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## DIGITAL BEHAVIOR

### OF UNIVERSITY STUDENTS: THE PARADOXICAL EFFECTS OF INSTITUTIONAL VS. PURPOSEFUL SOCIAL MEDIA USE ON PROBLEMATIC INTERNET USE

#### COMPORTAMIENTO DIGITAL DE LOS ESTUDIANTES UNIVERSITARIOS: LOS EFECTOS PARADÓJICOS DEL USO INSTITUCIONAL VS. INTENCIONAL DE LAS REDES SOCIALES SOBRE EL USO PROBLEMÁTICO DE INTERNET

Carolina Uzcátegui-Sánchez<sup>1</sup>

E-mail: [cuzcategui@umet.edu.ec](mailto:cuzcategui@umet.edu.ec)

ORCID: <https://orcid.org/0000-0002-0569-0384>

María de Fátima León de Álvarez<sup>1</sup>

E-mail: [mfleon@umet.edu.ec](mailto:mfleon@umet.edu.ec)

ORCID: <https://orcid.org/0000-0002-6918-7200>

Javier Solano-Solano<sup>1</sup>

E-mail: [jsolano@umet.edu.ec](mailto:jsolano@umet.edu.ec)

ORCID: <https://orcid.org/0000-0002-1419-8359>

<sup>1</sup> Universidad Metropolitana. Ecuador.

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## ABSTRACT

The integration of technology in higher education presents a paradox: it can enhance learning, but it is also associated with problematic internet use (PIU). This study investigated the differential relationship between academic internet use (IAU), student-defined purpose of social media use (SMU), and PIU. A cross-sectional design was used with a sample of 292 university students in Ecuador, residing in the provinces of Los Ríos, Manabí, Guayas, and El Oro. The analysis was performed using Partial Least Squares Structural Equations (PLS-SEM), with a reflective model of type I relationships. The results evidenced a paradoxical relationship: IAU was positively and significantly associated with higher PIU ( $\beta = 0.247$ ,  $p < 0.001$ ), while SMU showed a protective effect, being negatively associated with PIU ( $\beta = -0.263$ ,  $p < 0.001$ ). Likewise, significant moderating effects of gender were identified, indicating that men and women differentially experience the relationship between technological use and PIU. These findings demonstrate that the intentionality of technology use is more critical than the amount of use itself. It is concluded that universities should promote self-regulation strategies and purposeful use to reduce risks and maximize pedagogical benefits.

### Keywords:

Problematic internet use, social media, higher education, digital behavior.

## RESUMEN

La integración de la tecnología en la educación superior presenta una paradoja: puede mejorar el aprendizaje, pero también se asocia con el uso problemático de internet (PIU). Este estudio investigó la relación diferencial entre el uso académico de internet (IAU), el uso de redes sociales definido por el propósito del estudiante (SMU) y el PIU. Se empleó un diseño transversal con una muestra de 292 estudiantes universitarios en Ecuador, residentes en las provincias de Los Ríos, Manabí, Guayas y El Oro. El análisis se realizó mediante el modelo de ecuaciones estructurales de mínimos cuadrados parciales (PLS-SEM), con un modelo reflectivo de relaciones tipo I. Los resultados evidenciaron una relación paradójica: el IAU se asoció positiva y significativamente con un mayor PIU ( $\beta = 0.247$ ,  $p < 0.001$ ), mientras que el SMU mostró un efecto protector, asociándose negativamente con el PIU ( $\beta = -0.263$ ,  $p < 0.001$ ). Asimismo, se identificaron efectos moderadores significativos del género, lo que indica que hombres y mujeres experimentan de manera diferencial la relación entre el uso tecnológico y el PIU. Estos hallazgos demuestran que la intencionalidad del uso de la tecnología es más crítica que la cantidad de uso en sí misma. Se concluye que las universidades deben promover estrategias de autorregulación y un uso intencional para reducir riesgos y maximizar los beneficios pedagógicos.

### Palabras clave:

Uso problemático de internet, redes sociales, educación superior, comportamiento digital.

## INTRODUCTION

In the contemporary context of higher education, social media and digital technologies have become essential tools to facilitate access to information, promote academic collaboration, and sustain educational interaction, both synchronous and asynchronous. These platforms make it possible to share resources, resolve doubts in real time, and generate learning communities through forums, chats, or videoconferences. However, recent research warns that their intensive use also carries risks for the emotional well-being and academic performance of students, especially when there is a lack of self-regulation and control of exposure time.

