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Technostress and Academic Outcomes: The Mediating Role of Academic Procrastination among University Students in Algeria

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Abstract:

This study examines the impact of technostress on students' procrastination and academic performance in the context of technology supported learning. The data were collected in March 2026 through survey distributed to students in tlemcen university, Algeria. The results show that higher technostress led to more procrastination and lower academic performance. Technostress affects both younger and older students in a similar way, make it a universal issue. These findings show that too much exposure to digital tools can hurt students' study habits and results, highlighting the need for ways to reduce technostress and help students learn better in digital environments.

Keywords: technostress, academic procrastination, academic performance, university students, Algeria.

Introduction:

Technology and digital media tools have become increasingly prevalent and may influence many aspects of university students' lives. Excessive use of these digital applications has been linked to higher levels of stress and may negatively affect academic achievement. Over the past two decades, researchers have shown growing interest in understanding the adverse effects of technology. One such effect is "technostress", which refers to stress caused by the use of technology and has been widely documented in the literature, particularly among working professionals. Among students, technostress may place additional pressure on higher education institutions by contributing to reduced productivity, increased dropout rates, and distraction from academic tasks. In this context, the present study adopts the technostress scale proposed by (Tarafdar M. T.-N.-N., 2007) and validates the instrument within an academic setting. Additionally, the academic procrastination scale developed by (McCloskey, 2011) is used to measure academic procrastination among undergraduate and postgraduate students at Tlemcen University. The study aims to address the following research question:

How does technostress influence academic procrastination and academic performance among university students?

Based on the research question, the following hypotheses are proposed to examine the relationship between technostress, academic procrastination, and students' academic performance.

H0: technostress has a positive effect on academic procrastination.

H1: technostress negatively affects students' academic performance.

Objective of the study:

Procrastination, defined as irrational delay of tasks, has become a common issue among students and can negatively affect their academic performance. With the increasing use of technology in education students may also experience technostress “inability to cope with new technologies”. Technostress can influence students’ behavior, including their tendency to procrastination, and may consequently affect their academic performance. Therefore, this study examines the impact of technostress on students’ procrastination and academic performance in the context of technology supported learning

I. Literature review:

In this part of the research, we will discuss the theoretical background related to the main variables studied in this essay: technostress and academic procrastination. This theoretical framework aims to provide a deeper understanding of how these variables interact with each other and how they can impact students’ performance.

1- Technostress

The term “technostress” was first introduced by (Brod, 1984) and defined as: “*a modern disease of adaptation caused by an inability to cope with the new computer world technologies in unhealthy manner*”. Technostress is referred by different terminologies such as technophobia, computer anxiety and digital stress.

(Tarafdar M. T.-N.-N., 2007) defined technostress as a “problem of adaptation that individual experiences, when he or she is unable to cope with new technology”, And proposed a multi-dimensional scale with 5 components: techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty (Vrinda, 2021).

1.1- Theories of technostress

Theories and models explaining “**digital stress (technostress)**” help understand the psychological and social dynamics behind this growing phenomenon in the technological era (T. S., 2008; Tarafdar M. C., 2019). The “**neuroscientific perspective**” highlights the vulnerability of younger individuals, such as adolescents, whose cognitive development is not yet complete, making them more susceptible to technology-related stress (Casey, 2008). “**Self-Determination Theory**” explains how the basic psychological needs of competence, autonomy, and relatedness may drive excessive technology use as individuals try to satisfy these needs through digital activities, even when such use creates stress (Ryan, 2017).

In addition, “**Limited Capacity Theory**” and the “**Bottleneck Model**” provide a cognitive explanation, showing that human cognitive limits and the constant flow of information and multitasking can increase digital stress (Lang, 2000). Interactive models, such as “**Lazarus and Folkman’s model**”, emphasize the interaction between environmental demands and individual resources in determining stress levels, highlighting the role of cognitive appraisal and coping strategies in managing technostress (Tarafdar M. T.-N.-N., 2007).

1.2- Impacts of technostress on individuals’ well being

Digital stress (technostress) has several negative consequences that affect individuals in different aspects of life, physical, psychological and behavioral aspects.

