Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10, 677-691
2025
Publisher: Learning Gate
DOI: 10.55214/2576-8484.v9i10.10486

Technostress and emotional exhaustion in higher education: A qualitative-quantitative correlational study among undergraduate and graduate students

Azucena Natividad Prado-Espinoza[1*], Jesus Roger Chavez Parillo[2], Rosario Abigail Castelo-Collado[3], Miguel Angel Zuñiga-Marino[4], Gloria Angélica Achata-Gonzales[5], Bruceli Benito Ala-Gordillo[6]
[1,2,3,5]Universidad Nacional de San Agustín de Arequipa. Arequipa, Perú; apradoe@unsa.edu.pe (A.N.P.E.) jchavezpari@unsa.edu.pe (J.R.C.P.) rcasteloc@unsa.edu.pe (R.A.C.C.) gachata@unsa.edu.pe (G.A.G.).
[4]Universidad Católica de Santa María. Arequipa, Perú; mzuniga@ucsm.edu.pe (M.A.Z.M.).
[6]Universidad Tecnológica del Perú. Arequipa, Perú; gala@utp.edu.pe (B.B.A.G.).

Abstract: This study is situated within the growing dependence on digital technologies in higher education, which has raised concerns about their impact on students' emotional well-being. The primary objective was to determine the direct relationship between technostress and emotional exhaustion among undergraduate and graduate students, using a qualitative-quantitative correlational design. Two validated instruments were applied: one measuring technostress (assessing skepticism, fatigue, anxiety, and inefficacy) and another evaluating emotional exhaustion (including overload, overexertion, low mood, insomnia, headaches, fatigue, exhaustion, stress, and study overload). The findings revealed that most participants reported low levels of skepticism (51.7%) and fatigue (47.1%), while a significant proportion presented moderate levels of fatigue (46.6%) and anxiety (42%). Emotional exhaustion emerged intermittently in dimensions such as tension, insomnia, and fatigue. In addition, a noticeable decline in interest in ICT and feelings of frustration associated with their use were identified. Overall, the results confirm a direct relationship between technostress and emotional exhaustion, highlighting the urgency of developing targeted interventions to improve academic well-being.

Keywords: *Academic performance, Digital overexposure, Emotional exhaustion, Technostress, University students.*

1. Introduction

The rapid advancement of digital technologies has profoundly reshaped academic environments, generating demands that go beyond traditional methods of teaching and learning. This phenomenon has introduced concepts such as technostress, understood as the stress response produced by the excessive or inappropriate use of digital tools and platforms [1]. Similarly, emotional exhaustion has emerged as a form of affective depletion resulting from prolonged exposure to stressful conditions, and it is now recognized as a core dimension of burnout in educational contexts [2]. The intersection of these two constructs is particularly relevant in student populations, where the intensity of technology use combined with academic pressure creates environments conducive to symptoms of emotional strain.

This study is anchored on three theoretical foundations. The Digital Stress Theory proposes that continuous interaction with digital technologies increases cognitive and emotional overload, leading to higher levels of technostress [1]. The burnout model emphasizes emotional exhaustion as a central element, underscoring how prolonged exposure to demanding conditions reduces self-regulation and perceived efficacy [2]. Finally, recent integrative models suggest that technostress can act as a trigger that, through mediating and moderating processes, leads to emotional exhaustion particularly in high-pressure environments such as universities [3]. Together, these perspectives provide the conceptual

History: Received: 19 August 2025; Revised: 22 September 2025; Accepted: 25 September 2025; Published: 10 October 2025
* Correspondence: apradoe@unsa.edu.pe

framework to analyze the direct link between technostress and emotional exhaustion in undergraduate and graduate students.

Technostress often results in diminished academic performance and negative effects on students' psychological well-being [4]. This phenomenon has been especially pronounced among young learners coping with intensive academic workloads, further aggravated by the sudden shift to online education during the pandemic. This transition introduced additional challenges, including a lack of access to adequate technology and unstable internet connections [5, 6].

At present, university students face increasing academic and emotional demands, heightened by digital integration into their studies. These circumstances give rise to technostress, defined as discomfort caused by the pervasive use of information and communication technologies (ICT) and to emotional exhaustion, characterized by physical and psychological fatigue resulting from academic and emotional overload. Both factors may impair students' well-being and performance across undergraduate and graduate levels [7].

Recent studies have addressed aspects of technostress and emotional exhaustion in higher education. For instance, Asensio-Martínez et al. [1] identified a significant correlation between exposure to digital environments and emotional exhaustion. Similarly, Paguay-García et al. [2] highlighted specific dimensions of technostress, such as fatigue and anxiety, directly linked to emotional depletion. Fernández et al. [3] also showed that the increasing use of technology in virtual learning contexts contributes to reduced motivation and emotional vitality. Moreover, a study conducted at the Universidad Nacional Jorge Basadre Grohmann reported that 86.4% of students presented medium-to-high levels of technostress, with technofatigue, techno-anxiety, and techno-addiction as the most prevalent dimensions [7]. While some research has suggested that digital tools can enhance academic performance [8], excessive use has also been linked to stress and emotional imbalance. A multicenter study revealed that emotional exhaustion, caused by inefficient coping with academic adversity, is associated with energy loss, physical and psychological fatigue, and lack of motivation [9]. Collectively, these studies underscore the importance of examining both variables together.

