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Specific smartphone uses and how they relate to anxiety and depression in university students: a cross-cultural perspective

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ABSTRACT
People around the world spend hours of their daily lives using smartphones; therefore, it is important to conduct cross-cultural research on the effects of smartphone use on health and well-being as culture influences values, motivations and communication patterns. The purpose of this study was to explore 5 popular uses of the smartphone – messaging, browsing the Internet, posting social content, reading social content, and playing games – how they relate to anxiety and depression scores, and how they vary depending on the country of the participants: Spain, the United States, and Colombia. In all three countries the ranking of most popular uses was the same: (1) Messaging, (2) Reading social content, and (3) Browsing the Internet. In the USA, game playing contributed to anxiety scores whereas reading social content was a protective factor; regarding depression scores, text messaging was a contributing factor. In Spain, browsing the Internet contributed to anxiety scores; regarding depression scores, messaging was a contributing factor and posting social content was a protective factor. In Colombia, no specific use influenced anxiety scores; regarding depression scores, only game playing was a protective factor. Our results showed that in all the countries, problematic smartphone use contributed to anxiety scores.

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1. Introduction

The popularisation of handheld technology and its consequent permeation into all aspects of social and public life has created a sociocultural shift in communication/information practices around the world. With the rise of smartphones, more and more studies are coming out about the psychological and physical effects related to their frequent use, however, the role of culture on problematic smartphone use has been explored in few. This is a weakness in the literature since culture shapes an individual’s values, interests and communication practices, which then affect the manner in which they utilise Information and Communication Technologies (ICTs) such as smartphones, and in part determine the consequences of that use.

In 2017 there were 2.4 billion smartphone users (Murphy 2017) and 50% of all Internet use was conducted through a mobile phone (Kemp 2017). Considering that a third of the world is using smartphones and spending hours daily engaging with the device’s various functions, it is essential to study the effects of this use on health and wellbeing. Since smartphone users come from around the globe, it is also important to study smartphone behaviours through a cross-cultural perspective in order to better understand how certain contexts influence smartphone behaviours and their negative consequences.

1.1. Mental health in smartphone users

Although smartphones have provided unprecedented convenience and have made much of life’s tasks easier, their appeal and convenience make them highly reinforcing, which can lead to the development a compulsive attachment to the device that many have labelled smartphone addiction (Aljomaa et al. 2016; Bian and Leung 2015; Darcin et al. 2016; Haug et al. 2015; Hawi and Samaha 2016; Lin et al. 2014; Van Deursen et al. 2015) or what we consider to be more accurate – problematic use (Bianchi and Phillips 2005; Carbonell et al. 2018; Panova and Carbonell 2018; Lopez-Fernandez et al. 2017).

Problems related to heavy smartphone use arise in part because human attention is a limited resource and the attention devoted to the device is diverted from other important activities and mental processes, some of which are necessary for healthy development and psychological wellbeing, such as self-reflection (Immordino-Yang, Christodoulou, and Singh 2012) and emotional coping strategies (Panova and Lleras 2016). A growing body of research shows that excessive mobile
phone and Internet engagement are associated with various psychological problems, among them emotional instability (Augner and Hacker 2012; Eftekhar, Fullwood, and Morris 2014), maladaptive coping behaviours (Reid and Reid 2007; Nehra et al. 2012; Grellhesl and Punyanunt-Carter 2012, Panova and Lleras 2016), a decrease in mindful living (Thomée et al. 2010), sleep disturbances (Thomée, Härenstam, and Hagberg 2011; Murdock 2013; Demirci, Akgönül, and Akpinar 2015), anxiety (Pierce 2009; Thomée et al. 2010; Murdock 2013; Beranuy et al. 2009b; Panova and Lleras 2016) and depression (Thomée, Härenstam, and Hagberg 2011; Sanchez-Martinez and Otero 2009; Augner and Hacker 2012; Panova and Lleras 2016). Other problems can arise because the smartphone provides convenient access to a broad array of activities, some of which (e.g. gambling, pornography, etc.) have been proven to be problematic for healthy psychological development (Andreassen et al. 2016). In a recent review of the literature on problematic smartphone use and psychopathology, Elhai et al. (2017) found that the most common and stable effects were found between problematic smartphone use and depression (with at least medium effect sizes) and problematic smartphone use and anxiety (with small effect sizes).

