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Risks Analysis and Internet Perception Among Spanish University Students

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Abstract: Digital competence entails the healthy, safe, and responsible use of digital technologies to take engage in society, to learn, work and to interact with. However, the use of digital devices is not exempt of risks. The objectives of this study were to analyze the mediating effect of fear of missing out (FoMO) on phubbing and nomophobia, and to explore the perception of the use of Internet-connected devices among 522 Spanish university students, with an average age of 27.11 years. The 80.8% are women and 68.2% study degrees related with Educational Sciences. A mixed-methods approach was used, combining bivariate correlation with structural equation modelling (SEM), and qualitative content analysis. SEM analysis revealed that FoMO had a significant effect on nomophobia and phubbing. Qualitative content analysis underlined that the time spent, problematic use, and sense of dependence were the main concerns for participants. It is emphasized that the plethora of ICT opportunities exposes individuals to risk contexts, necessitating media education to mitigate psychological and social consequences stemming from Internet risks.

Keywords: *Risks analysis, technologies, structural equation modeling, qualitative content analysis, university students.*

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Introduction

The forms of interpersonal relationships have undergone a profound change, moving from face-to-face closeness to a preferential digitalization. In this aspect, the excessive use that adolescents, young people, and adults make of digital technologies and devices has had a lot to do with it. About 92.9% of Spanish population between 16 to 74 years old are connected to Internet once a week, while 84.2% do so several times a day (National Institute of Statistics, 2022). This same study highlights communication as the preferred use (93.8%), followed by entertainment (85.9%) and search/access to information (85.8%). In communicative terms, social networks (RRSS) and instant messaging (such as WhatsApp) are at the forefront. In a highly virtualized society defined by hyperconnection, the immediacy and reach of information, consumers find themselves "locked between screens" (Amat & Percovich, 2022), oblivious to what can happen or happens in a timely manner with the closest person.

Despite the multitude of positive aspects that technology offers, new risks have emerged that are caused using the Internet (Andrade Pérez & Guadix García, 2021). We can differentiate two types of risks: a) relational risks derived from relationships between people in the online context; b) and the dysfunctional risks that are due to the inappropriate or problematic use that a person makes of technology (Díaz-López et al., 2024). Nomophobia, phubbing, and fear of missing out (FoMO) are examples of this second type of category risks.

Nomophobia comes from the nexus of no mobile phone and phobia. It is a construct classified as a clinical case comparable to agoraphobia (King et al., 2010). Nomophobia addresses the psychosociological state of discomfort and irrational situational fear of not having access to the mobile phone, which translates into spending too much time on the device, always carrying the charger to ensure connection, irritability, and nervousness in the face of a restrictive situation of use. International data indicate 24.2% of nomophobia, with loss of control being the most common behavior in 55.6% of the surveyed population (Naser et al., 2023). The systematic review by Tuco et al. (2023), warns of 24% of university students with a medium profile of nomophobia, 56% at a moderate level, and 17% who confirm severe nomophobia. In

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Spain, higher levels of nomophobia have been identified in women and among adolescents between 12 and 16 years old, decreasing as age increases (Caba-Machado et al., 2024).

Phubbing refers to the behavior of ignoring, and disconnecting from reality, from the communicative and relational exchange with another person to be more aware of what is happening on the Internet (Karadağ et al., 2015). It represents contempt and a discourteous act of disconnection from the person in front of us, associating itself with digital dependence (Capilla Garrido & Cubo Delgado, 2017). The first research report about daily phubbing episodes announced a range between 49.3% and 69.3% in adults between 18 and 66 years old (Chotpitayasunondh & Douglas, 2016). In a more recent review, Aygar et al. (2021) found a 12.1% phubbing in people between 17 and 28 years old. Among Spanish university students, Caba-Machado et al. (2024) report a higher proportion of phubbing among women at the postgraduate level and in public universities. A more recent study concludes that phubbing behavior is highly extended among young Spanish students between 12 to 21 years old, with higher level of phone obsession score in girls and general phubbing level against boys (Barbed-Castrejón et al., 2024). Beyond the data, this phenomenon impacts the mental health of users and their psychological well-being, showing higher levels of depression, hostility, life dissatisfaction and social anxiety (Ergün et al., 2020).

On the other hand, FoMO is described as the irrational fear as a result of feeling displaced and outside of rewarding experiences that other people are experiencing, and in which one does not participate. It entails anxiety, restlessness, and the need to be hyperconnected to social networks (SNS) (Yam & Kumcağız, 2020). Sabir and Jabeen (2023) found 32% severe FoMO and 16.8% very severe FoMO in university students, figures lower than those reported in Brazil by Ferra Pêgo et al. (2022), who find 58% with a high level of FoMO. These data contrast with lower levels in the Spanish university sample (Caba-Machado et al., 2024).

Given the international data and highlighting the few previous studies about dysfunctional and social ICT risks among adolescent and young Spanish students, the main contribution of this study lies in the analysis of the relationship and the mediating effect of nomophobia, phubbing and FoMO. Some literature, specifically systematic reviews have shown the connection between the three risks of problematic smartphone and Internet use (Akbari et al., 2021), confirming a stronger significant link between phubbing to FoMO (Ansari et al., 2024), in contrast with Yam and Kumcağız (2020) who find that FoMO has a direct influence on phubbing, on mobile phone addiction (Hidalgo-Fuentes, 2023), and acting as a mediator between psychological needs and phubbing (Butt & Arshad, 2021). Also, Önal et al. (2023) confirm the correlation between nomophobia, phubbing, and FoMO with a negative effect of FoMO on quality of life while phubbing has a positive effect on life satisfaction. Other current research concludes that FoMO does not seem to have a direct effect on phubbing (Talan et al., 2024). In Spain, only some approaches have also pointed out the positive association between FoMO and phubbing but without delving into the direction and influence between variables (Blanca & Bendayan, 2018). Considering a qualitative view, Aksoy (2018) points out that FoMO, lack of friends, and social necessity of social media seems to be connected to social media addiction with significant gender differences. Recently, Bakır and Dilmaç (2023) examined the relationship between phubbing and mental health, showing that university students perceive people with phubbing behaviors as more introverted, loners, anxious, and technology-dependent than those less phubbers. Regarding scarce quantitative Spanish studies, qualitive research is even an interesting gap unusually analyzed. For that reason, a mixed study as we present could help to understand ICT risks, its extension and possibly impact on social relationships.