Despite these advances, critical gaps remain in the literature. First, there has been limited differentiation in analyzing technostress across undergraduate and graduate populations, as most studies focus on homogeneous groups [1]. Second, while technostress and emotional exhaustion have been examined separately, few studies have assessed their direct causal link within a single analytical model [2]. Finally, although the influence of digital contexts on emotional well-being is recognized, further exploration is needed into the underlying mechanisms through which technology exposure triggers emotional exhaustion [3]. Addressing these gaps, the present study aims to determine the direct relationship between technostress and emotional exhaustion in undergraduate and graduate students, thereby contributing empirical evidence that deepens our understanding of the impact of digital overexposure on students' emotional well-being and academic performance.

2. Methodology

2.1. Research Design

This research followed a non-experimental, cross-sectional, correlational design aimed at determining the relationship between technostress and emotional exhaustion in undergraduate and graduate students. This approach combined quantitative and qualitative analyses, allowing a comprehensive understanding of how both variables interact within academic contexts.

2.2. Participants

The sample consisted of 174 university students, of whom 132 were undergraduates and 42 were postgraduates. Participants were selected through non-probability sampling, ensuring heterogeneity across educational levels. Inclusion criteria required students to be actively enrolled in the institution, make regular use of digital technologies for learning, and provide informed consent. Exclusion criteria

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 677-691, 2025
DOI: 10.55214/2576-8484.v9i10.10486

involved conditions that could significantly affect emotional or cognitive responses, minimizing the influence of confounding variables.

2.3. Instruments

Technostress was measured using the RED-TICV scale, originally developed by Salanova et al. [10] in Spain and adapted to Peru by Albarrán Chávez [11]. This instrument evaluates skepticism, fatigue, anxiety, and inefficacy in relation to the use of information and communication technologies (ICT) [12].

Emotional exhaustion was assessed with the Emotional Exhaustion Scale (ECE) by Ramos, Moan, and Manga, adapted to the Peruvian context by Domínguez [13]. The scale is applicable to individuals aged 18–33 and evaluates indicators such as tension, overexertion, low mood, insomnia, headaches, fatigue, emotional depletion, stress, and academic overload [14]. Additionally, open-ended questions were included to capture students' perceptions of decreased interest in ICT, frustration caused by daily overload, and feelings of inefficacy when using digital tools.

2.4. Data Collection and Analysis

Data were collected online to guarantee ethical standards such as anonymity and confidentiality. Statistical software was used for descriptive and correlational analyses, including percentages, means, and Spearman's rho correlations, to examine the strength and direction of the relationship between technostress and emotional exhaustion. Qualitative responses were analyzed through thematic content analysis, enabling the identification of recurring patterns and shared perceptions of how technological overload affects academic performance and emotional well-being.

2.5. Bias Control and Limitations

To reduce potential biases, anonymity was assured, and a pilot test of the instruments was conducted to refine ambiguous items. Limitations include the non-probabilistic nature of the sampling and the self-selection of participants, which restricts generalizability. Moreover, the cross-sectional design prevents causal inferences, focusing instead on significant associations between the variables.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 677-691, 2025
DOI: 10.55214/2576-8484.v9i10.10486

3. Results

Table 1.
Demographic and Academic Characteristics of Undergraduate and Graduate Students (N = 174).

Characteristics	Frequency	Percentage (%)
Age (years)		
17–19	47	27.0
20–21	48	27.6
22–23	20	11.5
24–25	15	8.6
26–30	23	13.2
31–40	13	7.5
41–50	5	2.9
51–58	3	1.7
Sex		
Female	146	83.9
Male	28	16.1
Marital Status		
Married	15	8.6
Cohabiting	2	1.1
Divorced	1	0.6
Separated	2	1.1
Single	154	88.5
Academic Cycle		
2nd	21	12.1
3rd	62	35.6
4th	13	7.5
5th	9	5.2
7th	27	15.5
Postgraduate	42	24.1
Level of Studies		
Undergraduate	132	75.9
Postgraduate	42	24.1
Field of Study		
Nursing	119	68.4
Law	55	31.6

The data analysis shows that 54.6% of participants were between 17 and 23 years old, indicating that a large portion of the sample consisted of young individuals in the early years of their university studies. Regarding gender, female students predominated (83.9%), suggesting that gender may play a role in shaping experiences of technostress and emotional exhaustion. Furthermore, 88.5% of students were single, which may have implications for how personal factors, such as marital status, influence emotional well-being and stress levels. In terms of academic cycle, 35.6% of participants were in the second cycle, reflecting a substantial representation of first-year students a stage in which adapting to the university environment can heighten stress levels. Additionally, 75.9% of the sample were undergraduates, suggesting that this group is particularly prone to higher levels of technostress and emotional exhaustion. Finally, 68.4% were nursing students, while 31.6% were studying law.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 677-691, 2025
DOI: 10.55214/2576-8484.v9i10.10486

Table 2.
Use and Frequency of Information and Communication Technologies (ICT) in Students' Learning (N = 174).

