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Measuring Stress in University Settings: Social Challenges of Technology

By

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Abstract

This paper evaluates the different stress situations in university environments, from teachers' perspectives to students' views and their impact on social scenarios. For this purpose, a bibliographic search is carried out to explore those investigations carried out in different social spaces. The main results show that Latin American universities have a higher incidence of stress in teachers and less stress in students. In contrast, universities in European countries mainly present more stress on students and less stress on teachers. Furthermore, it reveals that the student demands for improving academic quality occur with greater emphasis in non-Latin countries.

Keywords: university education, university stress, education and society.

Introduction

Work stress experiences arise when job demands are high, and in turn, the resources in that environment are low [1]. Likewise, [1] four possible work situations are distinguished concerning demands and resources. Thus, a job with low resources and high demand levels will be stressful because the person cannot respond to these demanding requests. On the other hand, a job with high levels of demand but with high levels of resources may be an active but

not necessarily stressful job. However, a job with low levels of demands and low levels of resources is a low-stressful job, considered a passive job. Furthermore, finally, a job with high resources and low demands is a job with very low stress. In this sense, universities that offer the most demanding teaching staff should provide sufficient resources to ensure minimal stress levels and that the best results can be achieved.

New technologies, new work demands and the needs of globalization, in line with socioeconomic and socio-political changes are having an increasing impact on labor markets. Mental and emotional work, as well as low work flexibility, increasingly demanding social needs, and new forms of work activity, are some of the triggers of intense and frequent emotional situations that lead to stress at work [2]. Job stressors vary in frequency, intensity, duration, and predictability [3]. However, based on the content analysis, it is possible to establish eight categories of work stressors [3]: those related to the physical surroundings and the environment, those related to the work organization, the job and the functions of the position, and those caused by the role performed, those that refer to personal relationships, work merits, the structure and work climate of the organization, work-family relationships.

Emotions have been studied as triggers of stress in recent years. For this reason, they have been analyzed and observed by the medical sciences and other areas of study that have sought to evaluate and regulate them, control their manifestations, and consider the implications they may have on health and personal relationships. For the above reasons, some authors have developed questionnaires to assess stress in students based on a set of daily stressors [4], The survey contained 25 items: 12 referring to health, 6 to school and peers, and 7 to family, all with a discrimination index above 0.20. The results showed that schoolchildren were considerably affected by emotions, which produced significant stress levels. In addition, it was evidenced that high-stress levels showed students with more fragile health, with more symptoms and diseases than those without stressors in their lives [4], [5].

Electronic systems have also been developed for their detection based on the concerns that stress can cause in the population [6]. These investigations point out that some variables impacting stress manifestations are respiratory rate, eye muscle activity, skin conductivity, and blood pressure. According to the work of Betancourt and his colleagues [6] they managed to measure all these variables and perform an implementation with Arduino devices that allowed them to evaluate these parameters and yield results regarding stress. They also included support vector machines that offer reliable results to discriminate the presence or not of stress, specifically mathematical stress that the authors cataloged as one of the factors of more significant stress in the study population.

Another method used in stress detection has been hyper-dimensional visualization [7], which combines multidimensional scaling and virtual reality. This method used yielded empirical results that evidence the relevance of pulse variables in stress detection and the importance of reducing error by employing non-traditional methods for such detection. Furthermore, the developed system also allows distinguishing the modes of psychological functioning in people, detecting even lying as an emotion conducive to stress. The reception of electrical signals from the organism for stress detection is another procedure researchers use [8]. This method captures brain electrical signals through electrodes in the frontal and temporal lobes, which are processed by operational amplifiers that, in conjunction with a microprocessor, analyze the variables, which the medical specialist can further validate. In the reference [8] the study of alpha, beta, theta and delta signals produced in the frontal lobe, which is in charge of emotional behavioral expressions, was considered. The results showed that the processing of these signals requires greater rigor, since the method used adds noises and

interferences product of additional signals that could be found in the environment, such as WIFI signal, electric light, among others. However, the use of alpha and beta signals for stress classification was quite significant and allowed the detection of relaxation and excitation states typical of stress.