In the light of this reality, the aims of this research are: a) to analyze the direct effect of FoMO on phubbing and nomophobia; b) to explore the perception of university students regarding the use of devices connected to the Internet (ICD). Moreover, this second objective complements the mediation analysis, offering a qualitative exploratory look in terms of the concerns of the student population in the context of the dysfunctional use of ICT and associated consequences.

Methodology

Research Design

The research was a cross-sectional survey design. About the purpose of the enquiry, the study was descriptive, comparative, relational, and partially explanatory in scope. It was also exploratory through open-ended questions (Hernández-Samperi & Mendoza-Torres, 2018; Touron et al., 2023).

Sample

The sample consisted of 522 subjects from five Spanish universities: National University of Distance Education (n = 103), International University of Valencia (n = 107), University of Granada (n = 119), University of Murcia (n = 79) and Nebrija University (n = 114). Nineteen percent of the participants (n = 99) identified themselves as male, 80.8% (n = 422) as female and 0.2% (n = 1) as non-binary gender, with an age range between 18 and 57 years (Mean = 27.11, Standard deviation = 9.64). The majority were undergraduate students (64.6%, n = 337), followed by Master's students (22.4%, n = 118). 68.2% (n=356) were students from the field of educational sciences, 15.3% (n = 80) from business, administration, and accounting, 5.2% (n = 27) from social sciences, and 2.9% (n = 15) from humanities. Regarding the university of enrolment, 210 individuals (40.2%) belonged to online higher education institutions and the rest to face-

to-face (59.8%, n = 312). Regarding employment status, 42.5% (n = 222) were unemployed, 20.1% (n = 105) worked for a public company or institution and 19.7% (n = 103) worked for a private company or institution. In terms of marital status, 76.1% (n = 397) of the total were single and 15.1% (n = 79) were married. In terms of country of origin or provenance, 77% (n = 402) were Spanish, the rest from other countries. Participants were recruited by means of a non-probabilistic accidental sampling procedure or according to availability of research team (Gil Pascual, 2015; Pérez Juste et al., 2009). Volunteer university teachers participated in recruiting samples during lesson times and informed researchers after surveys were completed to check the information was completed. The inclusion criterion used was that the students in the sample were enrolled in subjects in which ICTs are commonly used.

Instruments

The instrument consisted of five dimensions. Dimension 1 (D1) contained sociodemographic data (gender, age, level of education, degree program, university, employment status, and country of origin). Dimension 2 (Nomophobia) was assessed using the Nomophobia Questionnaire Short-Form (NMPQ-SF) (Caba-Machado et al., 2024), consisting of 10 items evaluating four dimensions on a Likert scale with four response options (0 = "totally disagree" to 4 = "totally agree"): a) inability to access information (2 items), b) sacrificing convenience (3 items), c) inability to communicate (3 items), and d) loss of connection (2 items). The original questionnaire showed internal consistency of α = .89. For this study, the overall value was excellent (α = .93), as were the values for each dimension (α between .78 and .90). This scale assesses behaviors, feelings and sensations ranging from the discomfort of losing immediate access to information and the psychological reassurance of having control of smartphone access, to the negative feelings of losing immediate communication due to not having access to the phone or the loss of ubiquity due to not having connectivity. Dimension 3 (phubbing) employed the Phubbing Scale by Blanca and Bendayan (2018) with a bifactorial structure: a) communicative disruption (5 items), and b) obsession with the mobile phone (5 items). Items were rated on a Likert scale with 5 response options (0 = "never" to 4 = "always"). The original Spanish scale demonstrated high internal consistency (communicative disruption, α = .85; mobile phone obsession, α = .76), similar to the present study for overall scale (α = .84), communicative disruption (α = .77), and phone obsession (α = .72). This scale assesses the behavior of ignoring another individual due to the use of an electronic device connected to the Internet (usually a smartphone), which interferes with communication between people, encouraging a predisposition to non-verbal behavior, limiting face-to-face relationships, as well as direct contact with the environment surrounding the individuals involved in these situations. Dimension 4 (FoMO) utilized the scale by Gil et al. (2015), comprising 10 items rated on a five-point Likert scale (0 = "not true for me" to 4 = "extremely true for me") with good internal consistency in its original version (α = .87), like that obtained in this study. This scale assesses feelings of unease, which can be intense, triggered by a concern that friends or others may witness rewarding experiences from which one is absent. It is also defined as the fear of being left out or of constantly thinking that others are doing something more interesting than we are. It may manifest as some form of social anxiety and is characterized by the desire to remain socially connected. Lastly, Dimension 5 (D5) included an open-ended question asking participants to articulate their concerns and risks associated with the use of internet-connected digital devices.

Data Collection

Teachers and academic coordinators of the different institutions were contacted to facilitate class schedules and access to the samples. After that, from 12 January to 29 November 2023, four researchers and collaborating teachers went into classrooms or virtual classrooms, explaining the objectives of the research to the students, and providing instructions for completing the battery of instruments via a QR code. The ethical principles of the American Psychological Association (2017) and the provisions of the Organic Law (2018) were considered. At the end of the data collection, the qualitative content analysis of the open-ended question was carried out using Excel. Numerical data were analyzed using SPSS software (version 28) and IBM Amos (version 28).

