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Article

Determining symptomatic factors of nomophobia in Peruvian Students from the National University of Engineering

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Abstract: The use of cell phones has increased worldwide in the past few decades, particularly in children and adolescents. Using these devices provides personal benefits. Communicating through cell phones was a very important factor in the socioeconomic progress of developed countries. However, it is beyond doubt that its indiscriminate use can accompany certain psychiatric disorders or cause some disorder in a person, within the phobic group of anxiety disorders called nomophobia—associated with anxiety, nervousness, discomfort, and distress when contact with the smartphone is lost, mainly in young users. This research proposal aims to identify symptoms that have not yet been detected by intensive cell phone use, considering that in Peru there are few studies of human health engineering and the physical mental health. Is for this reason that in our study, we sought to identify the symptomatic factors of nomophobia presented by students at the National University of Engineering and its interference with their academic life. To accomplish this study, we designed a questionnaire according to our reality with the use of focus groups techniques when the test was taken in class. Three symptomatic factors of nomophobia were identified: feelings of anxiety, compulsive smartphone use, and feelings of anxiety and panic. The study included a representative sample of 461 students of different years of study engineering (21% women, 79% men, over 17 years of age). Finally, given the widespread adoption of smartphones and their integration into educational environments, the results of this study can help educators understand students' inclination to use their smartphones at all times.

Keywords: nomophobia; anxiety; phobia; panic.

1. Introduction

Continuous technological developments have changed the way that human beings manage their daily activities. In particular, information and communication technologies have become an indispensable part of our social interactions, work activities, and education.

However, the appearance of smaller electronic devices with higher computing capabilities has enabled the proliferation of cheap mobile devices, and smartphones are considered to be the latest Information and Communications Technology (ICT) development [1]. They are no longer just cell phones as, in addition to making calls or sending messages, they enable access to the Internet and thus a wide variety of services offered by the network of networks [2]. Cell phone use is widespread, even surpassing the population in some countries [3], while 70% of young people (15–24 years old) in the world use the Internet through various means, including mobile devices [4]. Mobile devices are used more widely among the young population. This is because young people adopt new technologies quickly and because using a smartphone is a status symbol within the tech-culture [5].At the end of

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2017 in Peru, the number of mobile lines that access the Internet was 21.2 million, this means that 2 of every 3 people accessed the Internet through mobile services, which gives us an idea of the number of smartphones in Peru[4]. On the other hand, social networks have become one of the largest and most influential components on the web, providing an easy platform to everyone, the young and the elderly alike. Many young people lose sight of the real world as they are absorbed in the virtual world and become slaves of technology [6].

Despite their considerable positive impacts, smartphones have a seemingly minor negative impact, called nomophobia, which can be as serious as the positive side if these phones are not used intelligently [7]. Nomophobia is an abbreviation of the English “no mobile phone phobia,” which translates into the fear of not having a cell phone. Specific phobias are frequent anxiety disorders, which also precede other psychiatric disorders such as depression and abusive use of toxic substances. There have been problematic situations where people are too close to their smartphones, presenting symptoms of behavioral addiction that interferes with their daily activities.

Studies have also been conducted on the problem of indiscriminate cell phone use. In [8], present a preliminary examination of the behavior of young Australians and their use of cell phones. This study explored the relationship between psychological predictors of the frequency of cell phone use and the participation of cell phones conceptualized as a cognitive and behavioral interaction of people with their cell phones. The participants in this study were young Australians between 15 and 24 years of age. Independently [9], present a study applied to individuals with panic disorder and agoraphobia because of dependence on their cell phones. Then [10], examine the role of cell phones in the lives of Belorussian and Polish students. This study included the analysis of a sample of students from Belarus and Poland. Consequent to this study, they concluded that almost 20% of students in Poland and 10% in Belarus have symptoms of cell phone addiction. Independently [11], mention that smartphones may cause compulsive checking habits.

In [12] argue that studies on the relationships between individuals and new technologies are relevant with the justification that new technologies produce changes in behavior, as well as feelings and symptoms, that must be studied and monitored continuously in modern society. Then [13], among their research results, mention that the most used application among young people is “WhatsApp” for instant messaging and that they may feel social exclusion if they are not included in a group.