The negative physical reactions include restlessness, headache, and fatigue while the induced psychological effects include burnout, reduced satisfaction with the technology being used, and job. Reduced productivity, decrease performance, and innovation are common negative behavioral effects. (Yao, 2023)

1.3- Technostress and student performance:

Nowadays, university students are in intense interaction with information communication technologies and social media platforms. It is likely that this interaction may cause digital stress in student, which in turn may affect their academic procrastination and performance. For example, receiving too many messages and notifications on a smartphone can be perceived as a stress factor, and in this case digital stress is the individuals’ subjective response to such stress factors. Therefore, if an individual experiences more digital stress than they can manage, various behavioral and emotional responses are expected. One of these behavioral responses is academic procrastination. (Vrinda, 2021)

2- Procrastination:

Procrastination is one of the most common challenges faced by university students, Procrastination is defined as the deliberate and repeated delay of academic tasks despite the student’s awareness of the negative consequences resulting from such delay (Steel P. a., 2016).

Research indicates that students who struggle with procrastination often postpone essential tasks such as completing assignments, preparing research papers, and studying for exams, which leads to: Poor academic performance, Increased levels of stress and anxiety, and Loss of opportunities for skill development and professional growth

2.1- Origins and Development of the Term

A- Linguistic Roots

The term “Procrastination” is composed of two Latin parts: “Pro”: meaning forward or in favor of “Crastinus”: meaning tomorrow or the time remaining until tomorrow (Steel P. a., 2016)

The term is derived from the Latin word “Procrastinare,” which carries multiple meanings such as swallowing, withdrawing, pausing temporarily, or postponing a task (Rosário, 2009).

B- Scientific Definitions:

Researchers have provided multiple definitions of procrastination:

Curtis define Procrastination as The act of Swallowing or postponing tasks; a widespread human behavior that may result in missing deadlines and increased stress (Sirois, 2023) .Procrastination is defined as the thoughtful and irrational delay of tasks without being aware of the possible negative consequences (Shoaib, 2025). Laeus explains that the procrastination is Avoidance performing a task that should be completed, replacing less pleasant activities with more pleasant ones, or less urgent tasks with more urgent ones (Lacus, 2015).

2.2- Main Causes of Procrastination

- **Task Aversiveness** :it is considered as one of the primary causes of procrastination: Individuals tend to avoid unpleasant stimuli (Steel P. , 2007), A task is perceived as aversive when it is associated with boredom, dissatisfaction, or resentment (Blunt & Pychyl, 2000). Task aversiveness leads to shifting priorities while pursuing goals, driven by the belief that procrastination will provide immediate relief from negative emotions (Svartdal & Lokke, 2022)
- **Lack of Energy**: Lack of energy plays a significant role in procrastination: It makes initiating tasks more difficult, it reduces self-control capacity, and it increases vulnerability to external distractions and temptations.
- **Technological Development and the Internet**: Rapid technological development has become one of the most significant drivers of procrastination: The rise in academic procrastination coincides with increased time spent on the Internet (He, 2017). Excessive use of electronic devices is associated with psychological variables linked to procrastination. High screen usage is associated with lower levels of self-regulation.

2.3- Academic Procrastination as a Specific Phenomenon

Academic procrastination is one of the most prevalent forms of procrastination and is defined as: "A student's tendency to delay or postpone engagement in learning activities and related behaviors" Or more specifically: "Behavior specific to academic environments, where students tend to delay completing tasks such as studying for exams or preparing homework assignments, despite their awareness of the need not to do so" (González-Brignardello, 2023) Although personality traits and procrastination each have been linked to academic achievement research examining their combined effects is still limited particularly in non-Western settings.

3- Previous study:

Technostress in education had received little attention in research so much more with students who are directly affected by online learning (RAMIREZ, 2022). previous studies have explored the relationship between technostress, academic procrastination and students' academic performance. In order to gain a comprehensive understanding of the topic, this section reviews the previous research conducted in the field.

