all of these are examined in terms of

incomplete or inaccurate information. After eliminating the incorrect surveys, 170 of these are found to be usable and analyses are conducted on these 170 surveys.

The survey form used in the study is composed of two sections. In the first part of the survey form, students are asked questions aimed at discovering the demographic characteristics of the students. These questions were related to gender, program, education style and class. In the second part of the survey, there was an Instructor Performance Evaluation Survey (IPES) composed of 15 questions aimed at determining the performance of the instructor. The questions of the survey were created with the aid of surveys (İçli,& Vural, 2010; Tektaş, et.al., 2010; Gökmen, et.al, 2010) conducted previously on the same subject. A five level Likert type scale is used in IPES (1=Strongly Disagree, 5=Strongly Agree).

Demographic Characteristics of the Responders

Table 1. Profile of the Responders

		N	%
Gender	Female	35	21
	Male	135	79
	Total	170	100
Department	Electronics	61	36
	Biomedical	49	29
	Communications	60	35
	Total	170	100
Type of Education	Formal	101	59
	Evening	69	41
	Total	170	100
Class	Freshmen	84	49
	Sophomore	86	51
	Total	170	100

The profile of the responders is given in Table 1. As seen in Table 1, there were a total of 170 participants in the survey. While 21% of the responders were female, 79% were male; and 36% of the responders were students in Electronics, 29% Biomedical and 35% were students in Communications department. According to Table 1, while majority of the responders attended formal education 59%, 41% of the students attended evening education classes. 49% of the students were freshmen and 51% of them were sophomores.

Results of Grey Relational Analysis

Calculation and assessment of grey relational coefficients: The raw data used in solution of Grey Relational Analysis are converted into a chart for the first five people and 170th person and given in Table 1. (Because of space limitations, not all raw data are given.) The figure in the last column of the table is the S0 reference number, i.e. grey relation element.

Table 2: Raw Data Used in Grey Relational Analysis

	S1	S2	S3	S4	S5	S6	S7	S8	S9	S10	S11	S12	S13	S14	S15	S0
K1	1	1	2	2	2	2	1	1	3	5	5	5	5	1	1	5
K2	4	2	3	4	4	3	3	3	2	5	5	5	5	3	4	5
K3	5	5	4	5	5	4	1	1	1	3	5	1	1	4	5	5
K4	2	1	5	3	1	5	3	5	5	5	5	5	5	3	4	5
K5	5	5	5	5	5	5	1	2	2	1	2	1	1	2	3	5
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.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
K170	3	4	2	4	4	2	2	2	3	4	4	4	4	4	2	5

Table 3 gives the difference data of the data in Table 2. The questions of the survey are prepared based on Likert scale (1: Strongly Disagree; 5: Strongly Agree). Difference data of the analysis are obtained by subtracting the sequence number of the answer from representation value of each responder (S0-SS). For instance, when creating the difference sequence: $S0 - S1 = = |5 - 1| = 4.$ Using the differences, maximum (max(S0-SS)) and minimum(min(S0- SS)) values are obtained to create Table 3.

Table 3: Difference Data used in Grey Relation Solution

	S0-S1	S0-S2	S0-S3	S0-S4	S0-S5	S0-S6	.	S0-S13	S0-S14	S0-S15
K1	4	4	3	3	3	3	.	0	4	4
K2	1	3	2	1	1	2	.	0	2	1
K3	0	0	1	0	0	1	.	4	1	0
K4	3	4	0	2	1	0	.	0	2	1
K5	0	0	0	0	0	0	.	4	3	2
.	.	.	.	.	.	.	.	.	.	.
.	.	.	.	.	.	.	.	.	.	.

.	.	.	.	.	.	.	.	.	.	.
K170	2	1	3	1	1	3	.	1	1	3
Mak.	4	4	4	4	4	4	4	4	4	4
Min.	0	0	0	0	0	.	0	0	0	0

For each responder and variable, grey relation grades of variables are obtained by taking the average of grey relation coefficients calculated by the grey relation coefficient formula.

Table 4: Grey Relation Coefficients and Grey Relation Grades of Variables

$\gamma(k_s, S_s)$	S1	S2	S3	S4	S5	…	…	…	S15
K1	0,33	0,33	0,40	0,40	0,40	…	…	…	0,33
K2	0,67	0,40	0,50	0,67	0,67	…	…	…	0,67
K3	1,00	1,00	0,67	1,00	1,00	…	…	…	1,00
K4	0,40	0,33	1,00	0,50	0,33	…		…	0,67
K5	1,00	1,00	1,00	1,00	1,00	…	…	…	0,50
Average Grey Relation Coefficients=Grey Relation Grades									
Γ_{S_S}	0,64	0,65	0,69	0,67	0,65	…	…	…	0,64

Grey relation grades shown with Γ in Table 5 are arranged in order of magnitude.

Table 5: Order of Magnitude of Grey Relation Grades of Variables

0,73	0,68	0,67	0,65	0,65	0,65	0,64	0,64	0,63	0,63	0,63	0,62	0,61	0,60	0,59
S11	S3	S10	S4	S15	S12	S8	S5	S7	S6	S1	S13	S2	S14	S9

When grey relation grades are ordered by magnitude, the responses to the statements below can be said to move away from strongly agree and move towards disagree:

S11) My instructor provides adequate guidance during course registrations.

S3) Instructors are competent in their own field, have comprehensive knowledge.

S10) My advisor gives me sufficient time and helps me in solving various problems.

S4) Instructors are using class hours effectively.

S15) Instructors give us opportunity to express our opinions and thoughts in classroom.

S12) When I first arrive school, my advisor informs me about the school, lecturers and the rules I should obey.

S8) Instructors' approach and communication with the students are good.

S5) Instructors follow the recent developments in their field and share these with the students.

S7) Instructors are fair and impartial towards the students.

S6) Instructors provide information about the students' status (attendance, performance, participation to the lecture, exam results) during the class.

S1) Instructors take their classes seriously and prepares well.

S13) Our advisors give us adequate information about job opportunities.

S2) Instructors arrive class on time and look presentable.

S14) Instructors bring speakers from the sector, organize field trips and provide information on relevant matters (career days, various meetings, job postings).

S9) It is possible to reach instructors outside the class hours.

Conclusion and Discussion

In Grey Relational Analysis used for assessing the instructor performance evaluation survey, students' answers to the statements are used directly instead of frequencies. Also, an analysis is conducted for 1 as Strongly Disagree and 5 as Strongly Agree as Grey Relation Value. In performance evaluation of instructor, the first item is the one on academic advising. Item on teaching performance comes in second. It becomes evident from this fact that when evaluating the performance of an instructor, activities both inside and outside the classroom are taken into consideration. The items that come last indicate that instructors are not able to allocate adequate time to their students because of immense course load in addition to high number of advisee students.

As a conclusion, when the data set is limited and low in number, in other words when the sample size is small, variables are intermittent and composed of continuous random variables, Grey Relational Analysis is proven to be an applicable and advantageous technique that can be applied in uncertain situations without necessitating a probability distribution. In analysis of the data, using direct answers of the responders instead of frequencies, simple, specific and net calculation steps instead of a number of functional processes and ability to analyze one-to-one interrelations of

data in a numerical manner make Grey Relational Analysis an advantageous one. When the advantages of the Grey Relational Analysis is considered together with the fact that it is of a deterministic type, contains no assumptions, and is a method that is easy to use and practical allows us to regard the analysis as a non-parametric technique.

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