Variable	Frequency	Percentage (%)
Use of ICT for studying		
Yes	174	100.0
Main access to ICT		
Mobile phone	58	33.3
University computers	8	4.6
At home	95	54.6
At work	13	7.5
Frequency of ICT use		
Two–three times per week	23	13.2
Once per day	34	19.5
Three–six times per day	56	32.2
Seven–twelve times per day	18	10.3
All the time	40	23.0
Once per week	3	1.7

All participants in the sample (100%) reported using ICT for academic purposes. Regarding the primary means of access, 54.6% of students connected from home, indicating a strong dependence on their personal environment to engage with educational technologies. Meanwhile, 33.3% relied on mobile phones as their main device, while 7.5% accessed ICT from their workplace. Only a small proportion, 4.6%, used university computers, which may suggest limited frequency or convenience when studying in institutional facilities.

With respect to frequency of use, most students (32.2%) reported connecting three to six times per day, reflecting frequent and consistent integration of ICT into their academic routines. Additionally, 23% indicated that they were online "all the time," pointing to a deep incorporation of digital tools into daily life. A further 19.5% used ICT once or twice per day, while 13.2% reported accessing them two to three times per week, suggesting comparatively lower reliance on digital technologies for their studies.

Table 3.
Distribution of Technostress Levels among Undergraduate and Graduate Students (N = 174).

Level of Technostress	Frequency	Percentage (%)
Low	51	29.3
Moderate	81	46.6
High	42	24.1
Total	174	100.0

Most students reported a moderate level of technostress (46.6%), followed by 29.3% with low levels and 24.1% with high levels. These results suggest that although a significant portion of students experience moderate stress linked to digital technologies, a considerable group presents high levels, highlighting the need for targeted support strategies.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 677-691, 2025
DOI: 10.55214/2576-8484.v9i10.10486

Table 4.
Dimensions of Technostress among Undergraduate and Graduate Students (N = 174).

Dimension	Level	Frequency	Percentage (%)
Skepticism	Low	90	51.7
	Moderate	80	46.0
	High	4	2.3
Fatigue	Low	82	47.1
	Moderate	81	46.6
	High	11	6.3
Anxiety	Low	64	36.8
	Moderate	73	42.0
	High	37	21.3
Inefficacy	Low	99	56.9
	Moderate	54	31.0
	High	21	12.1

The table provides a detailed overview of students' experiences with different dimensions of technology-related stress. Regarding skepticism, most participants (51.7%) reported low levels, while 46% indicated moderate levels. This suggests that although the majority do not feel excessively distrustful of technology, a substantial proportion maintains a moderately critical perspective. Concerning fatigue, 47.1% of students reported low levels, implying that most do not experience significant exhaustion associated with technology use. Nevertheless, 46.6% presented moderate levels of fatigue, highlighting the presence of a considerable subgroup affected by intensive interaction with digital tools.

In relation to anxiety, 42% of students reported moderate levels, and 36.8% indicated low levels, suggesting that not all students perceive technology use as a source of distress. Finally, with respect to inefficacy, more than half of the participants (56.9%) reported low levels, indicating that they do not generally feel ineffective when using technology. However, 31% reported moderate levels of inefficacy, which may reflect a connection between intensive technology use and students' perception of reduced ability to engage effectively with ICT.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 677-691, 2025
DOI: 10.55214/2576-8484.v9i10.10486

Table 5.
Distribution of Emotional Exhaustion by Dimension in Undergraduate and Graduate Students (N = 174).

Dimension	Response	Frequency	Percentage (%)
Excessive tension	Always	16	9.2
	Frequently	47	27.0
	Sometimes	64	36.8
	Rarely	40	23.0
	Never	7	4.0
Overexertion	Always	10	5.7
	Frequently	32	18.4
	Sometimes	55	31.6
	Rarely	59	33.9
	Never	18	10.3
Low mood	Always	7	4.0
	Frequently	31	17.8
	Sometimes	51	29.3
	Rarely	53	30.5
	Never	32	18.4
Insomnia	Always	7	4.0
	Frequently	44	25.3
	Sometimes	61	35.1
	Rarely	49	28.2
	Never	13	7.5
Headaches	Always	8	4.6
	Frequently	29	16.7
	Sometimes	52	29.9
	Rarely	60	34.5
	Never	25	14.4
Fatigue	Always	25	7.2
	Frequently	86	24.7
	Sometimes	131	37.6
	Rarely	89	25.6
	Never	17	4.9
Emotional exhaustion	Always	6	3.4
	Frequently	27	15.5
	Sometimes	65	37.4
	Rarely	59	33.9
	Never	17	9.8
Stress	Always	18	10.3
	Frequently	51	29.3
	Sometimes	43	24.7
	Rarely	53	30.5
	Never	9	5.2
Academic overload	Always	13	7.5
	Frequently	36	20.7
	Sometimes	71	40.8
	Rarely	45	25.9
	Never	9	5.2

The table outlines the various manifestations of emotional exhaustion, offering a clear perspective on how these conditions affect students' well-being. Regarding excessive tension, 36.4% of students reported experiencing it "sometimes," 27.0% reported it "frequently," and 9.2% indicated they experienced it "always." In terms of overexertion, the majority (31.6%) experienced it "sometimes," and 29.3% reported it "frequently," underscoring its relevance as a common issue among students.

Regarding diminished mood, 29.9% reported this symptom as occurring "sometimes," whereas 18.4% indicated they "never" experienced it. Insomnia was reported as "frequently" by 25.3% of students and "sometimes" by 28.2%, highlighting its significance as a factor negatively affecting rest

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 677-691, 2025
DOI: 10.55214/2576-8484.v9i10.10486

and emotional recovery. Headaches were reported as "sometimes" by 29.9% and "rarely" by 34.5%, suggesting that while headaches are common, they are not consistently severe.