In [14] mention that despite the many positive results, cell phones when used excessively are now often associated with potentially harmful and/or disruptive behaviors. Independently [1], consider nomophobia to be the phobia of the modern age that has been introduced into our lives as a by-product of the interaction between people and mobile information and communication technologies, particularly smartphones. In their studies, they identified and described the dimensions of nomophobia and developed a questionnaire to measure this nomophobia.

The classification of nomophobia is controversial [5]. Therefore, it is necessary to define the one that will be used for this study. We consider nomophobia to be a behavioral addiction to cell phones, which is manifested by psychological and physical symptoms of dependence. In [1], mention that nomophobia is an abbreviated form of "no mobile phone phobia" and is thought to stem from the excessive use of a mobile phone. Independently in [11],[15], mention that nomophobia is an emerging human behavior phenomenon stemming from widespread mobile phone use.

The teaching of each course at the National University of Engineering requires on average 2 to 3 hours, however there are many factors that can cause distraction in the classroom. One factor is the excessive use of cell phones. In [16], present a study to analyze the relationship between the level of nomophobia and the distraction associated with the use of smartphones. The study population were nursing students from the University of Almeria in Spain.

In [17], examine the impact of cell phone use in classroom learning, for this they perform a test to the students at the end of class, proving that who have the lowest score were students that immediately answered the text messages from their cell phone with regard to who had kept their cell phone. Independently in the studies of [18],[19] mentions that the ringing or notification of the cell

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phone, regardless of phone number it is, it can be a distractor in the classroom. In [20] mention that the excessive use of cell phones has led researchers to focus on how the use of cell phones affects learning and memory in classroom. The participants were recruited from undergraduate psychology courses.

The use of mobile phones causes alterations in the habits of daily life and perceptions of reality, which can be associated with negative results, such as deteriorated social interactions, social isolation, and mental health problems such as anxiety, depression and stress. The present study discusses nomophobia in relation to smartphone. In the absence of research information on nomophobia in our country, we believe that by carrying out this study, we will be able to identify the main symptomatic factors that are presented by National University of Engineering (UNI) students, that are caused by indiscriminate cell phone use, and that are not observable during the course of the students' daily lives.

To identify these factors, our contribution is to design a test according to our reality and use focus group techniques when the test is taken in classrooms. Consequently, we present three symptomatic factors of nomophobia in UNI students, which describe the need that students have for indiscriminate cell phone use. The present study is described as follows: In Section 2, we explain the methodology to be used. In Section 3, we describe the results obtained. Finally, in Section 4, we show the conclusions and future studies.

2. Methodology

Our study uses a transversal, correlational, and factorial research methodology. It was carried out in 461 male and female students at the National University of Engineering. To carry out the proposal, we completed the following stages that are shown in Figure 1, trying to adapt a methodology that allows to cover the most relevant aspect of our study and following the recommendations of other authors.

- Test Adaptation. Currently, there is a wide variety of tools to identify dependency problems that are associated with smartphone use and the use of other information and communication technologies [2]. However, in our study, we will use the "Test of Mobile Phone Dependence (TMDbrief) Questionnaire" [21] as a main reference, which evaluates the main characteristics of cell phone dependence: tolerance, withdrawal syndrome, change of impulse control, excessive use, etc., using an intercultural approach.
- Questionnaire Design. In this study, we describe the questionnaire design that was improved by focus group techniques [22].
- Questionnaire Validation. The questionnaire was validated using the Cronbach test [23].
- Sample Methodology. The sample methodology is defined to calculate sample size in correlational studies and is proportional to the population of the departments in the university.
- Factor Analysis Application. After the questionnaire was applied, factor analysis was performed, which is a statistical technique of data reduction used to explain the correlations between the variables that are observed in terms of a smaller number of variables that are not observed, called factors. In our study, three symptomatic factors were identified.
- Experimental Results. The questionnaires are processed using Statistical Package for the Social Sciences (SPSS) software for Windows to obtain the final reports and to be able to obtain the respective conclusions.