Despite their clear pedagogical benefits, these technologies function as a double-edged sword: although they favor communication, access to resources, and collaborative learning, they can also generate distraction, procrastination, and even catalyze patterns of problematic Internet use. The ambiguity lies in the fact that the same platforms designed to enhance education can act as sources of digital dependency when their use is not carefully structured.

Much of the existing literature addresses “academic use of technology” as a unitary construct, without differentiating the underlying modalities. This approach limits the understanding of why some students take academic advantage of digital tools while others develop problematic internet use, even while engaging in educational activities. In particular, research rarely distinguishes between institutionally imposed academic use, such as receiving mandatory notifications or submitting assignments via social media, and use guided by individual student purpose, in which students autonomously choose to employ social media for educational purposes. This lack of differentiation partly explains the contradictions observed in previous studies.

Therefore, the main objective of this study is to investigate how two different modalities of technological use -the Academic Internet Use imposed by the institution (IAU) and the purpose of use in social media defined by the student (SMU)- are differentially related to Problematic Internet Use (PIU) in university students in the Ecuadorian context. A Partial Least Squares Structural Equation (PLS-SEM) model is used to analyze the direct and interaction effects of gender, also considering control variables such as age, semester, field of study, and time of social network use.

This research makes a substantial theoretical and empirical contribution by systematically differentiating between IAU and SMU, showing that each modality has opposite effects on PIU. In addition, it introduces valuable evidence from a Latin American context underrepresented in the literature. The article is organized as follows: Section 2

reviews the theoretical framework on academic use, digital self-regulation, and self-determination theories; Section 3 presents the methodology and PLS-SEM analysis; Section 4 presents key results; and finally, Section 5 synthesizes the discussion, conclusions, practical implications, and directions for future research.

The use of the Internet, specifically through social media, is becoming increasingly widespread. According to Yildiz & Seferoglu (2019), whether for socializing, gaming, studying, or other purposes, users find in these spaces opportunities to share and address daily activities. However, excessive use may also cause problems at social, emotional, psychological, and even physical levels. Problematic use of social media is associated with excessive time spent or frequency of use, whether to view advertisements, satisfy the need for interaction, support learning, cope with loneliness, or alleviate social anxiety.

Kuss & Griffiths (2017), analyze issues related to social media addiction, which they define as the loss of control over connection time on these platforms, thereby affecting the user’s everyday life. Additionally, for individuals who exhibit addictive behaviors, attempting to avoid using social media leads to emotional and psychological distress, affecting their personal, academic, and professional lives. According to these authors, university students are especially susceptible to this problem due to their high exposure and social pressure, which compels them to remain permanently connected to social media. An analysis of this issue reveals a relationship between excessive use of social media and the perception of social isolation among young adults. This may be associated with feelings of loneliness or social disconnection, potentially affecting mental health and social well-being (Feng et al., 2025).

In the educational context, among the factors that negatively affect Internet use through academic social media are the time dedicated to being online, low self-regulation, and digital dependency. Along these lines, Ge et al. (2023), found a direct relationship between social media addiction and depression in university students. They identified possible causes such as low self-esteem, lack of social skills, and the isolation characteristic of depression. Ge et al. (2023), also associate this addiction with low self-esteem and higher levels of anxiety in these students. Beyond the specific behavior of students regarding social media, additional concerns include privacy, security, information quality, equity of access, and the digital divide.

From the perspective of academic engagement and university student performance, the use of social media has both positive and negative effects. While it generates opportunities for collaboration, communication, and access to educational resources, excessive use can lead to distraction, academic procrastination, and reduced

dedication to study, ultimately resulting in poor academic performance (Chen & Xiao, 2022).

These authors also concur with Salari et al. (2025); and Rasouli et al. (2025), who highlight the need for educational institutions to foster both the healthy use of academic social media and the development of digital self-regulation skills, thereby reducing susceptibility to addiction and enhancing control over social media use.

To regulate the rational use of social media within academia, it is necessary to implement policies and practices concerning their ethical use for educational purposes, accompanied by training and support for both faculty and students. In response to this issue, Chen & Xiao (2022); and Mandi et al. (2024), emphasizes the need to establish digital literacy programs aimed at guiding the balanced use of social media in educational settings. Likewise, he suggests that faculty members should promote responsible internet practices among university students. In this regard, Collier & Lohnes-Watulak (2023), stress the importance of encouraging critical and reflective thinking regarding the use of the Internet and social media.