The use of engineering in human biological processes is presented as a comprehensive medical technology that provides solutions to health problems. One of the most common computational applications for this type of analysis is intelligent computing, more specifically, artificial neural networks, which offer a vast response capacity for studying biological systems [9]. Other methods, such as logistic regression and virtual reality, have provided satisfactory general results in occupational health and medical scenarios [10], [11]. Intelligent computing offers a non-invasive procedure to categorize stress states, classify them and evaluate medical situations based on the results obtained. Computational intelligence also called evolutionary computation, and its application in engineering and medical processes have allowed the linking of natural processes to electronic systems [11], [12]. Furthermore, evolution has inspired computational models associated with the behavior of organisms, causing the development of new forms of information processing and data management [11], [13]. These systems are proposed as solutions to medical problems that guarantee non-invasive procedures with a minimum margin of error. In this sense, intelligent applications constituted within the evolutionary computation make it possible to provide answers to various medical situations challenging to categorize by traditional methods. Artificial intelligence encompasses all evolutionary computing processes, which in turn involves intelligent applications. It includes techniques such as artificial neural networks, optimization with swarms of particles, or evolutionary computing itself, i.e., strategies based on the intelligence that emerges from interactions in a collective, whether neurons, particles, or organisms [13] , [14].

This paper evaluates the measurement of stress from technology. It considers its use in university environments where teaching staff, especially in Latin America, face stressful stimuli that lead to personal attitudes that can trigger diseases.

Development

Medicine is a singular example of an uncertain domain, where implicit information, multiplicity, ambiguity, and imprecision make it essential to deal with uncertainty [15], [16]. Moreover, uncertainty is, along with knowledge and learning, one of the fundamental problems of artificial intelligence and its complements in intelligent computing [16].

Studying intelligent algorithms in medicine and health is essential for the clinical good because medicine and health represent complex daily life processes. It isn't easy to interpret and recognize with the naked eye or utilize a classical mathematical procedure. Several kinds of research, which show the analysis, identification, and classification of this type of medical variables and clinical processes have been published, among which we can mention the following: Spectral analysis of physiological parameters for emotion detection, hybrid model for the diagnosis of cardiovascular diseases based on artificial intelligence, decision trees as a tool in medical diagnosis, artificial intelligence to assist clinical diagnosis in medicine. All these processes demand intelligent algorithms to solve their non-linear nature [17], [18], [19].

Characterizing non-linear variables requires specific computational processing and recognition of physical and physiological variables, and in most cases, expert validation is required. It has led in recent times to the incorporation of artificial intelligence techniques to

develop systems where, with the support of experts, intrinsic characteristics of people are described in combination with psychological analysis, thus achieving a system suitable for different applications [20], [19]. The association of psychological analysis in combination with intelligent methods applied to medicine has made possible the efficient performance of systems that were previously not possible to implement [20].

The nonlinear variables of these systems, whose numerical complexity is remarkable, demand intelligent fuzzy control algorithms and artificial neural networks, which allow the system to have a satisfactory result. This way, it is possible to reach the objectives that have not been achieved so far with classical statistical techniques. This efficiency refers, among others, to the efficient tracking of paths and characterization of variables, the optimization of uncertain values and processes, the debugging of disturbances, and the association of physiological parameters with attitudinal parameters [21], [4].

A wide range of intelligent techniques is used for the characterization of human physiological variables, classification of emotional expressions, and stress recognition [22], [8], [6], [10]. Among others, the following may be mentioned: Robotic gesture recognition [5], Robust Real-Time Face Detection [6], Burnout research in the social services: a critique [7], Maslach Burnout Inventory [23]. Career Burnout: Causes and cures [9], entre otros. Unfortunately, these techniques individually do not produce precision in the results due to the complexity of the associated variables, such as those indicated in [24], [17], [25], [3]. However, by appropriately combining conventional medical methodologies with intelligent techniques, Specifically, Mandani type fuzzy logic and adaptive type neural networks, it is feasible to achieve the expected results when it comes to handling this type of complex variables [26], [27], [25]. From the above, it is possible to consider the analysis of human emotions using computational intelligence as a tool for preventive medical treatment, allowing the permanent evaluation of people to address their state of health. This type of system aims to contribute considerably to treating chronic diseases, diseases of the cardiac, dermal, and gastrointestinal systems, where it has been seen to be more prevalent in the presence of stress.