- (Acaray, 2026) This study examined how digital stress influences academic procrastination and psychological well-being, with ego depletion as a potential mediator. Data from 768 undergraduate students in Rize, Türkiye, collected in 2025 through a cross-sectional survey, were analyzed using Hayes' PROCESS macro. Results showed that digital stress increases academic procrastination and negatively affects psychological well-being, while ego depletion mediates these relationships.
- (Gamoso, 2023) This study investigated how academic procrastination and technostress influence student engagement among tourism and hospitality undergraduates, particularly in the context of online learning during the pandemic. Using a descriptive qualitative approach, data were gathered from 400 students via Google Forms and analyzed through Partial Least Squares Structural Equation Modeling (PLS-SEM). The findings revealed that, while most variables directly relate to student engagement, TPACK plays a significant mediating role between technostress and procrastination in shaping engagement.
- (RAMIREZ, 2022) This descriptive-correlational study investigated the attitudes, time management skills, technostress, and academic performance of elementary students engaged in online learning at a school in Camiguin Province. Using a four-section survey administered via Google Forms, data on student profile, attitude toward online learning, time management, and technostress were collected. The results showed that technostress, attitude, and time management significantly influenced students' academic performance during online learning.

II. Bibliometric study:

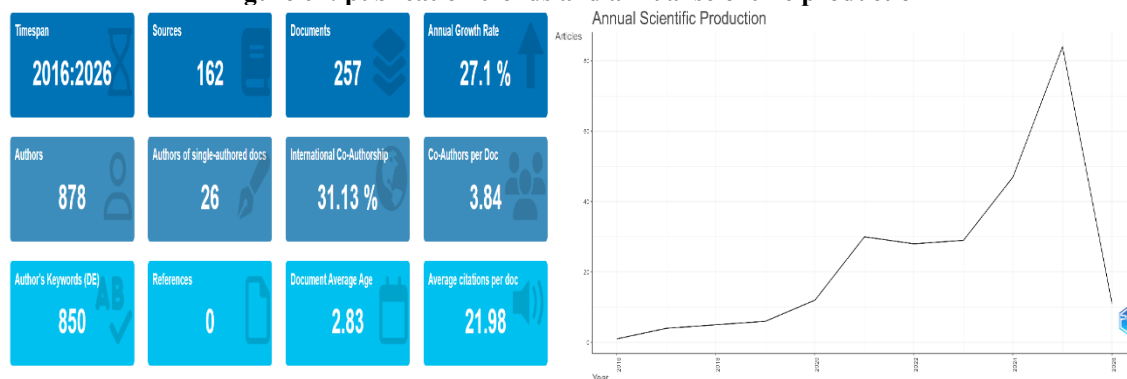
Previous studies have explored the relationship between technostress and students' academic performance, but their findings are inconsistent. Some research found that excessive use of technological devices can create strain that negatively affects students' academic performance and productivity. However, other studies reported that technostress does not have a significant effect on academic performance when students use technological devices for academic. Given these inconsistent findings, a bibliometric study was conducted to systematically analyze the existing literature on technostress and students' academic performance and procrastination, and to identify the main research trends in this field.

1- materials and methods:

The Scopus database was used as the main reference source, as it covers a wide range of academic disciplines. This was done by using the following keywords: ("technostress" OR "digital stress") AND "academic procrastination" AND "academic performance". The R software and Vosviewer were also used to perform bibliometric analysis on the collected studies.

2- bibliometric results:

Figure 01: publication trends and annual scientific production



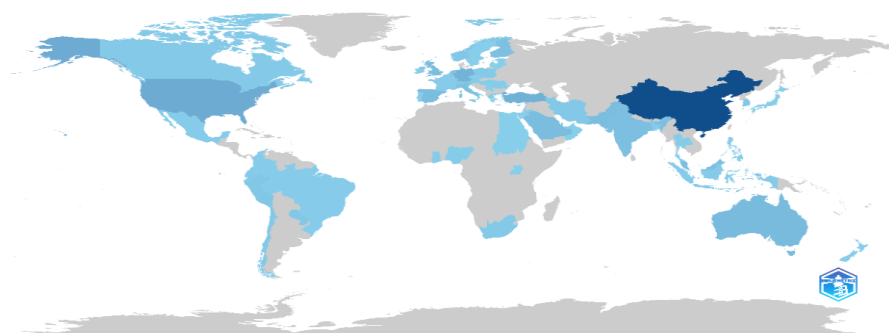
Source: Prepared by the researchers using R software.

We obtained 1,173 scientific documents. After excluding earlier studies that were not relevant to the topic of our research, 257 scientific articles remained for the period 2016–2026. These articles were produced by 878 researchers and involved the use of 850 keywords.