Analyzing of Data

All data were explored and analyzed using descriptive statistics. Data reliability was checked using Cronbach's alpha, and normality was assessed using skewness and kurtosis. Relationships between FoMO, phubbing, and nomophobia were examined through bivariate correlations. Structural Equation Modeling (SEM) model fit was evaluated using the most reliable fit indices (Hu & Bentler, 1999): relative chi-square statistic (χ^2/df), Root Mean Square Error of Approximation (RMSEA), Comparative Fit Index (CFI), Tucker-Lewis Index (TLI), and Standardized Root Mean Square Residual (SRMR). Adequate model fit was indicated by values of χ^2/df ≤ 2 to 3, RMSEA ≤ .08 (Browne & Cudeck, 1992), CFI and TLI ≥ .90 (Bentler & Bonett, 1980), and SRMR ≤ .08.

Finally, in the open-ended question, a qualitative analysis of the textual content was carried out with the aim of revealing the most frequent concerns of students regarding the use of digital devices connected to the Internet. For this purpose, the coding was carried out in a deductive way. This configuration started with a general dimension, from which different codes emerged during the analysis (Hernández-Samperi & Mendoza-Torres, 2018). In addition, the coding process for the open-ended question was carried out by a single researcher, so it was not possible to calculate inter-rater reliability.

However, the three remaining researchers supervised the coding process and participated in the selection of the most significant discourse fragments for each of the main codes extracted.

Findings/Results

Correlations Among Analysis Variables

All variables exhibited good reliabilities (see Table 1) (≥ .7). The absolute values of skewness and kurtosis for each variable fell within the interval of ± 1.96 and within the cutoff points for normal distribution data in SEM models (Brown, 2015). FoMO, nomophobia (total scale and by dimensions), and phubbing (total scale and by dimensions) showed significant relationships with each other ($p \leq .01$). Additionally, statistically significant negative correlations were found between age and all three study variables ($p \leq .01$) (Table 1).

Table 1. Correlation, Descriptive Statistics, and Reliability of Variables Used in SEM

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
FOMO (1)	1									
Nom_Total (2)	.44**	1								
Nom_Inf (3)	.36**	.81**	1							
Nom_Com (4)	.36**	.89**	.61**	1						
Nom_Conn (5)	.42**	.81**	.57**	.61**	1					
Nom_Conv(6)	.38**	.91**	.67**	.73**	.68**	1				
Phub_Total (7)	.53**	.58**	.51**	.47**	.53**	.52**	1			
Phub_disrup (8)	.44**	.48**	.41**	.37**	.49**	.43**	.90**	1		
Phub_obs (9)	.52**	.57**	.50**	.47**	.47**	.51**	.67**	-.23**	1	
Average	9.61	25.36	5.50	9.12	3.10	7.63	14.58	5.72	8.86	27.11
SD	7.15	14.10	3.29	5.13	3.12	4.77	6.53	3.28	3.85	9.64
α	.87	.96	.86	.90	.88	.79	.84	.768	.715	-
Skewness	.876	-.001	-.27	-.21	.77	.057	.339	.613	.121	1.17
Kurtosis	.275	-.779	-1.11	-1.00	-.39	-1.00	.262	.565	-.165	.288

Note: SD = standard deviation; α = Cronbach's Alpha. (1) fear of missing out; (2) nomophobia total; (3) nomophobia information; (4) nomophobia communication; (5) nomofobia connectedness; (6) nomofobia convenience; (7) phubbing total; (8) phubbing disruption; (9) phubbing obsession; *$p \leq .05$; **$p \leq .01$.

Differences in FoMO, Nomophobia, and Phubbing Scores by Gender

Statistically significant differences were found between women and men in both the overall mean score of phubbing (men: $M = 13.22$, $SD = 7.04$; women: $M = 14.90$, $SD = 6.38$; t = 2.31, $p < .05$, d = 0.26) and in the specific dimension of mobile phone obsession, favoring women (men: $M = 7.77$, $SD = 4.11$; women: $M = 9.10$, $SD = 3.75$; t = 3.11, $p < .001$, d = 0.35). Similarly, differences were observed in the nomophobia scale (men: $M = 19.67$ and $SD = 14.93$; women: $M = 26.69$ and $SD = 13.59$; t = 4.53, $p < .001$, d = 0.51), as well as in the analysis by dimensions: (1) inability to access information (men: $M = 5.18$, $SD = 3.30$; women: $M = 5.56$, $SD = 3.28$; t = 0.04, $p < .05$, d = 0.12); (2) sacrificing convenience (men: $M = 5.48$, $SD = 5.04$; women: $M = 8.13$, $SD = 4.57$; t = 5.08, $p < .001$, d = 0.57); (3) inability to communicate (men: $M = 6.74$, $SD = 5.35$; women: $M = 9.68$, $SD = 4.93$; t = 5.25, $p < .001$, d = 0.59); and (4) loss of connection (men: $M = 2.26$, $SD = 2.98$; women: $M = 3.30$, $SD = 3.12$; t = 3.01, $p < .001$; d = 0.34). However, no statistically significant differences by gender were found in FoMO (men: $M = 8.54$, $SD = 6.94$; women: $M = 9.85$, $SD = 7.19$; t = 1.64, $p > .05$).

