










“Technostress, transformational leadership, and academic performance of university students in South Colombia”

AUTHORS	Juan Manuel Andrade Navia 
	 Elías Ramírez Plazas 
	 Juan Camilo Ramírez 
	 Diego Bermeo Castro 
	
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Juan Manuel Andrade, Ph.D. in Agroindustry, Professor, Faculty of Economics and Management, Universidad Surcolombiana [Surcolombian University], Colombia. (Corresponding author)

Elías Ramírez Plazas, Ph.D. in Management, Professor, Faculty of Economics and Management, Universidad Surcolombiana [Surcolombian University], Colombia.

Juan Camilo Ramírez, M.Sc. in Project Management, Professor, Faculty of Economics and Management, Universidad Surcolombiana [Surcolombian University], Colombia.

Diego Bermeo Castro, M.Sc. in Management, Professor, Faculty of Economics and Management, Universidad Surcolombiana [Surcolombian University], Colombia.



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Juan Manuel Andrade (Colombia), Elías Ramírez Plazas (Colombia),
Juan Camilo Ramírez (Colombia), Diego Bermeo Castro (Colombia)

TECHNOSTRESS, TRANSFORMATIONAL LEADERSHIP, AND ACADEMIC PERFORMANCE OF UNIVERSITY STUDENTS IN SOUTH COLOMBIA

Abstract

The study aims to establish the moderation of transformational leadership in the relationship between technostress and academic performance of university students during the COVID-19 pandemic. This study was of a quantitative nature with the support of the deductive method and of an explanatory correlational type. Technostress was measured with an instrument adapted from the RED-Technostress scale; transformational leadership was measured with an instrument adapted from the short version of the Multifactor Leadership Questionnaire 5X model; and academic performance was measured with a scale developed by the authors. A non-probabilistic convenience sampling was used, and the constructs were evaluated using SEM and SPSS AMOS software. In total, 245 questionnaires were administered. The results show a negative and significant relationship between transformational leadership and technostress (-0.338 ; $p < 0.00$), a positive and significant relationship between transformational leadership and academic performance (0.472 ; $p < 0.00$), a negative and significant direct relationship between technostress and academic performance (-0.553 ; $p < 0.00$), and moderation of transformational leadership of the relationship between technostress and academic performance (-0.159 ; $p < 0.00$). Thus, teacher leadership moderates the relationship between technostress and students' academic performance, i.e., a high level of transformational leadership practices of teachers allows a lower impact of technostress and its manifestations on the students' academic performance. Likewise, technostress manifested by students was relatively low, lower than the levels expected and evidenced in other studies carried out in the business environment, possibly explained by their age and their being in a context of continuous learning.

Keywords

technostress, academic performance, transformational leadership, students, higher education, Colombia, COVID-19

JEL Classification

A22, I23, O15

INTRODUCTION

At the end of 2019, COVID-19 appeared in China for the first time; later, it spread worldwide, becoming a highly contagious pandemic (Mojica & Gonzales, 2020). Faced with this situation and on the recommendation of the World Health Organization, the countries adopted collective and mandatory confinement policies to contain it (Jung & Jun, 2020). The emergence of the pandemic interrupted the normal development of processes such as education and implied the adoption of practices related to virtuality by educational institutions (García, 2021).

In the case of higher education, the existence and previous management of digital platforms by the institutions probably influenced the fact that their adaptation to an educational process mediated by technology was less traumatic (Crawford et al., 2020). The countries were

generally oriented toward non-face-to-face education with alternatives such as virtual, remote, and distance education, depending on the resources and infrastructure available in each region (World Bank, 2020). This “new normal” was characterized by the continuity of education linked to technological means with the use of platforms (Krishnamurthy, 2020) of a different nature, such as Zoom, Teams, Meet, Moodle, Classroom, WhatsApp, Email, and YouTube, among others (Manrique et al., 2021).

Bedoya-Dorado et al. (2021) highlight that Colombia, with more than five months of rigorous restrictions on mobility and the closure of companies and public institutions, had the longest period of mandatory isolation or quarantine. For this reason, the Ministerio de Educación Nacional (2020) generated the guidelines for universities to develop virtual education processes, while the Ministerio del Trabajo (2020) did the same based on the new work modalities, including university teachers and administrators.

Indeed, higher education entered a virtual world to which students and teachers had to adapt. Although some people quickly adapt to technological demands due to their capabilities (Jiménez, 2010), others experience negative feelings and emotions in their interaction with technologies (Shu et al., 2011) expressed in psychosocial and physical risks such as fear, anxiety, resistance, and fatigue (Dias & Costa, 2008) strongly associated with stress (Jiménez, 2010). After the pandemic and the massive migration toward the use of information technologies in many areas of daily life, including higher education and the forced use of technology by students and teachers (Apaza et al., 2020), the phenomenon of technostress and its impact on people’s behavior have gained importance (Bencsik & Juhász, 2023).

