



# Use of the Neutrosophy to analyze the Mental Load of the public officials in the state university of Manabí

Oscar Nelson Veliz Gutiérrez<sup>1</sup>, Maritza Gutiérrez Ponce<sup>2</sup> and Neilys González Benítez<sup>3</sup>

<sup>1</sup>MS.c. en Prevención de Riesgos Laborales, Universidad del sur de Manabi, Ecuador, , Post Code: 130802. E-mail: osnevegu\_@hotmail.com

<sup>2</sup>Dra.C. Económicas, Universidad Estatal del Sur de Manabí, Ecuador. Post Code: 130802, Country. E-mail: maritagutieponce@hotmail.es

<sup>3</sup> Dra.C. Técnicas, Cnetro Meteorológico de Pinar del Río, Cuba, Post Code:20100. E-mail: neilysgonzalezbenitez@gmail.com

**Abstract.** The present investigative work is carried out in the installations of the state university of the Manabí south of the republic of the Ecuador, which was framed in the use of the Neutrosophy to analyze the level of mental load that possesses the public officials of the area of endless education and center of training of local development. The results reached favoured to the high direction of the institution to take and apply preventive and corrective criterions in benefit of the collaborators, based on the results it contributed the Neutrosoffia use to identify the main traces of mental load, that present the herons, executed the NTP 544 norm through the method of the NASA-TLX, method that it is applied in all work positions, for the sake of evaluating the different developed activities and the mental load they possess the herons. Also evaluated, from the results that it is obtained to apply the Neutrosoffia, the physical environmental factors that it falls in the mental stress of the herons, by using the LEST method, with the one which recognizes to him the recommended levels as for the level of mental load. Based on the obtained results plan preventive and corrective actions to prevent the levels of risk in the areas of study.

**Keywords:** Neutrosophy, Mental load, NASA TLX METHOD, corrective and preventive action, occupational safety and health.

## 1. Introduction

At present, the work positions tend to is more and more demanding for the herons. The technologic advances have caused an increase in the quantity of tasks and in the perceptive claims-cognitive of these, by making room for situations of more complex work, in those who the accumulation of tasks is frequent. The direct consequence of these factors is the increase of the mental load of work.

The search of the quality constitutes a current challenge in the development of the superior education, the who has your own system of knowledge and practical social, historically built in function of the moral duties arising from a status of the universities in the society. The university processes, meanwhile processes of the social science, for your own nature, have to the human being in your center, for it are identified as conscious processes and therefore of complex nature, holistic and dialectic [1].

The superior sustainable education of the countries in the process of development it is watched that it is constructed on structures that permit the institutional, individual role and collective through the integration, that facilitates be anticipated to the changes in the innovative development of the society of the knowledge [2].

Although exist numerous definitions, there is an accord in it recognizes that the mental load springs up for the report between the claims of a task or activity and the resources of those who forms up the individual that has to execute it [3].

Previous studies on mental load carried out by [4] investigate the influence of three variable related (instructions, climate and experience) with the task and a variable of the individual (takes in cognition) on the mental load and factors associated to the same (emotion), by verifying that the experience/training in the task is the manipulated variable that more effect has on the mental load; the factor takes in cognitive of negative beliefs is the one which more related is with mental load; the factor takes in cognitive that more variability of load explains is those of cognitive conscience.

Analysis not experimental, descriptive and transversal, carry out during the 2015 in 13 bank agencies of the provinces of Azuay and cane brake of Ecuador, as of a coincident sample of 204 working that it is played in the 14 existent positions, carry out with the objective to make evident the perception of mental load by using the NASA TLX method, it indicates that the herons perceive mental load in an average of 64.03 characterizing the as moderately high [5].

In the 2018, Almirall in study carried out in an undertaking of the Mexico center with the intensity of diagnosing the psychologic risks social labor and the risks perceived as of the questionnaire offered in the norm 035 and the inquiry of the three desires, obtain as a result that the inquiry of the three desires surpassed to the questionnaire proposed by the authors of the norm for time of application, qualification and performance of the evaluated and the investigators. It infers for this author that the distribution of tasks and your tied alternation to the level of attention that demands the same, will bear upon the perception of mental load, and the appearance of variations in the productivity, diminution in the performance and increase of errors [6].