Assessment of Measurement Model

All factor loadings were significant and ranged from .44 to .93 (see Figure 1). Moreover, the average variance extracted (AVE) for each construct was evaluated to determine convergent validity. The results showed that the AVE for Nomophobia was .69, for FoMO it was .36, and for Phubbing it was 0.32, both below the acceptable threshold of .50 (Nunnally & Bernstein, 1994), suggesting that these constructs may not be adequately capturing the variance of its indicator items and may require revision or further adjustment. However, Cronbach's alpha and composite reliability (CR) values exceeded the recommended threshold value of .70 (Nunnally & Bernstein, 1994). Therefore, due to acceptable values of factor loadings, Cronbach' alpha, and CR, and the theoretical relevance of the items to the FoMO and Phubbing constructs, the analyses of this study were continued.

Structural Equation Model

The presented model (Figure 1) demonstrated acceptable fit [χ^2 (378) = 1043.7; χ^2/df. = 2.761; $p < .001$; CFI = .922; RMSEA = .058; (90% CI = .054 - .062); SRMR = .076]. Results indicated that FoMO had a significant effect on nomophobia ($\beta = .611$, $p \leq .001$) and on phubbing ($\beta = .801$, $p \leq .001$).

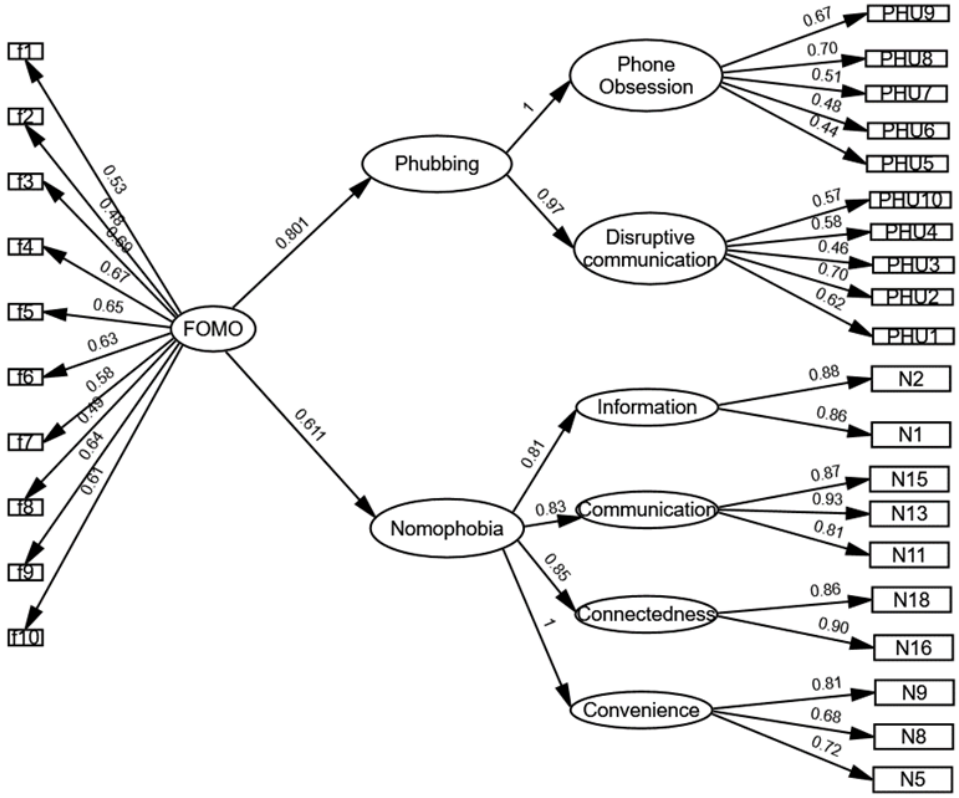

Figure 1. Structural Equation Model for FoMO, Phubbing, and Nomophobia Qualitative Analysis: Concerns About the Use of Electronic Devices

Confirmatory Factor Analysis and Invariance Test by Gender

Table 2 presents the goodness-of-fit indexes of the model for each of the groups according to gender. It also presents the measurement invariance models for these groups. The goodness-of-fit indexes show adequate values. This suggests that the model is relevant both for males and females. Concerning measurement invariance, as shown in Table 3, when comparing the restrictive models with the less restrictive ones, the values of ΔCFI < 0.01, and ΔRMSEA < 0.015 (Chen, 2007), allowed us to establish the measurement invariance by gender.

Table 3. Confirmatory Factor Analysis and Invariance Tests for Gender

Model	χ^2	df	RMSEA (IC 90%)	CFI	SRMR	TLI	ΔM	$\Delta\chi^2$	Δdf	ΔRMSEA	ΔCFI
Sex											
1. Males	562.994*	370	0.073 (0.061-0.085)	0.901	0.0	0.884	–	–	–	–	–
2. Females	834.340*	370	0.055 (0.050-0.060)	0.930	0.071	0.913	–	–	–	–	–
M1	1399.667*	740	0.041 (0.038-0.045)	0.923	0.066	0.910	–	–	–	–	–
M2	1447.683*	764	0.042 (0.038-0.045)	0.920	0.066	0.909	M2 vs. M1	48.016	24	0.001	-0.003
M3	1462.490*	769	0.042 (0.038-0.045)	0.919	0.066	0.908	M3 vs. M2	14.807	5	0.000	-0.001

Note. χ^2 = Chi-square; df = degrees of freedom, RMSEA = root mean square error of approximation, CFI = comparative fit index, SRMR = stand- ardized root mean square residual, TLI = Tucker-Lewis index (TLI), ΔX^2 = Chi-square difference, Δdf = difference in degrees of freedom, ΔRMSEA = difference in root mean square error of approximation, ΔCFI = difference in comparative fit index, M1 = configural invariance,M2 = metric invariance, M3 = scalar invariance. * $p < .001$

Out of the 522 participants, 337 (64.5%) responded to the open-ended question, expressing their concerns regarding the use of Electronic Communication Devices (ECDs) and mobile applications (see Figure 2 and Table 3). However, 63 individuals stated they had no concerns regarding these aspects, and 122 did not respond. The data highlighted the following main concerns and associated risks related to ECDs: the time spent on them (n=64) and their usage (excessive or otherwise) (n = 27), issues related to personal data (n = 47), privacy (n = 23), and security (n = 15), particularly regarding hacking incidents (n = 10). Additionally, there was notable concern regarding feelings of dependence or

attachment (n = 28) and addiction (n = 15), as well as anxiety if internet connection is lost (n = 25) or if contact with others cannot be maintained (n = 10).