Although most research in this field discusses problems associated with smartphone use using an addiction framework, which addresses the smartphone as a single addictive entity like a drug, other studies have looked at specific behaviours on the device. Murdock (2013) found that interpersonal stress was significantly and negatively associated with emotional wellbeing for participants who had high daily texting behaviour, leading her to conclude that texting is an unsuitable way to communicate when coping with interpersonal stress. Thomée et al. (2010) found that being highly accessible via the mobile phone’s communication functions was associated with stress, sleep disturbances, and symptoms of depression for both men and women. Carpenter (2012) looked at Facebook behaviours and found that entitlement/exhibitionism predicted retaliating against mean comments, seeking more social support than a person provides, and checking Facebook to see what others are saying about oneself. Studies such as these offer insight on the specific ways in which smartphone use can provide a platform for mental disorders to manifest and/or can contribute to or interact with the development of mental disorders.

1.2. Sex effects

Regarding the effect of sex on smartphone use, it has been consistently found that females are more likely to engage in social uses such as social media use (Laconi et al. 2018; Dufour et al. 2016) and messaging (Kim-brough et al. 2013), whereas males are more likely to engage in game playing (Greenberg et al. 2008; Puerta-Cortés et al. 2017). Smartphone use levels are different between sexes in different countries, and in many countries men exhibit much greater smartphone ownership and therefore greater use (Poushter 2016). Some studies have shown that females are more likely to engage in problematic smartphone use (Choi et al. 2015; Van Deursen et al. 2015) whereas other research has shown the contrary (Aljomaa et al. 2016).

1.3. The role of culture

Smartphones have become one of the primary channels for communication and information-gathering all around the world, and like with any other communication or information medium, understanding the context in which its use is rooted can offer rich insight into the dynamics and values of a society. Approaching smartphone research with consideration for the influence of culture can also provide insight as to why the effects of smartphone use vary in different studies.

That being said, few cross-cultural studies on smartphone use from a psychological perspective have been conducted in recent years, (Kang and Jung 2014; Leonard, Leonard, and Hudson 2006; Lopez-Fernandez 2015; Lopez-Fernandez et al. 2017; Yudes-Gómez, Baridon-Chauvie, and González-Cabrera 2018) leaving a gap in the literature on this subject. In one of the largest cross-cultural smartphone studies, Lopez-Fernandez et al. (2017) identified differences in smartphone use according to European region and found that participants in Northern European countries showed a preference for solitary activities such as managing e-mails, browsing the Internet and gaming, whereas participants in Southern European countries showed preferences for interpersonal activities like chatting and social media use. Leonard, Leonard, and Hudson (2006) compared American, Latino and European mobile phone users and found that American students were most likely to use mobile phones to escape their peers’ perception that they were alone or had nobody to communicate with, Latino participants used the mobile phones most heavily for group and family communication, and Ukrainian students were most likely to report the importance of the mobile phone as a status symbol. Findings like this provide insight into the motivations, gratifications and consequences associated with smartphone use for people of various profiles, and enrich the understanding of values and social dynamics in various cultures in the modern era.
1.4. Why USA, Spain and Colombia?

The three populations chosen for this study are each relevant in the field of smartphone research for distinct reasons. The United States is one of the top three countries in the world regarding the number of smartphone users (Statista 2017) and smartphone penetration (Newzoo 2018), therefore smartphones are deeply integrated into its societal functioning. As the USA is one of the most individualistic countries in the world (Hofstede Insights) smartphone users there are likely to show different smartphone usage patterns when compared to populations from more collectivist communities. Whereas in cross-cultural studies ICT users in the USA are often compared to ICT users in collectivistic countries in Asia (Chen and Nath 2016; Jackson and Wang 2013; Kang and Jung 2014), there are hardly any studies comparing it to collectivistic communities in South America.

