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Problematic Use of the Internet and Smartphones in University Students: 2006–2017

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Abstract: 1) Background: It has been more than a decade since the concern about addictive use of the Internet and mobile phones was first expressed and its possible inclusion into the lists of mental disorders has been a popular topic of discussion recently, thus it seems to be a fitting moment to investigate the evolution of this issue over time. The aim of the present study was to analyze the evolution of the perception of problematic Internet and smartphone use in young people over the period 2006–2017; 2) Methods: To this end, a questionnaire on Internet use habits and the CERI and CERM questionnaires on negative consequences of Internet and smartphone use were administered to a sample of 792 university students and compared with data from former studies over the period 2006–2017; 3) Results: The perception of problematic Internet and mobile phone use has increased over the last decade, social networks are considered responsible for this increase, and females are the ones perceived to be more affected than males. The degree to which participants agree with the statement "I am addicted to the Internet" can be used as a screening item for problematic use.

Keywords: Internet addiction; mobile phone addiction; online social network; university students; technological addictions; behavioral addictions

1. Introduction

Ever since Young [1] presented *Internet Addiction: the Emergence of a New Disorder* at the Congress of the American Psychological Association in Toronto, Internet addiction has been a widely discussed disorder in the media and in scientific literature [2]. The interest in the possible addiction to the Internet, video games, online role-playing games, television and mobile phones has given rise to a new field of study - addiction to Information and Communication Technologies (ICT), also known as technological addictions [3]. In fact, the DSM-5 [4] included addiction to video games in the list of disorders that should receive further research. Negative consequences of this problem include the possible increase of stress, anxiety, and/or the "paradox" of a lack of communication, especially among young people and adolescents [5–7].

Internet use and Internet access habits have recently evolved. For example, in 2015 in Spain there was a clear preference for the smartphone (88.2%) over the computer (78.2%) for accessing the Internet, especially for the ages of 14 – 19 years old. This evolution of preference for the phone over the computer was also observed for the accessing of leisure activities, which decreases the dominance of the computer in the professional and educational spheres [8]. Due to its popularity and because it is a relatively new device, the smartphone has raised concerns about its potential to be addictive [9–12]. This concern is in line with the development of concern about other possible behavioral addictions such as to the Internet or social media [13].

From our point of view, the concern over mobile phone addiction came in two distinct waves. The first was focused on the non-smart mobile phone and was mainly due to two factors: the amount of phone bills that the use led to and the high use of text messages. Phone bills were a point of concern because a flat rate did not exist and users needed a certain learning period to understand how to manage their use so that it remained within reasonable limits. On the other hand, text messages allowed users to express their emotions spontaneously, were less invasive and required less emotional involvement than 'face to face' interaction so they became very popular very quickly. When, thanks to new billing structures, users managed to control phone use spending and it seemed that worry on the subject was decreasing, smartphones emerged on the market. At that point a new wave of concern began about the possible addictive use of this highly appealing device, especially in regards to its use for accessing the Internet and certain applications such as social networks and messaging services.

To this concern we must add that the media tend to echo and spread negative information about the use of mobile phones. Results of these alerts are concepts such as the so-called technostress [14], smombie (a combination of "smartphone" and "zombie")[15], fear of missing out (fomo)[16] and nomophobia ("no-mobile-phone phobia") [17]. However, studies on the addictive consequences of both the 'old' mobile phone [9,18–21], the current smartphone [22–27], and the Internet are cross-sectional, therefore the temporal evolution of the smartphone and the Internet's addictive impact on the population is still unknown. Based on the aforementioned research as a background, the objective of the current study was to explore the evolution of the perception about problematic Internet and smartphone use in young people between the years 2006 and 2017.

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2. Materials and Method

Participants

792 students from the FPCEE Blanquerna of Ramon Llull University participated in the study in May 2017. They were studying psychology (30.7%), physical education and sports sciences (17.2%), education (47.6%) and speech therapy (4.5%). Their average age was 21.6 years old (SD = 3.3) and 76.5% were women.