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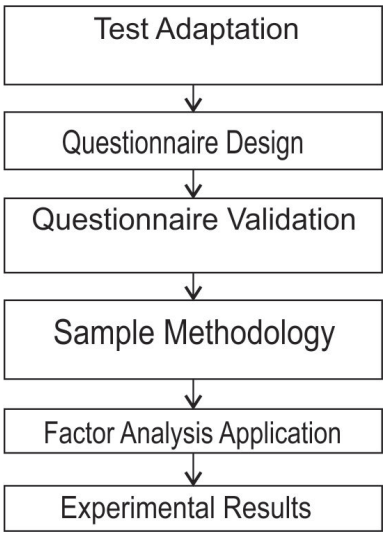

Figure 1. Methodology to carry out the proposal

2.1. Quantitative instrument used

The questionnaire used was carefully adapted and translated from the Test of Mobile Phone Dependence (TMDbrief) [21] on the basis of previous recommendations and previous study experience [2]. Because of the multicultural approach of TMDbrief, it was not necessary to validate the translation.

The questionnaire applied is objective and consists of four blocks. The first block corresponds to basic demographic data. The second block has 16 items, which show how UNI students relate to their smartphones, and each item proposes a statement that has seven response options, a Likert scale, with respect to students' level of agreement or disagreement with each sentence: 1 = Strongly disagree to 7 = Strongly agree.

A third block has three items with statements that link the interference of smartphone use with students' academic life, each with five response options—20%, 40%, 60%, 80%, and 100%—according to how the students view their experience. Finally, the fourth block, with five items, gathers information about the possible causes of their connection with their smartphones. This is shown in Table 1.

Table 1

NATIONAL UNIVERSITY OF ENGINEERING		
We want to adapt and apply the following test to the UNI student population, with the goal of offering help to those who use their cell phones in an unhealthy manner. Thank you for your responses.		
1. Age		
2. Gender:	a. Female	b. Male
3. Department		4. Major
The following questions related to how you use your cell phone.		

*Block*1

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Please indicate your level of agreement or disagreement with an "x" for the following statements in relation to smartphone or cell phone use	1=strongly disagree						7=strongly agree
1. If my smartphone or cell phone wasn't working for a long time and it would take a long time to fix it, I would feel very bad.	1	2	3	4	5	6	7
2. If I don't have my smartphone or cell phone, I feel bad.							
3. I don't think I could handle a week without my smartphone or cell phone.							
4. If I couldn't check my smartphone or cell phone for a while, I would want to check it.							
5. I spend more time than I should talking on my smartphone or cell phone, sending messages, and using other apps.							
6. I go to bed later or have slept less to use my smartphone or phone cell.							
7. I use my smartphone or cell phone (for calls, reading or sending messages, using WhatsApp, among other things) in situation that may not be dangerous but are not appropriate for smartphone use (such as while others are talking to me, etc).							
8. I need to use my smartphone or cell phone more often.							
9. I get angry or irritated when someone bothers me while I'm using my smartphone or cell phone.							
10. If my smartphone or cell phone is with me, I can't stop using it.							
11. Ever since I have had my smartphone or cell phone, I have increased sent messages.							
12. As soon as I get up in the morning, the first thing I do is see who called up or whether anyone sent me a message.							
13. When I feel lonely, I use my smartphone or cell phone to make calls, sen messages, etc.							
14. Right now, I would grab my smartphone or cell phone and send message, make a call, or check social networks.							
15. I feel nervous if I do not receive messages, calls, and notifications from social networks on my smartphone or cell phone.							
16. If I didn't have my smartphone or cell phone with me, I would feel bad because I wouldn't be able to check social networks.							

Block 2

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Mark your answer to the question with an "X":

	% of interference that it causes in my academic life				
	20%	40%	60%	80%	100%
1. My need to calm, which is what communicating with other people with my smartphone offers me.					
2. My difficulty in controlling the impulse to use my smartphone or cell phone.					
3. My constant desire to communicate with others and have new interpersonal relationships using my smartphone or cell phone					

Block 3

	Yes	No
I have difficulties in understanding myself and in deciding how to act, even in simple situations.		
I have difficulties in adapting to the changes and challenges that life poses.		
I have difficulties in tolerating and managing stressful situations.		
I have difficulties in understanding and maintaining good relationships with people.		
I have difficulties in maintaining a good temperament and a pleasant mood.		

