Modelling, Measurement and Control D
Vol. 45, No. 1-4, December, 2024, pp. 62-66
Journal homepage: http://iieta.org/journals/mmc_d

Characterization of Technostress in University Students

Susana García-Vilches*, Lizeth Armenta-Zazueta, Diego René López-Jacobo, Celia Yaneth Quiroz-Campas

Maestría en Educación, Instituto Tecnológico de Sonora, Campus Sur, Navojoa Sonora 85860, Mexico

Corresponding Author Email: Susana.garcia@potros.itson.edu.mx

https://doi.org/10.18280/mmc_d.451-409

Received: 24 October 2024
Revised: 30 November 2024
Accepted: 12 December 2024
Available online: 31 December 2024

Keywords:
Technostress, TIC's, stress

ABSTRACT

Technostress in university students is a growing concern, affecting concentration and emotional health in daily life. There is a lack of studies in Mexico, so research is needed to understand and address this phenomenon. This project aims to determine the levels of technostress in university students in the Southern Sonora region to establish strategies for regulating the use of technology that are essential to mitigate its negative effects.

1. INTRODUCTION

Technostress can be understood as unfavorable aspects of attitudes, thoughts, behaviors, or body physiology caused directly or indirectly by ICTs [1]. Technostress is pointed out as the existence of different factors that intervene in anxiety, fatigue, and emotional and cognitive exhaustion due to the excessive use of technology [2]. Studies carried out with higher education students in Spain have found that during the COVID-19 pandemic, students have presented worrying levels of technostress [3].

A research work carried out by Galarza [4] to identify the levels of technostress in terms of affective dimensions (fatigue and anxiety), cognitive (beliefs of ineffectiveness in the use of technologies), and attitudinal (skeptical attitude towards technologies) in university students; a sample of 200 students was collected where its main results highlight that the most significant percentages are found in the "medium" and "low" levels for the affective and cognitive dimensions (inefficiency). Specifically, the indices of fatigue, anxiety and ineffectiveness were mostly located in the "medium" level with percentages of 47%, 42.5% and 37%, respectively, while the "low" level values were 27%, 30.5% and 36%, respectively. These findings provide a detailed view of the levels of technostress among the university students evaluated.

Nowadays, technologies, the use of the Internet and Mobile Devices (MDs) are part of the daily life of young students and they have adopted them as part of their lifestyle. A study applied to Sonoran students shows that 82% suffer from stress, manifesting behaviors with concentration and anxiety problems, and in physiological matters it causes sleep disorders and headaches [5]. This research work aims to determine the levels of technostress presented by university students in a region of Southern Sonora.

2. THEORETICAL AND CONCEPTUAL FRAMEWORK

Technostress is considered a contemporary phenomenon in the rise of our society, exerting a significant impact and harmful effects that extend to various sectors such as health and education. This negative experience is characterized by the excessive use of information and communication technologies, with a particular focus on common and ubiquitous devices of today, such as smartphones, tablets, laptops and desktop computers, smartwatches, and information and communication systems such as email platforms, social networks, video conferencing, and audio [6].

The implications of technostress are diverse and manifest at different levels: physiological, psychosocial, organizational, and social. In addition, this phenomenon can weaken human contact in all contexts (academic, work, family) [7]. From a broader social perspective, technology challenges established norms and patterns of behavior, generating negative emotional reactions such as anxiety and fear [8]. It is noted that technological stress is not new, on the contrary, it is increasingly recurrent in people within their personal and work lives. Technostress has psychological effects such as addiction, which generates some signs and symptoms such as irritability, nervousness, anguish, anxiety, headaches such as constant headaches, gastrointestinal disorders, states such as episodes of frustration, lack of concentration, back pain, sleep problems and insomnia [9].

According to the results obtained from the Technostress Behaviors Questionnaire by Coppari et al. [10] applied to students, the following levels of technostress were determined based on their four dimensions of study-work, family relationships (partner, children, friends), vital functions (eating, going to the bathroom, eating) and mood (emotions; frustration, anxiety, depression, addiction).