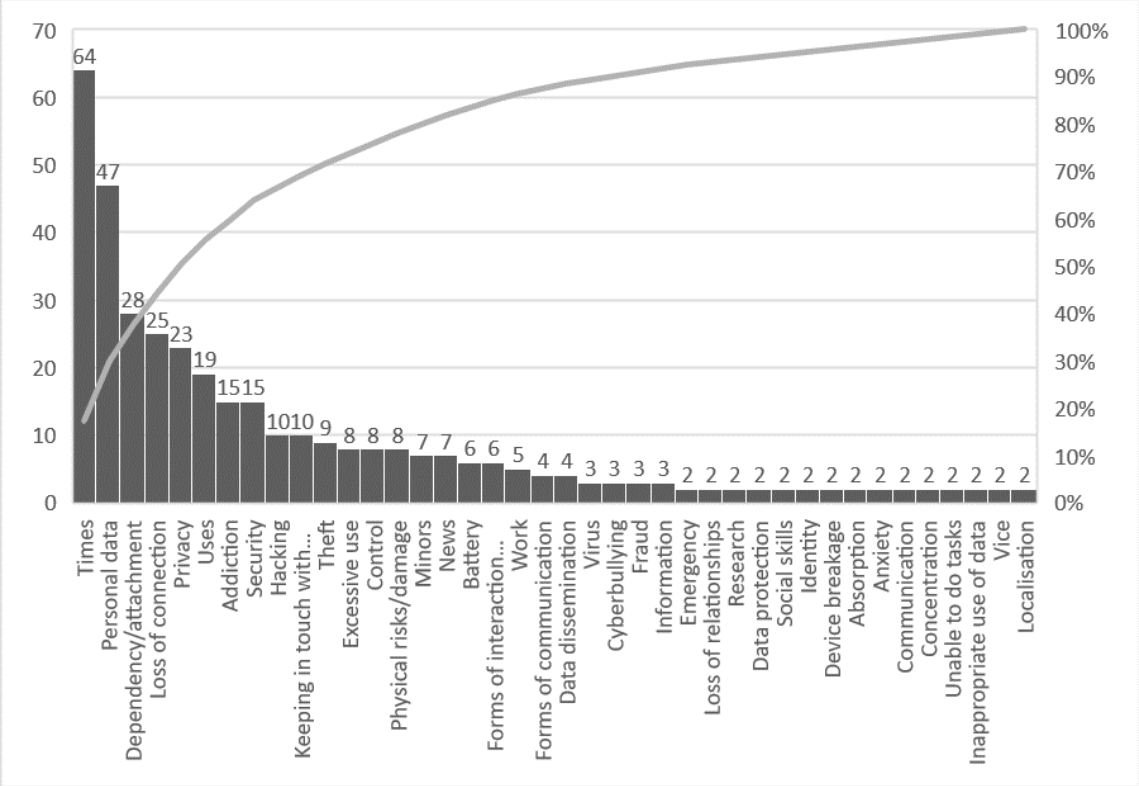

Figure 2. Frequency of Extracted Codes Regarding Concerns About the Use of ECDs

Table 3. Frequency and Percentages of Extracted Codes Regarding Concerns About the Use of ECDs

Codes	Frequency	Percentage
Time	74	19.52
Personal data	47	12.40
Dependency or attachment	28	7.39
Losing the connection	25	6.60
Privacy	23	6.06
Uses	19	5.00
Addiction	15	3.95
Security	15	3.95
Hacking	10	2.63
Keeping in touch with others	10	2.63
Theft	9	2.38
Excessive use	8	2.11
Control	8	2.11
Risks or physical damage	8	2.11
Minors	7	1.84
News	7	1.84
Battery	6	1.58
Ways of interacting and relating to others	6	1.58
Work	5	1.32
Communication forms	4	1.05
Data dissemination	4	1.05
Virus	3	0.79
Cyberbullying	3	0.79
Fraud	3	0.79
Absorption	2	0.53
Anxiety	2	0.53
Communication	2	0.53

Table 3. Continued

Codes	Frequency	Percentage
Concentration	2	0.53
Emergency	2	0.53
Academic studies	2	0.53
Social skills	2	0.53
Identity	2	0.53
Information	2	0.53
Location	2	0.53
Not being able to do homework	2	0.53
Loss of relationships	2	0.53
Data protection	2	0.53
Device breakage	2	0.53
Inappropriate use of data	2	0.53
Vice	2	0.53
Total	379	100

Regarding the aspect of time, participant (P) number 166, a female (hereinafter referred to as F), expressed her greatest discomfort: "that my usage time keeps increasing, leading to losing time that could be better spent on other things." Similarly, participant 160, a male (hereinafter referred to as M), stated: "the time we dedicate interrupts tasks that require full concentration. I believe that great ideas require deep concentration, and mobile phones prevent us from finding those extended periods." Others are aware that they spend "a lot of time with their mobile phones, even doing things or looking at content that doesn't interest me and to which I don't pay attention" (P200F), or that it takes away time "to live real experiences" (P36F). However, efforts are also identified to "spend less time each day, but I feel that when I get bored, I end up turning to my mobile phone. I have lost time doing creative things when I get bored because I am watching TikTok or reading news on Twitter" (P474F).

