Scientific Journal of **Applied Social and Clinical Science**

ESTIMATION OF TEACHING PERFORMANCE IN A HIGHER EDUCATION INSTITUTION

Hylda Marcela Gutiérrez Rodríguez
Professor of Engineering in Business Management at ``Tecnológico Nacional de Mexico``-``Instituto Tecnológico de Orizaba``, Veracruz, Mexico

Leticia Bretón Partida
Professor of Engineering in Business Management at ``Tecnológico Nacional de Mexico``–``Instituto Tecnológico de Orizaba``, Veracruz, Mexico

Ana Gabriela Cerón Zarate
Professor of Engineering in Business Management at``Tecnológico Nacional de Mexico``–``InstitutoTecnológico de Orizaba``, Veracruz, Mexico

María Elena Zepahua Neri
Professor of Engineering in Business Management at ``Tecnológico Nacional de Mexico``–``Instituto Tecnológico de Orizaba``, Veracruz, Mexico

Alan Dorantes Rodríguez
Business Management Engineering Student at``Tecnológico Nacional de Mexico``–``Instituto Tecnológico de Orizaba``, Veracuz, Mexico

Abstract: An analysis of the problems associated with measuring the performance of Business Management Engineering teachers at ``*Instituto Tecnológico de Orizaba*`` is presented, from the perspective of the Educational Model for the 21st Century of ``*Tecnológico Nacional de México*``. The objective of this research is the development of a fuzzy model to determine teaching performance, taking as input variables the three dimensions of the Educational Model for the 21st Century: philosophical dimension, academic dimension and organizational dimension. A series of items are proposed to evaluate each of the aspects considered as input variables. To validate the fuzzy model developed, a comparative analysis is presented between the results of the departmental evaluation of teaching performance carried out by the Institute against the results obtained by the fuzzy model. Finally, conclusions and proposals for future work are presented.

Keywords: diffuse model, resistance to change, educational model, 21st century.

INTRODUCTION

In an increasingly competitive and changing world, it is necessary for the functions performed to be increasingly effective and relevant, due to access to the information and technology at our disposal.

It is the responsibility of teachers to generate, through their performance, the necessary conditions to contribute to the development of their institution, in order to support the teaching-learning process of students who contribute to the economic and social development of the country.

This challenge becomes more relevant not only due to the nature of the commitment, but also by virtue of being one of the few public higher education options accessible to young people in the city of Orizaba, Veracruz. In this scenario and with the support of 60 years of important educational achievements, there is a duty to adapt and consolidate the mechanisms that allow updating the processes for the incorporation of processes applicable to reality and with a high level of competitiveness. Within public educational institutions, knowledge management emerges as a new form of mission responsible for adapting the institution to society.

The development of a model for evaluating the teaching performance of professors is a very useful tool for any higher education institution, because it allows us to know how each professor influences the achievement of the institution's objectives. Different types of models are found in the literature to evaluate performance, but models based on fuzzy logic have been presented in recent years, with quite satisfactory results. A fuzzy logic model, based on competencies, for the evaluation and selection of employees, was developed by (Golec & Kahya, 2007).

Fuzzy Logic provides an inference mechanism that allows modeling and simulating human reasoning procedures in systems based on the knowledge of experts in an activity or process. The fuzzy operators most used in system modeling are those of the Mandani type, Sugeno and neural networks (Dubrovin, Jolma and Turunen, 2002; Lozano and Fuentes, 2003; Isasi and Galván, 2004; Martín del Paso, 2005; Sosa, 2007; Macian, 2012). Therefore, the objective of this research is to analyze the teaching performance of the professors of the Department of Economic-Administrative Sciences of ``*Instituto Tecnológico de Orizaba*``, through a model based on fuzzy logic, using as input variables the three dimensions of the educational model for the XXI century.

METHOD DESCRIPTION

DEFINITION OF THE PROBLEM

The present investigation will be carried out among the teachers who belong to the Department of Economic-Administrative Sciences of ``*Instituto Tecnológico de Orizaba*``, during the period August - December 2023. Some teachers in the area carry out their work in the same way as when they entered the institution, 15 or 20 years, so the new ways of working and what they imply do not apply in their entirety. The above means that work is only done in order to comply with the requirements and procedures established by the current educational model; but without analyzing, recognizing or providing feedback on the benefits obtained by applying and executing said model. In informal interviews with students, information has been obtained from their perspective on the teacher's performance in the classroom, identifying that the teacher does not use various teaching strategies, such as projects, investigations, presentations, among others. He also does not use ICT in the classroom, for example: educational platforms, digital books, computers, specialized software; and multimedia equipment; On the contrary, the only resource he uses is the blackboard.

Therefore, this project will allow us to answer the following research question: What is the impact of the three dimensions of the educational model for the 21st century on the teaching performance of the professors of the Department of Economic-Administrative Sciences of a higher education institution? public of the State of Veracruz, who have migrated towards this educational model?

DESCRIPTION OF THE MODEL USED

This project will address the problem of developing a model based on fuzzy logic, to determine the resistance to change and the performance of the professors of the Business Management Engineering program of a higher education institution in the central area of the state of Veracruz.