According to Hofstede (1983), Colombia is one of the least individualistic countries in the world, therefore a comparison between the USA and Colombia regarding smartphone use practices was considered interesting for revealing cultural differences in smartphone use. Colombia also has much lower smartphone penetration than both the USA and Spain, which can highlight differences in smartphone use and consequences as a function of the novelty effect. In 2016, smartphone penetration was 34.4% in Colombia (Nixon 2017) whereas it was 72% in the United States and 71% in Spain (Poushter 2016).

Regarding the choice of Spain in this cross-cultural study, studies have shown that Spain has among the highest scores on smartphone/Internet use in Europe (Lopez-Fernandez et al. 2017; Tsitsika et al. 2014). Spanish smartphone users have also been noted as engaging significantly higher in interpersonal activities such as messaging on the smartphone than other researched countries (Laconi et al. 2018), thereby making Spanish users a unique population in regards to their smartphone behaviours.

1.5. Cultural profiles

For describing differences between cultures and cultural values, Hofstede’s four dimensions are most commonly used in the literature; power distance, uncertainty avoidance, individualism and masculinity (Hofstede 1983). For our study, we determined that the most relevant of these dimensions was individualism vs. collectivism as this dimension is most often used in cultural research (Schwartz 1994) and because our selected countries cover the full spectrum of that dimension: the USA is very high on individualism, Spain is right in the middle of the spectrum, and Colombia is very low on individualism. However, considering that these cultural dimensions were found and defined in the context of company workers in an organisational field (Hofstede 1983), their implications are broader and have a different focus than what the present study demands. We therefore used Hofstede’s framework as a starting point and framed the cultural differences in our participating countries with a narrower focus: community-oriented vs. less community-oriented, as this dimension seemed most relevant to describe the differences in the three samples, especially regarding communication and socialising practices in which smartphones play an important role.

We define community-oriented societies as societies in which it is common for the population to socialise face-to-face in non-structured contexts on a regular basis (e.g. going out for a coffee with friends or visiting family members multiple times a week, etc.). These behaviours are common in Barcelona, Spain and Ibagué, Colombia because those regions are mostly culturally homogenous (i.e. most people living there were born and grew up in the respective regions and share the same cultural background as the majority of their peers) which makes it easier for citizens to identify with most other members of the community and feel a sense of belonging. The weather in these regions is also mild to hot throughout the year, which makes it more common, desirable and easier to do activities outside and in social contexts.

We define less community-oriented societies as societies in which non-structured socialising behaviour is not very common for various reasons (boyd 2014) such as large distances between residential areas and social spaces (like in Midwestern suburbs in the United States), safety concerns (as in the Chicago area) and severe weather (such as long and very cold winters in the region). The Illinois area of the United States is very broad, characterised by large distances and mostly residential areas with relatively few social spaces and opportunities for gathering and socialising (especially for young people who do not drive or have access to vehicles). The population is also more heterogeneous than in Barcelona or Ibagué, meaning that it is more diverse with people from very different cultural, religious and socioeconomic backgrounds and nationalities living together, which makes it more difficult for a sense of a single cohesive identity to exist within the broader community.

The participants in this study are university students, which constitutes in Hofstede’s words, a narrow sample of participants that belong to ‘functionally equivalent
categories in each country, such as the sample of industrial company workers that he used (Hofstede 1983). Although neither industrial company workers nor university students are representative of the general population, they are both valuable slices of the population to study in cross-cultural research, especially regarding the use of smartphones. Young people aged 18–29 have the highest rates of smartphone use (Pew Research Center 2018) and are the most deeply involved with their technologies on a daily basis (GlobeNewswire 2017), therefore studying their smartphone behaviours is very important. In addition, as Schwartz states in his follow-up work to Hofstede’s study, ‘Students are younger, and their priorities may reflect the direction in which the culture is changing’ (Schwartz 1994).

1.6. The present study

As the review of the literature by Elhai et al. (2017) shows, anxiety and depression are two psychological problems consistently shown to be influenced by problematic smartphone use. To explore how this connection comes about and whether the link between smartphone use and psychopathology is different depending on the cultural context, the current study explored what specific behaviours young people from three cultural regions engage in on their smartphones and whether those behaviours were associated with anxiety and depression. The study was exploratory in nature, conducted to look for patterns and differences in the smartphone use of the participating regions. Considering the points of interest, our research questions were as follows:

1. What specific uses is problematic mobile phone use associated with?
2. Is problematic mobile phone use different between countries?
3. Do people from different countries use the smartphone in different ways?
4. Are there sex differences in the manner of smartphone use?
5. Is problematic mobile phone use related to higher anxiety and/or depression?
6. Are any specific smartphone uses more related to anxiety and depression than others?