Multiple studies have focused their attention on the consequences of technostress on individual and collective productivity in companies (Fuglseth & Sørebo, 2014; Salazar-Concha et al., 2022) and in personal lives of collaborators (Salo et al., 2019). However, few studies have analyzed this relationship in university students (Salazar-Concha et al., 2022), especially in the context of Latin American countries.

Given this context, questions arise about the dynamics of the relationship between technostress and the academic performance of university students in an emerging country, especially by analyzing the way and extent to which phenomena such as teacher leadership can affect this relationship positively or negatively.

1. LITERATURE REVIEW AND HYPOTHESES

The negative consequences resulting from the increasing interaction of people with technology are abundant in the specialized literature (Brillhart, 2004). One of these refers to the phenomenon of technostress, defined by Tarafdar et al. (2007, 2010, 2015) as the constant attempts of the individual to cope with constantly evolving technologies and the changing cognitive and social demands associated with their use in the context of constant connectivity, information overload, periodic system updates, constant uncertainties, continuous relearning, job demands, and technical drawbacks of information systems and technology architecture. For their part, Weil and Rosen (1997) consider technostress to be the set of negative feelings, thoughts, and behaviors of people derived,

directly or indirectly, from their interaction with technology.

In any case, the matter does not stop there, and it becomes more complicated when it is taken into account that people adopt and depend more and more on information and communication technologies. Technologies acquire a frenetic pace of evolution and sophistication that creates real gaps between the required technological capacities and the actual capacities of people; cultural changes are associated with the frequency and mode of use of technologies (Thomé et al., 2007).

Tarafdar et al. (2007) consider five sources of technostress:

- 1) The adoption of information and communication technology without a sufficiently ro-

bust support plan based on an organizational diagnosis.

- 2) Information overload due to the inability to store it correctly.
- 3) The invasion of people's privacy by technology due to their availability to attend to matters, which prevents them from mentally escaping their obligations and generates adverse feelings such as exhaustion and frustration.
- 4) The technological uncertainty associated with the concern generated by the possibility of being replaced by someone with greater technological skills.
- 5) The insecurity generated by the constant evolution and change of technology, which frequently forces people to be attentive to the new demands of technology.

However, studies report variable behavior in technostress in individuals according to characteristics such as age, gender, and education (Stadin et al., 2016), so it can be inferred that the phenomenon develops faster or slower within the framework of these demographic variables.

On the other hand, leadership has been defined as an individual property and as a process. As a process, it corresponds to the influence exerted on a group of people to achieve specific objectives, while as a property, it refers to a set of attributes that a person has to influence others (Jago, 1982). The concept of transformational leadership was first coined by Burns (1978) and later developed by Bass (1985) as one of the most effective types of leadership for motivating, developing, and performing followers. In other words, transformational leadership stands out because it enhances followers' trust, morality, and sacrifice (Gaskin et al., 2023).

Bass (1985) stated that transformational leadership comprises four dimensions. The idealized influence consists of leading by example with behavior directed with high moral and ethical standards to earn the respect of followers and obtain their loyalty; the inspiring motivation lies in inspiring followers to achieve goals and future states based

on a vision of the future shared by the leader (Bass & Avolio, 1993; Bono & Judge, 2004). Bass (1998) considers that the mixture of the above dimensions makes up the leader's charisma. The third dimension corresponds to intellectual stimulation focused on challenging followers to approach problems in different, new, and unique ways for their resolution; that is, stimulating to think divergently and design innovative strategies. There are also individualized considerations oriented toward the recognition of the needs of each follower as unique and, therefore, to accompany their development and growth individually (Bass & Avolio, 1993; Bono & Judge, 2004).

In this regard, transformational teacher leadership is expected to be characterized by impacting, improving, increasing, and recognizing its responsibility in training people and, therefore, stimulating said people to achieve better teaching and learning results (Li et al., 2020). In other words, transformational leadership happens when teachers get involved in the lives of their students and positively influence their performance and motivation in multiple ways, such as by granting rewards when they achieve their goals, collaborating with strategies to achieve their achievements, or providing an uplifting and pleasant environment for training (Qadan et al., 2023).

Regarding academic performance, Caldera et al. (2007) considers multiple interpretations of this concept, making it one of the most prolific fields of knowledge studies due to the constant concern of multiple sectors of society (Xun & Sun, 2023). Therefore, reaching a consensus on the term does not correspond to the objectives of this study. Thus, it limited itself to recognizing academic performance as the level of knowledge, skills, and abilities that the student acquires during the teaching-learning process, generally valued by teachers based on evaluation activities designed according to the objectives of the academic programs in which different courses are offered (Barbosa, 1975).

For the present study, the average final grade obtained by university students in each subject or course developed in their respective academic semesters was considered academic performance (Alducin-Ochoa & Vásquez-Martínez, 2017).