Instruments

The following instruments were used:

- Sociodemographic and Internet uses questionnaire. This questionnaire collects sociodemographic data (age, sex and university degree) and frequency of Internet use (for example, gambling, social networks, etc.) in a five points scale. The questionnaire included a Likert type question about the user's degree of agreement with the statement: "I am addicted to the Internet" and one question about gender and addiction: "Do you think that girls are more Internet addicted than boys?"
- Questionnaire on Experiences Related to the Internet (CERI)[28]. This questionnaire consists of 10 items about Internet use that are answered on a Likert scale.
- Mobile Experiences Questionnaire (CERM)[28]. This questionnaire consists of 10 items about mobile phone use that are answered on a Likert scale.

Procedure and data analysis

The university students were invited to participate in the study through an email containing a link to a Google Docs form. The data was exported to an Excel database which allowed the use of SPSS for its analysis. Informed consent was requested. No personal data was requested and it was not possible to connect any of the data from the questionnaires to academic records. The participants had to click on a box to give their consent and continue with the study. The students did not receive any monetary or academic reward for their participation. The study was approved by the Committee of Ethics and Research of the FPCEE Blanquerna, Universitat Ramon Llull.

The data on problematic Internet and mobile use obtained in this study via the CERI and CERM (called Cohort 6 hereinafter) was compared with data obtained from other cohorts of university students who had answered the CERI and CERM questionnaires in studies conducted by our team between 2005 and 2017:

- Cohort 1: 322 students from the fields of psychology, physical education, nursing, physiotherapy or communication in the Universitat Ramon Llull of Barcelona. The mean age was 19.71 years (SD = 1.73) and 72.7% were women. The data was collected during the 2005-2006 academic year [28].
- Cohort 2: 318 psychology students from the University of Illinois at Urbana-Champaign in the United States of which 51% were women, aged between 17 and 21 years. The data was collected during the 2013-2014 academic year[29].
- Cohort 3: 425 psychology students from the University of Illinois at Urbana-Champaign of whom 65.4% were women, with an average age of 19.5 (SD = 1.5). The data was collected during the 2015-2016 academic year [30].

- Cohort 4: 308 psychology students from the Universitat Ramon Llull. The mean age was 22.2 years (SD = 4.1) and 77.9% were women. The data was collected during the 2015-2016 academic year [30].
- Cohort 5: 308 psychology students from the University of Ibagué in Ibagué, Colombia. The mean age was 19.8 years (SD = 3.03) and 65.6% were women. The data was collected during the 2015-2016 academic year [30].

Student t-tests were calculated to compare men and women in relation to a) the type of use they engage in on the Internet, b) their scores on the CERI and CERM, and c) the degree of agreement that users expressed regarding the question "I'm addicted to the Internet." To check if the use of certain Internet functions is associated with negative consequences of use, correlations were calculated between the use of the Internet functions and scores on the CERI and CERM.

3. Results

The frequency of Internet uses is shown in Table 1. The most frequent activities on the Internet were checking emails and sending messages, participating in social networks and listening to music. The least frequent uses were gambling and visiting adult pages. Significant differences were found between men and women in all uses except online purchases, viewing of TV series, movies or videos, and administrative tasks.

Table 1. Most frequent Internet uses of university students.

	Frequency of use				
Internet uses	Men M (SD)	Women M (SD)	Total M (SD)	t	p
Phone calls and videoconferences	2,70 (1.12)	2,98 (1.11)	2,91(1.27)	2,97	.003
Email/ Chat	4,60 (0.66)	4,76 (0.54)	4,72(0.58)	3,38	.001
Social networking	4,11 (1.06)	4,34 (0.97)	4,28(0.99)	2,69	.007
General information	3,80 (1.04)	3,33 (1.07)	3,44(1.08)	5,18	.007
Shopping	2,11 (1.00)	2,11 (1.06)	2,11(1.05)	0.01	.987
Videogames	2,32 (1.29)	1,63 (0.93)	1,79(1.07)	7,94	.000
Gambling/ betting	1,44 (0.85)	1,06 (0.32)	1,15(0.53)	8,96	.000
Videos/TV series	3,43 (1.24)	3,52 (1.21)	3,50(1.22)	0.90	.364
Listening to music	3,99 (1.10)	4,24 (1.01)	4,18(1.04)	2,90	.004
Administrative tasks	2,58 (1.20)	2,60 (1.25)	2,59(1.24)	0,21	.832
Adult content	2,34 (1.08)	1,25 (0.65)	1,51(0.90)	16,07	.000
Academic activities	3,66 (1.01)	4,03 (0.99)	3,95(1.01)	4,46	.000

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The mean score on the CERI was 18.04 (SD = 4.50) and the mean score on the CERM was 15.77 (SD = 3.50). No statistically significant differences were observed between the scores for men and women nor among students from different degrees (F (4,787) = 1.24; p = .291 for the CERI and F (4.787) = 1.85; p = .116 for the CERM) (table 2). To the question, "Do you think girls are more addicted to the Internet than boys?", 73.2% answered affirmatively.