By tracking the evolution of scientific output, as shown in the figure above, we observe **fluctuations in the number of articles between 2016 and 2020**, ranging from 0 to a maximum of 17 articles in 2020. Subsequently, a **notable increase** in the number of articles is recorded during the 2020–2024 period, reaching 48 articles. The upward trend continues, **peaking in 2025** with more than 80 articles.

Figure 02: Geographic Distribution of the Research Topic

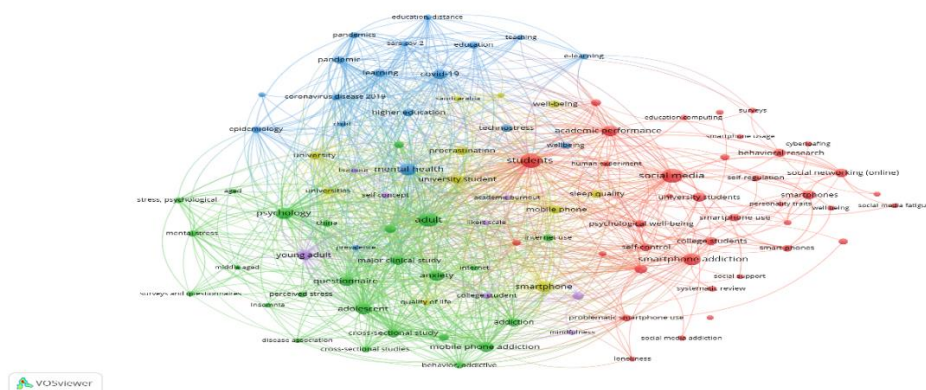
Country Scientific Production



Source: Prepared by the researchers using R software

With regard to the geographical distribution of scientific articles addressing the study topic, Figure 02 shows that the majority of articles focus on the **Chinese context**, with 200 articles recorded in 2026, followed by the **United States** with 50 articles in the same year. In contrast, studies dealing with the situation in Arab countries are almost non-existent.

Figure 03: Keywords Analysis



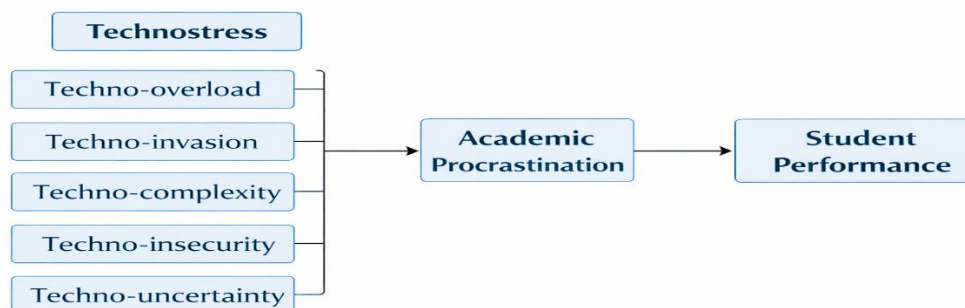
Source: Prepared by the researchers using VOSviewer software

Bibliometric analysis makes it possible to identify the most important keywords within the field of study. To determine the keywords used in this research, only those that appeared at least five times were considered. The results obtained are presented in Figure 03. The most significant keywords that are directly related to the study topic include: **technological stress, academic procrastination, academic performance, digital learning, student engagement, information and communication technology (ICT), learning outcomes, self-regulation, and higher education**. Collectively, these prior studies provide a foundation for understanding the complex interactions between technological stress, procrastination behavior, and academic achievement, while also highlighting the need for more region-specific research, particularly in Arab higher education contexts.

3- Research model:

Based on the overview, we propose the following research model:

Figure 04: research model



III. Methodology:

The hypotheses formulated for this purpose were tested within the framework of the analysis of data collected through an online survey using a quantitative research design. A cross-sectional study was conducted in March 2026 using convenience sample to collect 62 data points from undergraduate and graduate students enrolled in Tlemcen University, Algeria.

To contextualize the findings from the survey (N=62), two primary scientific concepts are utilized:

- **Techno-Overload and Cognitive Exhaustion:** According to (Ragu-Nathan, 2008), techno-overload occurs when ICTs force users to work faster and longer, leading to a decline in productivity. This aligns with the study's findings where 63% of students felt forced to work faster, and this dimension recorded the highest mean score of 3.88.
- **The Procrastination-Stress Cycle:** (T. S., 2008) argue that procrastination is a form of short-term mood regulation. In the digital context, "Techno-Invasion" (encroachment on personal time) creates psychological pressure, leading students to delay tasks as a defense mechanism.