Low: An individual who maintains a healthy balance between technology use and daily responsibilities. They

maintain strong interpersonal relationships and manage their time online responsibly, ensuring that study, work and vital functions are not significantly affected. They have a strong relationship with technology and avoid negative emotional states related to excessive device use.

Medium: Relates to a person who experiences occasional interruptions in their daily activities due to using devices. Although they manage to fulfill their responsibilities, they can sometimes become distracted, which affects their concentration and productivity. They maintain interpersonal relationships but may generate occasional disconnection due to technological distractions. Sometimes, they have mild technostress symptoms, but they manage them effectively.

High: Identified as humans who face frequent interruptions in their daily activities due to excessive use of devices, significantly affecting their academic and work performance and emotional health. They perceive a significant disconnection in their interpersonal relationships and may face sleep patterns, eating and physical activity disturbances due to overdependence on technology. They suffer from severe symptoms of technostress, such as anxiety and irritability, which contribute significantly to their emotional distress.

3. METHODOLOGY

This quantitative, correlational, non-experimental and transactional study seeks to measure and analyze the relationship between variables without manipulating or intervening between them, determining the correlation between the use of ICTs and the levels of technostress in their natural environment. It was carried out with the participation of university students from the state of Sonora, with an age range between 17 years - 35 years. There is direct access to the students, therefore a part of the population was taken using a non-probabilistic convenience sampling, which facilitates the selection of participants for the study in a direct, efficient and representative way. Both genders are considered male and female, and belong from the first to the ninth semester of a degree in different educational programs of interest, such as Industrial Engineering and Education Sciences, in two universities in the southern region of Sonora.

The “Technostress Behavior Questionnaire” developed by Coppari et al. [10] demonstrates a high-reliability index with a Cronbach alpha coefficient α=.90, indicating satisfactory internal consistency. This instrument aims to evaluate the negative impact of using ICT in various areas, such as studies, work and social relationships, including areas such as family, friends and partner, as well as vital functions and health, including mood and emotions. It consists of 35 items distributed in four main dimensions: the first dimension addresses study and work (4 items), second dimension: focuses on family relationships, couples, children and friends (6 items), the third dimension evaluates vital functions such as eating and sleeping, among others (6 items), while the fourth dimension analyzes the impact on mood and emotions (19 items). Responses are established using a five-point Likert-type scale, where 5 = Always, 4 = Almost always, 3 = Sometimes, 2 = Almost never and 1 = Never.

It was carried out in different public higher education institutions in a region in the south of the state of Sonora (Mexico). To do so, authorization was requested from the corresponding authorities of the universities through a member of this research who will explain the nature and objectives of the study. Later, different means of communication, such as WhatsApp and institutional email, were used for the application, for which a form created on the Google page will be structured and the link will be sent to them so they can access the instrument.

Based on the ethical principles of research, the anonymous, confidential, and voluntary nature of participation is assured, and informed consent was also requested; this was done through an unavoidable acceptance item to continue with the questionnaire. Participants are also asked to fill in their sociodemographic characteristics such as: age, sex, semester, university and educational program to which they belong. And finally, they proceeded to answer the 35 items of the instrument.

A descriptive statistical analysis (frequency, percentage, mean, standard deviation) was performed on the sample and scales implemented; the reliability of the instrument will be ensured through the Cronbach Alpha test and Normality Tests with Asymmetry and Kurtosis values +/- 2 [11]. Subsequently, percentile calculations are used using technostress levels to determine the percentage that suffers from this phenomenon, considering that percentiles 10-30 are High technostress values (3), percentiles 40-60 are Medium technostress values (2) and percentiles 70-90 are Low technostress values (1).

4. RESULTS

Cronbach's alpha is a coefficient used to measure the internal consistency of a measurement instrument, such as a questionnaire or a scale. This coefficient is calculated using a general formula that estimates the instrument's reliability. It should be noted that reliability refers to the scores obtained from a questionnaire or scale applied to a specific group of people within a given sample [12].

Using the Cronbach's alpha criterion, the reliability of this instrument was composed of 35 items, and its dimensions were determined using the SPSS tool. This statistical program offers the option of evaluating how the alpha coefficient changes when eliminating an item from the instrument. When selecting this option, it was found that the first dimension of the instrument, "impact on study-work", which contained four items, did not adequately assess technostress since its alpha was low. Therefore, it was decided to eliminate this dimension and its four items. As a result, the instrument was left with 31 items distributed in 3 dimensions: family relationships, friends, partners, etc.; vital functions; and mood and emotions.