Fatigue emerged as one of the most prevalent symptoms, with 37.6% experiencing it "sometimes" and 25.5% "rarely," indicating that fatigue is a frequent but not constant condition. Emotional exhaustion itself was reported as "sometimes" by 37.4% of students, reflecting the intensity of emotional demands faced in academic contexts. Stress was reported as "rarely" by 30.5% and "frequently" by 24.7%, illustrating its fluctuating nature among the participants. Finally, study overload affected 40.8% of students as "sometimes," representing a significant concern, as it directly impacts both emotional well-being and academic performance.

Table 6.
Tests of Normality.

Variable	Kolmogorov-Smirnova			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Technostress	0.091	174	0.001	0.968	174	0.000
Emotional exhaustion	0.068	174	0.050	0.986	174	0.073

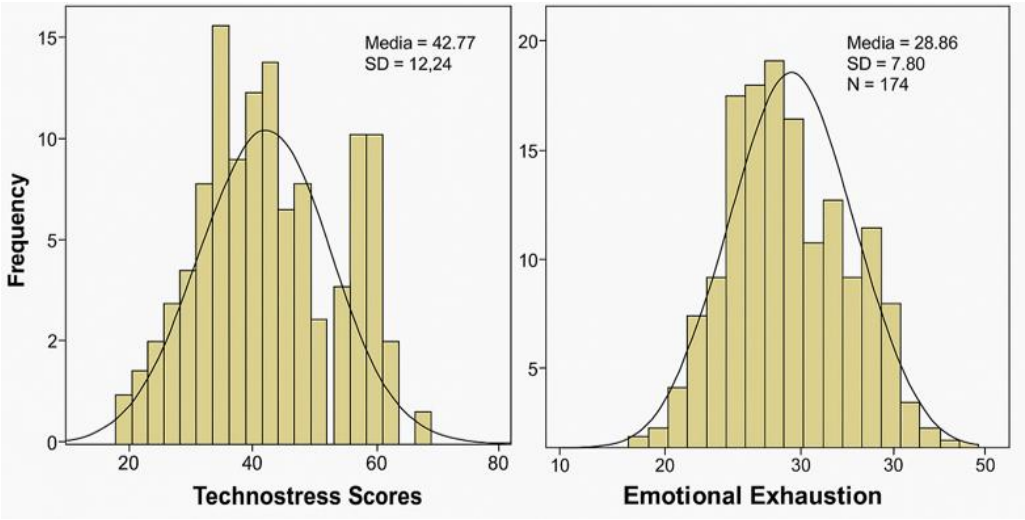

Figure 1.
Distribution of technostress and emotional exhaustion levels among participants.

3.1. Interpretation of Normality Tests

Normality tests were conducted on the variables of technostress and emotional exhaustion using both the Kolmogorov-Smirnov and Shapiro-Wilk tests. For technostress, the significance level obtained from the Kolmogorov-Smirnov test was 0.001, which is below the conventional threshold of 0.05. This result indicates that the data do not follow a normal distribution. Similarly, the Shapiro-Wilk test yielded a significance value of 0.000, also below 0.05, reinforcing the conclusion that technostress data deviate from normality.

In the case of emotional exhaustion, the Kolmogorov-Smirnov test produced a significance value of 0.050, equal to the standard significance level of 0.05, suggesting that the data may follow a normal distribution, although the result is marginally significant. However, the Shapiro-Wilk test yielded a significance value of 0.073, which is greater than 0.05, indicating that emotional exhaustion data may conform to a normal distribution, though the evidence remains inconclusive.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 677-691, 2025
DOI: 10.55214/2576-8484.v9i10.10486

Table 7.
Correlations – Emotional Exhaustion and Technostress.

Variable	Spearman's Rho Correlation Coefficient	Sig. (2-tailed)	N
Technostress	0.379**	0.000	174

The Spearman correlation coefficient between technostress and emotional exhaustion was 0.379, indicating a moderate positive relationship between the two variables. In other words, as technostress levels increase, emotional exhaustion also tends to rise. The two-tailed significance value associated with this correlation was 0.000, which is far below the 0.01 threshold, thereby confirming that the correlation is statistically significant. This demonstrates that the observed association is not the result of chance but rather reflects a genuine relationship between technostress and emotional exhaustion within the sample studied.