Based on it before outlined, in investigation this letter proposes apply the Neutrosophy to know the factors they fall in the mental load they possess the public officials of the area of endless education and center of training of local development of the state university of the Manabí south of the republic of the Ecuador. Mental load that presents uncertainty, which fond of the directives to take care of the cognitive health of the herons in institution happiness. The Neutrosophic finds to him related with the logical Neutrosophy she considers to him an area for the treatment of the uncertainty for which your use in the presence of these situations is favorable for the support to takes it of decisions.

Leyva y Smarandache [7], they base one's opinion on the Neutrosophy, defined for [8] as the new chase of the philosophy that studies the origin, nature and reaches of the neutralities, as well as your interactions with different ideational specters, just as; (A): it is an idea, proposition, theory, happening, concept or entity, as well as; anti (A): it is the opposed thing of (A); y (neut-A) be important nor (A) nor anti (A), that is to say, the between you and me extreme neutrality according to [9].

The mental load they possess the public officials of the area of endless education and center of training of local development of the state university of the Manabí south of the republic of the Ecuador, it shows oneself to be through vagrant concepts to imprecise, where the limits between this type of concepts possess common parts between the traces they present the affected herons for a mental load, it is for it that it is proposed the Neutrosofía use in order to decrease the uncertainty in such a case.

From the psychological viewpoint, it is useful to possess tools to facilitate the support to takes it of decisions, it is for it and according to the advance of the technologies of the information and the communications (TIC) that making use of the joined Neutrosophy of unique value, as having defined it [10], capable of use linguistic variables according to refer [11], increase the interpretability in the models of recommendation and the employment of the indetermination as it appears in the presence of the manifestations that presents the public officials of the area of endless education and center of training of local development of the state university of the Manabí south of the republic of the Ecuador with a high mental load, in which does to him necessary decide the incident factors that causes you the mental load.

## 2. Materials and methods

Investigation this letter answers the growing interest that this problem has originated in the officials of the area of endless education and the center of training and develop premise (CECADEL) of the state university of the Manabí south (UNESUM). For it, it tries to contribute to the increase of the knowledge on the phenomenon of mental load in the area of study to favor it takes of decisions about the matter and take preventive and corrective criterions. For which it decides as purpose know the mental load they possess the public officials of the area of endless education and center of training of local development of the state university of the Manabí south of the republic of the Ecuador.

For it selects a population of 150 herons of the state university of the Manabí south of the republic of the Ecuador. In this population it makes a previous study and verified that 90% of the herons is officials of the area of endless education and of the center of training and develop premise, the manifestations they refer on the mental load they possess are manifestations imprecise, in interviews carried out to them, made evident own sig-

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*Oscar Nelson Veliz Gutiérrez<sup>1</sup>, Maritza Gutiérrez Ponce<sup>2</sup> and Neilys González Benítez<sup>3</sup>*

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nals of a high mental load, standing out is the physical environmental factors that, it fell in the mental stress of the herons, I damage in the labor environment or academic, alterations in the social habitual activities and in the relations of life with the others.

Other factors were identified through the traverse of the method of the NASA TLX, departing from an analysis to the tasks, and the definition of the exigencies they require the executions of the tasks that develop the officials of the area of endless education and of the center of training and develop premise in the state university of the Manabí south of the republic of the Ecuador.

Obtained the factors of incidence major apply a unique value, with the objective to obtain major interpretability in the obtained results, for it employed the 1 equation.

$$A = \{ (x, uA(x), rA(x), vA(x)) : x \in X \} \quad (1)$$

I keeping in mind that (x) it is the universe of discourse (population 150 officials of the area of endless education and of the center of training and develop premise) by obtaining according to the equation 1, the joined Neutrosophical of unique value A on x.

Where:  $uA(x): X \rightarrow [0,1]$ ,  $rA(x): X \rightarrow [0,1]$ ,  $vA(x): X \rightarrow [0,1]$ ; con  $0 \leq uA(x) + rA(x) + vA(x) \leq 3$  for all  $x \in X$ . The interval (x),  $rA(x)$  y  $vA(x)$  they denote the memberships to true, uncertain and it false of x in to, respectively. For questions of convenience a number of the joined Neutrosophical of unique value is expressed in 2.

$$A = (a, b, c) \quad (2)$$

Where:  $a, b, c \in [0,1]$ ,  $a + b + c \leq 3$

With the method of the NASA TLX, which constitutes a tool of application in all work positions, according to the NTP 544 and that facilitates information about how can carry out in situations of work an esteem of the mental load [12].