Due to the significant growth of machines and the advance in technology in today's society, it is necessary to integrate them to provide solutions to human situations that require special attention, as is the case of emotions and stressful situations. These can have significant negative consequences on the performance of individuals and the production of companies and institutions. It is currently possible to use artificial intelligence to simulate natural systems of human behavior and obtain optimal results with minimum error; the most common are artificial neural networks and particle swarm optimization systems. In this way, tools can be generated that facilitate medical evaluation and allow the characterization of attitudinal parameters in people to ensure that the performance and functions to be fulfilled in a given position are executed in an ideal way.

It is essential to highlight the study of the parameters related to human emotional states, both physical and hormonal, and from these, to use engineering and artificial intelligence to construct a suitable system for the classification of stress. Stress is caused by emotional states, which can be measured from the parameters of breathing, pulse, voice, and face. Fadin and Alvarez [38] propose the characterization of human attitudes by implementing the discrete cosine transform and the multilayer perceptron as hybrid tools for determining factors of complex perception, such as image segmentation. In this work, artificial neural network algorithms are proposed for clustering variables associated with human behavior, such as stress, from the physiological point of view.

For the development of this work, stress situations in university environments are analyzed from the perspective of university teachers. For this purpose, the teaching function's criteria are considered, such as the teaching of classes, administrative management, research activities, and links with society. In other words, the teacher's responsibilities as a member of the university environment and as part of society are studied.

Ekman [7] pointed out that the six primary emotions can be recognized in facial expressions universally and that these do not depend on culture, but have a biological origin, are anger, disgust, fear, joy, sadness, and surprise. Likewise, to develop intelligent systems that interact naturally with human beings, human emotions must be recognized from facial expressions [28].

The previous Section 2 showed the general bibliographic foundations of the research. Section 3, which follows, shows methodological aspects supporting the development. Finally, the results are shown in Section 4, followed by the conclusions and recommendations derived from this research.

Methodology

A literature review and content analysis methodology were used, highlighting the contributions proposed by [29] and [2]. In this methodology, the social elements of the environment that generate stress were analyzed, as well as the engineering techniques developed to measure them. In this work, stress is considered a social problem that can be detected through technology, avoiding health situations that can be harmful to people in university work environments, where the emotional balance of teachers is of great importance for student welfare. In this sense, a content analysis of the work proposed by [29] where stress is described mathematically and contrasted with the assessments described by [2] where new engineering techniques are proposed to address stressful situations in work environments. This analysis aims to understand the relevance of stress in university teachers in Latin America, where essential workloads prevail, with significant competitive demands in areas such as research and management. For this purpose, university professors in some Latin American countries were consulted through surveys to know their perceptions of university workload.

The questionnaire was adapted from the one proposed by Dr. Luis de Rivera [30]. It was composed of 20 closed questions, obtaining a Cronbach's Alpha of 0.92 points, which provides us with an appropriate validation for the study. The questions were composed of a five-choice Likert scale to evaluate Latino teachers' posture in university activities and the possible stressful situations to which they could be exposed. The sample was voluntary and was composed of people of different ages between 25 and 55 years old, of both sexes, making a total of 285 respondents from different universities in different countries.

Results

After the study has been carried out, the following results can be shown:

Concerning content analysis.

The literature review observed that the work proposed by [29] describes the importance of controlling stressful stimuli since these directly impact disease generation. Furthermore, according to [29] and [31], where stress is analyzed mathematically, dynamic equations show a relationship

between stress and disease. In this sense, it was found that a significant number of diseases are caused or intensified by stress, including high blood pressure and skin problems, among others.

On the other hand, considering that proposed by [2], whose work is based on that developed by [29], an analysis of stress has been considered, observing that when the stressor increases, the stress level also increases. Consequently, the affected person tends to find solutions to balance this situation. Unfortunately, these solutions are alcohol consumption, overeating, partying, and other activities often used to disguise the stressful situation and not solve the problem. This behavior is also linked to a self-defense mechanism of the organism and resistance to coping with stressful situations. When these possible solutions act, an improvement in the state of health is observed, which, in turn, will decrease as the stressor continues to be present and the apparent solutions cannot produce the expected natural effect. Finally, the help of a medical professional will be indispensable (Figure 1).