II. Result and discussion

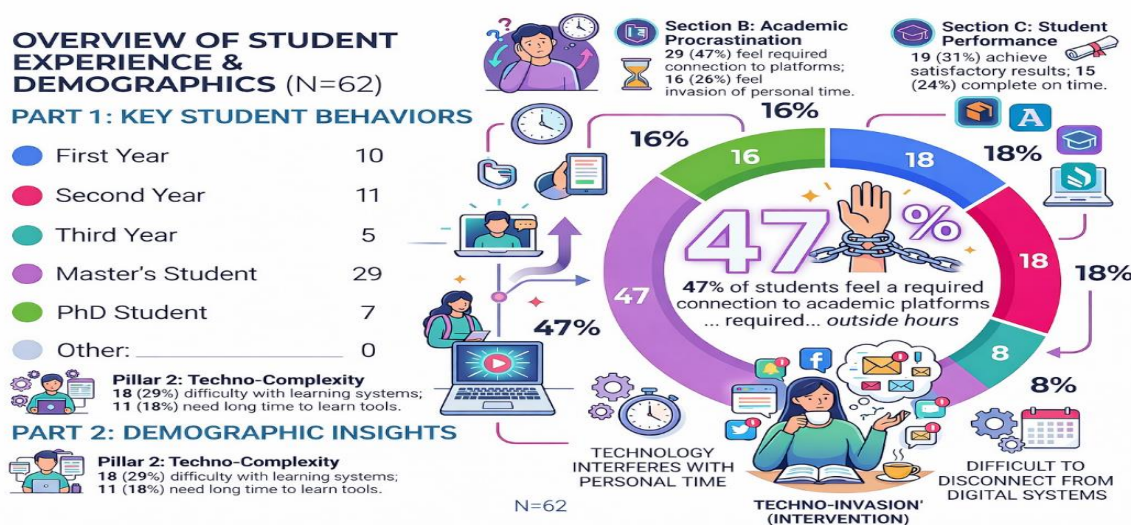
1- Demographic Characteristics:

The study was conducted on a sample of 62 students, with characteristics distributed as follows:

1. **Age:** Participants' ages ranged from 17 to 53 years. The "critical mass" (approximately 46%) was concentrated within the 20–25 age group.
2. **Academic Level:** Second-year undergraduate and Master's students recorded the highest participation rates. This reflects the perspectives of a group with intermediate to advanced experience in navigating university systems.
3. **Specialization:** The sample was dominated by students from the Humanities and Social Sciences, followed by Economic and Technical Sciences.

Table 1: Distribution of Participants by Age Group:

Age Group	Frequency	Percentage (%)
Youth (17–25 years)	46	74.2%
Adults (26–40 years)	10	16.1%
Over 40 years	6	9.7%
Total	62	100%



Dominant Group: The vast majority of participants belong to the youth category (under 25 years old), accounting for 74.2%. This explains the previously mentioned findings regarding the strong correlation with digital platforms.

Age Range: The age of the sample participants ranges from a minimum of 17 years to a maximum of 53 years.

Approximate Mean (Average): The average age of the study sample is approximately 25.5 years.

3. Major / Field of Study:

Humanities	5
Social Sciences	1
Business / Management	6
Natural Sciences	1
Engineering	0
Information Technology	0
Medicine / Health Sciences	0
Other:	

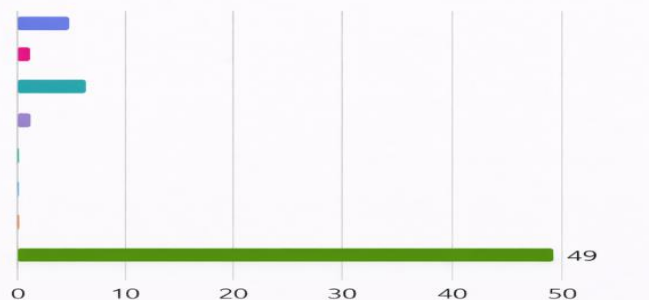
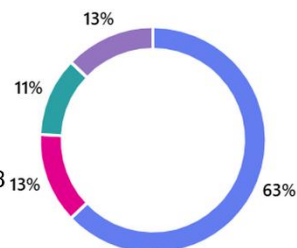