Table 2. Average scores of university students in the CERI and in the CERM

	Men M(SD)	Women M(SD)	Total M (SD)	
CERM	15.77(3.55) N = 186	15.77(3.50) N = 606	15,77 (3.50) N = 792	t(790)=.012 (p =.884)
CERI	18.09(4.81) N = 186	18.04(4.41) N = 606	18,04 (4.50) N = 792	t(790)=.146 (p =.990)

The correlation between the CERI and the CERM was .76 (p = .000). The correlations between CERI and CERM with each of the different online functions were low, with the most relevant correlation being between social networks and both the CERI (r = .23; p = .000) and the CERM (r = .21; p = .000) (see table 3).

Table 3. Correlations between CERI and CERM with the uses of the Internet

Internet uses	CERI	CERM
Email/ Chat	.15**	.14**
Social networking	.23**	.21**
General information	.14**	.08
Shopping	.14**	.12**
Videogames	.10**	.11**
Gambling/ betting	.15**	.17**
Videos/TV series	.12**	.11**
Listen music	.18**	.17**
Administration	.03	.04
Adult content	.12	.13**
Academic activities	.07	.01
Phone calls/ videoconferences	.04	.08

Note: ** p<.001

Regarding the self-assessment of whether they considered themselves addicted to the Internet, 375 students (47.4%) either agreed or agreed strongly with this statement. Table 4 shows that people who

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"strongly agree" with the statement "I am addicted to the internet" obtained significantly higher results than the rest of the participants on both the CERI and the CERM. The correlations with the CERI and CERM were .38 (p = .000) and .34 (p = .000) respectively.

Table 4. Level of agreement of the statement "I am addicted to the Internet" with the scores in CERI and CERM

Level of agreement	CERI M(SD)	CERM M(SD)
Strongly agree	21.89(4.71) n = 93	18.47(4.22) n = 93
Agree	19.02(4.20) n = 282	16.45(3.25) n = 282
Neither agree nor disagree	16.82(3.81) n = 275	14.89(3.09) n = 275
Disagree	15.90(3.58) n = 123	14.35(2.71) n = 123
Totally disagree	16.47(6.85) n = 19	14.47(4.25) n = 19

As shown in table 5, the scores on the CERI and CERM grew from 2005 to 2013 and remained stable as of the 2013-14 academic year. The scores on the CERI (F [5.3625] = 55.44, p = .000) and the CERM (F [6.8629] = 377.72, p = .000) of the first two cohorts were significantly lower than those of the later cohorts. The number of students who showed problematic Internet use went from 1.5% in 2005 to 6.4% in 2017 and from 0.6% to 3.0%, in the case of problematic mobile phone use. The correlation between CERI and CERM was "moderate" up to 2014 and increased to "high" as of 2015.

Table 5. Scores of the university students cohorts on the CERI and the CERM

Cohort	Year	CERI M (SD)	CERM M (SD)	Correlation CERI/CERM	Problematic use CERI (%)	Problematic use CERM (%)
Cohort 1	2005-06	17,01 (5,10)	13,57 (3.92)	.439 **	2,2%	0,9%
Cohort 2	2013-14	19,65 (5,06)	17,83 (4.39)	.530 **	9,2%	8,6%
Cohort 3	2015-16	18,64 (5,03)	18,38 (4.09)	.692**	7,5%	8,1%
Cohort 4	2015-16	17,05 (4,06)	16,68 (3.51)	.734**	2,0%	3,0%
Cohort 5	2015-16	17,98(5,41)	17,88 (4.98)	.851**	9,3%	11,5%

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Cohort 6	2016-17	18,04 (4,50)	15,77 (3.50)	.760**	6,4%	3,0%

Note: ** p<.001

4. Discussion

The objective of this study was to evaluate the perception of problematic Internet and mobile phone use and compare these results with those of similar cohorts from up to a decade ago. One of the problems presented by studies evaluating technological addictions to the Internet, social networks, mobile phones and video games is the absence of longitudinal studies. It is difficult for these studies to monitor a cohort in the medium or long term because the questionnaires are administered in person or online to: i) cohorts obtained in the general population through social networks or the like; ii) samples of high school or university students; iii) video gamers identified in forums. Other factors that make longitudinal study difficult are that the anonymity of the participants is respected and because of the existence of time limitations and limitations on funding for the research projects and doctoral theses. To overcome this difficulty, this study compared data from different cohorts of university students.

