Multivariate Analysis of the Work Environment in a University Due to Covid-19

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Abstract[1]

The global situation experienced due to the advance of the covid-19 pandemic and the requirements of social isolation has affected multiple sectors, especially the education sector. In particular, teachers, support workers and university students have taken on a great challenge by recognizing that conditions have changed but learning is not delayed. Therefore, they have seen the need to implement virtual education strategies in a short period of time. For the universities in which face-to-face was the daily learning model, which do not have the necessary infrastructure for the new virtual modality, it has been a threat to the environment as they were forced, under these conditions, to migrate from face-to-face education to non-attendance. face-to-face, emergent way.

That is why this study emphasizes the adverse effects of the social emergency caused by COVID-19 in the university teaching work environment, the appearance of stress and the need for institutions to adopt measures to improve their situation in terms of technology organization, methods and techniques and improve their digital skills in line with emerging global trends and realities, to avoid negative consequences on the mental health of their teachers and students.

Keywords: *Multivariate Analysis, Covid-19 Pandemic, Organizational Culture, Work Climate, Work Stress, Virtual Teachig.*

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1. Introduction

The Organizational Culture (OC) and as part of its context, the Work Environment is made up of the values, principles, traditions and ways of doing things shared by the members of the organization, which directly influence the way they act and they differentiate one organization from others. In general, the O.C. It covers three main areas: first, it is a perception, it is invisible and intangible, but employees perceive it in what they experience within the organization. Second, it is descriptive. It has to do with what is perceived and how the members of the organization describe it, regardless of whether they prefer it or not. Third, it is a shared culture; regardless of whether the members of the organization occupy different job positions, they all tend to describe the culture of the company in similar terms (Robbins, 1993; 1994; Robbins & Coulter, 2014). A direct manifestation of the O.C., is the Work Climate created in each context and under certain circumstances. It contains, management policies, practices and human resources (Moreira,2002).

The Work Climate is shown as the perception and appreciation of the employees of the processes and procedures (structural aspects), the relationships between people and the physical environment, which affect the organization; it aims to achieve its purpose or reason for being, effectively, it must effectively manage the various variables that compose it as an integrated system: environment, strategy, structure, technology, work system, managerial functions, relationships and affect the reactions of employees' behavior, and modify performance professional and the organization (García, 2009). This has been affected by the recent changes assumed by education, particularly by Higher Education.

This work is aimed at measuring the Organizational Climate in a university Faculty in the process of change due to an emergency as a result of the Covid-19 pandemic, from the face-to-face academic modality to the virtual modality of teaching, in an inappropriate context to the use, in a traditional way, of the type of technology that this modality requires. There are aspects in the field of professional competencies for this type of non-face-to-face modality, which require gradual changes and which have not been able to be addressed effectively as a result of the urgency with which this challenge of continuity of education with distancing has been assumed social. This has made it difficult, to a great extent, to strengthen the academy in a new

modality; however, it has been an imperative in this context, to migrate to a non-face-to-face education despite the limitations.

But, to fulfill the purpose of education at this level, the university must ensure the maintenance of the necessary balance between the basic components that allow it to be configured as an integrated system. One of them is the variable or human factor, its behavior, their habits and customs that directly affect their performance. Education professionals (direct and indirect) have to meet three kinds of conditions to fulfill their task with dignity: those that belong properly to the personality, those assigned to technical and scientific training and those included in the vocational inclination. The professional-student relationship (to a greater extent teacher-student) requires at all times a strong dose of ethics, professionalism, and pedagogy on the part of the professional, who must not only be able to transmit knowledge (instruction) but also to educate through his own example (Villa & Pons, 2005).

However, as a result of the above, a set of reactions has been generated in the human factor at the organizational level that to some extent have affected their best performance, especially academic: high levels of stress, effects on the quality of life of teachers and students, as well as in academic results. For this reason, as part of a very complex real problem situation, it has been decided by the authorities of the aforementioned object of study, to prioritize the diagnosis of the labor context, specifically the Labor Climate.
In the research that serves as a sample to the present work, the Work Climate is explained through ten primary characteristics that in general terms concentrate the essence of the same: 1. Implication (IM), 2. Cohesion (CO), 3. Support (AP), 4. Autonomy (AU), 5. Organization (OR), 6. Pressure (PR), 7. Clarity (CL), Control (CN), 9. Innovation (IN), 10. Comfort (CF) 7.8. These variables require adjustments in light of the changes that have generated transformations in the university environment, especially in the teaching workplace. That is why this study emphasizes the adverse effects of the social emergency caused by COVID-19 in the university teaching work environment.