Table 1 shows the overall reliability of the instrument, with a Cronbach's alpha of 0.933 for the remaining 31 items, indicating high internal consistency. This value suggests that the instrument is reliable for measuring technostress in students.

Table 1. Reliability of the instrument

Cronbach's Alpha	N Elements
0.933	31

Table 2. Cronbach 's alpha by dimension

Dimension	Alpha
Impact on family relationships, partners, children and friendships	0.746
Impact on vital functions (eating, sleeping, etc.)	0.728
Impact on mood and emotions	0.908

Table 2 presents the reliability of each dimension of the instrument. The dimension "Impact on family relationships, the dimension "Impact on vital functions (eating, sleeping, etc.)" has an alpha of 0.728, suggesting acceptable reliability. Finally, the dimension "Impact on mood and emotions" has an alpha of 0.908, indicating high internal consistency. These Cronbach's alpha values per dimension confirm that each part of the instrument is suitable and reliable for assessing students' different aspects of technostress.

As part of the statistical analysis, verifying that the collected data have a normal distribution is essential. This facilitates the application of many analytical techniques and the precise interpretation of the results. The variable should show a behavior compatible with the normal distribution since this indicates a well-managed process where the necessary measures have been taken to reduce dispersion [13]. In this research, asymmetry and kurtosis were used, following the recommendations of the study [14], who mentioned that these values can be used to define the amplitude of the distribution and its symmetry. The criterion of Asymmetry and Kurtosis values of +/- 2 was used, as suggested by the study [11].

It can be observed in Table 3 where its first dimension in family relationships, friends, partner, etc., presents an asymmetry value of 0.962, indicating a bias to the right; most students experience a low impact on their relationships, but some report a much greater impact; the kurtosis of 1.428 suggests a distribution with more extreme values than a normal distribution, indicating that some students report significantly high or low impacts. In the second dimension of life functions (eating, toileting, etc.), the skewness value is 0.209, close to 0, suggesting a fairly symmetric distribution with most students reporting similar levels of impact. At the same time, the kurtosis of -0.073 indicates a normal-like distribution, with a moderate amount of outliers. Finally, in the dimension of mood and emotions, the skewness value is 0.974, indicating a right skew; most students have a low or moderate impact on their mood and emotions, but some experience a significant impact; the kurtosis of 1.494 reflects a distribution with more outliers, with some students reporting an extremely high impact on their mood and emotions.

Table 3. Test of normality in dimensions

Dimension	Asymmetry	Kurtosis
Impact on relationships family, partner, children, and friends	0.962	1.428
Impact on functions vital (eating, sleeping, etc.)	0.209	-0.073
Impact on the mood and emotions	0.974	1.494

Table 4. Normality test for the technostress levels variable

Dimension	Asymmetry	Kurtosis
Technostress levels	0.755	1.097

Additionally, in Table 4, the variable considered on the levels of technostress, in general, shows an asymmetry value of 0.755, indicating a distribution skewed to the right, and a kurtosis of 1.097, suggesting the presence of more extreme values than in a normal distribution. The percentiles of the Technostress Behaviors Questionnaire by Coppari et al. [10] were used considering the responses of the participants in this study to build the following levels of technostress based on its three dimensions: family relationships (partner, children, friends), vital functions (eating, going to the bathroom, eating) and mood (emotions; frustration, anxiety, depression, addiction).

Table 5 presents the technostress values corresponding to the percentiles selected: Level low: the percentiles 10 and 30 indicate levels low technostress, with values of 1.41 and 1.82 respectively; these values indicate that the Participants experience technostress minimum. Medium level: the percentiles 40 and 60, with values of 1.95 and 2.22 where they represent a medium level of technostress, indicating an experience of technostress moderate in the participants. High level: the percentiles 70 and 90, with values of 2.59 and 2.90 indicate that Participants report a significant level of technostress.