Taken globally, the results of the study support the idea that the perception of problematic use of the Internet and mobile phones exists and has increased over the last decade. This perception seems to accompany the growth of Internet use and all kinds of electronic devices that have a screen, with which our samples became familiar during their adolescence [31]. This problematic use of the Internet is specific and not general; that is, it depends on the concrete activity that is carried out [32,33], which we can also affirm for mobile phones [34,35]. Given that the Internet applications most used by university students are e-mail and messaging, participating in social networks and listening to music, we infer that the increase in the perception of problematic use is associated with the use of online social networks, which is the only truly new activity in users' interaction with electronic devices that have a screen. The activities in which the university students invest the least time are betting games and adult pages, like in other similar samples [32,33,35] and as is expected for university students. However, despite the existence of problematic use, it seems that the term 'addiction' is an inadequate construct because: i) problematic use does not depend on the mobile phone or the Internet itself, but on the activities accessed on them; ii) problematic use can be the symptom of other disorders, not a primary disorder in itself [10,35]; and iii) there is a risk that labeling this problematic use an addiction is pathologizing daily life [36]. The questionnaires used make it possible to detect a concern about certain technology-based behaviors but in no case to issue a clinical diagnosis.

It is difficult to compare our data on problematic mobile use with those of other studies due to the use of different measuring instruments. A preliminary comparison shows that the range of values for problematic users or addicts ranges between 0% and 35%, with 10% - 20% being the most frequent values [7,10,12], although there have been reports of 48% in university students [22]. In recent research, the percentages ranged from 3.9% in Belgium to 1% in Poland, with 1.7% addicts identified in the Spanish sample [35].

It is also not surprising that the Internet uses of young men and women are quite different from each other as there are differences in behavior and attitudes between them in the real world which are perpetuated in the network. Women use social networks and academic applications more and listen to

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more music than men. Men play more videogames and betting games, and use more adult pages than women. In any case, women's problematic use is greater, which may be because they use social networks more and because of the role that those social networks play in communication and in creating and maintaining connections [27,35,37].

The average scores on the CERI were higher than on the CERM as has been the case with these instruments in other studies [28,29,38]. No differences were found between men and women in the problematic use of the mobile phone despite this being a frequent result in other investigations [27,35,38,39]. Although the Internet activities of men and women are different, there were no differences found in the problematic use of the Internet [38,40]. However, the perception of our students is that women are more addicted to the Internet than men probably due to the fact that using social networks is more common than using video games, or it may be due to a perception that the female sex is more vulnerable to this type of problem because it is related to communication practices such as establishing and actively maintaining relationships, which women engage in more than men[24] and because this type of communication management is connected to social stress which women may be more sensitive to [27].

Social network use is the only Internet use that moderately correlates with CERI and CERM. The other correlations, in line with other studies, are low or nonexistent [35]. In fact, social network use is considered, along with video games, to be the use with the highest risk of becoming problematic [41,42] even though there is a lack of empirical confirmation [13]. This low correlation with the different Internet uses can be explained because we are talking about a population that, as a whole, bets little and consumes little pornography, which leads us to think that we would obtain higher correlations if the CERI and the CERM were applied to cohorts of people extracted from the general population, who would be more likely to bet online, consume pornography and/or be intensive videogamers.

The correlation between the CERI and CERM was high. In fact, we wonder if it is still convenient to use both the CERI and the CERM since the CERI and the CERM since at the current time both measures may be considered equivalent in the context of young people's technology use; young people use the mobile phone more and more frequently to access the Internet [8,27,35] and tend not to distinguish between the platform (mobile vs computer) and the program/application. The current study confirms this intuition and advises that technology's evolution forces us to change and update certain research questions. For example, when we designed the CERM, the mobile phones used by students did not have access to the Internet, whereas at the present moment in Spain, there is not really a distinction between mobile phones and smartphones because they are considered synonymous. We draw upon an anecdote to illustrate this situation. When the first papers expressing concern about mobile phone addiction were published [9] over a decade ago they were about mobile phones without the Internet. However, last year when we showed a fourth-year psychology student a picture of an old Nokia phone from that era, one of them asked: "But... was it possible to be addicted to *that*?" This question reveals to what extent the diagnosis of technological addictions is influenced by time and social and culture change.