As mentioned above, technostress is a feeling derived from a poor adaptation of people to technology and its constant changes (Jena, 2015), so within the learning framework, there is evidence of the consequences it generates in students. University students' continued use of information and telecommunications technologies, including technostress (Oladosu et al., 2020).

In that order, learning at any level implies constant interaction between teachers and students (Ding et al., 2023), so teacher leadership is essential to prevent or stimulate the appearance of stressors. For Tepper (2000), the behavior of leaders is one of the most common and frequent generators of stressors in organizations, so abusive and exhausting behavior stimulates the appearance of stress. Similarly, poor, autocratic, and authoritarian leadership behaviors are associated with stress (Peiró, 2004). Based on the above, a link can be inferred between the leadership style of teachers and the technostress experienced by university students, to the extent that teacher behavior and conduct generate the conditions for the development of the learning process.

Likewise, the literature suggests that leaders in organizations have the tools to inhibit technostress, that is, mechanisms that allow the levels of tension experienced by people to decrease in their interaction with technology (Fuglseth & Sørebo, 2014). Ragu-Nathan et al. (2008) classify them into three types: provision of technical support, bringing technologies closer to people, and encouraging people's participation in technology-related processes. Therefore, the practices of the leader or manager can increase or decrease the risk of experiencing technostress since they are directly involved with the stressors described above; that is, a leader who provides support can attenuate technostress levels (Murrell et al., 1992).

On the other hand, technostress is a feeling accompanied by physical and mental experiences such as fatigue and exhaustion (Brooks & Calif, 2017), which could severely decrease people's performance (Ayyagari et al., 2011). Qi (2019) considers that, in the case of university students, technostress can cause burnout, decrease learning commitment, and reduce academic performance. Likewise, Wang et al. (2020) found empirical ev-

idence of a regular prevalence of technostress in public university students and its role as a generator of exhaustion, which in turn negatively affected their perceived performance. Finally, multiple authors recognize that leadership in educational processes affects the quality of teaching-learning and educational results, including academic performance (Du Plessis, 2013).

In summary, from the literature review, a relationship can be inferred between the phenomenon of technostress and the academic performance exhibited by university students due to the multiple consequences generated by stress, such as physical and emotional exhaustion, negative feelings, and apathy in people, which could be linked to the decrease in the performance of university students. This relationship can be enhanced or attenuated by the action or omission of transformational leadership teaching practices.

Therefore, the objective of this study was to evaluate the relationship between technostress and students' academic performance, moderated by transformational teacher leadership practices, in undergraduate programs of public and private institutions in a peripheral region of southern Colombia during the COVID-19 pandemic.

Consequently, this study proposes the following hypotheses:

- H1: *There is a negative and significant relationship between transformational teacher leadership and students' perceived technostress in higher education institutions.*
- H2: *There is a positive and significant relationship between transformational teacher leadership and students' academic performance in higher education institutions.*
- H3: *There is a negative and significant relationship between technostress and students' academic performance in higher education institutions.*
- H4: *The relationship between technostress and students' academic performance is moderated by transformational teacher leadership practices in higher education institutions.*

2. METHODS

This study was developed under the quantitative paradigm, using the deductive and explanatory correlational method to determine the causes and correlations between the constructs of transformational leadership, technostress, and academic performance (Creswell & Cheryl, 2017). In that order, since it is a study of a quantitative nature, the variables studied were analyzed and quantified in numerical data to evaluate the results using statistical techniques to verify the hypotheses.

Study participants included university students from multiple academic programs at the undergraduate level from public and private higher education institutions in a peripheral region of southern Colombia. The inclusion criteria corresponded to students of legal age and active during the years 2020, 2021, and 2022 who reported the use of technologies (Google Meet, Zoom, WebEx, and Microsoft Teams, among others) to develop their academic training. The sampling used was non-probabilistic, specifically convenience sampling.

The study information was collected between January and April 2023. To address the students, a letter was previously sent to the heads and coor-

dinators of the academic programs of the selected higher education institutions, requesting authorization to apply physically for the respective surveys. A survey-type instrument of forty-six (46) questions was designed to measure the respective variables. The constructs were measured using a five-point Likert scale ranging from “strongly disagree” (1) to “strongly agree” (5). To measure the technostress variable, the study used the RED-Technostress scale proposed by Llorens et al. (2011) and adapted to the Latin American university student context by Eidman and Felleau (2021). For the transformational leadership variable, the items were taken from the Multifactor Leadership Questionnaire 5X short version (MLQ-5X) by Bass and Avolio (1995) and adapted for the Latin American university teaching context by Pérez et al. (2015). For the academic performance variable, the items were adapted from an own scale developed and validated by the authors.