2. Materials and Methods

2.1. Participants

Participants were students from three universities, one in each country. Participants were recruited via an email sent by the professors to all students in the Spanish and Colombian colleges, and via a ‘Subject Pool’ (or SONA) in the United States university (a programme that allows students who need research participation credit for their classes to apply to take part in a study). A total of 1709 students filled out the online questionnaire either partially or fully (765 from Spain, 440 from Colombia, and 504 from the United States). After dropping the incomplete responses, 425 were left from the USA, 308 from Spain and 308 from Colombia. The US participants received class credit for their participation whereas the Spanish and Colombian participants did not, which is likely the reason for the lower dropout rate in the US sample. The American participants were 278 females (65.4%), the Spanish participants were 240 females (77.9%) and the Colombian students were 202 females (65.6%). The mean age of American students was 19.56 (SD = 1.68; range 18–30), the mean age of Spanish students was 21.59 (SD = 2.51; range 18–30), and the mean age of Colombian student was 19.99 (SD = 2.05; range 18–30). The Spanish participants were somewhat older than the other two groups (F = 85; p < .001).

2.2. Measures

Mobile Related Experiences Questionnaire (CERM): Developed by Beranuy et al. (2009b) and validated by Beranuy et al. (2009a), and translated to English in collaboration with Panova and Lleras (2016). The questionnaire is used to measure the problematic uses of the mobile phone. The English version of this questionnaire was created with the approval of the original authors, via a process of several forward and back translations conducted by a team of students and researchers proficient-to-fluent in English and Spanish. The same process was conducted with the Colombian team to make small adjustments to the Spanish version so that the wording of the questionnaire adhered to Colombian Spanish. Both translations were approved by the original authors. This procedure is in accordance with the standards for cross-cultural adaptation (Muñiz, Elosua, and Hambleton 2013). The questionnaire comprises 10 Likert type items with four answer options (1 to 4) reflecting a degree of frequency between never (1) and quite a lot (4) and includes items such as ‘Have you had the risk of losing an important relationship, a job or an academic opportunity due to your cell phone use?’ and ‘Do you think that life without your cell phone is boring, empty, and sad?’ The score is calculated by adding together the answers to all the items. The reliability (Cronbach’s Alpha) for the present study was .78. Confirmatory factor analysis showed a good fit of the scale model: root mean square error of
2.3. Procedure

Participants who chose to complete the study clicked the link provided to them either from the email or from the SONA website (USA) and were redirected to the questionnaire on the web host Qualtrics. They could answer the questionnaire from anywhere as well as pause it and finish it later if they so chose, or not finish if they did not want to. When a participant accessed the questionnaire, they were presented with a document explaining the study and were asked to provide their informed consent in order to continue. The questionnaire took an average of 10–15 min to complete but there was no time limit. After all data was collected, responses were imported from the Qualtrics host servers to a database compatible with the statistical package Excel. No identifying information was collected from the participants and their responses were encoded as a set of random numbers and letters. IP numbers were not tracked. The data was analysed using the Statistical Package for Social Sciences version 16.0 and EQS 6.1. Some data collected were not related to the smartphone focus of the current study and will therefore be presented elsewhere.

This research was approved by the Facultad de Psicología, Ciències de l’Educació i de l’Esport’ ethical board.

2.4. Data analysis

First, normality distribution was tested. Afterwards, the factor structure of questionnaires was examined using Confirmatory analysis (CFA), with generalised least squares (GLS) estimation and robust methods. Model fit was evaluated based on the comparative fit index (CFI), Tucker-Lewis index (TLI), root-mean-square error of approximation (RMSEA). As for CFA, CFI and TLI > .90, RMSEA < .08 typically reflect acceptable fit and CFI and TLI > .95, indicates excellent fit (Brown 2006; Marsh et al. 2014). Descriptive and correlational analyses were performed. To test country and sex differences in the study, a bifactorial (sex by country) Analysis of Variance (General Linear Model procedure) was performed. When main effects were significant, post-hoc comparisons (with Bonferroni adjustment for multiple comparisons) were computed. Finally, a hierarchical regression analysis was performed, where anxiety and depression were the dependent variables and sociodemographic data, uses and CERM were entered as the independent predictors. There were no missing values in the variables included.