To obtain the results according to the expressions 1 and 2 analyze the aspects that it is represented in the figure 1, in which it is shows a sequence in passing that share in bearing to enter a state of mental load, by considering that the load is not an own characteristic of the task, rather is the result of the interaction between the requests of the task; the circumstances as develops to him and the personal capacitances as it is; conducts and perceptions of the heron.

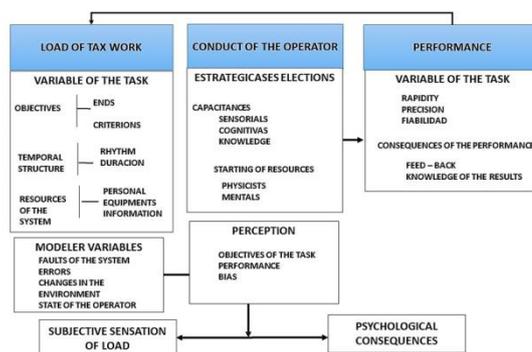
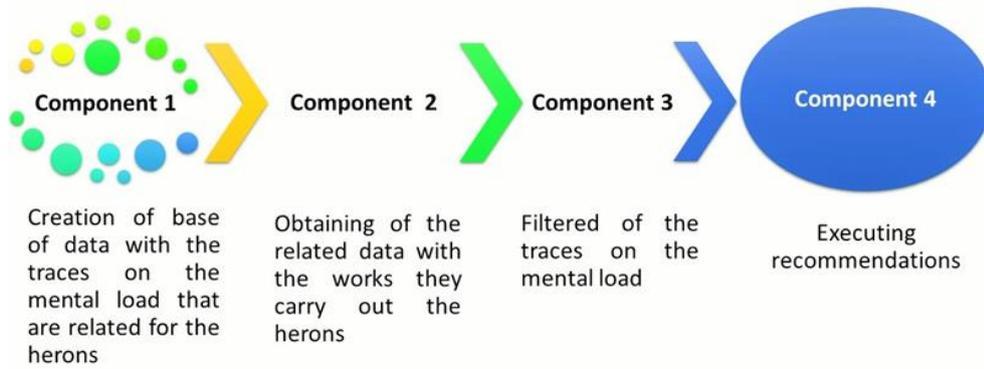


Figure 1. Interaction of work with the person. Source: [12].

The sequence in passing, that it is shown in the figure 1, share in bearing to enter a state of mental load, which contributes to select those herons with major probability to possess mental, favorable load to recommend to the specialist psychologists, of the herons, and specially the officials of the area of endless education and of the center of training and develop premise, that require of a major concepts die attention vagrant and imprecise, recommendation that is to base in knowledge, which is represented in linguistic terms and the indetermination by means of numbers of the joined Neutrosophical of unique value, by proposing the model that is presented in the figure 2.



**Figure 2.** Model proposed to execute the flux of work of the joined Neutrosophical of unique value.

Each component of the proposed model it details then as well as the activities of the mathematical model that supports the proposal.

**Component 1:** Creation of base of data with the traces of the mental load that are related for the herons

Every one of the traces of the mental load that are related for the herons correspond with  $a_i$ , they will be described for a whole of characteristics that will agree the related traces for the herons.

$$C = \{c_1, \dots, c_k, \dots, c_l\} \quad (3)$$

For the obtaining of the base of data the traces on mental related load for the herons it is obtained by means of Neutrosophical numbers of unique value [13].

Being  $A^* = (A_1^*, A_2^*, \dots, A_n^*)$  a regular vector Neutrosophical of unique value such that  $A_j^* = (a_j^*, b_j^*, c_j^*)$   $j = (1, 2, \dots, n)$  y  $B_i = (B_{i1}, B_{i2}, \dots, B_{im})$ ,  $i = (1, 2, \dots, m)$   $m$  vectors of  $n$  neutrosophics numbers of unique value such that  $B_{ij} = (a_{ij}, b_{ij}, c_{ij})$ ,  $i = (1, 2, \dots, m)$ ,  $j = (1, 2, \dots, n)$ ; then the Euclidean distance is defined as the  $B_i$  y  $A^*$ .