A total of 153 who work in a Faculty of Industrial Engineering participated in the study (teachers, researchers and administrative-teaching professionals). The study design was cross-sectional, analytical and descriptive, using the techniques of the interview and the questionnaire. The data was collected through the questionnaire structured in 10 blocks

administered to 91 respondents. The data collected was analyzed using the SPSS and AMOS software, aimed at carrying out the Exploratory Factor Analysis of Principal Components and the Confirmatory Factor Analysis, in order to identify and study the variables that have affected the work environment and have had a greater impact on the high rates of work stress and other effects mentioned by this concept.

2. Materials and Methods

The sample used is composed of 91 teachers, who work in the three careers of the Faculty under study: Industrial Engineering, Teleinformatics and Systems; randomly selected from a total of 153 teaching workers.
The instruments used were interviews, direct observation and the Moos Wess Scale.

The Work Environment Scale (WES) by Moos R.H. et al., adapted into Spanish by Fernández Ballesteros R et al for TEA Ediciones (Moos et al., 1984). This instrument assesses socio-environmental characteristics and personal relationships at work (Moos et.al.,1981, 1984). It consists of 90 items with two answer possibilities (true / false), grouped in 10 subscales that evaluate three (3) fundamental dimensions, which are:

1.- Relationships. It is a dimension made up of the Implication (IM), Cohesion (CO) and Support (AP) subscales, which assess the degree to which employees are interested and engaged in their work and the degree to which management supports employees and employees. encourages support for each other.
2.- Self-realization or orientation towards some objectives is appreciated through the subscales: Autonomy (AU), Organization (OR) and Pressure (PR), which evaluate the degree to which employees are encouraged to be self-sufficient and make their own decisions; the importance given to good planning, efficiency and completion of tasks and the degree to which work pressure or urgency dominates the work environment.
3.- Stability / Change, is the dimension appreciated by the Clarity (CL), Control (CN), Innovation (IN) and Comfort (CF) subscales. These subscales assess the degree to which employees know what is expected of their daily task and how the rules and work plans are explained to them; the degree to which management uses standards and pressure to control employees; the importance given to variety, change and new proposals and finally the

degree to which the physical environment contributes to creating a pleasant work environment.

For the analysis of the WES Scale, the direct scores (PD) of each subscale were calculated, the means of these subscales were obtained, and the data were typified (PT), according to the typification scale established by the scale and from this made the corresponding evaluations that allowed to carry out a general characterization of the prevailing Work Climate, laying the foundations for the creation of the conditions required to assume an institutional management system favorable to virtual education, based on the process approach and in correspondence with it, define the variables to improve in their performance through the organization and development of intervention programs that contribute to raising, if required, levels of job satisfaction. For the interpretation of the results of this scale, we established a neutral value at level 50, of positive climate above and negative climate below (Villa & Pons, 2005).

The procedure applied for the analysis contains three fundamental moments and is shown in figure No. 1.

For the processing and analysis of the data, the statistical software of Social Sciences SPSS (Statistical Package for Social Sciences) was used, using basic statistics and factorial analysis. In order to find the factors that defined the Organizational Climate in the Faculty, a Factor Analysis of Principal Components was carried out, for this the ten (10) variables that make up the Scale of Social Climate at Work, Work Environment Scale (WES) (Moos et.al.,1981, 1984; Moos, 2008; García et.al., 2014). Once these factors were identified, the goodness of fit was verified by means of a Confirmatory Factor Analysis using a group of indicators that represent the total fit (Chion & Vincent, 2016).

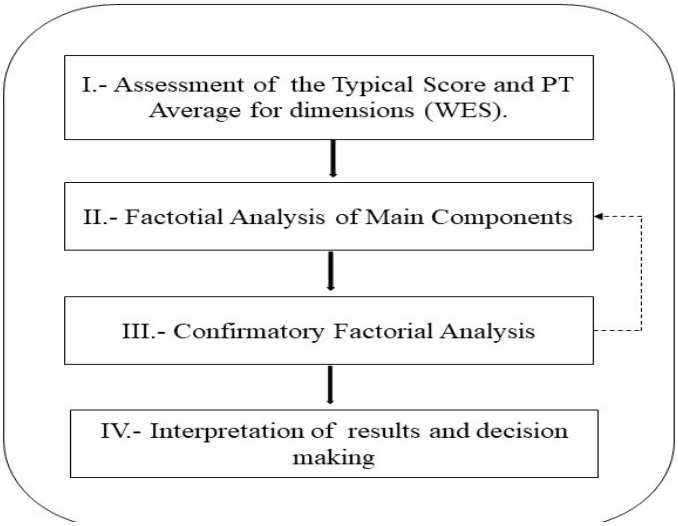

Figure 1: Procedure for the study of Work Climate.

3. Analysis and Results

3.1. Determination of the General and Average PT by Dimensions.

Table 1 shows the mean values by dimensions and the typical scores of the ten component subscales of the WES.

Table 1: Typical Score S (general) and average PT by dimensions, of the different component subscales of the WES.