Block 4

2.1.1. Reliability, Consistency, and Validation of the instrument used

The reliability analysis was carried out to understand the internal consistency of the scale, i.e., the correlation between the items analyzed, as well as to assess the reliability or homogeneity of the questions [23] in block 2. Cronbach's alpha coefficient (α), developed by Lee J. Cronbach, enables us to find the internal consistency of a scale, i.e., the correlation between the items analyzed, and also to assess the reliability or homogeneity of the questions[23]. This coefficient oscillates between 0 and 1, where 0 means a reliability assessment of null and 1 represents total reliability. In addition, internal consistency is considered high if it is between 0.70 and 0.90. Values below 0.70 indicate low internal consistency and those above 0.90 suggest that the scale has several items that measure exactly the same [24].

To calculate Cronbach's alpha coefficient, using the variance of the items and the variance of the total score, we use the following formula.

$$\alpha = \left[\frac{k}{k-1}\right]\left[1 - \frac{\sum_{i=1}^{k} S_i^2}{S_T^2}\right] \quad (1)$$

Where:
S_i^2 : Is the variance of each item
S_T^2 : Is the variance of all rows
k : Is the number of questions or items
The calculation of the value of Cronbach's alpha was processed with the help of SPSS Software. Table 2 shows the results.

Table 2. Reliability Statistics.

Cronbach's alpha	Cronbach's alpha based on the categorized elements	Number of elements
0.873	0.883	16

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The value of Cronbach's alpha (α = 0.873) shows that the questionnaire exhibits high internal consistency. The questionnaire was previously improved in focus group sessions to verify the interpretation and adequacy of the items [22].

In [25] defines the pilot test as applying a questionnaire to a small sample of the units of analysis to identify and eliminate possible problems in the questionnaire's design. The instrument in question was validated with a pilot sample of 30 students from the National University of Engineering to eliminate inconsistencies or questions within the questionnaire.

2.2. Sample size

It is necessary to estimate the correlations, relationship, or association between the two variables—symptoms and indiscriminate smartphone use—hence, it is necessary to establish the calculation of the sample size using the following formula [26]:

$$n_0 = \left\{ \frac{Z_{1-\alpha/2} + Z_{1-\beta}}{\frac{1}{2} \cdot \ln \frac{1+r}{1-r}} \right\}^2 + 3 \tag{2}$$

Where:

n_0	:	Sample size
α	:	Level of significance, which is universally chosen as 5% (error type I)
$Z_{1-\alpha/2}$	:	Value of the standard normal variable corresponding to a confidence level
β	:	Probability of accepting a false hypothesis, when this is really false (error type II), this value is fixed around 0.2 in a majority of cases, thus it will have a test power of 80%
$Z_{1-\beta}$	:	P-Normal variable value for a test power of 85%, the value of which in the normal table is 1.04
r	:	Value of the correlation from which a relationship is considered in our study

Assuming a 5 % level of significance, a test power of 85 %, and r = 0.15, a sample size of 397 students is reached. This size was increased to 16 % of the size calculated to cover the non-response rate, culminating in the obtainment of a sample of 461 students to be used. In this way, we comply with evaluating a representative sample for our study, which guarantees valid results.

2.3. Variable classification

Variables: Age, Gender, Department, and Major correspond to variables for the descriptive study of the sample (block 1). The dependent variables, i.e., the scores obtained from the 16 statements on how students relate to their smartphones (indiscriminate smartphone use), and the independent variable, symptoms, are detailed in 16 sentences in the second block of the survey. See Table 1.

Likewise, the percentage (extent) of interference with students' academic life (block 3) and support by which students relate to their cell phone (block 4) are variables for descriptive, inferential and non-correlational analysis.

2.4. Data collection procedures

The questionnaires were administered to the students on the National University of Engineering campus at different times and in areas near the university, the participants had 10 minutes to complete the test. We tried to consider different schedules because first semester students have classes in the mornings, while those in the last cycles usually have classes in the afternoon or evening. The respondents answered the questionnaire's questions freely and voluntarily. The recommendation was to respond truthfully and to try to answer as quickly as possible. No incentive was offered for participation. With this, it was possible to collect the data in an anonymous and reliable way, covering different types of students of the university.