The model will be developed with Mamdani-type fuzzy inference, which allows modeling and simulating human reasoning procedures in systems based on the knowledge of experts in an activity or process (Golec & Kahya, 2007). In this research, the process considered as a case study is the teaching-learning process under the new Educational Model for the 21st century, while the simulation of the fuzzy model was developed using the MATLAB fuzzy logic tool.

HYPOTHESIS

The teaching performance of the professors of the Department of Economic-Administrative Sciences of ``*Instituto Tecnológico de Orizaba*``, can be determined with a model based on fuzzy logic using the three dimensions of the educational model for the 21st century as input variables.

CONCEPTUAL DEFINITION

For this study, the concept of teaching performance is the set of educational activities carried out by the teacher to promote the training and development of generic and specific competencies in students, having as independent variables the philosophical dimension, the academic dimension and the organizational dimension of the Educational Model for the 21st Century. The philosophical dimension focuses on the human being and all its educational strategies focus on learning. In addition to training competent professionals, the Model encourages the

orientation of life projects towards the search for self-realization, in a scenario of continuous promotion of humanism. One of the philosophical principles of this model establishes comprehensive education as a continuous process of development of all the potential of the human being. In its training, meaningful learning is promoted through the work of the facilitator, through reflection and participation, supported by cutting-edge technology, and ensuring the quality, timeliness and relevance of the learning.

The academic dimension integrates the reference parameters for professional training, the conception of learning and its conditions, as well as the standards of educational practice at the ``*Tecnológico Nacional de México*``.

The model privileges learning experiences over traditional forms of teaching. In other words, the experiences that arise from one's own need for knowledge which, in turn, is generated by prior knowledge, which ensures the interested and active participation of the learner and, at the same time, defines the role of the facilitator. Therefore, the model seeks the construction of learning environments, inside and outside the institutions around which the resources of the system and its environment are arranged, from the physical infrastructure to the new information technologies, and is supported for a flexible, efficient and integrated administration in its objectives and goals to achieve the educational project of the ``*Tecnológico Nacional de México*``.

The organizational dimension contributes to the fulfillment of the purposes of the model and guarantees that the system's resources are substantially dedicated to the educational process to ensure its success. This dimension is supported by the practice of high performance that is derived from organizational theories of quality and modern social approaches of humanism that consider the human being as the origin and destination of all the efforts and resources of the institutions. At ``*Tecnológico Nacional de México*``, educational management is carried out with a focus on processes based on the philosophy of high performance, whose permanent purpose is to exceed the highest indicators and improve work results, with the drive and motivation of the values and convictions of the human being. Educational administration for high performance guides and focuses human beings towards achieving the institutional mission and vision through the application of methods, techniques and instruments of efficiency and quality that contribute to the development of human potential.

DEVELOPMENT OF THE MODEL BASED ON FUZZY LOGIC

A model with Mamdani-type fuzzy inference was developed. Figure 1 shows the five fuzzy sets that were used. The range was established from 0 to 5, because the results of the departmental evaluation of the professors of the Department of Economic and Administrative Sciences that were used to validate this research are standardized in that range. The complete fuzzy model was developed in modular, interconnected blocks with three inputs and one output. The fuzzy rules were established heuristically, taking the MacVicar-Whelan distribution as a starting point.
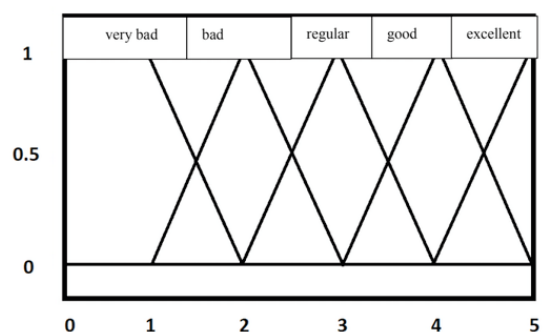

Figure1: Fuzzy sets

Indicators	Items	Performance level
Person	1,2,3	
Teaching learning process	10,11,12	Philosophical dimension
Dignity, equity, justice and respect	15,16,17	

Table 1: Items used to evaluate teaching performance in the philosophical dimension.

Indicators	Items	Performance level
Teaching strategies and use of ICTs	4,5,6	
Evaluation	7,8,9	Academic dimension
Preparation of Planning and Didactic Instrumentation	10,11,12	

Table 2: Items used to evaluate teaching performance in the academic dimension.

Indicators	Items	Performance level
Use of ICTs	7,8,9	
Team work	12,13,14	Organizational dimension
Leadership, proactive attitude, motivation	17,18,19	

Table 3: Items used to evaluate teaching performance in the organizational dimension.

Performance level	Qualification	Teaching Performance
Philosophical Dimension	4.625	
Academic Dimension	4.128	4.328 (on a scale of 1 to 5)
Organizational Dimension	3.98	

Table 4: Performance results and resistance to change of a teacher with a rating of 4.55.