(4)

$$d_i = \left( \frac{1}{3} \sum_{j=1}^n \{ (|a_{ij} - a_j^*|)^2 + (|b_{ij} - b_j^*|)^2 + (|c_{ij} - c_j^*|)^2 \} \right)^{1/2} \quad (i = 1, 2, \dots, m)$$

As of the Euclidean distance it can define a measure of similitude, according to refer [14]. when carrying out the calculation it is considered that in the measure that the alternative  $A_i$  it is more near the data of the herons ( $s_j$ ) major will be the similitude, which permits establish an order between alternatives [15]. The data of the herons they present traces of mental load can be obtained in a direct way as of experts.

(5)

$$s_i = 1 - \left( \frac{1}{3} \sum_{j=1}^n \{ (|a_{ij} - a_j^*|)^2 + (|b_{ij} - b_j^*|)^2 + (|c_{ij} - c_j^*|)^2 \} \right)^{1/2}$$

The valuations of the traces of mental load  $a_j$ , as it shows oneself to be in the equation 5, it is expressed by using the linguistic scale  $S$ ,  $v_k^j \in S$ . Where;  $S = \{s_1, \dots, s_\alpha\}$  it is the whole of linguistic term defined to evaluate the characteristics  $c_k$  by using the Neutrosophical numbers of unique value. For this the linguistic terms to employ are defined previously. It describes the whole of symptoms that presents the herons, they are taken to a mathematical expression,

**Component 2.** Obtaining of the data of the works they carry out the herons

In this component obtains the information of the works they carry out the herons that originates mental load and that cause organic upsets or stress to the ones that be subdued, by storing these causes in the base of data, as informative registers of the herons with related traces with the mental load to the one that are found subdued, those which represent mathematically as shows in the expression 7.

(7)

$$p_e = \{p_{1e}, \dots, p_{ke}, \dots, p_{le}\}$$

The registers of the herons are integrated for a whole of attributes that are represented.

The registers are obtained by means of a reasoning based on cases, taking under consideration similar cases according to the related traces with the mental load to the one that are found subdued the herons or by means of the call focuses conversational [16].

**Component 3.** Filtered of the traces on mental load

In this component filter the traces on mental load they present the herons according to the registers stored in the base of data previously created, in order to find which is the traces that with major frequency presents the herons subdued abundantly mental, in correspondence with the results obtained filter the more frequent traces, useful result to analyze the herons by means of the traces that are beginning to present, it who contributes to the support of takes it of decisions of the specialist psychologists due to that is achieved a diagnosis to |priori| and is to have think up of the level of mental load that present the herons. This procedure it become fulfilled by calculating the similitude between registered of traces of the herons  $P_e$  and each sign  $a_j$  registered in the base of data. For the calculation of the total similitude it employs to him the equation 9.

$$(8)$$

$$F_{aj} = \{v_1^j, \dots, v_k^j, \dots, v_l^j\}, j = 1, \dots, n$$

The function  $S$  calculate the similitude between the values of the registers of the herons and those of the traces of mental load  $a_j$ .

**Component 4:** Executing recommendations

Calculated the similitude between the register of the herons with traces of mental load and that is to find stored in the base of data, previously created, the traces of presence of mental load are arranged according to the similitude obtained, it who is represented for the vector of similitude that it shows oneself to be in the expression 9.

$$(9)$$

$$D = (d_1, \dots, d_n)$$

The results of acceptance major will be those, that better satisfy the needs of the register of the herons with traces of mental load, that is to say those who possess major similitude.

After applying the model and filtered the herons with traces of mental load identify the main dimensions of every one, standing out the mental exigency, physical and temporal, the effort, the performance and the level of frustration, it who is useful to compare them for placentas, can select for each couple, which is the sign that is perceived as a major source of load. as of these elections obtains a weight for each dimension, in function of the number of times that has been selected [12].

Likewise, based on the norm NTP 544 indicated the form of valuation of these weights taking values between 0 (for the dimension that has not been selected in any occasion and therefore not considers to him relevant) and 5 (for the dimension that always has been selected and therefore it is considered that it is the source of more important load).

The same of the correct weight whole can be used for variations of a same task or for a group of tasks sub. Moreover, the weights give diagnostic information about the nature of the load of work tax for the task since provide data brings near two sources of interpersonal variability.

Finally, decides to him the prudent global stocking, whose value is obtained by dividing the total of the divided prudent punctuation for the total of the weight that always will be 15. Consequently, the result will be the prudent global stocking, whose value won't decide the index of load of work. This index varied between 0 and 100, to major index will be the mental load.