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3. Results and Discussions

3.1. Descriptive analysis

A total of 461 completed questionnaires were processed from the database, using the SPSS software package for Windows (version 19.0, SPSS, Inc. Chicago, IL, USA). According to reports issued by SPSS, the sample consisted of 21% men and 79% women. With regard to the ages of the students in the sample, 35.8% were 17–19 years old; 30.4% were 20–21 years old; and 33.8% were 22 years old and above. The mean and standard deviation of age was 20.81 $\pm$ 0.12 with an age range of 17 to 32 years. See Table 3 for these results.

Table 3. Percentage distribution of respondents by age.

Age	Frecuency	Percentage (%)
[17, 19]	165	35.8
[20, 21]	140	30.4
[22, or more]	156	33.8
Total	**461**	**100**

With regard to how long they had used a smartphone, 31.9% of students had one in use for more than 5 years; 30.2% had one in use for 3–4 years; and 37.9% had one in use for less than 2 years. See Table 4 for these results.

Table 4. How long the respondent has had a smartphone.

	Frecuency	Percentage (%)
Less than a year	37	8
More than 1 year but less than 2	72	15.6
More than 2 years but less than 3	66	14.3
More than 3 years but less than 4	77	16.7
More than 4 years but less than 5	62	13.5
More than 5 years	147	31.9
Total	**461**	**100**

When asked whether they had a data plan that would allow them to access the Internet, 68.3% of the respondents answered yes and 31.7% answered that they did not have a data plan.

With regard to the total time dedicated to smartphone use per day, 26.8% answered that they used their smartphones for a total of 1–3 hours a day. The majority (34.1%) answered that they used their smartphones for 4–5 hours; 19.1% answered saying 5–10 hours; and 20% answered saying 10 or more hours a day. Table 5 shows these results.

Table 5. Time per day devoted to smartphone use.

Time per day	Frecuency	Percentage (%)
1 to 3 hours	124	26.8
4 to 5 hours	157	34.1
6 to 9 hours	88	19.1
10 or more	92	20.0
Total	**461**	**100**

With regard to the number of times they usually checked their smartphones in a day, 25.8% of the respondents answered that they checked 1–8 times; 24.5% checked 9–16 times; 29.7% checked 17–30 times; and 20% checked 31 or more times. Table 6 shows these results.

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Table 6. Frecuency of checking smartphone or cell phone per day.

Time per day	Frecuency	Percentage (%)
1 to 8 times	119	25.8
9 to 16 times	113	24.5
17 to 30 times	137	29.7
31 or more times	92	20.0
Total	461	**100**

We can note that 7.6% of students responded to the survey stating that they checked their smartphones every 5 minutes; 33.2% checked every 10–20 minutes; 38.2% checked every 30–60 minutes; and 21% checked every 2 hours or less. Table 7 shows these results.

Table 7. How often do you think you usually check your smartphone or cell phone?.

Frecuency	Frecuency	Percentage (%)
Every 5 minutes	35	7.6
Every 10 minutes	76	16.5
Every 20 minutes	77	16.7
Every 30 minutes	93	20.2
Every hour	83	18.0
Every 2 hours	37	8.0
Every 3 hours or less	60	13.0
Total	**461**	**100**

3.2. Correlation analysis

In the item correlation matrix of block 2, we observed variables that correlate moderately, with the rest of the variables exhibiting low correlations. However, the determinant value of the correlation matrix is close to 0, which indicates that the matrix variables are linearly related, which, in turn, supports the continuity of the analysis in the main components. See Table 8 for these results.

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Table 8. Correlation matrix for the 16 items in the questionnaire.