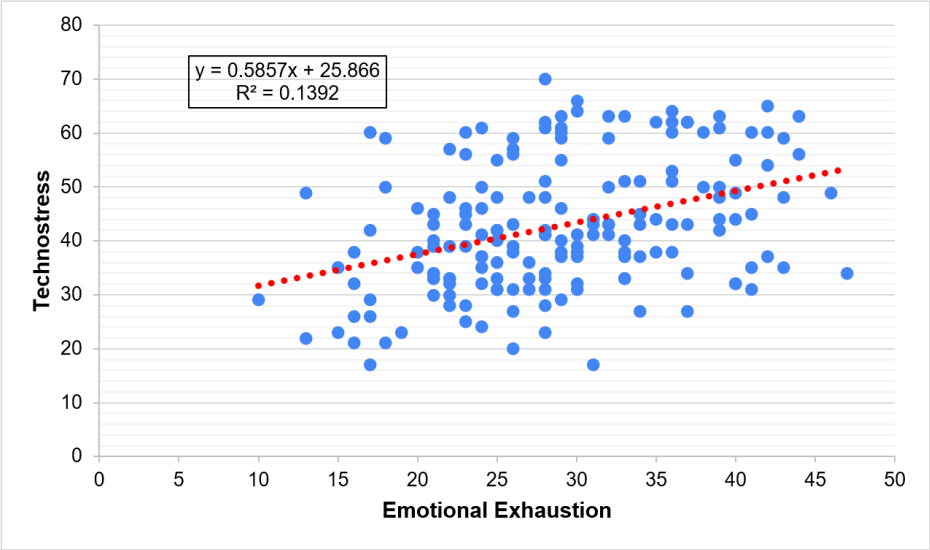

Figure 2.
Correlation between technostress and emotional exhaustion among participants.
Note: The scatter plot illustrates a positive linear relationship between technostress and emotional exhaustion, indicating that higher levels of emotional exhaustion are associated with increased technostress. The regression line ($y = 0.5857x + 25.866$) and the coefficient of determination ($R^2 = 0.1392$) suggest a moderate but meaningful association between both variables.

The sample size (N) consisted of 174 students. The significance value (Sig.) was 0.000, which is lower than 0.01, indicating that the correlation is statistically significant at the 99% confidence level. The correlation coefficient was 0.379, reflecting a moderate positive relationship: higher levels of technostress are associated with greater emotional exhaustion. The double asterisk (**) further confirms that the relationship is significant at the 0.01 (1%) level.

Table 8.
Spearman's Rho Correlation Between Technostress and Emotional Exhaustion.

Dimension	Spearman's Rho Correlation Coefficient	Sig. (2-tailed)	N
Skepticism	0.152*	0.045	174
Fatigue	0.355**	0.000	174
Anxiety	0.337**	0.000	174
Inefficacy	0.326**	0.000	174

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 677-691, 2025
DOI: 10.55214/2576-8484.v9i10.10486

The correlations between the dimensions of technostress and emotional exhaustion were analyzed using Spearman's rho coefficients along with their corresponding significance values.

Skepticism: The correlation coefficient was 0.152, indicating a very weak positive association between skepticism and emotional exhaustion. The significance value was 0.045, which is below the 0.05 threshold, confirming that the correlation is statistically significant. However, given the weak strength of the relationship, its practical relevance is marginal.

Fatigue: The correlation coefficient was 0.355, reflecting a moderate positive association between fatigue and emotional exhaustion. The significance value of 0.000 demonstrates high statistical significance. This suggests that as fatigue increases, emotional exhaustion also rises, highlighting fatigue as a meaningful contributor to students' emotional depletion.

Anxiety: The correlation coefficient was 0.337, indicating a moderate positive relationship with emotional exhaustion. The significance value of 0.000 further confirms that this association is statistically significant. These results suggest that higher levels of anxiety are linked to increased emotional exhaustion, underscoring the importance of managing stress and anxiety to mitigate emotional fatigue.

Inefficacy: The correlation coefficient was 0.326, also indicating a moderate positive relationship with emotional exhaustion. With a significance value of 0.000, this correlation is statistically significant. This finding suggests that greater perceptions of inefficacy are associated with higher emotional exhaustion, implying that frustration and the sense of incompetence in handling ICT significantly contribute to students' emotional fatigue.

Table 9.
Spearman's Rho Correlations Between Technostress and Emotional Exhaustion by Level of Study.

Level of Study	Spearman's Rho Correlation Coefficient	Sig. (2-tailed)	N
Undergraduate	0.429**	0.000	132
Graduate	0.536**	0.000	42

The table presents the correlation between technostress and emotional exhaustion among undergraduate and graduate students in nursing and law, using Spearman's rho coefficient.

- Undergraduate level: The correlation was positive and moderate (Rho = 0.429). The significance value ($p = 0.000$) indicates that this relationship is statistically significant ($p < 0.01$). This result demonstrates that, among undergraduate students, higher levels of technostress are associated with greater emotional exhaustion.
- Graduate level: The correlation was also positive but slightly stronger (Rho = 0.536). Once again, the relationship was statistically significant ($p = 0.000$). This indicates that, for graduate students, increases in technostress are even more closely linked to heightened emotional exhaustion compared to the undergraduate group.

Overall, both populations (undergraduate and graduate) exhibited a significant positive relationship between technostress and emotional exhaustion, with the association being stronger among graduate students.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 677-691, 2025
DOI: 10.55214/2576-8484.v9i10.10486

4. Qualitative Analysis

Table 10.
Qualitative Analysis of Technostress Among Undergraduate and Graduate Students.

Categories	Subcategories	Interpretation
Time and Use of ICT	Decreased interest in ICT over time	A considerable portion of students reported a decline in their interest in technology over time. This may be linked to technological overload or fatigue caused by constant ICT use.
	Lower involvement in ICT use	Many students appeared to lose motivation or interest in interacting with ICT, which may reflect emotional fatigue or exhaustion from continuous digital interaction.
Perception of Work and ICT	Criticism of the ICT contribution	Some students began questioning the actual value of ICT in their work, suggesting a possible disconnection between expectations and outcomes.
	Doubts about the value of working with ICT	This response reflects the uncertainty students may experience regarding the usefulness and impact of ICT on their learning and academic performance.
Performance and Efficiency with ICT	Difficulty with tasks after ICT use	Many students felt that working with ICT became more challenging when already tired, underscoring the impact of fatigue on academic performance.
	Exhaustion after ICT use	A significant proportion of students reported exhaustion after using ICT, suggesting cognitive overload resulting from constant technology use.
Impact of ICT on Emotional Well-Being	Anxiety about ICT misuse	This result highlights anxiety or fear associated with the inappropriate use of ICT, which may be linked to the pressure of digital responsibility.
	Discomfort when working with ICT	Students showed signs of discomfort when working with ICT, possibly due to frustration caused by excessive reliance on technology.
Efficiency in ICT Use	Sense of inefficiency when using ICT	Many students felt ineffective when using ICT, contributing to frustration and stress.
	Difficulty when working with technologies	A large proportion of students found technology use challenging, which could generate anxiety and hinder academic performance.