The treatment and analysis of the information were carried out in two phases. First, the reliability and validity of the hypothesized model were established. The instrument’s reliability was established with Cronbach’s Alpha for each variable. At the same time, the validity was carried out with confirmatory factor analysis (CFA) for multidimensional variables such as transforma-

Table 1. Operationalization of variables

Variable	Dimensions	Questions
Technostress (TE) (Eidman & Felleau, 2021; Llorens et al., 2011)	Skepticism	1. With the passage of time, ICT interests me less and less.
		2. I feel less and less involved in the use of ICT.
		3. I feel more and more mistrustful of the contribution of ICT to my study.
		4. I doubt the results of studying through ICT.
	Fatigue	5. I find it difficult to relax after a day of studying using ICT.
		6. When I finish studying with ICT, I feel exhausted.
		7. I am so tired when I finish studying with ICT that I cannot do anything else.
		8. I find it difficult to concentrate after studying with ICT.
	Anxiety	9. I feel tense and anxious when studying with ICT.
		10. It scares me to think that I can destroy a large amount of information due to the inappropriate use of ICT.
		11. I hesitate to use ICT for fear of making mistakes.
		12. Studying with ICT makes me feel uncomfortable, irritable, and impatient.
	Inefficiency	13. I consider that I am ineffective in using technologies.
		14. It is difficult for me to study through ICT.
		15. People consider that I am ineffective in using ICT.
		16. I am insecure that I will finish my tasks well when I use ICT.
	Addiction	17. I think I overuse ICT in my daily life.
		18. I continuously use ICT, even outside my study hours.
		19. I am constantly busy with ICT (for example, checking email, looking for information on the internet, etc.) even outside of study hours.
		20. I have anxiety if I do not have access to ICT (Internet, email, telephone, social networks, etc.).
21. An internal impulse compels me to use them anywhere and anytime.		
22. I dedicate more time to ICT than being with friends, family, hobbies, etc.		

Table 1 (cont.). Operationalization of variables

Variable	Dimensions	Questions
Transformational leadership (LTF) (Bass & Avolio, 1995; Pérez et al., 2015)	Idealized influence	Attributed 1. The teacher talks about the importance of being a person with values and beliefs. 2. The teacher expresses the importance of having a sense of duty or responsibility. 3. The teacher considers the ethical and moral consequences of his decisions. 4. The teacher stresses the importance of respect for others and teamwork. 5. I feel proud that he is my teacher.
		Conduct 6. For the sake of his students, he goes beyond his own interests. 7. The teacher acts in a way that earns my respect. 8. I consider the teacher to be trustworthy and safe.
	Motivational inspiration	9. The teacher talks enthusiastically about the future. 10. The teacher talks enthusiastically about the goals to be achieved. 11. The teacher proposes a vision of the future that motivates us. 12. The teacher expresses confidence that the students will achieve the goals.
	Intellectual stimulation	13. The teacher values criticism, valuing it if it is appropriate. 14. The teacher seeks us to analyze different points of view when we must solve problems. 15. The teacher gets him to see the problems from different points of view. 16. The teacher suggests new ways of seeing how to finish homework.
	Individual consideration	17. The teacher treats us individually and not as one more. 18. The teacher dedicates enough time to attend to the students individually. 19. The teacher considers that we have different needs, abilities, and aspirations. 20. The teacher helps me develop my strengths or strong points.
Academic performance (RA)	Final grades	1. My final grade point average for the term was passing. 2. I satisfactorily passed each of the subjects studied. 3. I had problems with the final grades of some subjects. 4. My grades were in line with my academic performance.

tional leadership and technostress. AFC was not performed for the academic performance variable because it is a one-dimensional variable.

In the second phase, the constructs were evaluated using structural equation modeling (SEM) to deepen the relationship between the constructs and the mediation relationship. Structural equation modeling provides better estimates for evaluating complex relationship frameworks involving mediations (Hair et al., 2021).

3. RESULTS

The sociodemographic results related to gender, age, and seniority at the university are shown in Table 2. Of the 245 valid questionnaires applied,

69.4% (170) were female and 30.6% (75) were male. Regarding age, the category between 18 and 25 years stands out with 81.6% (180), followed by the category of 25 and 30 years with 13.9% (34), and, finally, the category over 30 years with 4.50% (11). Likewise, in the one related to the seniority of the students, the majority corresponded to the category between 3 and 5 years with 49.4% (121), followed by the categories: between 1 and 2 years with 27.8% (68), less than 1 year with 18.4% (45), and more than 5 years with 4.50% (11).

Table 3 presents the descriptive statistics of the variables studied. The averages of the three variables analyzed (technostress, transformational leadership, and academic performance) indicate low values, especially in the case of technostress,

Table 2. Demographic characteristics

Demographic variables	Category	Frequency	Percentage
Gender	Female	170	69.4
	Male	75	30.6
Age	18 and 25 years	180	81.6
	25 and 30 years	34	13.9
	More than 30 years	11	4.50
Antiquity	Less than 1 year	45	18.4
	1 and 2 years	68	27.8
	3 and 5 years	121	49.4
	More than 5 years	11	4.50

which obtained an average rating of less than three on a five-point scale. The transformational leadership scales obtained an average of 3.69 and academic performance reached an average of 3.56, evidencing medium levels, with a downward trend, of qualification in the two variables mentioned. The above evidence indicates a low level of technostress in students and discrete levels of transformational leadership exhibited by teachers of undergraduate programs in public and private universities in the region. Likewise, the level of academic performance presented was low, exposing a student's performance to certain drawbacks.