Items	Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Q-7	Q-8	Q-9	Q-10	Q-11	Q-12	Q-13	Q-14	Q-15	Q-16
Q-1	1.000	0.600	0.482	0.408	0.271	0.273	0.190	0.292	0.229	0.276	0.213	0.234	0.244	0.268	0.261	0.367
Q-2	0.600	1.000	0.507	0.457	0.313	0.258	0.236	0.402	0.406	0.400	0.247	0.252	0.302	0.343	0.435	0.480
Q-3	0.482	0.507	1.000	0.450	0.336	0.239	0.196	0.365	0.450	0.404	0.206	0.162	0.179	0.307	0.419	0.406
Q-4	0.408	0.457	0.450	1.000	0.374	0.390	0.261	0.306	0.273	0.369	0.281	0.356	0.356	0.316	0.313	0.445
Q-5	0.271	0.313	0.336	0.374	1.000	0.475	0.350	0.351	0.286	0.427	0.320	0.324	0.334	0.378	0.335	0.345
Q-6	0.273	0.258	0.239	0.390	0.475	1.000	0.316	0.292	0.181	0.334	0.302	0.366	0.320	0.275	0.219	0.283
Q-7	0.190	0.236	0.196	0.261	0.350	0.316	1.000	0.332	0.241	0.255	0.193	0.277	0.288	0.328	0.274	0.313
Q-8	0.292	0.402	0.365	0.306	0.351	0.292	0.332	1.000	0.396	0.457	0.211	0.262	0.254	0.452	0.437	0.415
Q-9	0.229	0.406	0.450	0.273	0.286	0.181	0.241	0.396	1.000	0.533	0.211	0.169	0.262	0.417	0.606	0.506
Q-10	0.276	0.400	0.404	0.369	0.427	0.334	0.255	0.457	0.533	1.000	0.198	0.341	0.295	0.472	0.495	0.479
Q-11	0.213	0.247	0.206	0.281	0.320	0.302	0.193	0.211	0.211	0.198	1.000	0.269	0.394	0.172	252	263
Q-12	0.234	0.252	0.162	0.356	0.324	0.366	0.277	0.262	0.169	0.341	0.269	1.000	0.426	0.371	0.234	0.369
Q-13	0.244	0.302	0.179	0.356	0.334	0.320	0.288	0.254	0.262	0.295	0.394	0.426	1.000	0.314	0.313	0.321
Q-14	0.268	0.343	0.307	0.316	0.378	0.275	0.328	0.452	0.417	0.472	0.172	0.371	0.314	1.000	0.469	0.529
Q-15	0.261	0.435	0.419	0.313	0.335	0.219	0.274	0.437	0.606	0.495	0.252	0.234	0.313	0.469	1.000	0.601
Q-16	0.367	0.480	0.406	0.445	0.345	0.283	0.313	0.415	0.506	0.479	0.263	0.369	0.321	0.529	0.601	1.000

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3.3. Kaiser–Meyer–Olkin (KMO) measurement

This indicates the percentage of variance that the analyzed variables have in common; 0.6 and above is considered a good sample adaptation for a factor analysis [27], [28].

$$KMO = \frac{\sum_{i \neq j} r_{ij}^2}{\sum_{i \neq j} r_{ij}^2 + \sum_{i \neq j} r_{ij,m}^2} \quad (3)$$

Where:
r_{ij}: Represents the simple correlation coefficient between the variables i and j.
$r_{ij,m}$: Represents the partial correlation coefficient between the variables i and j, eliminating the effect of the remaining m variables.

In Table 9, we see that the Kaiser–Meyer–Olkin (KMO) that was obtained, take the value = 0.913 > 0.6; hence, it indicates that the data reduction process is good.

Table 9. KMO and Bartlett Test.

Kaiser-Meyer-Olkin sampling adequacy measurement		0.913
Barlett's sphericity test	Approx. Chi squared	2748.056
	df	120
	Sig.	0.000

3.4. Bartlett's sphericity test

The Bartlett sphericity test result that contrasts its null hypothesis that the correlation matrix is an identity matrix (there is no correlation between the variables) has been obtained as shown in Table 9 (p-value = 0.000 < 0.05); hence, the Bartlett null hypothesis is rejected. Thus, the results of these tests indicate that the factor analysis can be considered to be appropriate [29],[30], [31].

3.5. Factor analysis

In Table 10, which shows explained variance, three factors explain 55.166% of the variance. These factors are extracted via the analysis of main components, and the criteria that support its application are the Kaiser–Meyer–Olkin measurement test result, which takes a value of 0.913, and the Bartlett sphericity test, in which the p-value < 0.05; hence, it makes sense to perform the factor analysis.

Table 10. Total explained variance. Extraction method: Principal component analysis.