SUBSCALES	PD	PT	AVERAGE PT BY DIMENSIONS
IM	7,5	66* +	
CO	4,0	49	
AP	4,0	51	55
AU	3,5	52	
OR	4,0	51	
PR	9,0	76* +	60
CL	3,5	51	
CN	7,0	61	
IN	1,5	48	
CF	3,0	44	51
Significant values of positive or negative Work Climate (significantly above the neutral value)			

In the first moment of the analysis of the Work Climate Scale, it is obtained that the profile provided by the ten subscales is characterized by the presence of a maximum elevation in the Control subscale (CN), in which those investigated feel that the authorities more and more people turn to the exercise of control over performance, at a time when virtual education and the lack of confluence of teachers in the usual physical spaces of the Faculty, requires different monitoring methods, given the situation of change in the forms of supervision previously employed; It is then that by means of increasingly stringent rules and resolutions, it is intended to replace the supervision developed previously by methods of another nature. In this case, since it is not evaluated by work results, there is an increasing emphasis on the "how" and on the use of time. Therefore, a behavior of the Control is shown above the neutral value, but it does not guarantee the effectiveness that is required of it in these new circumstances.

However, to this, the level of the subscale or variable "involvement" (MI) * + is manifested, it also shows an outstanding level (66 +) in the study, in which the participants feel interested and committed to their work. Related to the above and as a result of the emergency or urgent condition with which the aforementioned change in the educational model has had to be assumed, it then manifests itself with the value higher than the neutral level of the scale, as shown in the Figure No.1, the Pressure subscale (PR) * -, highlighting the effect that has most affected the new situations manifested by the Workplace Climate (76-), among which work stress, lack of concentration of students in virtual classes, especially videoconference sessions (synchronous) and the quality of participation in tutoring sessions, as well as non-compliance with the regulations regarding the structure of the classrooms and other teaching parameters that previously they did not exist in the face-to-face mode. Together with all of the above, not all the clarity (CL) required in the new provisions is shown, especially if there are changes in them with significant dynamism, which generates uncertainty and insecurity among those who must execute said provisions.

All the other values belonging to the rest of the subscales are at or below the neutral value (50), meaning that they belong to a positive climate that is not very significant or negative, which implies the existence of conditions not favorable to the changes that They are required to undertake before the contingencies already referred to.

3.2. Factor Analysis of Principal Components

The Organizational Climate is a multidimensional component that can be decomposed into various elements or variables, which, when studied in their multiple interrelationships, must then be grouped into factors that explain their behavior, which not only contributes to the analysis due to its objectivity, but also that facilitates its understanding and concrete explanation. That is why, in this case, the Factor Analysis of Principal Components is used.

The instrument applied for the diagnosis of the work environment was statistically validated to check its reliability and construct validity, which means that the instrument measures what is to be measured and that it is applied so many times under similar conditions, it will yield the same results. The construct validity of the same was verified by using the Factor Analysis of Principal Components (Table 2).

As a result, it was obtained that the Kaiser Meyer & Olkin Coefficient (KMO), expresses that the extracted factors explain the dispersion between the variables and, the Bartlett Sphericity Test shows that the variables that express the concepts related to Work Climate, are related and that the Correlation Matrix of the variables is not an identity matrix (Table 2).

Table 2: KMO and Bartlett's Test

Kaiser-Meyer-Olkin (KMO) goodness of fit measure		,931
Bartlett's test	Approximate Chi-square	1302,483
	D f	45
	Sig.	,000

The application of the Cronbach's Alpha test, as shown in Table 3, shows that the instrument used for the diagnosis of Work Climate is reliable.

Table 3: Reliability Statistics

Cronbach Alpha	Number of items
,964	10

The result of the Kendall Test confirms the Construct Validity of the main instrument used for the study of Work Climate.

Through the statistical analysis carried out, two (2) main components were extracted that explain 89.6% of the total variance (Table 5) and it is observed that the following variables are grouped in a significant way:
F1: Cohesion (CO), Organization (OR), Clarity in goals (CL), Control (CN), Innovation (IN), Comfort and Comfort (CF) and F2: Involvement (IM), Support (AP), Autonomy (AU), Labor Pressure (PR).

Table 4: Kendall's W Test

	Average rank
IM	8,48
CO	5,09
AP	4,51
AU	5,96
OR	4,81
PR	9,49
CL	3,63
CN	7,97
IN	2,74
CF	2,33

N	91
Kendall's W	,659
Chi-square	539,887
D. f.	9
Asymt. Sig.	,000

The two (2) factors / components, with the variables they contain explain the above. The first factor (F1) explains 48.8% of the total variability and the second factor (F2), 40.8% of it, which implies that they are all correlated with each other. In this way, it is explained how Integration between work methods and styles (F1), and Implication in change actions (F2) explain 89.6% of the total variability.