Something similar is occurring with Internet addiction. In the last decade we have learned that it is convenient to distinguish between behavioral addictions that take place on the Internet (for example, pathological gambling), the specific uses of the Internet that can become problematic (for example, videogames and social networks) and a possible generalized Internet addiction [32,33]. The students who

responded to the CERI ten years ago did so whilst thinking primarily about their connection to the Internet via their computer, whereas now they access the Internet indiscriminately from their mobile phones, home computer or university computer. One example of how old Internet use has altered in recent years is the application WhatsApp. WhatsApp is a telephone messaging service but it shares many features with social networks and as of 2016 it can be accessed from the computer. Therefore, students can use WhatsApp on their mobile phones or from their laptop when they are in the classroom and they create class groups on both WhatsApp and Facebook indiscriminately. Another example of the merging of lines between phone applications and Internet applications is the difficulty in distinguishing between how much time is dedicated to each application or program, since it is so common to work in multi-screen mode. Students can write an academic paper, answers emails and have a conversation on WhatsApp, all at the same time.

The analysis of the scores of the CERI and the CERM in this decade offers some revealing ideas. The perception of problematic Internet and mobile use has increased, and so has their correlation with each other, probably due to the emergence of the smartphone which merges their features. The comparison between the university students from the United States, Colombia and Spain indicates that the university students of all three countries share a similar perception about their problematic use, with the Colombian students being the most worried about it and the Spanish students being the least worried. At the current state of understanding on the subject, we are not in a position to know if the differences in the responses by students in these countries are due to real differences in the problems caused by the devices or if they are due to different perceptions about the influence that these technologies have on their lives. Obviously, we need to highlight the relevance of the difference in economic aspects, access to technology, and communication habits among the three countries as well as in cross-cultural studies in Europe [35] and in the world [43].

Although we have already mentioned the limitations of the CERI and CERM (they were created in the cell phone era before the smartphone and are self-report measures), they are easy to use and to score, thereby inviting us to continue using them when possible in order to study the evolution of the perception of problematic use of the Internet and mobile phones. They indicate, not so much the prevalence of an addiction, but the perception of a problem by respondents. Although the correlation of the CERI and CERM with the statement "I am addicted to the internet" was moderate the people who are "very much in agreement" and "agree" with this statement obtained significantly higher results than the rest in both the CERI and the CERM. So much so that it would be possible to use this single question to detect problematic mobile phone use, as has already been suggested [33,44]. It is highlighted that our students seem to have a perception about their Internet addiction more in line with the data obtained through the questionnaires than the participants in the study done by Pontes, Szabo and Griffiths [33] in which 51.9% of the participants identified themselves as Internet addicts.

This study is not without limitations. Firstly, university students have a higher than average level of academic development and their use of the Internet and mobile phones is not necessarily representative of the use that other young people engage in. Secondly, problematic use of these technologies does not correspond to any diagnostic entity and may be a reflection of their social impact. Thirdly, both the CERI and the CERM may have been outdated, firstly because a general use of the Internet is no longer conceivable, rather a specific one, and more so because of the new and expanded uses of smartphones.

Finally, it is possible that some differences found in this study are influenced by the cultural differences between the samples more so than by the temporal differences.

5. Conclusions

Although men and women use the Internet differently, their problematic use of the Internet and mobile phones are quite similar. In university students, use of social networks is the main factor responsible for the perception of problematic use; a casuistry that has increased in the decade 2006-2016. Despite the limitations of the CERI and CERM, using the same measurements at different time points offers valuable information about the evolution of the perception of problematic Internet and mobile phone use. It is convenient to repeat the studies using the same instrument to understand the perception of problematic Internet and mobile phone use even if it lacks clinical significance. The perception of problematic use, roughly speaking, follows a pattern similar to that of university students from other cultures. The degree of agreement with the statement "I am addicted to the Internet" can be used as a screening question for problematic use. Young people are worried about the phenomenon and it is convenient to keep track of their perception on the issue in order to design, if necessary, orientation campaigns for an adequate use of these technologies.

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