Figure 5. Techno-Overload among students

[En savoir plus](#)

Techno-Overload

1. Technology forces me to work faster. — 39
2. Online learning platforms increase my academic workload. — 8
3. I have to complete more tasks because of technology. — 7
4. Technology makes my academic requirements more intensive. — 8



The results show that 63% of respondents feel that technology forces them to work faster, while 13% believe that online learning platforms increase their academic workload. In addition, 11% report that technology requires them to complete more tasks, and 13% state that technology makes their academic requirements more intensive.

Table 2: Statistical Analysis of Technostress Dimensions:

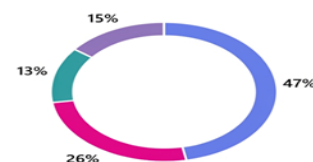
Technostress Dimension	Mean (X ⁻)	Level	Statistical Interpretation
Techno-Overload	3.88	High	The perception that technology dictates a work pace exceeding human capacity.
Techno-Invasion	3.52	High	The overlap of notifications and educational platforms with personal time and rest.
Techno-Uncertainty	3.20	Moderate	Anxiety resulting from continuous updates and changes in system interfaces.
Techno-Complexity	2.85	Moderate	Technical difficulty in utilizing digital tools (the least influential dimension).

Conclusion : The core issue for the study sample lies in "Techno-Density" (manifested through overload and invasion) rather than the "Technical Difficulty" of using digital tools.

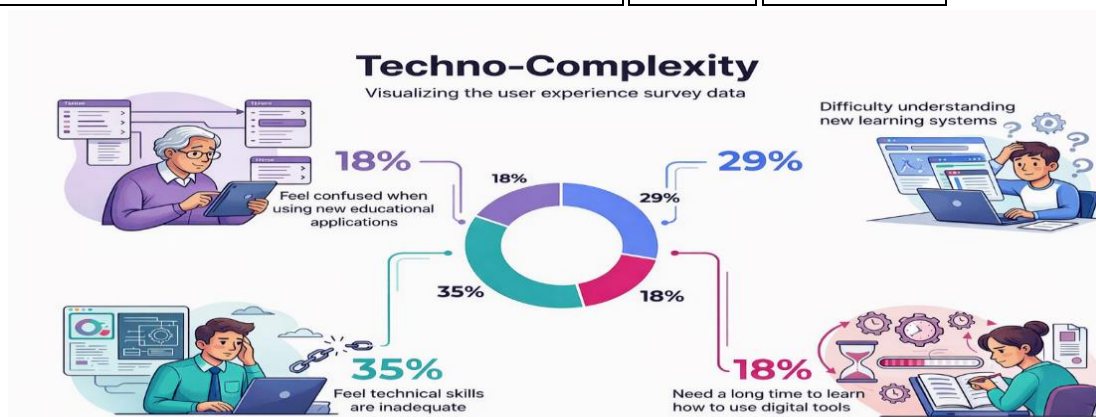
6. Second Dimension: Technological Intervention (Techno-Invasion)

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- I feel required to stay connected to academic platforms all the time.
- Technology interferes with my personal time.
- It is difficult for me to disconnect from digital learning systems.
- I receive academic notifications even outside study hours.

**Table 3: Analysis of Techno-Invasion Dimensions and Their Impact:**

Statement	Frequency	Percentage (%)
I feel required to stay connected to academic platforms at all times.	29	47%
Technology interferes with my personal time.	16	26%
I receive academic notifications even outside of study hours.	9	15%
It is difficult for me to disconnect from digital learning systems.	8	13%
Total	62	100%

**Table 4: Analysis of Techno-Complexity Dimensions:**

Statement	Frequency	Percentage (%)
I sometimes feel my technical skills are inadequate.	22	35%
I find it difficult to understand new learning systems.	18	29%

Statement	Frequency	Percentage (%)
I feel confused when using new educational applications.	11	18%
I need a long time to learn how to use digital tools.	11	18%
Total	62	100%

Analytical Observations:

- **Primary Barrier:** The data indicates that a perceived inadequacy of technical skills constitutes the most significant barrier for the study sample, affecting 35% of participants.
- **Statistical Parity:** There is an equal distribution (18% each) between the feeling of cognitive confusion when using new applications and the requirement of extended periods to master digital tools.