Table 5. Test of normality in dimensions

Percentiles	Values
Low	
10	1.41
30	1.82
Half	
40	1.95
60	2.22
High	
70	2.59
90	2.9

Table 6 breaks down the Technostress levels by dimension specific: Impact on relationships family, friends, partner, etc.: Low: the percentiles 10 and 30, with values of 1.17 and 1.50, respectively, show that most students experience an impact low in their relationships. Medium: the percentiles 40 and 60, with values of 1.67 and 2.00, indicate a moderate impact in this dimension. High: the 70th and 90th percentiles, with values of 2.17 and 2.95, indicate a high impact, with some students reporting difficulties significant in their relationships.

Table 6. Technostress levels by dimension

Dimensions	Percentiles					
	10	30	40	60	70	90
Impact on family relationships, friends, partners, etc.	1.17	1.5	1.67	2	2.17	2.95
Impact on vital functions (eating, going to the bathroom, etc.)	1.5	2	2.17	2.67	2.83	3.33
Impact on mood and emotions	1.32	1.63	1.79	2.05	2.21	2.84

Impact on functions vital eating, going to the bathroom, etc.): Low: the percentiles 10 and 30, with values of 1.50 and 2.00, indicates that most of the students have an impact low in their vital functions. Medium: the percentiles 40 and 60, with values of 2.17 and 2.67 indicate an impact moderate in this dimension. High: the percentiles 70 and 90, with values of 2.83 and 3.33 indicate a high impact, reflecting issues significant in the functions vital of some students.

Impact on the mood and emotions: Low: the percentiles 10 and 30, with values of 1.32 and 1.63 belong to an impact low in the mood and the emotions. Medium: the percentiles 40 and 60, with values of 1.79 and 2.05 represent an impact moderate in this dimension. High: the 70th and 90th percentiles, with values of 2.21 and 2.84, indicate a high impact, with some students experiencing difficulties emotional significant. These

Technostress level constructions are essential to detect the need for interventions specific to address he technostress, particularly in those students that present the levels further high stress related to technology.

5. CONCLUSIONS

5.1 Discussion

This study's main results reveal that most university students in the sample presented a medium or high level of technostress. This situation represents an opportunity to develop appropriate strategies to help mitigate technostress and reduce the negative effects it causes in many students, such as anxiety and eating disorders, depression and social well-being problems. These findings coincide with the results of the study [15], who found that more than 50% of their students present medium, high and severe levels of technostress. In addition, studies [3, 16] mention that their students also show worrying levels of technostress, which causes physical problems and behavioral tension.

Another significant finding coincides with the study [17] that as technostress increases in students, so do the negative impacts on their family relationships, friendships, and relationships, as well as severe problems in their vital functions, such as eating and using the bathroom, in addition to affecting their mental health, mood, and emotions. On the other hand, Estrada Araoz et al. [16] highlight in their research that technostress has caused symptoms such as anxiety, physical problems, and behavioral tension. These studies underline the importance of detecting and addressing technostress in students, as it can affect their quality of life, psychological well-being, and academic performance.

5.2 Conclusion

It is essential to focus research on this topic of interest to better understand and address the specific challenges Mexican university students face about technology use. Table 7 shows that in this study it can be concluded regarding the levels of technostress in higher education students, considering 402 participants in this research to determine the level of technostress it was found that more than 50% of university students have a medium and high level of technostress, which implies that the person sometimes interrupts their daily activities due to the use of devices, sometimes they can get distracted, which affects their concentration and productivity. They maintain certain interpersonal relationships, but may generate occasional disconnection due to technological distractions. And they may suffer from severe symptoms of technostress, such as anxiety and irritability, which contribute significantly to their emotional discomfort.

Table 7. Technostress levels (N=402)

Level	N	%
High	123	30.60%
Half	117	29.10%
Low	162	40.30%

The need to address the negative impact of technology on the emotional health and well-being of college students is evident. Strategies are required to promote balanced use and foster self-regulation skills, which are essential to mitigate technostress. Although government programs have been implemented in Mexico to integrate technology into daily life, the lack of scientific studies on technostress in the Mexican population is notable [18].