Table 3. Descriptive statistics

Variables	Sample	Average	Standard deviation
Technostress	245	2.88	1.05
Transformational leadership	245	3.69	0.94
Academic performance	245	3.56	0.95

The reliability of the scales used in the study was evaluated with Cronbach's Alpha (α) and composite reliability (CR) (see Table 4). Cronbach's Alpha for the Technostress scale ($\alpha = .903$) and

Transformational Leadership ($\alpha = .940$) were excellent. In contrast, for the Academic Performance scale ($\alpha = .687$), it was acceptable (George & Mallery, 2003). Likewise, the results of the composite reliability were within the recommended range: 0.70-0.90 (Hair et al., 2021).

On the other hand, the values of the average extracted variance (AVE) obtained were greater than 0.5 for the dimensions: skepticism (.506), fatigue (.541), anxiety (.505), inefficacy (.510), addiction (.545), idealized influence (.502), motivational inspiration (.624), intellectual stimulation (.505), individual consideration (.555), and final grades (.500). Likewise, the factor loadings of the items were between 0.583 and .924, some very close and most above the recommended value of 0.6 (Hair et al., 2021). Therefore, there are no problems with convergent validity.

In the development of the research, a Confirmatory Factor Analysis (CFA) was carried out for the multidimensional variable of technostress. As can be seen in Figure 1, the relationships of the construct with the dimensions of skepticism (E), fatigue

Table 4. Reliability and validity

Variable	Dimension	Item	Factor loading (β)	Cronbach's alpha, if suppressed (α)	Compound reliability (CR)	Average variance extracted (AVE)
Technostress ($\alpha = .903$)	Skepticism ($\alpha = .786$)	TE1	.764	.887	.802	.506
		TE2	.791	.888		
		TE3	.641	.888		
		TE4	.636	.886		
	Fatigue ($\alpha = .854$)	TE5	.784	.886	.824	.541
		TE6	.678	.886		
		TE7	.731	.887		
		TE8	.746	.886		
	Anxiety ($\alpha = .795$)	TE9	.887	.887	.799	.505
		TE10	.589	.886		
		TE11	.705	.887		
		TE12	.626	.887		
	Inefficiency ($\alpha = .829$)	TE13	.744	.887	.804	.510
		TE14	.605	.887		
		TE15	.654	.888		
		TE16	.834	.887		
	Addiction ($\alpha = .831$)	TE17	.854	.887	.876	.545
		TE18	.577	.887		
		TE19	.797	.888		
		TE20	.775	.886		
		TE21	.697	.890		
		TE22	.698	.891		

Table 4 (cont.). Reliability and validity

Variable	Dimension	Item	Factor loading (β)	Cronbach's alpha, if suppressed (α)	Compound reliability (CR)	Average variance extracted (AVE)
Transformational leadership ($a = .940$)	Idealized Influence ($a = .880$)	LTF1	.655	.889	.888	.502
		LTF2	.772	.890		
		LTF3	.827	.887		
		LTF4	.619	.886		
		LTF5	.677	.886		
		LTF6	.633	.887		
		LTF7	.671	.888		
		LTF8	.785	.889		
	Motivational inspiration ($a = .865$)	LTF9	.728	.889	.867	.624
		LTF10	.924	.887		
		LTF11	.790	.888		
		LTF12	.700	.887		
	Intellectual stimulation ($a = .797$)	LTF13	.875	.887	.800	.505
		LTF14	.646	.889		
		LTF15	.598	.888		
		LTF16	.695	.889		
	Individual Consideration ($a = .798$)	LTF17	.846	.888	.831	.555
		LTF18	.782	.888		
		LTF19	.712	.888		
		LTF20	.623	.888		
Academic performance ($a = .687$)	Final grades ($a = .687$)	RA1	.761	.893	.795	.500
		RA2	.860	.893		
		RA3	.587	.895		
		RA4	.583	.893		

(F), anxiety (AN), ineffectiveness (I), and addiction (AD) were determined. The goodness-of-fit statistics of the variable were adequate (CMIN = 414.058; $df = 196$, $p < 0.000$; CMIN/ $df = 2.113 < 3.00$; CFI = 0.915 > 0.90; TLI = 0.899 > 0.90; IFI = 0.916 > 0.90, RFI = 0.825 > 0.90, NFI = 0.851 > 0.90, PNFI = 0.60 > 0.722 > 0.90, PCFI = 0.60 > 0.776 > 0.90, RMSEA = 0.068 \leq 0.08), which supports the reliability and validity of the technostress scale.