Performance level	Qualification	Resistance to change
Philosophical Dimension	3.98	
Academic Dimension	3.225	3.419 (on a scale of 1 to 5)
Organizational Dimension	3.625	

Table 5: Performance results and resistance to change of a teacher with a rating of 3.55.

TECHNIQUES AND INSTRUMENTS FOR DATA COLLECTION

The instrument used in this research is a self-developed questionnaire that allows us to know teaching performance and resistance to change. A Likert-type scale with five response alternatives is used: a) Strongly agree, b) Agree, c) Neither agree nor disagree, d) Disagree, e) Strongly disagree; with 19 items. This scale measures teacher performance, from their own perspective, and is evaluated in three dimensions: philosophical, academic and organizational. The questionnaire has been validated with an exhaustive review of the theoretical framework, and it was also reviewed by three experts belonging to the Division of Postgraduate Studies and Research of an educational institution in the state of Veracruz. The questionnaire used is presented in the Appendix.

The table 1 presents the indicators and items used to evaluate the teaching performance of teachers in the philosophical dimension, while Table 2 presents the indicators and items used to measure performance in the academic dimension and, in Table 3, the indicators and items used to measure performance in the organizational dimension.

RESULTS

The results obtained with the model based on fuzzy logic were evaluated and compared against the results of the departmental evaluation of the professors of the Department of Economic-Administrative Sciences of ``*Instituto Tecnológico de Orizaba*``, and a

summary of results is presented below.

The table 4 presents the results obtained with the model based on fuzzy logic, for the teacher who obtained the highest score in the departmental evaluation August - December 2017, with a global score of 4.63 (on a scale of 0 to 5).

The table 5 presents the results obtained with the model based on fuzzy logic, for the teacher who obtained the lowest score in the departmental evaluation August - December 2017, with a global score of 3.75 (on a scale of 0 to 5).

CONCLUSIONS

The results demonstrate that the grades obtained in the departmental evaluation are quite close to the levels of teaching performance obtained with the fuzzy model, both in the philosophical dimension and in the academic dimension. However, the best evaluated teacher reached a significantly lower level in the performance of the organizational dimension with respect to the result of the departmental evaluation, which is understandable because in this dimension the use of ICT is evaluated and, in that sense, even The best teachers are affected by the lack of this type of resources in their institutions.

REFERENCES

Dubrovin, T., Jolma, A. y Turunen, E. (2002). Fuzzy Model for Real-Time Reservoir Operation. Journal of Water Resources Planning and Management, 128(1), 66-73.

Golec, A. y Kahya, E. (2007). A fuzzy model for competency-based employee evaluation and selection. *Computers and Industrial Engineering. 52* (1), 143-161.

Lozano, C. y Fuentes, F. (2003). *Tratamiento borroso del intangible en la valoración de empresas en internet.* Consulta realizada el 10 de marzo de 2018, disponible en http://www.eumed.net/cursecon/libreria/clg-ffm/index.htm

Macián, H. (2012). Utilización de lógica difusa en la gestión de embalses. Aplicación a los ríos Sorbe, Esla y Mijares. Tesis doctoral. Universidad de Oviedo, España.

Martín del Paso, M. (2005). *Aplicaciones de las redes neuronales artificiales a problemas de predicción y clasificación financiera.* España: Departamento de Economía Financiera y Contabilidad, Universidad Rey Juan Carlos.

Manjarrés, A., Castell, R. & Luna, C. (2013). Modelo de Evaluación del Desempeño Basado en Competencias. *INGENIARE, Universidad Libre-Barranquilla. 15* (1), 11-29. ISSN: 1909-2458.

Oreg. S. & Jeremieretal. (2003). Resistance to change: Developing an individual differences measure. *Journal of applied psychology, 88* (4) 680-693 Consulta realizada el 23 de febrero de 2017, disponible en http://psycnet.apa.org/buy/2003-99635-011

Sosa, M.C. (2007) Inteligencia artificial en la gestión financiera empresarial. Revista Pensamiento y Gestión, 23(2), 153-186.

APPENDIX

QUESTIONNAIRE USED IN THE RESEARCH

1. You attend all your classes.

2. If you do not attend class, present proof to your immediate boss.

3. You always start your classes on time.

4. You use educational platforms in your teaching practice.

5. You use digital books in your teaching practice.

6. You use computers/tablets in your teaching practice.

7. You use a projection cannon in your teaching practice.

8. You use specialized software in your teaching practice.

9. You use videos in your teaching practice.

10. You prepare in time the programmatic progress of the subjects to be taught.

11. You develop the didactic instrumentation by competencies for all the subjects to be taught.

12. You participate in the exchange of experiences between peers to improve your teaching practice.

13. You pay attention to institutional provisions in your teaching practice.

14. You design learning evaluation strategies in accordance with the current regulatory framework.

15. You foster an ethical classroom environment.

16. You foster an inclusive classroom environment.

17. You foster an equitable classroom environment.

18. You consider that the changes in your Institute are necessary.

19. With the change in the educational model, you are willing to assume other responsibilities in your teaching work.