EduSol
Vol. 17. Núm. 58
ISSN: 1729-8091
Publicada en línea: 11 de enero de 2017 (http://edusol.cug.co.cu)

Construction and measurement of competences in a teaching department

Yanelis Cobas-Ortiz
University of Guantánamo, Cuba
Email address:
yanelisco@cug.co.cu

Received: July 20, 2016
Aceptado: Sept. 21, 2016

Resumen: La medición de competencias laborales se ha venido realizando, sobre todo, a través del currículum vitae, las entrevistas de trabajo o la evaluación del desempeño, y se han notado sesgos sustanciales en estos tipos de mediciones. Es por ello que en este artículo se exponen los resultados de una medición que utiliza las vías y fundamentos teóricos propuestos por el investigador cubano Pérez Capdevila. Se logra construir y medir las competencias en un departamento docente a partir de la evaluación de aptitudes y actitudes, identificadas como necesarias para el desempeño en esa área de trabajo.

Palabras clave: Gestión por competencias; Competencias laborales; Competencias profesionales; Medición de intangibles; Mixtura de conjuntos borrosos

Abstract: The measurement of labor competences has been done through evaluations of the curriculum vitae, job interviews or the evaluation of labor performance. However, substantial slips have occurred in these types of measurements. It is for it that reason that this article exhibits the results of a measurement that uses alternative routes and theoretical essentials proposed by the Cuban investigator Pérez Capdevila. The construction and measurement of the competences in a teaching department was accomplished, using an evaluation of aptitudes and attitudes identified as necessary for the performance in that area.

Keywords: Competences management; Labor competences; Professional competences; Intangible assets´ measurement; Mixture of fuzzy sets

Introduction

The importance that managing competences has at present is well-known; it centers its studies not only in the labor area, but also in the needs of other areas. The author Cuesta (2005) explained that the management of competences is based on the search of an explanation to individuals' successful performance in specific labor contexts. In addition, one of the most difficult tasks that this area of the scientific knowledge has consists in the measurement of competences, given their intangible character.

Finding a standard conception from the perspective of individual competences based in consent among authors proves to be highly complex. In regard to this matter (Schippmann *et al*, 2000) refers:

> […] existe una amplia gama de definiciones, incluso entre una población especialista bastante homogénea, subrayando la dificultad de apuntar con precisión una definición estándar del término. Esta falta de acuerdo general no debe ser demasiado sorprendente, dado los múltiples dominios en los cuales el término "competente" o "competencia" es prevaleciente". (p. 707)

Taking into consideration the fact that scientific consent regarding competences is difficult, there are over 75 different definitions in literature. Of them, a great deal is very general, very singular, redundant or simplistic.

An example of a too general definition, while simplistic, is Boyatzis´ in 1982, who defined competences as the set of personal characteristics, directly related to a good performance of certain job or task. In 1992, Kanungo and Misra described competences as intellectual capabilities which allow the realization of generic, cognitive activities, which result in singular knowledge. Other strictly behavioral definition, declares that competences are a dimension of open and manifest conducts which allow a person to act efficiently (Wordruffe, 1993).

A remarkable redundancy from the levels of inclusion of the elements of the set appears in the definition of the Cuban Norm 3000 of 2007, where it is stated that work competences are a synergetic set of knowledge, skills, experiences, sentiments, attitudes, motivations, personal characteristics and values, based on the proven appropriateness, associated to a higher performance of the worker and the organization, in correspondence with the technical, productive and service demands.

Due to it this paper takes into account the perspective of the Cuban investigator Pérez Capdevila (2012), who defines competences as the identifiable and evaluable set of aptitudes (knowledge, skills, capabilities, experiences, and so forth) and attitudes (namely conducts, motivations, beliefs, values, sentiments, and so on) which allow a person to perform efficiently.