On the other hand, the confirmatory factor analysis (CFA) was carried out for the multidimensional variable of transformational leadership. As can be seen in Figure 2, the relationships of the construct with the dimensions of individualized consideration (IC), inspiring motivation (IM), intellectual stimulation (IS), idealized attributed influence (IIA), and idealized behavioral influence (IIC) were determined. The goodness-of-fit statistics of the variable were adequate (CMIN = 282.372; $df = 157$, $p < 0.000$; CMIN/ $df = 1.799 < 3.00$; CFI = 0.953 > 0.90; TLI = 0.943 > 0.90; IFI = 0.953 > 0.90, RFI = 0.879 > 0.90, NFI = 0.900 > 0.90, PNFI = 0.60 > 0.744 > 0.90, PCFI = 0.60 > 0.787 > 0.90, RMSEA

= 0.057 \leq 0.08), which supports the reliability and validity of the transformational leadership scale.

The hypothesized structural model aims to show that the relationship between technostress and the academic performance of undergraduate students is moderated by perceived teacher transformational leadership practices (see Figure 3). As a first measure, the goodness of fit indices of the model were established, obtaining favorable results (CMIN = 1537.225; $df = 971$, $p < 0.000$; CMIN/ $df = 1.583 < 3.00$; CFI = 0.899 > 0.90; TLI = 0.892 > 0.90, IFI = 0.900 > 0.90, RFI = 0.753 > 0.90, NFI = 0.769 > 0.90, PNFI = 0.60 > 0.721 > 0.90, PCFI = 0.60 > 0.843 > 0.90, RMSEA = 0.049 \leq 0.08).

As can be seen in Table 5, there is a negative and insignificant relationship between technostress (TE) and transformational leadership (LTF) (-0.338 ; $p < 0.00$), supporting hypothesis 1. Likewise, there is a positive and insignificant relationship between transformational leadership (LTF) and academic performance (AR) (0.472; $p < 0.00$). On the other hand, a positive and insignificant direct rela-