Regarding the use of ECDs, participants show some distress over "the excessive use" of these devices (P170F, P365F) and perceive that prolonged practice may cause "the loss of traditional things that people used to enjoy, such as taking contact with nature or a night of board games" (P65F). Additionally, there is a certain desire to prevent these habits in minors. That is, by focusing on "the excessive and continued use of the internet by children and adolescents" (P314M), "the way my teenage children use these devices" (P506F), or "the indiscriminate use that minors have. I worry that my young daughter may access any content, pornography, violence, blackmail..." (P514F). However, others point out that ECDs "help and facilitate certain tasks..." (P328M).

On the other hand, participants are overwhelmed by cybersecurity issues such as "the exposure of my data" (P17F), in case "something personal is leaked and disclosed without my consent" (P35F), or "that someone may have access to private information about me" (P67F), such as "conversations and photos" (P197F) or "passwords, credit card numbers," etc. (P483M). They "are afraid of losing privacy" (P45F), "identity theft and privacy of what you upload" (P87F), "being hacked and having personal data stolen" (P146F), or "having information or personal data stolen" (P98F). They also fear that "in some places, there is not adequate privacy... that someone I don't know knows about me and my surroundings" (P306F) and "data privacy because many people can access your information" (P379F).

The need for continued use of ECDs has also been emphasized by respondents, who state that they do not want to "depend on them so much in my daily life" (P85F) or stop experiencing "the dependence that their use creates" (P373M, P508F) or "the dependency that results from it" (P520F). They do not want to develop "a strong dependency on these devices" (P118F), nor an "addiction" (P213M, P249F) or "anxiety" (P137F), as they increasingly feel "more hooked" (P124F). In this context, they believe that "many people are very dependent on their mobile phones to extreme levels and may end up not knowing how to live without internet access or a mobile phone" (P173M) or that "there are too many people dependent on this technology almost as if it were a drug, where they lose their real identity to become slaves of their own electronic devices" (P298F). They point out the ease of "getting hooked on them and losing track of time... I feel that most of the time I spend on them is not useful to me" (P457F). Similarly, they are concerned about "falling into addiction and losing quality time" (P473F), "the addiction that almost everyone has nowadays" (P499F) or that "this type of addiction increases every day, and we are not aware of this problem" (P503F).

University students express great concern about being "without internet" (P304F) or "connection" (P491F, P504F), without "battery" (P19F), or without "coverage" (P396M). They also worry about "not being able to communicate with my family" (P198F) and "friends" (P378F), as well as "maintaining contact" with important people in their closest circle (P211F).

Thus, the categories emerging from the qualitative content analysis have been grouped into 5 major concerns associated with the use of Internet-connected mobile devices: (a) concerns related to mental health and academic performance (anxiety, absorption, addiction, dependence, vice, lack of concentration, inability to perform academic tasks); (b)

concerns related to relationships and communication (social skills, cyberbullying, loss of relationships with others, ways of interacting and relating to others, ways of communicating and maintaining contact with friends, family or partner); c) concerns related to use (overuse, time of use, uses of devices by minors, use of devices for work or study, lack of control over use); d) security concerns (identity, privacy, data dissemination, personal data, data protection, data misuse, hacking, fraud, user location and location, device theft or breakage, viruses and availability of the device for use in an emergency); e) other concerns (veracity of news and information, loss of internet connection, device battery drain and physical risks or damage from use of the device).

To conclude this section, it should be recalled that the fear of missing out or being disconnected from social networks could contribute to a tendency to ignore surrounding subjects in favor of mobile device use and also to the development of an over-dependence on the device. Therefore, in order to integrate the quantitative and qualitative results, it is appropriate to comment that concerns related to mental health and academic performance could be linked to nomophobia, since this irrational fear of not having access to the Internet or being disconnected leads to a constant need to be connected and an excessive dependence on the device, which results in these concerns being verbalized by the subjects as 'addition', 'vice' or 'absorption'. Similarly, this same overuse of the device could also have implications for students in terms of completing academic tasks or establishing and maintaining an intensive study day, especially due to 'lack of concentration'.

Secondly, communication and relationship concerns could be linked to both nomophobia and the fear of missing out. Perhaps the emergence of mobile phone communication may be changing ways of interacting and relating to others (e.g. social skills), promoting virtual communication on a regular basis as opposed to face-to-face communication, encouraging the perpetration of cyberbullying, fostering isolation (cf. students' concerns about maintaining contact with others) and contributing to students' feeling that they are missing out on social events or meaningful experiences that others share through social networks or instant messaging applications. Along the same lines, the concerns noted above could also have analogies with phubbing in the dimension of mobile phone obsession ('excessive use of the device') but not in terms of communicative disruption.

Thirdly, concerns related to the use of the device itself, the 'loss of connection' to the Internet or the 'battery' drain seem to be clearly linked to nomophobia. Subjects verbalize concerns about showing a lack of 'control' over the use of digital devices connected to the Internet, which could be interpreted as an indicator of this phenomenon.

Finally, it is worth noting that security concerns could be twofold. That is, there may be cases in which the subject feels an irrational fear of being with no communication (nomophobia), not being able to 'locate' and 'locate' him/herself, nor to use the device in an 'emergency', either by 'theft' or 'breakage' of the device. However, others might experience this as a kind of liberation, as a parenthesis in the continuous hyperconnectedness of today's society. On the other hand, the risk and fear of 'fraud', 'hacking' or 'dissemination of personal data' could also be reasons for the increased need to be constantly connected, to protect, control and update one's virtual 'identity'.

Discussion

The new possibilities of relationships, leisure and learning emanating from the Internet have propelled the emergence of various risks that can put the mental health and quality of life of the youngest people at risk. In this research, three of the most prevalent dysfunctional risks in the university population were analyzed, FoMO, nomophobia and phubbing, as well as the relationship and effect between them.