Component	Initial eigenvalues			Extraction sums of squared loadings			Rotation sums of squared loadings		
	Total	%variance	%gathered	Total	%variance	%gathered	Total	%variance	%gathered
1	6.187	38.668	38.668	6.187	38.668	38.668	3.517	21.984	21.984
2	1.453	9.084	47.752	1.453	9.085	47.752	2.917	18.231	40.214
3	1.186	7.414	55.166	1.186	7.414	55.166	2.392	14.952	55.166

With regard to the component matrix, to be able to perform the interpretation of the factors, we used Table 11 on the rotated component matrix by rotating varimax [29],[30],[31] to discover hidden relationships within the components and the respective indicators, which facilitates the interpretability of the factors. The table highlights values above 0.45 to achieve better exposure of the initial variables obtained for each component or factor.

Table 11. Rotated component matrix and its associated indicators

Item		component		
		1	2	3
Q9	I get angry or irritated when someone bothers me while I'm using my smartphone.	**.784**	.039	0.186
Q15	I feel nervous if I do not receive messages, calls, and notifications from social networks on my smartphone.	**.783**	.146	.201
Q10	If my smartphone is with me, I can't stop using it.	**.678**	.264	. 206
Q16	If I didn't have my smartphone with me, I would feel bad because I wouldn't be able to check social networks.	**.666**	.271	.302
Q14	Right now, I would grab my smartphone and send a message, make a call, or check social networks.	**.658**	.339	.074
Q8	I need to use my smartphone more often.	**.585**	.243	.212
Q12	As soon as I wake up in the morning, the first thing I do is see who called me or whether someone has sent me a message.	.198	**.689**	.057
Q6	I go to bed later or have slept less to use my smartphone.	.090	**.684**	.215
Q13	When I feel lonely, I use my smartphone to make calls, send messages, etc.	.191	**.667**	.100
Q5	I spend more time than I should talking on my smartphone, sending messages, and using other apps.	.295	**.581**	.197
Q11	Ever since I have had smartphone, I have increased sent messages.	.059	**.560**	.207
Q7	I use my smartphone (for calls, reading, or sending messages and using WhatsApp, among other things), in situations that may not be dangerous but are not appropriate for smartphone use (such as while others are talking to me, etc.).	.326	**.495**	.007
Q1	If my smartphone wasn't working for a long time and it would take a long time to fix it, I would feel very bad	.104	.219	**.809**
Q2	If I don't have my smartphone, I feel bad.	.373	.176	**.731**
Q3	I don't think I could handle a week without my smartphone.	.393	.049	**.692**
Q4	If I couldn't check my smartphone for a while, I would want to check it.	.166	.461	**.570**

Extraction method: analysis of main components.
Rotation method: Varimax with Kaiser standardization.
a: The rotation converged in 6 iterations.

The matrix shows three components, where each component has 16 items, and on the basis of Table 11, we can interpret each of them:

Component 1: This component includes the set of attributes of the nomophobia questionnaire that describe students' sense of need to be with their smartphones. This component we want to extract the following items: Q9, Q15, Q10, Q16, Q14 and Q8. These will be the factor that we call "Anxiety Sensation" factor, which explains 38.668% of the total variability. UNI students' sense of anxiety is related to the unfounded need for smartphones.

Component 2: This component contains six variables that are considered to be within those that do not find alternative resources to entertain themselves. This component we want to extract the following items: Q12, Q6, Q13, Q5, Q11 and Q7. These will be the factor that we call "Compulsive Smartphone Use" factor, which explains 9.084% of the total variability, and which is reflected in the students' compulsive need to interact with their smartphones.

Component 3: This includes the characteristics of low emotion. This component we want to extract the following items: Q1, Q2, Q3 and Q4. These will be the factor that we call "Anxiety and Panic Sensation" factor, which explains 7.414% of the total variability. This factor reflects UNI students' state if they feel that they have been away from their smartphones for a long period of time.

3.6. Interference of smartphone use in academic life

When asked about the percentage (extent) of interference caused by students' smartphone use in academic life regarding the three characteristics shown in Table12, the students responded in the following fashion:

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Table 12. Interference of students' smartphone use in academic activity.