3. Results

3.1. Descriptive analysis

The Kolmogorov–Smirnov test for normality was performed. Statistics showed not normal distribution in all non-categorical variables, even though Kurtosis, except for anxiety, were not large. Considering the large sample and keeping in mind Rasch and Guiard (2004) regarding the robustness of the parametric approach for statistical inferences, we decided to use parametric tests.

Taking into account available cutoff points for the CERM (Carbonell et al. 2012), 33.6% of participants with scores between 10 and 15 points could be labelled as having ‘no problems with mobile phone use’, 56.6% with scores between 16 and 23 points could be labelled as having ‘occasional problems with mobile phone use’ and 7.7% with scores between 24 and 40 points could be labelled as having ‘frequent problems with mobile phone use’. The values of mean scores for anxiety and depression as measured by the MASQ are lower than reported in previous studies (Nitschke et al. 2001).
Table 1. Correlations.

<table>
<thead>
<tr>
<th>Variable</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Age</td>
<td>20.44</td>
<td>3.01</td>
<td>-0.04</td>
<td>-16**</td>
<td>-18**</td>
<td>-01</td>
<td>-08</td>
<td>-16**</td>
<td>-05</td>
</tr>
<tr>
<td>2. Messaging</td>
<td>3.41</td>
<td>0.77</td>
<td>-</td>
<td>18**</td>
<td>30**</td>
<td>-07</td>
<td>-09</td>
<td>-01</td>
<td>-09**</td>
</tr>
<tr>
<td>3. Posting social content</td>
<td>1.82</td>
<td>0.86</td>
<td>-</td>
<td></td>
<td>36**</td>
<td>14**</td>
<td>18**</td>
<td>-09</td>
<td>-06</td>
</tr>
<tr>
<td>4. Reading social content</td>
<td>2.92</td>
<td>0.95</td>
<td>-</td>
<td>-01</td>
<td></td>
<td>24**</td>
<td>06</td>
<td>05</td>
<td>32**</td>
</tr>
<tr>
<td>5. Playing</td>
<td>1.67</td>
<td>0.93</td>
<td>-</td>
<td>18**</td>
<td></td>
<td>02</td>
<td>-16</td>
<td>03</td>
<td></td>
</tr>
<tr>
<td>6. Browsing</td>
<td>2.44</td>
<td>0.89</td>
<td>-</td>
<td>10**</td>
<td>03</td>
<td></td>
<td>12**</td>
<td></td>
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<tr>
<td>7. Anxiety</td>
<td>2.92</td>
<td>0.95</td>
<td>-</td>
<td></td>
<td>-21**</td>
<td></td>
<td>36**</td>
<td></td>
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<tr>
<td>8. Depression</td>
<td>1.68</td>
<td>0.93</td>
<td>-</td>
<td></td>
<td>-</td>
<td></td>
<td>06</td>
<td></td>
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<tr>
<td>9. CERM</td>
<td>2.44</td>
<td>0.89</td>
<td>-</td>
<td></td>
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</tbody>
</table>

* = <.05  
** = <.01

Regarding Types of Use, for the total sample, the ranking of activities that users reported they do very frequently are 1. Messaging (57% of total sample), 2. Reading social content (30.7% of total sample) and 3. Browsing the Internet (13.7% of total sample). This ranking was the same for each of the individual countries as well.

Correlations between study variables are presented in Table 1. Age correlated negatively with posting social content, reading social content, CERM and anxiety, indicating that older participants had lower scores on those measures. Regarding specific uses and their relationships with anxiety and depression: anxiety was significantly correlated with posting of social content and browsing the Internet, although correlations were low. Depression was significantly correlated with messaging and playing games (negatively correlated) on the smartphone and correlations were again low. Finally, CERM showed high correlations with posting of social content and browsing the Internet, and there were lower but significant correlations between CERM with browsing the Internet and messaging.