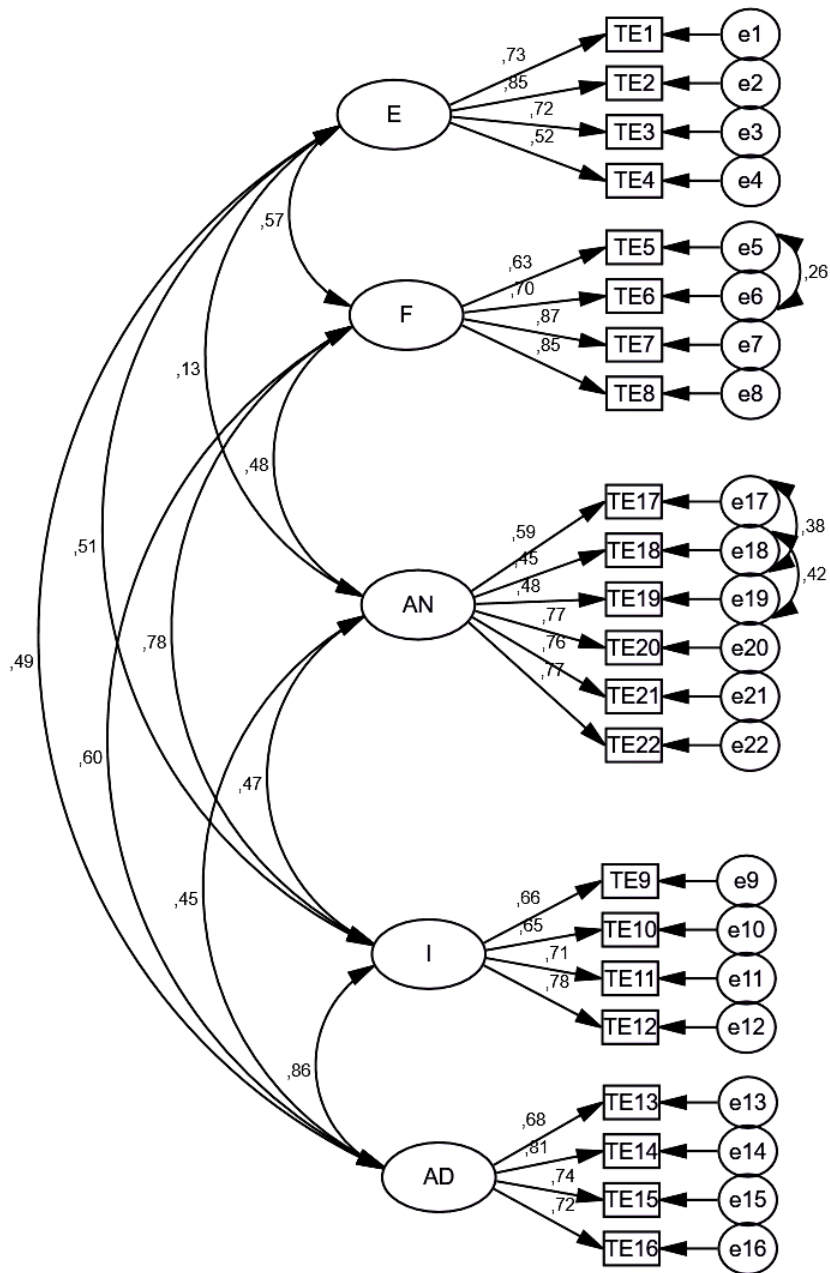


Figure 1. AFC technostress

Table 5. Analysis of theoretically hypothesized relationships

Relationship	Estimated	
	Model 1	Model 2 (indirect)
LTF → TE	-.338*** [H1 is supported]	
LTF → RA	.472*** [H2 is supported]	-.159*** [H4 is supported]
TE → RA	-.553*** [H3 is supported]	

Note: *** $p < 0.00$. LTF = transformational leadership; TE = technostress; RA = academic performance.

relationship was evidenced between technostress (TE) and academic performance (AR) (-0.553; $p < 0.00$). Finally, it was evidenced that transformational

leadership (LTF) affects the relationship between technostress (TE) and academic performance (AR) (-0.159; $p < 0.00$).

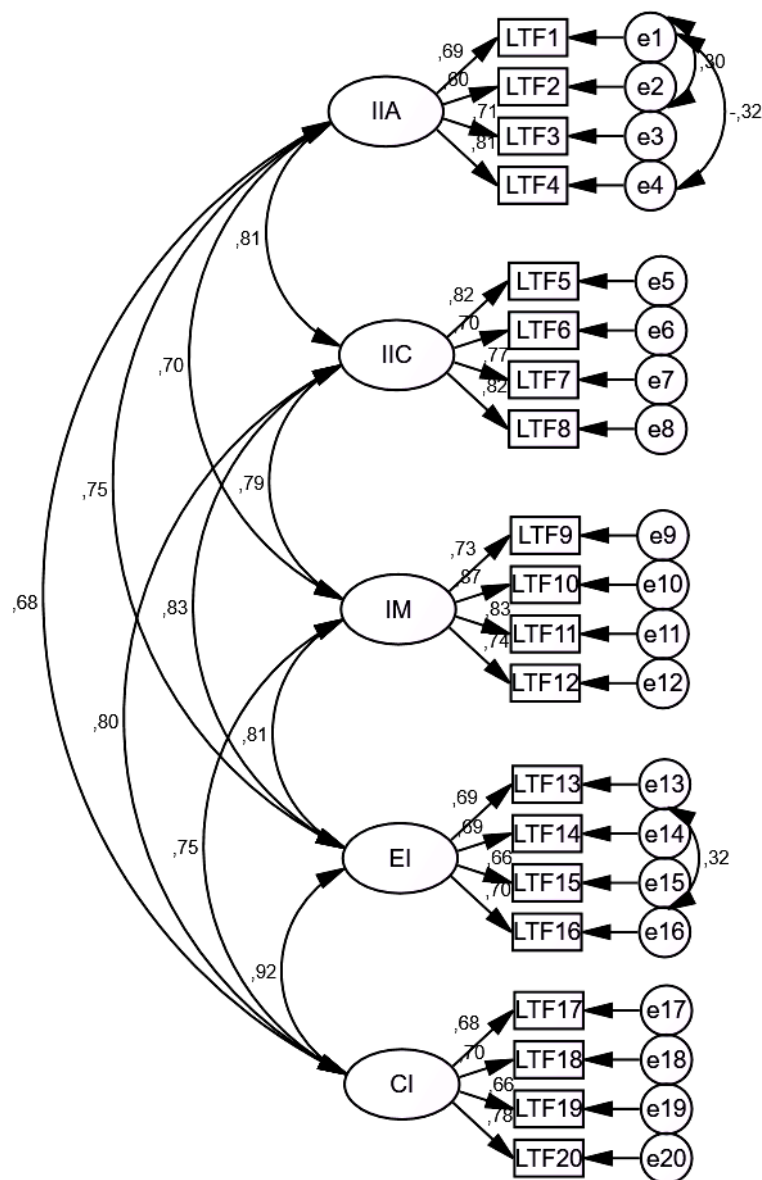


Figure 2. AFC transformational leadership

4. DISCUSSION

Testing H1, the results have shown a negative and insignificant relationship between students' technostress and teachers' transformational leadership in higher education institutions (-0.338 ; $p < 0.00$). In this regard, the findings do not fully agree with what exists in the current literature. For example, Avolio et al. (2009) found that transformational leadership reduces stress levels in followers and improves their performance, while Murrell et al. (1992) and Beehr et al. (1990) consider that certain leader behaviors decrease levels of tension and fatigue, which are predictors of stress.