The Rotated Components Matrix, using the Varimax Method, shows the correlations between the variables of the instrument and the two factors extracted (Table 6). Factor 1 that refers to the Integration between the methods and work styles to manage change (stability / change) and Factor 2 that groups together everything that refers to Implication in change actions in the face of contingency and Effects on self-fulfillment in this context, in which significant negative effects are shown in terms of autonomy and work pressure, fundamentally. Table 6 shows the correlations between the factors and the variables (subscales) that represent them.

Table 5: Eigenvalues and Proportions of Original Variance

Components	Initial eigen-values			Sums of squared saturations of extraction			Sums of squared saturations of rotation		
	Total	% of variance	% cumulative	Total	% of variance	% cumulative	Total	% of variance	% cumulative
1	7,847	78,466	78,466	7,847	78,466	78,466	4,877	48,772	48,772
2	1,110	11,102	89,568	1,110	11,102	89,568	4,080	40,796	89,568
3	,299	2,994	92,562						
4	,164	1,640	94,202						
5	,139	1,388	95,590						
6	,118	1,175	96,766						
7	,103	1,034	97,800						
8	,097	,968	98,768						
9	,072	,725	99,493						
10	,051	,507	100,000						

Table 6: Total Matrix Sampling Adequacy

	Components	
	1	2
IM	,286	,903
CO	,759	,565
AP	,551	,770
AU	,490	,809
OR	,904	,313
PR	,251	,923
CL	,695	,631
CN	,925	,286
IN	,833	,404
CF	,874	,323

3.3. Confirmatory Factor Analysis

The Confirmatory Factor Analysis applied to each factor (Tables 7 and 8), shows in each case that the relationship between the factors and the corresponding variables present a good fit, by virtue of the values of the indicators and that in all cases, the values of the R2 statistic are high. All this indicates that the behavior of both factors can be explained by the variables corresponding to the subscales of the instrument used.

Table 7: Confirmatory Factor Analysis Factor 1 (Integration between Methods and Work Styles for Change).

FACTOR	ÍTEM	Standard lambda parameter (t- value)	Reliability
F1	CO	0,901	0,968
	OR	0,953	
	CL	0,865	
	CN	0,963	
	IN	0.892	
	CF	0.919	

Goodness of Fit Measures of the Model								
	S-B χ^2 (p)	GFI	AGFI	NNFI	IFI	CFI	χ^2/gl	RMSEA
	7.342 (6) (p=0,4)	0.909	0,904	1.019	1.009	1.000	1.22	0.000

Table 8: Confirmatory Factor Analysis Factor 2 (Implication in Exchange Actions).

FACTOR	ÍTEM	Standard lambda parameter (t-value)	Reliability
F2	IMP	0,924	0,946
	AP	0,909	
	AU	0,924	
	PR	0,921	

Goodness of Fit Measures of the Model								
	S-B χ^2 (p)	GFI	AGFI	NNFI	IFI	CFI	χ^2/gl	RMSEA
	49.823 (25) (p=0,3)	0.984	0,904	1.026	1.004	1.000	1,96	0.000

3.4. Interpretation of Results and Decision Making

Significant relationships were found between the organizational climate, the organization, the work pressure and the stress derived from it, as well as between these variables and the socio-labor and organizational variables.
In the end, it is suggested to introduce system modifications in the selected academic strategy, ranging from work and management methods, to possible Organizational Development intervention programs that include changes related to attitudes and behaviors that complement the new knowledge. Development of the professional competences required in the new conditions of virtual distance education in both teachers and students, by university authorities and human resources managers.

4. Conclusions

Consequently, the study carried out shows the need to introduce modifications in the dynamics of the organization, in the educational and teaching support strategies and the management approach used, by the management teams in general, which would result in in the changes that are required by the environment and the organization itself to implement a virtual education system even in emergency conditions that reduces the levels of work pressure and ensures the strengthening of cohesion focused on goals, support between functional areas, comfort, and academic autonomy, based on a greater effectiveness of control and organization of work and management. In this way, continuously improve the behavior of the indicators and institutional quality, with the consequent benefit for professionals, the institution and society.

From this study the need to make modifications in some cultural variables is obtained, in this way a greater emphasis should be placed on the changes aimed at achieving:

1. More effective work and management methods and styles for the management of change processes (F1), based on cohesion, precise organization and clarity in the goals required to guarantee efficient and dynamic work with full knowledge of what is expected of each member of the organization, the socialization of the goals to be achieved and the effective control over the performance results.

2. An attitude towards change (F2) based on a greater degree of commitment and involvement, of support to the rest of the members of the groups and a greater degree of knowledge of what is expected of each one without extreme pressure and with projection enough to assume unavoidable variations in the execution of teaching under the new conditions without affecting the quality of it.

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