The definition synthesizes elements of the rest of two large groups, it is flexible since each organization can choose which attitudes and aptitudes it needs, and, on the other hand, it is useful since it facilitates the measurement through evaluations.

Taking into account the previous statements and considering competences asa mixture of aptitudes and attitudes, we proceed to seize the theory of the mixture of fuzzy sets (Pérez Capdevila, 2015), to construct and measure each competence, discussing the results obtained in a teaching department, which is the main goal of the paper.

Development

The logic of human reasoning is not a dichotomic logic, not even polytomic, but a logic of fuzzy truths, of fuzzy conjunctions, and rules of fuzzy nature. This truth posed the need of conceiving a new branch of mathematics: Fuzzy mathematics, which has a basement in fuzzy sets (Pérez Capdevila, 2012, p. 10).

What´s new, from the perspective of fuzzy mathematics, lies, not in stating another solution or criterion, but in directly recommend a prescriptive and descriptive change at a theoretical level, designing a model and the mechanisms to solve incertitude, contributing to a better adjustment of reality (Pérez Capdevila, 2012, p. 10).

Fuzzy mathematics has emerged as a solution in diverse areas, since systems based upon it are considerably simple and adaptable, with few variations of parameters and easily adaptable to particular cases, in an unified way of working with both linguistic expressions and numerical data, they do not required sophisticated algorithms for implementing; however their main foundation is the manipulation of the subjective and uncertain, due to the fact that human reasoning and commonsense are proximate, and, given the imprecision of our language, it becomes actable (Pérez Capdevila, 2012a, p. 10).

A fuzzy set is a set of ordered pairs (x; f(x)), where x is the element and f(x) is a function expressing the degree of appertain of that element to the set, which takes values of 0 to 1, where 0 means that the element does not appertain to set, and 1 means that it is fully included in the set, the rest of values from 0 to 1express the degree of the appurtenance of each element to the set (Pérez Capdevila, 2012, p. 11).

Let´s analyze the following example: given fuzzy set A = {(a; f(a)); (b; f(b)); (c; f(c)); (d; f(d))}

If the elements *a*, *b*, *c* and *d*, identify the workers who over accomplish the plan of income and f(a) < f(b) < f(c) < f(d), then it can be asserted that, as an example, *d* is the one who over accomplishes more and *a* is the one who over accomplishes less, likewise *b* accomplishes more than *a* and less than *c* (adapted from Pérez Capdevila, 2013).

Following the idea that aptitudes, attitudes and the competences of a person are evidently components of a fuzzy set; then, from the theory of the mixture of fuzzy sets we choose the following definition:

Given the fuzzy sets $W_1 = \{(w_{11}, f(w_{11})), (w_{12}, f(w_{12}),\ldots, (w_{1i}, f(w_{1i})\}$, $W_2 = \{(w_{21}, f(w_{21})), (w_{22}, f(w_{22}),\ldots, (w_{2j}, f(w_{2j})\}$,..., $W_m = \{(w_{m1}, f(w_{m1})), (w_{m2}, f(w_{m2}),\ldots, (w_{2k}, f(w_{2k})\}$.

If, taking that fuzzy set as a starting point we obtain $M = \{(m_1, f(m_1)), (m_2, f(m_2),\ldots, (m_n, f(m_n)\}$, so as to m_i, where i=1, 2,…,*n*, it is a combination of elements W_k, k=1, 2,…,*m*, all elements of W_k are part of at least one m_i, and the values of the $f(m_i)$ are the arithmetic media of the values of the function of the elements that make up each m_i, then, we can name M a mix, complete fuzzy set and the operation that generated complete mixture of the fuzzy set W_k. The elements of M are named mixtures, the W_k are named fuzzy administrative sets and for identifying its elements we use the name of each element of the mixture (Pérez Capdevila, 2015).