Social media are channels that foster social interaction, information dissemination, collaboration, and learning. The concept of social media dates back to the 1990s with the emergence of virtual communities and online interaction platforms that enabled users to connect and communicate digitally. During this period, the first steps in the development of online social media were taken, introducing new features such as user profiles, contact lists, and messaging tools. Their evolution, growth, and popularity are undeniable, and it is impossible to overlook the significance of platforms such as Facebook or LinkedIn, among others. These platforms have become massive and highly innovative, introducing functionalities that have transformed the way users communicate, evolving from online communities to a determining factor in the digital life of contemporary society.

Such is the importance of social media that Williams (2006), coined the term digital social capital, underscoring the relevance of online interactions and their contribution to the social capital of individuals and communities. Naturally, the value of this capital depends on the quality of relationships and the perceived support available online, which are influenced by opportunities for new connections, the transfer of relevant information, and even emotional and instrumental support.

In educational settings, social media is a common and essential tool for communication, learning, and collaboration between students and faculty. Their use can even motivate students and increase their engagement with learning.

Just as online platforms stimulate interaction, academic social media and virtual communities enable participation

and collaborative knowledge building. Successful participation and interaction in academic social media, beyond sharing educational activities and helpful information, bring students together across time and space. Ideally, they foster a digital identity supported by the confidence that, as peers, students can actively participate and collaborate in these spaces.

In this context, these channels democratize and facilitate the collective coordination of university students in both curricular and extracurricular academic projects. The absence of formal structures allows for massive, even global, participation, empowering students to contribute to online discussions.

Social media enables faculty to provide personalized learning experiences, complemented by peer support through forums, chats, sessions, and online study groups. Students can ask questions, receive feedback, resolve academic doubts, and contribute to addressing the questions of peers. These platforms facilitate access to educational resources, promote peer collaboration, and support interactive learning through online discussions, even serving as a protective factor against problems associated with internet use (Ma et al., 2025).

From a teaching perspective, under a student-centered pedagogical approach, the Internet and social media become supportive tools that enhance the instructor's role as a guide and facilitator. This support enables practical, timely, and personalized feedback (Anderson & Dron, 2020) through comments, live chats, or direct messages. They serve as a relevant support mechanism in the construction of meaningful knowledge, where flexible and informal online learning communities foster student autonomy and reflection.

According to Anderson & Dron (2020), the benefits of social media in higher education transcend learning, contributing to graduates' professional development. Students build professional media (e.g., LinkedIn), creating disciplinary connections, following labor market trends, and identifying employment opportunities.

While theoretical reviews highlight the benefits of academic use of social media—such as collaboration, student engagement, and access to educational resources, empirical evidence shows that excessive use may have adverse effects on mental health and academic performance. Several studies indicate that problematic or addictive use of social media is associated with anxiety disorders, depression, academic burnout, and low motivation (Ge et al., 2023; Ma et al., 2025; Feng et al., 2025). Likewise, excessive social media use has been shown to distract from the study process, contributing to a decline in academic performance (Chen & Xiao, 2022; Salari et al., 2025). A

preliminary study with university students notes that while social media can facilitate academic tasks, their predominant use often acts as a distractor among first-year students.

PLS-SEM is a robust statistical method that allows the examination of hypothesized relationships between factors even in complex models. PLS-SEM can be used even when the data collected do not show a normal (Gaussian) distribution and the sample size is small ( $n > 100$ ). In addition, it improves reliability and construct validity, making it potentially suitable for models based on composite variables (constructs) in exploratory studies (Chin, 1998).

The proposed model includes three primary latent constructs: PIU, SMU, and IAU. These are operationalized in indicators specified in Table 1, where their position in the model and internal consistency values are shown.

Table 1. Constructs and theoretical basis.

Constructs	Latent variable role	Basis
PIU	Endogenous	It is based on the notion of social network addiction as a loss of control, with adverse effects on daily and academic life (Feng et al., 2025; Ge et al., 2023).
SMU	Exogenous	Based on literature that recognizes the positive role of social media in learning, collaboration, and academic communication (Anderson & Dron, 2020; Chen & Xiao, 2022).
IAU	Exogenous	Supported by studies documenting the integration of social media in educational contexts for assignments, teacher communication, and assignment submission (Ma et al., 2025).