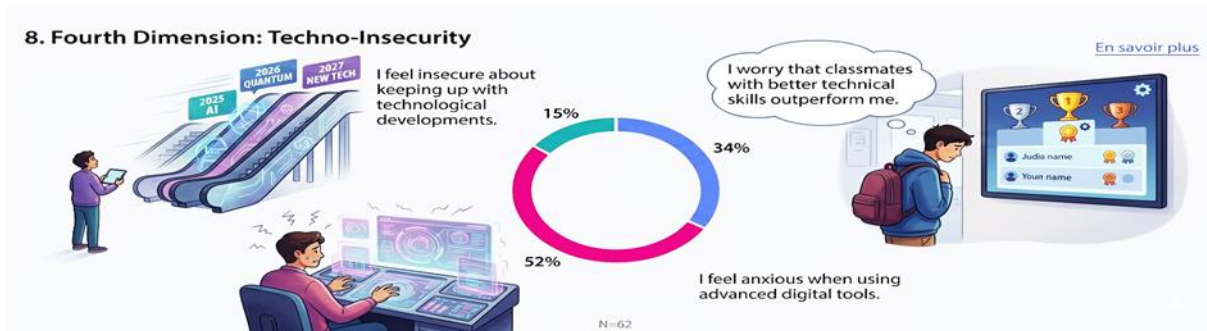


Table 5: Analysis of Techno-Uncertainty and Digital Anxiety:

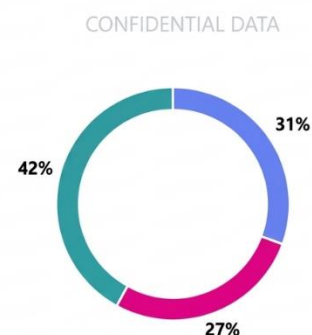
Statement	Frequency	Percentage (%)
I feel anxious when using advanced digital tools.	32	52%
I worry that classmates with better technical skills outperform me.	21	34%
I feel insecure about keeping up with technological developments.	9	14%*
Total	62	100%

Analytical Findings:

- **Primary Stressor:** The majority of the sample (52%) suffers from direct anxiety when interacting with advanced digital tools, indicating a significant psychological barrier to technology adoption.
- **Competitive Academic Pressure:** There are clear concerns regarding academic competition based on technical proficiency among 34% of the sample, suggesting that students fear their grades may be affected by their digital skills rather than their cognitive abilities.

9. Fifth Dimension: Techno-Uncertainty

Statement	Frequency	Percentage (%)
Frequent updates in learning systems confuse me.	19	31%
Continuous changes in digital platforms cause me stress.	17	27%
I feel unstable due to ongoing technological changes.	26	42%
Total	62	100%



Statistical Analysis of Techno-Uncertainty:

- **Key Indicator :** This dimension reveals that "Perceived Instability" (42%) is the strongest indicator of Techno-Uncertainty within the study sample.
- **Sample Size Consistency:** The total number of responses for this dimension is 62 , ensuring consistency with the overall sample size.

Section B : Academic Procrastination

The data revealed high levels of academic procrastination associated with technological usage, distributed as follows:

Table 6: Analysis of Academic Procrastination Behaviors:

Statement	Frequency	Percentage (%)
I delay starting academic tasks until the last minute.	17	27.4%
I find it difficult to begin important academic tasks.	13	21.0%
I require time pressure to initiate work.	10	16.1%
I fail to adhere to the study schedules I set.	9	14.5%
I postpone exam preparation until the dates are imminent.	8	12.9%
I begin working on tasks later than initially intended.	4	6.5%
I divert time to secondary activities when assignments are due.	1	1.6%
Total	62	100%

Key Analytical Findings:

- **Most Prevalent Behavior:** The data identifies task procrastination until the last minute as the most common behavioral pattern, recorded with 17 frequencies.
- **Time Pressure as a Driver:** The analysis reveals that time pressure serves as a primary motivational driver for work among a significant portion of the sample (16.1%).