To start with, when considering gender, our results did not show statistically significant differences between men and women in FoMO, contrary to other studies that report higher levels of FoMO in women (Stead & Bibby, 2017), or, in turn, higher in men (Qutishat & Sharour, 2019). Regarding nomophobia, our results show higher level of nomophobia among women, coinciding with previous studies in a Spanish sample (Caba-Machado et al., 2024). A possible explanation could be that women are more socially motivated to use smartphones (Fischer-Grote et al., 2019). In phubbing, the same reality is seen with statistically significant differences by gender in favor of women, especially in the dimension of obsession with the telephone, similar to what was found by Chotpitayasunondh & Douglas (2016) and Invernón et al. (2023). A possible explanation is that women feel a greater need to check their mobile phones constantly (Fischer-Grote et al., 2019).

The gender variable has been the subject of analysis in a large part of the scientific literature, although not always with consensus, with a greater presence of women at medium and high levels in these dysfunctional risks being appreciated, due to their more social use of telephones and social network. Furthermore, this seems to have a positive relationship with higher levels of phubbing (Álvarez-Menéndez & Moral-Jiménez, 2020) and nomophobia compared to men. As for the discrepancies in the result according to gender, it could be explained by the different age ranges used in each study as well as the different countries of the sample because the prevalences and the invariance depend on the context and the age of the sample (Caba-Machado et al., 2024).

Additionally, the effect that FoMO has on nomophobia was analyzed, and a significant relationship between both risks was found. It was identified that FoMO has a direct effect on nomophobia. These outcomes are in line with those reported

by Gezgin et al. (2018) in university students in Turkey, and by Wen et al. (2023) in China. We can deduce that the underlying concern of FoMO lies in the fear of missing out on something that is published on social networks or instant messaging applications that are accessed in 99% of cases through the smartphone (Andrade Pérez & Guadix García, 2021). Therefore, the instrumental nature of nomophobia is closely linked to the use of the mobile device. On most occasions, this device is used, based on the Ditrendia (2021) report to consult social networks and instant messaging applications, which in turn are the main causes of FoMO.

On the other hand, the relationship between FoMO and phubbing was confirmed, in addition to the direct and significant effect of FoMO on phubbing. These results are consistent with those reported by Chi et al. (2022) in a sample of young Chinese university students and by Correa-Rojas et al. (2022) in university students in Peru. Furthermore, they are in line with those also found in studies carried out in other educational stages, in which the relationship between FoMO and phubbing is highlighted (Franchina et al., 2018). Additionally, in the analysis of measurement invariance, we compared models that imposed more restrictions with those that imposed fewer restrictions. The results indicated that measurement invariance was held across different genders. However, these findings differ from those found in other research (Talan et al., 2024), in which no significant effect of FoMO on phubbing is observed. Furthermore, previous studies indicate that young people are more comfortable in virtual interaction than in face-to-face interaction (Díaz-López et al., 2023), so the use of smartphones in social situations allows them to escape, avoid uncomfortable moments or conversations (Ochs & Sauer, 2023). Also, because, simply and sometimes, its use may be due to the involuntary and compulsive nature of the consultations (Ksinan et al., 2021), or the difficulty of in-person interaction due to the loss of basic social skills (De la Cruz Sandoval et al., 2019).

In this situation, the relationship between the two phenomena is especially alarming when taking into account that review studies have independently linked nomophobia, FoMO and phubbing with serious anxiety problems (Bitar et al., 2023; Daraj et al., 2023; Moura et al., 2021), anxiety social (Dempsey et al., 2019; Ergün et al., 2020; Tárrega-Piquer et al., 2023;) and decreased academic performance and procrastination (Rachman et al., 2019; Tuco et al., 2023). Additionally, these risks can interfere with sleep patterns (Caba-Machado et al., 2024) and overall mental health, exacerbating the negative impacts on academic performance and personal well-being (Adams & Kisler, 2013). Most recently, Tunc-Aksan and Akbay (2019) confirm than FoMO, smartphone addiction and perceived academic competence predict social media addiction where FoMO and smartphone addiction combined explained almost 30% of variance in terms of mediation effect. These results bring to light that technologies have a direct impact on cognitive development (Khan et al., 2023).

The qualitative content analysis highlights the main concerns that university students have regarding hyperconnection. Thus, it seems that what worries young people most in cyberspace are: concerns related to mental health and academic performance (anxiety, absorption, addiction, dependence, vice, lack of concentration, inability to perform academic tasks); concerns related to relationships and communication (social skills, cyberbullying, loss of relationships with others, ways of interacting and relating to others, ways of communicating and maintaining contact with friends, family or partner); concerns related to use (overuse, time of use, uses of devices by minors, use of devices for work or study, lack of control over use); security concerns (identity, privacy, data dissemination, personal data, data protection, data misuse, hacking, fraud, user location and location, device theft or breakage, viruses and availability of the device for use in an emergency); other concerns (veracity of news and information, loss of internet connection, device battery drain and physical risks or damage from use of the device This finding is very significant, since it shows that young people are not very worried about phubbing, since they seem not to be aware of the consequences of phubbing, such as that it reduces the degree of interaction with other friends and is associated with low levels of empathy (Uncu et al., 2024), producing a negative impact on satisfaction with social relationships, personal and emotional well-being, and satisfaction with life (Rachman et al., 2019). In this regard, in an attempt to compare the concerns of young people with the challenges presented by the network, a meta-analysis study found that the main psychological challenges are confidence in the use of cyber space, privacy, attention, dignity, axiological impact, cyber reality and deception, cyberbullying, sickness, fatigue and the cyber isolation (Khawrin & Nderego, 2022). In this sense, there is an intermediate degree of concordance between the concerns of young people on the Internet found in the present study and the challenges of cyberspace found by Khawrin and Nderego (2022).