The measurement model is specified in a reflective manner, where it is assumed that variations in the latent constructs are reflected in the observed indicators. In matrix terms, the measurement model is expressed as:

$$D = C' \cdot Y + \varepsilon$$

Where  $D$  is a  $J \times 1$  vector of observed indicators,  $Y$  is a  $P \times 1$  vector of latent variables,  $C$  is the matrix of loadings between constructs and indicators, and  $\varepsilon$  is a vector of measurement errors. In this study,  $J = 16$  indicators and  $P = 3$  constructs.

The structural (internal) model defines the construct PIU as endogenous, explained by SMU, IAU, and the control variables Gender, Semester, Age, Field of study, and SM (social media) time use. Its formulation is as follows:

$$PIU = \beta_1 \cdot SMU + \beta_2 \cdot IAU + \beta_3 \cdot gender + \beta_4 \cdot semester + \beta_5 \cdot age + \beta_6 \cdot field\ of\ study + \beta_7 \cdot SM\ time\ use + \zeta$$

In this formulation,  $\beta$  denotes the path coefficients capturing the strength and direction of relationships among constructs, and  $\zeta$  represents the residual variance in the endogenous latent construct not explained by the exogenous variables.  $SMU$  and  $IAU$  are treated as exogenous constructs, while  $PIU$  is the endogenous construct.

On the other hand, the weighting model, which allows estimating the latent variables from their indicators, is defined as follows:

$$Y = W' \cdot D$$

Where  $W$  represents the matrix of weights assigned to the indicators, overall, the analysis is structured in three sub-models:

- Measurement model: it is specified reflectively for all constructs, where  $D = C' \cdot Y + \varepsilon$ .
- Structural model: links the exogenous constructs and the control variables to the endogenous constructs, where  $Y = B' \cdot Y + \zeta$ .
- Weighting model: where the latent variables are estimated from the observed indicators, for which  $Y = W' \cdot D$ .
- Based on the literature review and the formulation of the theoretical model, the following hypotheses were formulated:
  - H1: A greater focus on the academic purpose of ICT use decreases problematic internet use
  - H2: A higher level of academic use of the internet is associated with an increase in problematic internet use.

In addition to the primary constructs, the inclusion of control variables allows capturing possible differences in problematic Internet use linked to sociodemographic and academic factors. Previous studies have indicated that age and gender may influence the propensity for digital addiction behaviors and the intensity of social network use (Ge et al., 2023). Likewise, academic semester and field of study have been considered in research on digital performance and habits of college students (Salari et al., 2025). Finally, the time of social network use constitutes a relevant factor in the literature as it is associated with increased exposure and the possibility of dependence (Varchetta et al., 2024; Feng et al., 2025;).

## MATERIALS AND METHODS

The present study adopted a descriptive cross-sectional design aimed at analyzing the phenomena related to the hypotheses proposed. The data collection instrument was a self-administered questionnaire applied to a sample of 292 participants aged 16 and above, residing in the Ecuadorian coastal provinces of Los Ríos, Manabí, Guayas, and El Oro. All participants reported using social media for educational purposes, which was considered relevant to explore the relationship between the academic use of these platforms and behaviors associated with problematic Internet use.

The sample was obtained through non-probabilistic convenience sampling with quotas, given the ease of access to university students from institutions such as PUCEM, UTEQ, UMET, and the Universidad de Guayaquil. This procedure allowed for efficient data collection consistent with the research objectives. In terms of demographics, 95% of the participants were between 16 and 28 years of age; 62% were female, and 57% were in their first year of university. Also, 45% reported using ICT technologies between 6 and 10 hours per day. The vast majority had technological infrastructure at home: 96% had an Internet connection, and 95% had a personal computer. This profile reflects a predominantly young and digitally active

population, which is particularly relevant for online behavioral research.

The questionnaire was structured using a 5-point Likert scale (1 = “strongly disagree”, 5 = “strongly agree”), designed to measure attitudes and perceptions in two main dimensions: (i) student behavior in social media and ICT use in education; and (ii) perceived effects of ICT use. The instrument was adapted from the ad hoc model developed by López-Barbosa et al. (2019) on ICT use and academic performance in university students in Mexico. The adaptation was supported by experts, which ensured content validity in the Ecuadorian context.