The factors influencing technostress (family relationships, life functions, mood and emotions) revealed a clear association: a greater negative impact is observed in these areas as technostress increases. This study provides an in-depth understanding of technostress among university students and its implications for mental health and academic performance. Most participants showed medium to high levels of technostress, indicating that digital technologies have a noticeable impact on their daily lives. This is reflected in the interruption of daily activities, distractions that affect concentration and productivity, and symptoms of stress that affect students' performance.

5.3 Recommendations

Universities must implement training programs in information and communication technologies (ICT) aimed at students from the moment they enter the institution, as mentioned [19]. These programs should focus on the efficient and healthy use of ICT, covering technical aspects and strategies to manage time and avoid technological overload. Training should include educational platforms, online collaboration tools, and techniques to minimize distractions and maximize student productivity.

Collaboration with families and local communities can be key to addressing technostress. Universities should engage families in awareness and education programs on technostress, promoting a balanced use of technology at home. In addition, they can establish partnerships with community organizations to develop initiatives that support students' digital well-being.

To continue exploring this line of research that addresses human adaptation to continuous technological innovations, which are increasingly being integrated naturally into all daily activities. These include implementing time management strategies, conscious use of technology, and training programs to improve digital skills and reduce technological dependence.

It has been observed that the technological support provided by ICT areas has become a significant advantage in the educational process, minimizing the technological stress that both students and teachers could experience. Collaboration between educators and technology experts has made it possible to optimize the teaching environment, thus creating favorable conditions for effective learning and reducing the barriers that technostress could impose on the path to digital education [20].

Finally, it is important for universities to continually evaluate and adjust their policies related to ICT use and technostress management. Policies should be flexible and adapt to the changing needs of students and technological advances. Student feedback should be integral to the evaluation process, ensuring that the policies and strategies implemented are effective and relevant.

REFERENCES

[1] Cuervo Carabel, T., Orviz Martínez, N., Arce García, S., Fernández Suárez, I. (2018). Technostress in communication and technology society: Scoping literature review from the web of science. Archivos de

Prevencion de Riesgos Laborales, 1: 18-25. https://doi.org/10.12961/aprl.2018.21.1.04

[2] Rodríguez-Vásquez, D.J., Totolhua-Reyes, B.A., Domínguez-Torres, L., Rojas-Solís, J.L., La Rosa-Díaz, D. (2021). Tecnoestrés: Un análisis descriptivo en docentes universitarios durante la contingencia sanitaria por COVID-19 (Technostress: An exploratory study in university professors during the health contingency due to COVID-19). Enseñanza en Investigación en Psicología, 3(2): 225-237.

[3] Penado Abilleira, M., Ríos-de-Deus, M.P., Rodicio-García, M.L., Mosquera-González, M.J., Rego-Agraso, L. (2021). Objective technostress in university students during the COVID-19 pandemic. In Digital Media and Teaching Methodologies: Improving Education Through Comprehensive Learning, pp. 256-267. Madrid, España: Adaya Press. https://www.adayapress.com/wp-content/uploads/2021/06/medidoc26.pdf.

[4] Galarza, F. (2018). New communication technologies (ICT): their relationship with technostress in university students Bachelor's thesis, Universidad Siglo 21. https://repositorio.21.edu.ar/bitstream/handle/ues21/16463/GALARZA%20FRANCINA.pdf?sequence=1.

[5] Leticia Guadalupe, P.M., Valenzuela Blanca, A. (2018). Academic stress and coping strategies in students of the social sciences division of the University of Sonora. Its impact on the quality of education. Bachelor's thesis, University of Sonora.

[6] Rey-Merchán, M. del C., Vargas-Jimena, J.M., López-Arquillos, A. (2022). Tecnoestrés como riesgo psicosocial en las relaciones laborales. TRABAJO. Revista Iberoamericana de Relaciones Laborales, 39: 4-13. https://doi.org/10.33776/trabajo.v39i.4883

[7] Calderón Loeza, G.Y., Sánchez Escobedo, P. (2021). Impact of the use of mobile devices on the learning of adolescent students. Emerging Trends in Education. https://doi.org/10.19136/etie.a3n6.4040