However, some precedents have found very weak and insignificant relationships between technostress and transformational leadership (Khan et al., 2022). The results found may have an explanation in the sector and population analyzed since young people approached people from the university educational field, probably digital natives with an advanced level of skills and autonomy. A large part of the studies that link the phenomena are conducted in the business environment, with the working population and the elderly.

Regarding H2, the results showed a positive and moderately significant relationship between

teachers' transformational leadership and students' academic performance (0.472; $p < 0.00$). Thus, in the literature, there is ample empirical evidence that shows a strong relationship between transformational leadership and performance of teachers (Lan et al., 2019); transformational leadership and employee performance in SMEs (Shah et al., 2022); and transformational leadership and the performance of university employees (Khan et al., 2022). However, studies that have proven a relationship between the transformational leadership exhibited by teachers and its potential positive consequences for student achievement are less frequent (Du Plessis, 2013). The results of the study exposed discrete levels of transformational leadership in teaching practices, possibly affected by technological mediation. This primarily refers to non-native digital people who had to make a great effort to adopt the available technological resources, for which, probably, they did not have the knowledge, skills, and pedagogical and technological resources to provide confidence, support, constant communication, and supervision to the teaching-learning processes mediated by information technologies. Indeed, the levels of academic performance were discrete, so a correspondence between the mentioned variables is inferred.

Regarding H3, a negative and significant relationship was established between technostress and students' academic performance in higher education institutions (-0.553 ; $p < 0.00$). In this regard, multiple investigations report the consequences caused by technostress on the well-being, behavior, and performance of people (Upadhyaya & Acharya, 2020). However, an essential part of the studies have focused on employees (Tarafdar et al., 2007, 2011), teachers (Li & Wang, 2021), librarians (Ahmad & Amin, 2012), and older adults (Nimrod, 2018), and very few focused on university students (Yao & Wang, 2023). On the other hand, Qi (2019) found no negative relation-

ship between technostress, apparently generated using mobile devices, and academic performance in university students. Thus, technologies and their use affect the training and learning process differently than their use and consequences in the workplace. It should be noted that, in the present investigation, the levels of technostress reported by the students were low, so its effect on student performance may not have experienced strong consequences.

Finally, regarding H4, it can be concluded that the relationship between technostress and student academic performance is moderated by teachers' transformational leadership in higher education institutions in the South Colombian region (-0.159 ; $p < 0.00$). Although more robust findings were expected in this investigation, there is sufficient support to accept H4. Indeed, for Yang et al. (2019), within organizations, the existence of variables such as social support serves to cushion the impact of technostress on work performance, a phenomenon that can be extrapolated with some caution to the field of higher education, specifically in the case of students. However, it should be noted that technological equipment – computers and mobile devices – in teaching-learning does not necessarily generate technostress in the students analyzed. This can be attributed to the fact that most of them (more than 80%) are between 18 and 25 years old; they can be classified as digital natives, that is, people who have normalized the use of information technologies within their daily lives, so they hardly experience extreme situations.

Therefore, this study contributes along the lines of a few studies focused on technostress in students given that, as mentioned above, current research has focused on employees of companies and teachers (Joo et al., 2016), especially when these results are not entirely aligned with what has been found so far in related literature.

CONCLUSION

This study evaluated the relationship between technostress and academic performance, moderated by transformational leadership, in university students from undergraduate programs at public and private institutions in a peripheral region of southern Colombia during the COVID-19 pandemic. In this regard, it was established that there is moderation on the part of teachers' transformational leadership, although not at the levels expected and evidenced in other studies carried out in different contexts, such

as business. Thus, the present investigation exposed discrete levels of technostress in university students because of the use of information technologies in their training processes. Similarly, the relationship between technostress and transformational leadership and transformational leadership and academic performance was insignificant. Finally, the relationship between technostress and academic performance was significant; however, as noted, the technostress levels were low, as was the transformational leadership perceived by the students.

AUTHOR CONTRIBUTIONS

Conceptualization: Juan Manuel Andrade.

Data curation: Juan Manuel Andrade, Elías Ramírez Plazas, Juan Camilo Ramírez.

Formal analysis: Juan Manuel Andrade, Elías Ramírez Plazas, Juan Camilo Ramírez.

Investigation: Juan Manuel Andrade, Elías Ramírez Plazas, Juan Camilo Ramírez, Diego Bermeo Castro.

Methodology: Juan Manuel Andrade.

Resources: Juan Manuel Andrade, Elías Ramírez Plazas, Juan Camilo Ramírez, Diego Bermeo Castro.

Software: Juan Manuel Andrade.

Supervision: Juan Manuel Andrade.

Validation: Juan Manuel Andrade, Elías Ramírez Plazas, Juan Camilo Ramírez, Diego Bermeo Castro.

Visualization: Elías Ramírez Plazas, Juan Camilo Ramírez.

Writing – original draft: Juan Manuel Andrade.

Writing – review & editing: Juan Manuel Andrade, Elías Ramírez Plazas, Juan Camilo Ramírez, Diego Bermeo Castro.

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