Additionally, an exploratory factor analysis was conducted to optimize the structure of the instrument and reduce the dimensionality of the initial questionnaire, composed of 30 items. As a result of this process, and after using the principal components method with Varimax rotation, the items with low or redundant factor loadings (loadings <0.50) were purged, leaving a final version of 21 items distributed in three primary constructs. This reduction did not compromise the internal consistency of the instrument, since the overall Cronbach’s alpha went from 0.983 in the initial version to 0.962 in the final version, showing a very high level of reliability and appropriate for subsequent analysis by PLS-SEM.

## RESULTS AND DISCUSSION

The application of PLS-SEM modeling was carried out through the SmartPLS software in its version 4 where it ran a reflective model of type I relationships between constructs for 292 observations.

In reflective models, the evaluation starts with the analysis of the factor loadings of the indicators. A value above 0.700 is considered acceptable, as it ensures that the construct explains at least 50% of the variance of the indicator. For this reason, it was decided to eliminate those indicators that did not meet this criterion, so we went from 21 indicators to an adjusted version of 16, as shown in Table 2.

Table 2. Measurement model fit for the reflective model.

Construct	Indicator	Factor loading	CA	rho_a	AVE
PIU	C2. Forget to eat	0.773	0.938	0.948	0.706
	C3. Difficult to stop using	0.846			
	C4. Withdrawal anxiety	0.733			
	C5. Class distraction	0.791			
	C6. Teacher reprimand	0.875			
	C7. Neglect responsibilities	0.752			
	C9. Friends annoyed	0.796			
	C10. Bothered by the insistence	0.829			

SMU	D12. ICT helps education	0.875	0.979	0.861	0.622
	D15. ICT eases research	0.821			
	D16. Teachers use ICT	0.827			
	D17. ICT supports student communication	0.889			
	D19. Video conferences aid teamwork	0.769			
IAU	D3. Teachers notify via social media	0.716	0.970	0.919	0.701
	D7. Submit assignments via social media	0.726			
	D10. Social media allowed in class	0.890			

Note. The proposed model incorporates a total of 16 indicators, distributed among the three constructs: eight related to PIU, five to SMU, and three to IAU. This distribution ensures adequate coverage of the theoretical dimensions identified.

The next step in the evaluation of the constructs was the analysis of the convergent validity of the reflective constructs. Convergent validity measures the extent to which a construct converges with its indicators and explains the variance of its items. Convergent validity is determined by the Average Variance Extracted (AVE) for all items associated with that construct. The AVE value is calculated as the mean of the squared loadings of all indicators associated with that construct.

The cut-off point of the AVE is 0.50, so values equal or higher are acceptable, as this indicates an average; the construct explains at least 50% of the variance of the items. Thus, all the indicators of the constructs of the model have an AVE greater than 0.50, showing convergent validity (see Table 2).

After the reliability and convergent validity of the reflective constructs, it is necessary to determine the discriminant validity of the constructs. Discriminant validity determines how different a construct is from others in the model.

The most robust way to do this is through the Heterotrait-Monotrait Ratio of Correlations (HTMT) criterion, where, according to Henseler et al. (2015), discriminant validity is confirmed when the HTMT coefficient is lower than 0.85 (strict criterion) or 0.90 (laxer criterion). For the model analyzed, it can be indicated that there is discriminant validity, given that all HTMT coefficients are less than 0.85, as shown in Table 3. In addition, the inclusion of control variables (age, gender, semester, field of study, and time in social media) does not negatively affect this validity, since their HTMT ratios also remain within the recommended margins.

Table 3. HTMT matrix among constructs and control variables.

Constructs	IAU	PIU	SMU	age	field of study	SM time use	semester	gender
IAU	1							
PIU	0.261	1						
SMU	0.086	0.258	1					
Age	0.177	0.150	0.040	1				
Field of study	0.052	0.118	0.041	0.238	1			
SM time use	0.086	0.086	0.059	0.059	0.125	1		
Semester	0.246	0.137	0.236	0.499	0.141	0.058	1	
Gender	0.096	0.226	0.179	0.001	0.057	0.013	0.054	1

After performing the reliability and validity analysis of the constructs, the structural model is evaluated. For which it is required to consider the following criteria: a) coefficient of determination (R<sup>2</sup>), b) cross-validation redundancy (Q<sup>2</sup>), and c) Path coefficients (Sasstedt et al., 2014)

The R<sup>2</sup> is a measure related to the variance explained in each of the dependent constructs (endogenous variable), so it is assumed as a predictive measure of the model. Chin (1998) suggest guidelines regarding cut-off points, where 0.75 or more is considered substantial, 0.50 to 0.74 is moderate, 0.25 to 0.49 is weak but acceptable, and values less than 0.25 are considered very weak. However, they may be helpful in exploratory studies. In the scope of this study, the R<sup>2</sup> is interpreted as weak but acceptable, see Table 4, given that the model analyzes a complex phenomenon, with

multicausal components and influenced by psychological, social, and technological factors, so an R2 of 38% is theoretically acceptable.