From the previous definition, two fuzzy administrative sets were selected, one, having as ingredients the aptitudes needed by the department and the other included attitudes. It was achieved through brainstorming, and in the same way several evaluations were made on their current state in the department, concluding in the following results expressed in charts, where the first column identifies the symbol that represents each attitude or aptitude and in the last column a V identifies the evaluation granted by the collectiveness.

S	Description of aptitudes (Components)	V
P_1	Full knowledge of the subject taught	0.98
P_2	Skills to identify opportunities	0.75
P_3	Capabilities for using time rationally	0.75
P_4	Capabilities for decision making	0.80
P_5	Ability for prioritizing	0.70
P_6	Capability to manage stress	0.65
P_7	Capability to face challenges	0.80
P_8	Ability to manage conflicts	0.80
P_9	Ability to communicate	0.90
P_{10}	Creativity	0.75
P_{11}	Knowledge about the sports	0.95
P_{12}	Flexible mind	0.85
P_{13}	Ability for propitiating autonomous learning	0.77
P_{14}	Skills for exploiting virtual learning	0.55
P_{15}	Experience in scientific research	0.80

Chart 1: Fuzzy set of aptitudes administration

Source: The author. Adapted from Pérez Capdevila, 2015

As it can be appreciated, the best valued aptitudes are full knowledge of the subject taught, and knowledge about the sports. Whereas the less valued are the skills for exploiting virtual learning, the capability to manage stress and the ability for prioritizing, in that order.

S	Description of attitudes (Components)	V
C_1	Acts independently	0.95
C_2	Keeps the workplace clean and organized	0.90
C_3	Measures and keeps track of the results	0.95
C_4	Is concerned about inefficiency and wasted time	0.95
C_5	Acts calmed when problems emerge	0.75
C_6	Is creative when solving situations	0.90
C_7	Keeps good interpersonal relations	0.95
C_8	Expresses opinions firmly	0.85
C_9	Honesty	0.95
C_{10}	Shows concern about reaching the objectives with quality	0.90
C_{11}	Is not easily angered	0.90
C_{12}	Promotes values within the institution	0.95
C_{13}	Respects the rules of the institution	0.85
C_{14}	Respects other people´s opinions	0.80
C_{15}	Shows certainty about his/her personality	0.95
C_{16}	Volunteers for challenging activities	0.90
C_{17}	Is concerned about transmitting a positive image of the institution	0.95
C_{18}	Mutual help feelings	0.90
C_{19}	Overcomes obstacles	0.90
C_{20}	Is independent	0.80

Chart 2: Fuzzy set of attitudes administration

Source: The author. Adapted from Pérez Capdevila, 2015

In this case most attitudes have been valued above 0.8, only three of them are equal or under that value and are: being independent, respecting other people´s opinions, and acting calmed when problems emerge.

Taking as a base these resources the mixtures are formed, namely competences, and in this case all the components belong to one of the mixtures, obtaining a complete mixture of fuzzy sets. In what follows, a list of the competences proposed by the department as key for its development, in a chart of two columns with its symbol and its description.

S	Description of competences (Mixtures)
M_1	Self confidence
M_2	Self control
M_3	Identity
M_4	Initiative

M_5	Achievement
M_6	Planning and organizing
M_7	Team work
M_8	Leadership
M_9	Exemplar attitude

Chart 3: Competences

Source: The author.

The procedure continued by selecting the components for each of these mixtures, and then it was calculated the value taking into account the definition of fuzzy set mixture, which resulted in the data expressed in the following charts, where V is the resulting value of each competence (mixture).