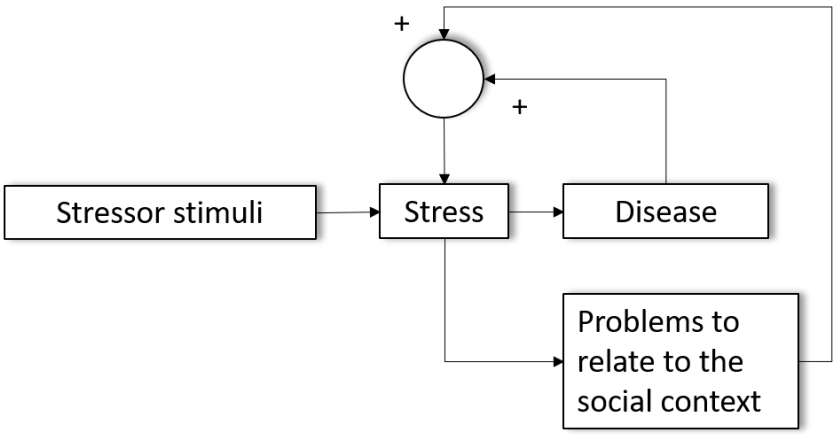

Figure 1. *Stressor stimuli and their effect on health.*

Different bibliographies argue that stress can trigger diseases and that these stressful situations are not perceptible initially. Therefore, the person is unaware of the problem until it is already advanced. Therefore, this paper proposes that stress be measured continuously and permanently in the university environment. This action could avoid possible health problems in the teaching staff and the counterproductive attitudes that derive from stress, such as bad mood, low tolerance, and irritability.

Regarding the survey

A survey was carried out to find out the possible stressful situations that teachers in Latin America present, trying to investigate the activities they perform as part of the teaching function and correlating them with the local context. The main results found in the survey were:

1. In countries such as Ecuador and Peru, it was observed that there is good economic stability. However, there is a large workload, including administrative management, classroom, research, and liaison activities. In this sense, it was also observed that the workload for classroom activities varies from 16 to 24 hours per week, with the remaining 14 to 16 hours available for class and exam preparation, student services, research, liaison, and administrative management. It is exceptionally abundant for a teaching job, which can lead to possible work stress and family and social relationship problems.
2. In countries such as Argentina, Uruguay, and Paraguay, greater work tranquility was observed, with less administrative pressure and greater autonomy for teaching functions.

3. E In countries such as Chile, it was observed that the teaching job, although demanding, lacks job stability for some, and most contracts are not permanent and long-term. Therefore, it leads to possible stressful situations for the teaching staff.
4. A particular case was observed in Venezuela, where teachers have no administrative requirements. Most of the demands are academic, and there are few demands concerning liaison and research activities. There is no pressure to comply with schedules or to attend to students. However, social pressures are high; the context's economic demands do not allow teachers' adequate participation in their activities, which can cause stressful situations.
5. The academic situation in Latin America is worrisome since dropout rates are high, teaching skills are not the most competitive worldwide, and the educational infrastructure is not always appropriate for entrepreneurship, research, and teaching. In addition, there are underlying problems with the overall education system in the region, which may pose a risk of stress to the teaching staff.

Conclusions

The following conclusions can be extracted from the research carried out:

1. Teacher work stress in the university sector can represent a notorious problem for their educational quality since a teacher with high-stress levels cannot concentrate properly and cannot give adequate results to the daily demands of his position. It can also harm the treatment of students and other university community members.
2. Recognizing possible stress situations in the teaching staff can be an essential investment for universities since it allows them to attack problems quickly and avoid possible future problems. In addition, this early detection can represent an improvement for teachers in their family environment, social context, and interaction with students.
3. Latin America is a region where university education presents essential nuances. For example, in some countries, the demands for the teacher to perform administrative activities exceed the academic demands, while in others, the academic demands are the most important. This diversity of criteria and forms may imply a university education that is not competitive in the global industry. Furthermore, it leads to possible stressful situations at the regional level due to the lack of impetus of universities to reach important achievements.
4. The measurement of stress in university environments can be an arduous but essential task since it can improve situations for teachers, allowing them to grow professionally and contribute significantly to university work.

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