Table 4. R<sup>2</sup>, Adjusted R2 y Q2 of the structural model.

Endogenous constructs	R2	Adjusted R2	Q2
PIU	0.381	0.324	0.218

Another procedure to evaluate the predictive relevance of the model is through the Q2 (Stone-Geisser), which is described as a measure of prediction, and is obtained through blindfolding analysis in SmartPLS. For its interpretation, it is indicated that, if Q2 is greater than 0, the model has predictive relevance for the endogenous construct, while if Q2 is equal to 0, there is no predictive power.

Subsequently, the strength and significance of the path coefficients are evaluated by the relationships established in the model and the hypotheses built from them. For the above, a bootstrapping analysis was performed with 5000 subsamples, yielding four relationships between the variables (see Table 5). The results show that academic internet use is positively and significantly associated with problematic internet use, while the educational purposes of social media have an adverse effect. Gender was also significant, but with different directions between men and women. In contrast, the other control variables and moderating interactions did not show statistically significant effects.

Table 5. Hypotheses, path coefficients, t-values, and statistical significance in the structural model.

Hypotheses		Path Coefficients	t-value
IAU → PIU	Supported (positive)	0.247 ***	3.453
SMU → PIU	Supported (negative)	-0.263 ***	3.040
Age x SMU → PIU	Not supported	0.086	1.054
Age x IAU → PIU	Not supported	0.039	1.174
Field of study → PIU	Not supported	0.229	1.553
SM time use → PIU	Not supported	0.048	0.786
Semester x SMU → PIU	Not supported	0.048	0.650
Semester x IAU → PIU	Not supported	0.020	0.220
Gender x SMU → PIU	Supported (negative)	-0.113 *	1.703

Gender x IAU → PIU	Supported (positive)	0.118 **	1.909
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Note: \*\*\* p<0.001, \*\* p<0.01, \* p<0.05

The present study set out to investigate the complex relationship between different modalities of digital technology use for academic purposes and the development of PIU among university students. Using a PLS-SEM approach the analysis confirmed not only the existence of significant associations but also revealed a paradox at the heart of digital transformation in higher education: the purpose and agency with which students employ these tools are decisive determinants of their outcomes, generating opposed effects (see Figure 1). Specifically, while the use of social media for well-defined educational purposes (SMU) functions as a protective factor, reducing PIU, the academic use of the Internet imposed by institutional structures (IAU) is, counterintuitively, associated with increased PIU.

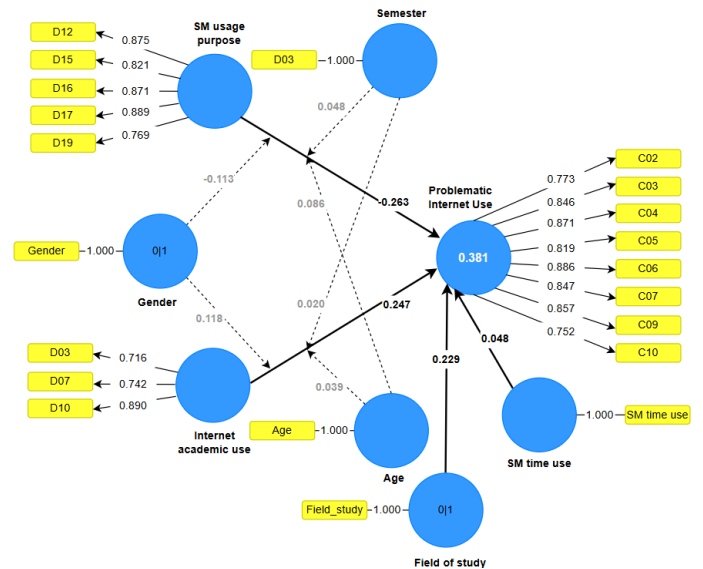


Figure 1. Adjusted path model of the structural model.