This analysis highlights how the use of information and communication technologies (ICT) influences students both academically and emotionally. As students increase their use of ICT, their interest in these tools tends to decline, suggesting potential technological overload or fatigue resulting from constant engagement. Such overexposure can lead to cognitive fatigue, diminishing motivation to interact with ICT and, consequently, affecting academic performance. From an emotional standpoint, students appear to face difficulties not only in completing tasks that require ICT but also in how they perceive the value and effectiveness of these technologies in their academic work. Some express doubts about the actual benefits of ICT, indicating that its use may not always contribute meaningfully to learning outcomes or expected academic performance. This sense of uncertainty often generates frustration and insecurity, negatively shaping students' self-perception of their academic achievement.

With regard to emotional impact, anxiety associated with frequent ICT use becomes evident. Students may experience stress due to the constant demand to rely on these tools, which produces a generalized discomfort that undermines emotional well-being. This anxiety is often tied to a perception of ICT as uncontrollable, impairing the ability to focus and complete tasks effectively. In terms of efficiency and performance, many students encounter additional challenges when working with ICT, leading to mental exhaustion and feelings of inefficacy. Such fatigue appears to be closely linked to cognitive overload caused by excessive technology use, which further limits the ability to sustain optimal academic performance. In this sense, while ICT offers undeniable educational benefits, it can simultaneously become a source of stress and anxiety if not adequately managed, ultimately disturbing students' emotional balance and academic outcomes.

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 677-691, 2025
DOI: 10.55214/2576-8484.v9i10.10486

Table 11.
Qualitative Analysis of Emotional Exhaustion Among Undergraduate and Graduate Students.

Categories	Subcategories	Interpretation
Tension and Academic Effort	Academic tension	Tension is a common response during examinations, reflecting the academic pressure students face.
	Effort	The lack of immediate or satisfactory results can be a source of frustration and exhaustion.
Mood and Emotional Health	Mood	Emotional exhaustion caused by excessive ICT use or academic pressure may lead to an inexplicable sense of discouragement.
	Emotional fatigue	Physical and emotional fatigue is prevalent and directly related to the constant pressure of studying and using technologies.
Sleep and Rest	Sleep problems	Sleep quality is affected by academic demands, which exacerbate both exhaustion and technostress.
Physical and Cognitive Stress	Physical pain	Headaches are a common physical symptom of technostress and may indicate cognitive overload resulting from prolonged ICT use and academic workload.
	Mental fatigue	Mental exhaustion is a direct consequence of academic demands and constant technology use, negatively impacting emotional well-being.
ICT Use and Emotional Effects	Stress from ICT use	Intensive use of ICT for studying contributes to stress perception, demonstrating how technology can become an additional source of pressure.

This analysis illustrates how multiple factors associated with the use of information and communication technologies (ICT) affect students' physical and emotional well-being as well as their academic performance. Academic tension emerges as a common response to examinations and heavy workloads, generating a pervasive sense of stress and fatigue caused by constant pressure to achieve satisfactory results. Such academic stress is further intensified by the mental effort required to meet demanding tasks, which often results in frustration and emotional exhaustion.

At the same time, students' mood and emotional health are compromised by emotional fatigue, which is linked both to the excessive use of ICT and the constant pressure to engage with these tools, frequently leading to a generalized sense of discouragement. Sleep and rest are also affected, as mental fatigue derived from academic demands and technological stress reduces sleep quality and heightens overall tiredness. This phenomenon is strongly associated with technostress, a condition produced by the prolonged and excessive use of ICT that exacerbates the sense of exhaustion. Physically, many students report headaches, a common symptom of cognitive overload that reflects the strain produced by both academic pressures and intensive digital engagement. Mental fatigue thus becomes a direct consequence of sustained interaction with technology, undermining students' emotional well-being.

Finally, the intensive use of ICT for studying contributes to an increased perception of stress, as technologies, rather than serving solely as learning tools, also function as an additional source of pressure. In sum, continuous exposure to ICT can trap students in a vicious cycle of academic and emotional stress, negatively affecting their physical health, mental balance, and academic performance.

5. Discussion

Technostress and emotional exhaustion among university students constitute a complex, multifactorial phenomenon that has been the subject of several qualitative-quantitative investigations. The results of this study align with a common trend in the literature, indicating that intensive use of information and communication technologies (ICT) significantly contributes to symptoms of technostress, which in turn are closely related to emotional exhaustion or burnout in university settings.