Mixture	**Components**										**V**
	P_1	**P_4**	**P_5**	**P_6**	**P_7**	**P_8**	**C_1**	**C_5**	**C_{15}**	**C_{16}**	
M_1	0.98	0.80	0.70	0.65	0.80	0.80	0.95	0.75	0.95	0.90	**0.83**

Chart 4: Self- confidence mixture with its components and values

Source: the author

Mixture	**Components**						**V**
	P_4	**P_8**	**P_{12}**	**C_5**	**C_{11}**	**C_{15}**	
M_2	0.80	0.80	0.85	0.75	0.90	0.95	**0.84**

Chart 5: Self-control mixture with its components and values

Source: the author

Mixture	**Components**											**V**
	P_1	**P_{10}**	**P_{11}**	**P_{13}**	**P_{14}**	**P_{15}**	**C_7**	**C_{12}**	**C_{13}**	**C_{14}**	**C_{15}**	**C_{17}**	
M_3	0.98	0.75	0.95	0.77	0.55	0.80	0.95	0.95	0.85	0.80	0.95	0.95	**0.85**

Chart 6: Identity mixture with its components and values

Source: the author

Mixture	**Components**											**V**
	P_2	**P_4**	**P_7**	**P_{10}**	**P_{11}**	**P_{15}**	**C_9**	**C_{10}**	**C_{15}**	**C_{16}**	**C_{19}**	**C_{20}**	
M_4	0.75	0.80	0.80	0.75	0.95	0.80	0.95	0.90	0.95	0.90	0.90	0.80	**0.85**

Chart 7: Initiative mixture with its components and values

Source: the author

Mixture	Components						
	P_1	**P_2**	**P_3**	**P_4**	**P_5**	**P_{11}**	**P_{12}**
M_5	0.98	0.75	0.75	0.80	0.70	0.95	0.85

Chart 8: Achievement mixture with its components and values

Source: the author

Mixture	Components										V
	C_1	**C_3**	**C_4**	**C_9**	**C_{15}**	**C_{16}**	**C_{17}**	**C_{18}**	**C_{19}**	**C_{20}**	
M_5	0.95	0.95	0.95	0.95	0.95	0.90	0.95	0.90	0.90	0.80	**0.88**

Chart 8 (Cont.): Achievement mixture with its components C_i and values

Source: the author

Mixture	Components								V
	P_1	**P_3**	**P_5**	**P_{11}**	**C_2**	**C_4**	**C_{12}**	**C_{13}**	
M_6	0.98	0.75	0.70	0.95	0.90	0.95	0.95	0.85	**0.88**

Chart 9: Planning and organizing mixture with its components and values

Source: the author

Mixture	Components								
	P_1	**P_2**	**P_3**	**P_4**	**P_5**	**P_8**	**P_9**	**P_{12}**	**P_{15}**
M_7	0.98	0.75	0.75	0.80	0.70	0.80	0.90	0.85	0.80

Chart 10: Team work mixture with its components P_i and values

Source: the author

Mixture	Components											V
	C_1	**C_5**	**C_{15}**	**C_{16}**	**C_1**	**C_5**	**C_1**	**C_5**	**C_{15}**	**C_{16}**	**C_{16}**	
M_7	0.95	0.75	0.90	0.95	0.85	0.95	0.90	0.90	0.80	0.90	0.80	**0.85**

Chart10 (Cont.): Team work mixture with its components C_i and values

Source: the autor

Mixture	Components										
	P_1	**P_2**	**P_3**	**P_4**	**P_5**	**P_6**	**P_7**	**P_8**	**P_9**	**P_{11}**	**P_{12}**
M_8	0.98	0.75	0.75	0.80	0.70	0.65	0.80	0.80	0.90	0.95	0.85

Chart 11: Leadership mixture with its components P_i and values

Source: the author

Mixture	Components													V
	C_1	C_{10}	C_{11}	C_{13}	C_{14}	C_{15}	C_1	C_{10}	C_{11}	C_{13}	C_{14}	C_{15}	C_{15}	
M_8	0.95	0.75	0.90	0.95	0.85	0.95	0.90	0.90	0.80	0.95	0.90	0.90	0.80	**0.85**

Chart 11 (Cont.): Leadership mixture with its components C_i and values

Source: the author

Mixture	Components							
	P_1	P_4	P_8	P_9	P_{11}	P_{12}	P_{13}	P_{15}
M_9	0.98	0.80	0.80	0.90	0.95	0.85	0.77	0.80