### The double-edged sword: Deconstructing the paradox of IAU

The most salient finding of this study is the dichotomy between the effects of IAU and SMU on PIU, providing empirical support to the metaphor of educational technology as a double-edged sword. The same set of tools may be beneficial or harmful depending on the context in which they are implemented. This study contributes to the literature by elucidating the mechanisms that help explain this apparent contradiction.

### The detrimental path: IAU as a facilitator of PIU

The significant and positive path coefficient between IAU and PIU ( $\beta = 0.247$ ,  $p < 0.001$ ) is, at first glance, puzzling. Why should Internet use for academic tasks, such as

receiving notifications from professors or submitting assignments, lead to problematic behaviors? The interpretation should not be that academic work causes addiction, but rather that how academic Internet use is being implemented creates an environment conducive to self-control failure—a central component of PIU (Rasouli et al., 2025).

This mechanism can be explained through the concept of context collapse. The indicators defining IAU (e.g., “Teachers notify via social media,” “Social media allowed in class”) imply the integration of academic tasks into platforms originally designed for leisure and social interaction. This overlap of contexts exposes students to cognitive cues for entertainment (notifications, infinite feeds, peer interactions) while they are expected to concentrate on academic activities. Such exposure generates substantial cognitive load.

Research on digital distraction and multitasking has consistently demonstrated that human attentional capacity is limited and that frequent task-switching entails cognitive costs (Koessmeier & Büttner, 2021). Attempting to focus on academic reading while receiving notifications from the same platform used for social interaction leads to cycles of disengagement and re-engagement. This process not only diminishes learning efficiency but also depletes self-control, which, according to ego-depletion theory, is a finite resource (Yang et al., 2024). As this resource is consumed throughout the day, the ability to resist non-academic temptations on the same platform declines, facilitating procrastination and compulsive use (Rasouli et al., 2025). Thus, the positive path from IAU to PIU does not suggest that academic tasks are inherently problematic but highlights that their implementation in digitally “noisy” and weakly structured environments fosters the conditions for problematic patterns to emerge.

### The protective path: SMU as a buffer

In contrast, the negative and significant path coefficient between SMU and PIU ( $\beta = -0.263$ ,  $p < 0.001$ ) underscores the protective role of intentionality and perceived utility. The SMU construct (e.g., “ICT helps education,” “ICT supports student communication”) reflects a proactive, goal-oriented orientation. When students perceive digital tools not as sources of obligations and constant notifications but as instruments to pursue their academic objectives, their engagement fundamentally changes.

This finding aligns closely with the Self-Determination Theory, which argues that satisfying basic psychological needs for autonomy, competence, and relatedness fosters intrinsic motivation and healthier engagement. Within SMU, students exercise autonomy by choosing to use technology for specific purposes (e.g., research), while experiencing competence when technology demonstrably supports their effectiveness. This sense of agency

functions as a psychological buffer against the addictive characteristics of social media platforms.

Moreover, the result resonates with research on self-regulated learning (SRL), which emphasizes students’ capacity to set goals, select strategies, monitor progress, and adapt behaviors accordingly. The intentional academic use of technology, as captured by SMU, exemplifies SRL in the digital domain. A student actively seeking information for a project is demonstrating metacognitive skills and resource management that counteract the passive, aimless use characteristic of PIU. Therefore, the protective effect of SMU arises not simply because “good use” of technology is beneficial, but because such use reflects a broader set of self-regulatory competencies that themselves protect against addictive behaviors (Coker et al., 2025).

### Gendered pathways to PIU

The study further revealed significant gender interaction effects, indicating that men and women may experience the paradox of academic technology in different ways. The negative coefficient for the Gender  $\times$  SMU interaction ( $\beta = -0.113$ ,  $p < 0.05$ ) suggests that the protective effect of intentional SMU is more substantial for one gender. Literature indicates that women are more likely to use social media for communication and relationship maintenance (Varchetta et al., 2024), which may explain why collaborative academic uses of these platforms align more naturally with their digital practices, enhancing the protective effect.