Multiple studies emphasize that emotional exhaustion, linked to both physical and psychological fatigue, is intensified by the overload of academic and technological demands. For example, Calsina and Peñaloza [15] highlight the importance of properly managing emotional exhaustion to enhance

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 677-691, 2025
DOI: 10.55214/2576-8484.v9i10.10486

academic performance and foster students' self-efficacy. Nevertheless, their analysis does not explicitly address the role of technostress derived from excessive ICT use in shaping emotional outcomes. This gap reflects a broader limitation in existing literature, where many studies overlook technological variables when analyzing students' emotional health [14, 16].

Similarly, Mérida-López et al. [17] argue that high academic demands in distance graduate programs are strongly associated with emotional exhaustion, yet they do not explore the specific impact of ICT. This omission leaves unexamined how particular dimensions of technostress, such as fatigue, anxiety, and inefficacy, affect students' well-being. In this respect, Rivera and Sánchez [18] note that ICT, when used excessively or inappropriately, can be a significant source of stress. However, their work also stops short of specifying how distinct technostress dimensions contribute to emotional depletion.

The findings of Condori Sinty et al. [19] are particularly relevant, as they establish a positive correlation between excessive social media use and emotional exhaustion. While this underscores one facet of technostress, the focus on a single technological platform restricts the ability to assess the broader impact of digital overexposure. In a similar vein, Salas et al. [20] report that widespread ICT use in academic life is associated with increased levels of emotional exhaustion and decreased academic efficacy. Yet, as with other studies, the analysis does not delve into the differentiated effects of technostress dimensions on emotional well-being.

Another notable aspect across the reviewed studies is the growing concern regarding the influence of ICT on students' emotional health, particularly in graduate programs, where academic demands are considerably higher. Research by Araneda and Rocamora [21] and Ardiles-Irarrázabal et al. [22] demonstrates strong correlations between emotional exhaustion and disorders derived from academic overload. However, they also fail to clarify how intensive ICT use specifically contributes to such disorders. The differences observed between undergraduate and graduate students, as noted by Condori Sinty et al. [19], are also noteworthy. In general, graduate students appear to experience higher levels of technostress and emotional exhaustion, a phenomenon likely explained by the greater academic pressure and complexity of tasks at this stage. Furthermore, the transition to online learning environments has exacerbated these challenges, particularly in post-pandemic contexts, as highlighted in the findings of Ardiles-Irarrázabal et al. [22].

6. Conclusion

From a quantitative perspective, most participants reported low levels of skepticism toward technology (51.7%), although 46% showed moderate levels, reflecting a moderately critical stance. Analysis of fatigue indicated that 47.1% experienced low fatigue and 46.6% moderate fatigue, suggesting that although widespread severe exhaustion was not evident, a considerable proportion of students were negatively affected by intensive ICT use. Regarding anxiety, 42% of students reported moderate levels and 36.8% low levels. In the inefficacy dimension, more than half (56.9%) indicated low perceptions of inefficacy in their ability to interact with ICT, while 31% scored at moderate levels. Concerning emotional exhaustion, factors such as excessive tension (36.4% "sometimes" and 27.0% "frequently"), overexertion, insomnia, and emotional depletion (37.4% "sometimes") highlighted the presence of significant emotional demands, which, although not constant, had a clear impact on students' well-being and academic performance. Complementing these findings, the qualitative analysis revealed that many students perceived a decline in their interest and motivation to engage with technology. This tendency appeared to be associated with cognitive and emotional overload resulting from continuous ICT use, generating anxiety, frustration, and feelings of inefficacy that ultimately undermined academic performance.

In relation to the stated objective to determine the direct relationship between technostress and emotional exhaustion in undergraduate and graduate students, the results confirmed a clear and significant link between the two variables. The qualitative-quantitative correlational design employed facilitated the identification of associations indicating that the dimensions of technostress (skepticism,

Edelweiss Applied Science and Technology
ISSN: 2576-8484
Vol. 9, No. 10: 677-691, 2025
DOI: 10.55214/2576-8484.v9i10.10486

fatigue, anxiety, and inefficacy) were directly connected to various indicators of emotional exhaustion, including tension, insomnia, and fatigue. Excessive and, in some cases, inappropriate use of ICT was found to contribute to the deterioration of students' emotional well-being, with concomitant adverse effects on academic performance. The adoption of a mixed correlational approach not only enabled the quantification of these phenomena but also advanced understanding of the underlying mechanisms through which technological overexposure fosters emotional depletion.

Transparency:

The authors confirm that the manuscript is an honest, accurate, and transparent account of the study; that no vital features of the study have been omitted; and that any discrepancies from the study as planned have been explained. This study followed all ethical practices during writing.

Copyright:

References

[1] Á. Asensio-Martínez, A. Morales-Villuendas, A. Aguilar-Latorre, B. Masluk, S. Gascón-Santos, and M. A. Sánchez-Calavera, "Predictors of student health: Technostress, academic stress, and social support," *Acciones e Investigaciones Sociales*, vol. 45, 2024. https://doi.org/10.26754/ojs_ais/accionesinvestigsoc.20244510452

[2] M. Paguay-García, E. Valarezo, and E. Cabezas-Heredia, "Technostress in university students: Case study," *AXIOMA*, vol. 1, no. 31, pp. 11-20, 2024. https://doi.org/10.26621/ra.v1i31.961

[3] J. L. Q. Fernández, U. I. Q. Fernández, C. V. F. Clavo, and P. Y. H. Domínguez, "Technostress in the academic burnout of Peruvian university students," *Areté: Revista Digital del Doctorado en Educación de la Universidad Central de Venezuela*, vol. 10, no. 19, pp. 165-181, 2024.