Percentage of interference	My need to be calm, which is what communicating with other people through my smartphone offers me.		My difficulty in controlling the impulse to use my smartphone.		My constant desire to communicate with others and have new interpersonal relationships using my smartphone.	
	Frequency	Percentage(%)	Frequency	Percentage(%)	Frequency	Percentage(%)
20%	131	28.4	152	33	162	35.1
40%	195	42.3	162	35.1	145	31.5
60%	102	22.1	93	20.2	105	22.8
80%	102	22.1	93	20.2	105	22.8
100%	5	1.1	10	2.2	10	2.2
Total	**461**	**100**	**461**	**100**	**461**	**100**

As discussion of the results obtained, we achieve the following that are important to note because of its relevance in the life or the student academic:

Our results indicate that the sense of calmness transmitted by communicating with other people through a smartphone has a high degree of interference with students' academic life, with the highest percentage of responses (42.3% and 22.1%) concentrated in the interference assessment between 40% and 60%. With regard to the difficulty that students have in controlling the impulse that makes them use smartphones, they have a high degree of interference in students' academic life, with the highest percentage of answers (35.1% and 20.2%) concentrated in the interference assessment between 40% and 60%. With regard to the constant desire to communicate with others and have new interpersonal relationships using smartphones, the highest percentage of responses (35.1% and 31.5%) is concentrated in the interference assessment between 20% and 40%.

To analyze the differences between the sub-scale scores according to the percentage of smartphone interference with academic activity, the analysis of variance of a factor was made with post-hoc comparisons using Tukey's contrast [32]. In this test, groups are separated by the percentage of smartphone interference in students' academic life (20%, 40%, 60%, 80%, and 100%).

From the analysis of results, no differences were observed in the average assessment of smartphone interference with students' academic life corresponding to the range between 20% and 40% ($p > 0.05$) or between 80% and 100% ($p > 0.05$). In the rest of the sub-scales, the differences between the average assessments are significant ($p < 0.05$). The sub-scales were divided into three groups according to the differences between the average scores: Group 1 (20% and 40%), Group 2 (60%), and Group 3 (80% and 100%). For this new group, Tukey's contrast was completed to analyze the differences between the average scores.

Also, in Table 13, we noted that the differences in the mean scores between the groups are significant ($p < 0.05$). We can also see that the average of Group 1 is greater than that of Group 2 and that the average of Group 2 is greater than that of Group 3 (Group 1 > Group 2 > Group 3), which leads us to conclude that the average of responses on the interference caused by smartphones in students' academic life is concentrated between Group 1 (20% and 40%) and Group 2 (60%).

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Table 13. Multiple comparisons: Average scores based on the percentage of smartphone interference in academic life

			Difference of means (I-J)	Standard error	Sig.	95% confidence interval	
						Lower limit	Upper limit
HSD Tukey	group1	group2	57,83333*	12.57671	.002	24.2804	91.3863
		group3	135,16667*	10.26884	.000	107.7708	162.5625
	group2	group1	-57,83333*	12.57671	.002	-91.3863	-24.2804
		group3	77.33333*	12.57671	.000	43.7804	110.8863
	group3	group1	-135.16667*	10.26884	.000	-162.5625	-107.7708
		group2	-77.33333*	12.57671	.000	-110.8863	-43.7804

* The difference in means is significant at the level of 0.05.

4. Conclusions

As a result of the performed process, and following a methodology of research adopted, validate the study and we get the following conclusions. The results in the interference of smartphone use in academic life, indicate the sense of calmness transmitted by students at the National University of Engineering from communicating with other people using smartphones, with a high degree of smartphone interference in students' academic life demonstrated on the basis of a majority of responses collected. The assessment of interference in academic life concentrated between 40% and 60%.

From the factor analysis, we concluded that there are three symptomatic factors of nomophobia in students at the National University of Engineering that describe the sensation that students experience when they feel the need to be with their smartphones and these are: sensation of anxiety, compulsive amartphone use and sensation of anxiety and panic.

These conclusions support our proposition that there are indeed enough indications to affirm that there are symptomatic factors present in the students at the National University of Engineering because of indiscriminate smartphone use.

Plans for future study are geared toward expanding the research to other social interest groups where it is necessary to have an instrument for the identification of nomophobic symptomatic factors that provide valuable information to be used in clinical and research contexts of psychological health professionals, leading to solutions being proposed and strategies chalked out to overcome nomophobia in Peru.

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Abbreviations

The following abbreviations are used in this manuscript:

MDPI	Multidisciplinary Digital Publishing Institute
DOAJ	Directory of open access journals
TLA	Three letter acronym
LD	linear dichroism

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Sample Availability: Samples of the compounds ..... are available from the authors.