**Section C: Student Performance****Table 7: Analysis of Student Performance and Digital Academic Efficacy :**

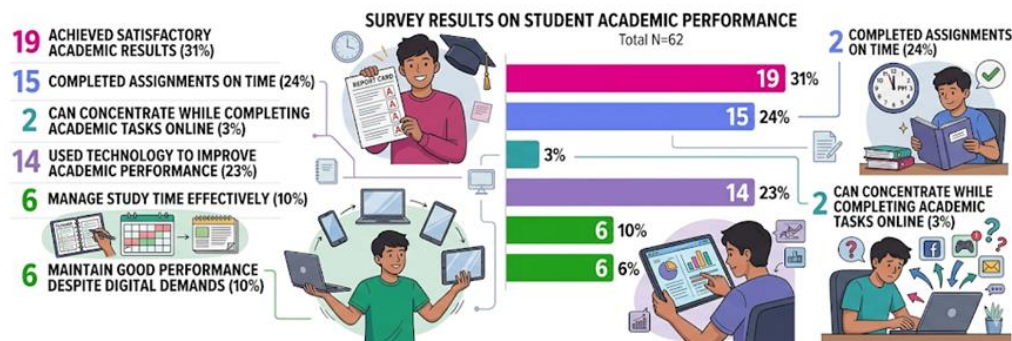
Statement	Frequency	Percentage (%)
I achieve satisfactory academic results.	19	30.6%
I complete my assignments on time.	15	24.2%
I utilize technology to enhance my academic performance.	14	22.6%
I manage my study time effectively.	6	9.7%
I maintain consistent performance despite digital demands.	6	9.7%
I am able to concentrate while completing academic tasks online.	2	3.2%

Statement	Frequency	Percentage (%)
Total	62	100%

Key Analytical Observations :

- **Positive Outcome:** The most favorable result indicates that 30.6% of participants achieve satisfactory academic outcomes, suggesting a level of resilience despite the technological pressures identified.
- **Critical Concern (The Concentration Gap):** A highly significant observation is the sharp decline in cognitive focus while working via digital platforms. This recorded the lowest frequency (only 2 instances), strongly indicating a severe impact of digital distraction and "technostress" on students' deep-work capabilities.

11. Question

[En savoir plus](#)

IV. Conclusion:

1- Discussion and Interpretation of Results:

The findings of this study align with the contemporary digital reality, establishing "Techno-Overload" as the most influential independent variable. When students perceive that technology is omnipresent -effectively "pursuing" them across time and space (Techno-Invasion)- it generates psychological pressure that manifests behaviorally as "Academic Procrastination."

Regarding the age variable, the results indicates that technostress is a "Universal Phenomenon." It does not significantly differ between younger and older students, as the inherent nature of digital instructional design imposes similar cognitive and psychological demands on all users regardless of their demographic background.

2- Proposed Recommendations:

A. For University Institutions: "Technological Stability"

Since "Techno-Uncertainty" and "Constant Updates" were identified as primary stressors, the following is recommended:

- **Unified Digital Ecosystem:** Transitioning from fragmented tools (Email, Moodle, Telegram, Classroom) to a single, unified official platform to prevent student distraction.
- **System Consistency:** Avoiding interface changes or the introduction of new tools mid-semester. Sudden transitions force students to deplete cognitive energy on "how to use" the system rather than engaging with the "scientific content."

B. For Faculty Members: "Digital Compassion"

Given that "Overload" is the leading cause of stress in this research, instructors should:

- **Calculate "Technical Overhead":** When assigning tasks, faculty must account for the time required for the assignment itself plus the time needed for platform navigation, uploading, and potential connectivity issues.
- **Quality Over Quantity:** Prioritizing focused, high-impact tasks over a high volume of digital assignments, acknowledging the cumulative pressure from multiple courses and platforms.

C. For Students: "Psychological and Temporal Protection"

Since "Techno-Invasion" infringes upon privacy and triggers "procrastination as an escape," students should:

- **Establish Digital Boundaries (Digital Detox):** Allocating specific hours daily to be strictly "technology-free" to restore mental focus and cognitive clarity.
- **Notification Filtering:** Disabling educational platform alerts during rest and sleep hours. This prevents the "feeling of being pursued" by technology, thereby reducing the psychological urge to postpone tasks (Procrastination).

Executive Summary of Recommendations:

- The University provides Stability.

- **The Professor** provides Balance.
- **The Student** provides Self-Protection.

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