[4] J. M. A. Navia, E. M. J. Zapata, and R. J. Zapata, "The complex relationship between technostress and academic performance in young college students," *Salud, Ciencia y Tecnología*, vol. 4, p. 1012, 2024. https://doi.org/10.56294/saludcyt20241012

[5] L. Medina-Gual *et al.*, "The impact of the pandemic on Mexican higher secondary education: An analysis from pedagogical, psychological, and technological perspectives," *Revista Iberoamericana de Educación*, vol. 86, no. 2, pp. 125-146, 2021. https://doi.org/10.35362/rie8624356

[6] L. P. C. Covarrubias and P. A. Pérez, "Transition to virtual learning and its effects: Technostress in university students in the context of COVID-19," *Revista Panamericana de Pedagogía*, vol. 34, pp. 52-71, 2022. https://doi.org/10.21555/rpp.vi34.2581

[7] R. H. Llanque, "Technostress and academic performance in nursing students during COVID-19," *Investigación e Innovación: Revista Científica de Enfermería*, vol. 1, no. 2, pp. 21-27, 2021. https://doi.org/10.33326/27905543.2021.2.1218

[8] R. M. Navarrete Enríquez, J. T. Remache Cachimuel, and V. M. Reyes, "Use of digital tools and academic performance in nursing students: A case study at a Technological Institute," *Prohominum. Revista de Ciencias Sociales y Humanas*, vol. 6, no. 2, pp. 227-242, 2024. https://doi.org/10.47606/acven/ph0245

[9] A. Osorio Supler *et al.*, "Emotional exhaustion in nursing students: A multicenter study," *Revista da Escola de Enfermagem da USP*, vol. 58, p. e20220319, 2024. https://doi.org/10.1590/1980-220x-reeusp-2022-0319es

[10] M. Salanova, S. Llorens, and E. Cifre, *RED-TICV: Technological stress assessment scale for workers and students.* Castellón, Spain: Universitat Jaume I, 2003.

[11] J. Albarrán Chávez, Adaptation of RED-TICV for the Peruvian context, Master's Thesis, Universidad Nacional Mayor de San Marcos, 2017.

[12] M. Salanova, S. Llorens, and E. Cifre, *NTP 730: Technostress: Concept, measurement and psychosocial intervention [PDF].* Madrid, España: Instituto Nacional de Seguridad e Higiene en el Trabajo (INSHT), 2018.

[13] J. Domínguez, "Adaptation of the emotional exhaustion scale (ECE) for the Peruvian context, " Unpublished Master's Thesis, Universidad Nacional Mayor de San Marcos, 2014.

[14] Gonzales, "Emotional exhaustion scale (EES) for college students: Psychometric properties and association," 2022. https://psiquiatria.com/bibliopsiquis/escala-de-cansancio-emocional-ece-para-estudiantes-universitarios-propiedades-psicometricas-y-asociacion

[15] D. J. P. Calsina and A. P. P. Peñaloza, "Emotional exhaustion and academic self-efficacy in university students in the final years of their studies," *Hitos Educativos. Revista de Investigación Científica*, vol. 1, no. 1, pp. 37–48, 2024.

[16] L. F. Bravo, "Social media addiction, academic procrastination, and emotional exhaustion among students at a private university in Lima, Peru," *RIEE| Revista Internacional de Estudios en Educación*, vol. 22, no. 1, pp. 51-60, 2022. https://doi.org/10.37354/riee.2022.220

[17] S. Mérida-López, N. Extremera, and C. Quintana-Orts, "Academic demands in distance learning postgraduate studies and their links with burnout and regulation of one's own emotions," *Revista internacional de pedagogía e innovación educativa*, vol. 3, no. 1, pp. 139-154, 2023. https://doi.org/10.51660/ripie.v3i1.118

[18] J. R. M. Rivera and M. S. Sánchez, "The influence of information and communication technologies in the socio-emotional sphere," *Latam: revista latinoamericana de Ciencias Sociales y Humanidades*, vol. 5, no. 4, pp. 2654 – 2665, 2024. https://doi.org/10.56712/latam.v5i4.2445

[19] T. Condori Sinty, A. Quispe Mamani, and Y. Quiro Sucapuca, "Social media addiction and emotional exhaustion among psychology students at a private university in Juliaca, 2022," *Revista Científica de Ciencias de la Salud*, vol. 16, no. 2, pp. 18–32, 2023. https://doi.org/10.17162/rccs.v16i2.1959

[20] I. X. T. Salas, J. J. P. Coila, A. P. P. Peñaloza, and O. C. Mamani, "Academic burnout in university students," *PURISUM. Revista de Investigación en Ciencias Sociales*, vol. 1, no. 1, pp. 43-53, 2024. https://doi.org/10.62785/prics.v1.i1.5

[21] D. S. Araneda and P. Z. Rocamora, "Burnout syndrome and its impact on the emotional well-being of Chilean university students," *European Public & Social Innovation Review*, vol. 9, pp. 1-19, 2024. https://doi.org/10.31637/epsir-2024-1665

[22] R. A. Ardiles-Irarrázabal *et al.*, "Post-pandemic emotional disorders and academic burnout in nursing students," *Ciencia y enfermería*, vol. 30, p. 22, 2024.