Conclusion

The several forms of interpersonal relationships have undergone a deep change, turning from face-to-face closeness to a digitalized due to the massive and excessive use of Information and Communication Technologies by adolescents, young people, and adults. Cyberspace can show another “dark side” where people were exposed to several risks. In this study, we analyze three of them (nomophobia, phubbing and FoMO) to respond to the following objectives: a) to analyze the mediating effect of FoMO on phubbing and nomophobia; and b) to explore the perception of university students regarding the use of devices connected to the Internet (ICD).

The present research shows that nomophobia, phubbing and FoMO have extended among Spanish university students as examples of dysfunctional and social risks regarding digital devices. Furthermore, some variables as gender seems to be connected to them with a greater presence of women at medium and high levels in these problematic risks. Other

important result is the effect that FoMO has on nomophobia, finding a significant relationship between both. Besides, it was identified that FoMO has a direct effect on nomophobia. In the similar way, the relationship between FoMO and phubbing was confirmed, in addition to the direct and significant effect of FoMO on phubbing. This happens because young people, driven by the fear of missing out on what is happening in cyberspace, ignore the person they are interacting with in person to check their smartphone.

Regarding qualitative analysis, our results point out that several young people's main concerns are indicators of nomophobia and FoMO. However, it is striking how snubbing others or losing face-to-face interactions do not seem to be such relevant aspects. It seems that although young adults are aware of cyberspace's dark side accepting these risks, there is no real acceptance of the possible social media or digital devices dependence. In this context, we can assume the severity of the psychological and educational consequences of these risks together can increase exponentially. These phenomena have important implications for educators from early levels for the academic success and comprehensive development of people.

In sum, several conclusions can be drawn. First, it is worth pointing out that university students are not explicitly concerned about phubbing and its consequences. Furthermore, the effects that FoMO produces on phubbing may be accentuating and manifesting that the preference for virtual communication prevails over face-to-face interaction. Thus, individuals with a high degree of FoMO could prioritize digital interactions over face-to-face ones, as they fear missing out on online updates or interactions. This constant concern about staying up to date in the digital realm leads them to frequently check their devices, even when in the company of others. Additionally, it has been found that FoMO has a direct effect on nomophobia, so both phenomena, in addition to being closely linked conceptually, feed each other. Therefore, when access to the smartphone is limited or the device is unavailable, individuals with FoMO may experience heightened levels of anxiety and stress, manifesting symptoms of nomophobia. Nomophobia, therefore, is understood as a direct response to the anxiety generated by FoMO, exacerbating technological dependence, and negatively affecting psychological well-being. The findings of this research represent an original and novel contribution to the scientific corpus given that no previous study has analyzed the impact of FoMO on nomophobia and phubbing in a Spanish university population.

Recommendations

A series of practical implications of an educational nature emerge from this study. Firstly, there is a need to design and implement preventive actions such as talks, seminars or workshops that mainly inform young people about the risks of cyberspace and how they can impact their daily lives. Secondly, it is necessary to intervene with those young university students who present risks and whose quality of life is being affected. As well as that, longitudinal studies are needed to analyze the relationship along the time between the variables. Finally, it seems necessary to promote social initiatives among young people for the practical stimulation of face-to-face interaction and to promote other leisure options beyond screens. In short, it appeals to the need for a profound social change, in which we stop looking at the smartphone to be able to look at what is in front of us and what is really happening at that moment.

Limitations

Several limitations of this study should be acknowledged when interpreting the results. Firstly, the sampling was carried out following a non-probabilistic criterion with a smaller proportion of men than women. This is justified considering the exploratory nature of the study as it is a first approach to the three phenomena of interest that led to greater speed in data collection. For this, the accessibility criteria of the interviewers were considered, together with the financing received from one of the collaborating universities. This caveat is intended to be resolved with the expansion of the sample range to other universities and population that allows establishing more conclusive data than those already reported from our data. In this sense, a second limitation would be related to the length of the instrument and the social desirability bias to be considered in research that addresses topics related to the critical analysis of behavioral traits. The prevalences of FoMO, nomophobia and phubbing could have been included. Furthermore, the results of the reliability and convergent validity analysis showed that, although the AVE for FoMO and Phubbing was below the recommended threshold of .50, both Cronbach's alpha and composite reliability values exceeded the value of .70, indicating good internal consistency. Since all factor loadings of both constructs were good and all items are considered theoretically relevant, we proceeded with the relevant analyses in this study. However, it is recommended to consider the inclusion of new items and the re-evaluation of the model for both constructs in future studies to improve convergent validity. Finally, although the model fit and parameter estimates are adequate, a direction of causality cannot be concluded, so future research should examine the longitudinal relationships between FoMO, nomophobia, and phubbing.

Ethics Statements

Data collection was authorized by the ethics committee of the International University of Valencia (VIU), Spain. Furthermore, students consent to participate using a short form attached to the survey. All data were treated in accordance with Regulation EU 2016/679 of the protection of personal data (European Parliament and the Council of the European Union, 2016), as well as the Organic Law (2018) about personal data protection and safeguard of digital rights.

Authorship Contribution Statement

Rubio-Hernández: Data acquisition, qualitative analysis/interpretation, drafting manuscript, critical revision of manuscript. Giménez-Gualdo: Conceptualization, data acquisition, introduction writing, editing/reviewing, critical revision of manuscript, and final approval. Díaz-López: Data acquisition, conceptualization reviewing, drafting manuscript, critical revision of manuscript. Caba-Machado: Drafting manuscript, data analysis/interpretation, statistical analysis, critical revision of manuscript.

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