Chart 12: Exemplar attitude mixture with its components P_i and values

Source: the author

Mixture	Components														V
	C_2	C_5	C_7	C_8	C_9	C_{11}	C_{12}	C_{13}	C_{14}	C_{15}	C_{17}	C_{18}	C_{19}	C_{20}	
M_9	0.90	0.75	0.95	0.85	0.95	0.90	0.95	0.85	0.80	0.95	0.95	0.90	0.90	0.80	**0.88**

Chart 12 (Cont.): Exemplar attitude mixture with its components C_i and values

Source: the author

It can hereby be concluded the most important competences in the department: the professors are guided to achievement, they have good projection and effective planning and organization, and they are examples for their pupils. It is also remarkable that from the nine competences measured all are valued above 0,8, which means that they are developed completely to a good level, being the less valued self- confidence and self- control, with 0.83 y 0.84 respectively.

It becomes clear, that way, that the department must continue working on the development of the competences selected as essential, trying to reach values above 0,9, for which it will have to accomplish systematic evaluations, once or twice a year.

It is necessary to explain at this point that the components´ qualifications included in larger numbers of mixtures (competences) were the complete knowledge of the subject of study, the capability to make decisions, and the knowledge of the sports activity to be taught, measured in seven out of the nine mixtures possible, that is, they represented a 77, 7 % of the mixtures. On the contrary, the aptitude for virtual learning was the one that took part in just one of the mixtures.

In addition, the component attitudes that took most part in the mixtures were acting calmed in front of stressful situations, honesty and being independent, every one of the five out of nine,

made possible a 55,5 %, while the less included competence was contributing ideas to impact positively in the results of work.

This first experience served for both the author and for the members of the department, as a starting point for systematic updating and the development of expertise in the use of this method to build up competences.

Conclusions

The applied method has been useful for constructing competences regarding the aptitudes and attitudes that the teaching department considers necessary for its performance. In addition, its flexibility has been demonstrated when determining which ones of those qualities determine or make a competence.

The concept of mixture of fuzzy sets, along with the definition of competences that we have presented in this work, have made easy the measurements for evaluating attitudes, aptitudes, and competences. It has been proven that the department is made of professors who act guided to the achievement of goals, with good projection for planning and organization, and that are examples for their students.

Finally, it is pertinent to emphasize that the competences at the department possess high moral values, even though improvements can be still made. As well, there is great importance in the attitudes: acting calmed in front of stressful situations, and being honest and independent. On the other hand, it was clear the importance of aptitudes as: complete knowledge of the subject of study to be taught, the capability to make decisions, and the knowledge about sports.

Bibliographic References

Boyatzis, R. (1982). *The competent manager: A model for effective performance*. New York: John Wiley & Sons.

Cuesta, A. (2005). *Tecnología de gestión de recursos humanos (2 ed.)*. La Habana: Academia.

Kanungo, R. N., Misra, S. (1992). Managerial resourcefulness: A reconceptualization of management skills. *Human Relations*, *45* (12), p. 1311-1332.

Pérez Capdevila, J. (2012). Competencias laborales: Remozamiento del concepto, método para evaluarlas, medirlas y caracterizar a las personas. *Avanzada Científica*, *15* (1), 1-19.

Pérez Capdevila, J. (2012a). Una teoría de la adecuación. *Avanzada Científica, 16* (1), 1-8.

Pérez Capdevila, J. (2015). On the mixture of fuzzy sets and examples of application in management. *Panorama Económico*, 23, 42-58.

Schippmann, J. S., y otros. (2000). The practice of competency modeling. *Personnel Psychology*, *53*(3), 707.

Wordruffe, C. (1993). What is meant by a competency*? Leadership and Organization Development Journal*, *14* (1), 29-36.