[8] Bondanini, G., Giorgi, G., Ariza-Montes, A., Vega-Muñoz, A., Andreucci-Annunziata, P. (2020). Technostress dark side of technology in the workplace: A scientometric analysis. International Journal of Environmental Research and Public Health, 17(21): 8013. https://doi.org/10.3390/ijerph17218013

[9] Salazar-Concha, C., Ficapal-Cusí, P., Boada-Grau, J. (2023). Technostress. Evolution of the concept and its main consequences. Teuken Bidikay-Latin American Journal of Research in Organizations, Environment and Society, 11(17): 165-180. https://doi.org/10.33571/teuken.v11n17a9

[10] Coppari, N.B., Bagnoli, L., Codas, G., López, H., Martínez, Ú., Martínez, L., Montanía, M. (2018). Validity and reliability of the technostress questionnaire in Paraguayan students. Perspectives in Psychology: Journal of Psychology and Related Sciences, 15(2): 40-55. https://www.redalyc.org/articulo.oa?id=483558849004.

[11] Valdés Cuervo, A.A., García Vázquez, F.I., Torres Acuña, G.M., Urías Murrieta, M., Grijalva Quiñones, C.S. (2019). Measurement in educational research with the support of SPSS and AMOS. Technological Institute of Sonora. https://www.researchgate.net/profile/Fernanda-Garcia-Vazquez/publication/341622791_Medicion_en_Investigacion_Educativa_con_Apoyo_del_SPSS_y_el_AMOS/links/5ef6118f92851c52d6fdf302/Medicion-en-Investigacion-Educativa-con-Apoyo-del-SPSS-y-el-AMOS.pdf.

[12] Rodriguez-Rodriguez, J., Reguant-Álvarez, M. (2020). Calculate the reliability of a questionnaire or scale using the SPSS: Cronbach's alpha coefficient. REIRE Rev. D'innovació I Recer. En Educ, 13: 1-13. https://doi.org/10.1344/reire2020.13.230048

[13] Cabrera, G., Zanazzi, J.F., Zanazzi, J.L., Boaglio, L. (2017). Comparison of powers in statistical tests of normality, with sparse data. Rev. FCEF N, 4(2): 47-52.

[14] Rodriguez, D., Hernandez, J., Simbaqueva, O. (2015). Statistical analysis of the atmospheric clarity index for the city of Bogota. Scientific Journal, 21(1): 65-70. https://doi.org/10.14483/udistrital.jour.RC.2015.21.a6

[15] Cruz Covarrubias, L.P., Aguilar Pérez, P. (2022). Transition to virtual learning and its effects: technostress in university students in the context of COVID-19. Revista Panamericana De Pedagogía, 34: 52-71. https://doi.org/10.21555/rpp.vi34.2581.

[16] Estrada Araoz, G.E., Gallegos Ramos, N.A., Huaypar Loayza, K.H., Valverde Paredes, Y., Quispe Herrera, R. (2021). Technostress in students of a public university in the Peruvian Amazon during the COVID-19 pandemic. Revista Brasileira De Educação Do Campo, 6: e12777. https://doi.org/10.20873/uft.rbec.e12777

[17] Oladosu, K.K., Alasan, N.J., Ibironke, E.S., Ajani, H.A., Jimoh, T.A. (2020). Learning with smart devices: Influence of technostress on undergraduate students' learning at university of Ilorin, Nigeria. International Journal of Education and Development using Information and Communication Technology, 16(2): 40-47.

[18] Villavicencio-Ayub, E., Ibarra Aguilar, D.G., Calleja, N. (2020). Technostress in the Mexican population and its relationship with sociodemographic and labor variables. Psicogente, 23(44): 27-53.

[19] Suria, R. (2023). Use of technologies, technostress, and their influence on academic performance in university students. Anuario de Psicología/The UB Journal of Psychology, 53(2): 33-42. https://doi.org/10.1344/ANPSIC2023.53/2.4

[20] Montes de Oca, J., Alcántara, S., Domínguez, A. (2021). Technostress in university teachers and students: Measurement in times of COVID-19. RILCO Journal of Sustainable Development, Business, Entrepreneurship and Education, 3(16): 98-109. https://dialnet.unirioja.es/servlet/articulo?codigo=8569300.