Conversely, the positive coefficient for the Gender  $\times$  IAU interaction ( $\beta = 0.118$ ,  $p < 0.01$ ) suggests that the detrimental effect of institutionally imposed IAU is more substantial for the other gender. Previous studies indicate that women may be more vulnerable to social anxiety and fear of missing out (FoMO) in social media contexts (Mandić et al., 2024). In this setting, constant academic notifications and the pressure to remain perpetually connected could exacerbate these vulnerabilities, making such uses more problematic. While men are also affected, their PIU may be more closely linked to compulsive entertainment or gaming, which are less directly triggered by academic notifications (Varchetta et al., 2024). These interpretations are inferential and warrant further investigation, but highlight the importance of gender-sensitive approaches to digital well-being.

### Theoretical and practical implications

From a theoretical standpoint, the main contribution of this study is the demonstration that the construct “academic Internet use” must be disaggregated. Treating it as a homogeneous variable conceals opposing effects and produces an incomplete understanding of PIU. Future

theoretical models should explicitly differentiate between (a) intentional, agentic use driven by student learning goals, and (b) structurally imposed, reactive use driven by institutional requirements. This distinction is crucial for developing more accurate theories of risk and protective factors in digital learning environments.

Additionally, the findings provide ecological validity to theories of self-control. By showing how the design of digital learning environments—particularly the integration of academic tasks into distracting platforms—facilitates self-control failure, the study extends laboratory-based psychological concepts into the complex reality of students' daily lives. Consequently, models of PIU should incorporate environmental and instructional design variables as predictors of self-control depletion.

In practice, the findings demand a paradigm shift in how higher education institutions integrate technology, moving from a tool-centered to a student-centered and well-being-centered approach. A tripartite action framework is proposed:

- **For Students:** Promote digital mindfulness and self-regulation. Workshops and resources should equip students with metacognitive skills, time management techniques such as the Pomodoro method, and conscious creation of “technology-free zones” for deep work and rest (Yosep et al., 2024).
- **For Educators:** Adopt a critical digital pedagogy. Instead of technocratic implementation, educators should design learning activities that cultivate critical evaluation of technology's role, active distraction management, and ethical, intentional use (Collier & Lohnes-Watulak, 2023).
- **For Institutions:** Build supportive digital ecosystems. Universities should implement holistic digital well-being frameworks, integrating mental health, academic support, and IT policy. Measures may include investing in robust digital literacy initiatives and adopting learning management systems (LMS) that centralize communication while reducing reliance on commercial social media platforms (Suardipa et al., 2024).

Despite its contributions, this study presents several limitations. Its cross-sectional design restricts causal inference; longitudinal studies are required to test directional hypotheses. The convenience sample from coastal Ecuadorian provinces limits generalizability across different contexts and cultures. Additionally, reliance on self-reported data raises the risk of social desirability bias and recall errors.

Future research should prioritize longitudinal designs to examine whether prolonged exposure to high IAU environments reduces self-control capacity over time. Experimental and quasi-experimental studies could test the effectiveness of critical digital pedagogy interventions. Qualitative methods (e.g., interviews, focus groups,

diary studies) would provide richer insights into students' lived experiences with digital distraction and context collapse. Finally, cross-cultural replications, particularly in other Latin American nations, would test the robustness of these findings across diverse educational and socio-cultural settings.

## CONCLUSIONS

This study examined the paradoxical effects of digital technology use in higher education, focusing on the relationship between SMU, IAU, and PIU. The findings confirm that intentional and goal-oriented use of social media for academic purposes acts as a protective factor, significantly reducing PIU ( $\beta = -0.263$ ). In contrast, institutionally imposed IAU was positively associated with increased PIU ( $\beta = 0.247$ ), underscoring the risk of integrating academic tasks into platforms originally designed for leisure and social interaction.

A significant moderating effect of gender further revealed that the relationship between technology use and PIU differs across student groups, highlighting the importance of tailoring institutional strategies to these differences. Meanwhile, other control variables—such as age, semester, field of study, and total time spent on social media—did not show significant direct effects, indicating that the quality and purpose of use matter more than the quantity of time online.

In light of these results, the study emphasizes the need for higher education institutions to balance the benefits of digital transformation with measures that safeguard student well-being. This involves not only enhancing digital literacy but also fostering self-regulation skills and promoting responsible, purpose-driven engagement with technology.

Ultimately, the challenge for universities is to design technological integration models that go beyond tool proficiency to include guidelines and practices that reduce cognitive overload and protect students' mental health. Addressing this paradox is essential to ensure that the promise of digital innovation translates into genuine educational improvement.

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