**3. Results**

The obtained results when using a joined neutrophysical of unique value, by keeping in mind the base of data ( $A = \{a_1, a_2, a_3, a_4, a_5\}$ ) it describes for the whole of attributes ( $C = \{c_1, c_2, c_3, c_4, c_5\}$ ), attributes that were valued according to the linguistic scale that is to show in the table 1, defined for [13].

Linguistic term	SVN
Extremely good (EB)	(1,0,0)
Very very good (MMB)	(0.9, 0.1,0.1)
Very good (MB)	(0.8,0,15,0.20)
Good (B)	(0.70,0.25,0.30)
Moderately good (MDB)	(0.60,0.35,0.40)
Stocking (M)	(0.50,0.50,0.50)
Moderately bad (MDM)	(0.40,0.65,0.60)
Bad (MA)	(0.30,0.75,0.70)
Very bad (MM)	(0.20,0.85,0.80)
Very very bad (MMM)	(0.10,0.90,0.90)
Extremely bad (EM)	(0,1,1)

Table 1. Linguistic scale. Source: [13].

The valuations obtained when applying the model that is shown in the figure 1, it is stored in the base of data previously created the obtained result in the expression 10.

$$Pe = \{MDB, MB, MMB, MB\} \tag{11}$$

The results that are reflected in the expression 11 , it is demonstrated according to the linguistic scale that is to present in the table 1, by making room for the |interpretability| of the proposed model to decide the herons with mental load that possess mental, physical and temporal exigency, the who is moderately good (MDB), also the interpretability to decide the herons they require of major gain courage, it is very good (MB), it is interpreted, moreover, in the proposed model that the performance of the herons is very very good (MMB) and also very good obtain (MB) the interpretability of the level of frustration they possess the herons they possess mental load. The calculation of the similitude between the register of the herons with mental load and the amounts of wine laid in vats for aging traces in the base of data shows in the table 2.

a1	a2	a3	a4
0.46	0.78	0.44	0.86

**Table 2:** Similitude between the traces of mental load and the register of the having herons for mental load. Source: Own manufacture.

Based on the obtained results recommends attend to him those traces that more approach the characteristics of the having herons for mental load according to your register. An arranging of the compiled traces, to carry out recommendations is the one which is shown in the expression 12.

$$\{a_4, a_2, a_1, a_3\} \tag{12}$$

By keeping in mind the arranging that is presented through the equation 12, recommends attend to him in the first place to the herons that possess a high level of frustration, then must give to him follow-up to the performance of the herons, recommend afterwards attention to the herons they require of major gain courage to carry out the work.

If the recommendations are on the nearer traces, these are the relative thing to the performance of the herons ( $a_3$ ) and to those who it is corresponded with the level of frustration that possesses the herons ( $a_2$ ).

The obtained results when making use of the Neutrosophy contribute resulted to apply the NASA TLX method in the different work positions that are part of the development of activities of the area of endless education and CECADEL. These results contribute to that the own officials can punctuate the tasks to carry out for the sake of taking decisions to decrease the mental load of the herons and specially of the public officials of the area of endless education and center of training of local development of the state university of the Manabí south of the republic of the Ecuador.

## Conclusion

At present article presented a model of recommendations of traces of mental load of the public officials of the area of endless education and center of training of local development of the state university of the Manabí south of the republic of the equator, the same it is carried out by following the focussing based on knowledge, by using the employment of the general numbers Neutrosophical of unique value to express linguistic terms.

It worked to him with a base of knowledge that it is stored in a base of data, previously created, to store all characteristics and representations of the herons with mental load. The obtained results compared and kept in mind to him the criterion of experts, as well as the obtaining of the weights of the characteristics by using valuations in group.

With the results obtained it is shown that the present study can serve as starting point for other departments and areas of the state university of the south of Manabí, in order to know the level of mental load that possess your working, and with that, it improves the mental comfort of the collaborators if requires to him.

The general results indicate that the level of mental load they possess the officials of the area of endless education and CECADEL of the state university of the Manabí south is to intercede. In this sense, plan preventive and corrective actions to prevent the level of risk detected, results that it is shown in the table 1, in which is reflected the need of total commitment of the high direction of the UNESUM, and the hierarchical levels superiors that are priced at position of the area of endless education and CECADEL, whom must be worried besides the good administrative functioning of the area and it will be responsible for looks after the good health of the herons.

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