3.2. Mean comparisons

Descriptive statistics for scores on uses, anxiety, depression and problematic mobile phone use, for the three countries are presented in Table 2.

3.3. Multivariate analysis of variance

The multivariate analysis of variance for the effects of country and sex on uses showed significant effects of country for messaging, posting of social content and playing games (see Table 3). Post-hoc comparisons show that Spanish participants had superior scores than USA (mean difference = .41) and Colombia (difference = .31) in messaging. Colombian participants showed the highest scores in posting of social content (mean difference = -.39 for USA, and .55 for Spain). Colombia also showed the highest scores in game playing (mean difference = -.48 for USA, and for Spain).

Regarding sex there are significant effects in posting of social content, reading of social content and game playing, with females in the overall sample being superior on posting (however, females in Colombia had lower posting scores than males) and reading of social content, but males in every country superior on game playing. There is no country by sex interaction for any use except for game playing, as Colombian males showed the highest scores on that activity.

The multivariate analysis of variance for the effects of country and sex on anxiety, depression and CERM (see Table 4). Post-hoc comparisons show that USA was superior to Spain on anxiety (mean difference = 2.91) but had no significant difference with Colombia. However, an interaction of country by sex was detected for anxiety as US males had the highest anxiety scores. USA was also superior to Spain on depression (mean difference = 2.81) and to Colombia (mean difference = 4.40). On problematic mobile phone use Spain showed significantly lower scores than the
USA (mean difference = −1.67) and Colombia (mean difference = −1.18) but the USA and Colombia were not significantly different from each other. No sex effects were observed.

3.4. Linear regression

Results of the hierarchical regression analysis for each country are shown in Table 5. For anxiety as the dependent variable, after controlling for age and sex, in the case of USA participants, uses accounted for a 4.6% of the scores variance and CERM added an additional 9.8%. Playing games and using the smartphone in a problematic way (CERM) are related to anxiety scores whereas reading of social content appeared to be a protective use. In the case of Spanish participants, uses accounted for a 5.3% of scores variance and CERM added an additional 15.4%. Browsing the Internet and using the smartphone in a problematic way (CERM) appeared to be related to anxiety scores. For Colombians, no use explained the variance in anxiety scores, and CERM accounted for all the 17.8% scores variance.

For depression as the dependent variable, after controlling for age and sex, in the case of USA participants, messaging accounted for 6.4% of variance. For Spanish participants, the uses of messaging and posting of social content accounted for 5.7% of scores variance. Whereas messaging appeared to be related to depression scores, posting social content appeared to be a protective use against depression for Spanish participants. For Colombian participants, playing games on the smartphone accounted for the 5.6% of variance in depression scores; however, it appeared to be a protective use. For all three countries CERM scores showed no effect on depression scores.

4. Discussion

The aim of the present study was to explore the relationship between specific uses on the smartphone with anxiety and depression, and to observe if there were differences in smartphone behaviours, anxiety and depression scores depending on the country of the participants. We will discuss the relevant findings in the context of the formulated research questions.

(1) What specific uses is problematic mobile phone use associated with?

Problematic mobile phone use was most highly correlated with the uses of posting social content and reading social content, (i.e. the social media related functions). These findings are in line with previous research that has found social media use to be an important contributor to problematic smartphone use (Oberst et al. 2017). Elhai et al. (2016) suggest that problematic smartphone use can arise from several pathways – habitual use and checking behaviours, seeking excessive reassurance, and reluctance to miss important information or content – which start as positive reinforcement that turns into compulsory behaviour that then becomes negative

| Table 3. Tests of between-subjects effects for the factors country and sex on uses. |
| Source | Variable | F | p | \( \eta^2 \) |
| Country | Messaging | 21.45 | <.001 | .040 |
| | Posting social content | 25.99 | <.001 | .066 |
| | Reading social content | 3.66 | <.05 | .007 |
| | Playing | 36.17 | <.001 | .066 |
| | Browsing | 4.93 | <.05 | .010 |
| | Messaging | 1 | >.05 | .001 |
| | Posting social content | 70.99 | <.001 | .079 |
| | Reading social content | 39.77 | <.001 | .037 |
| | Playing | 46.85 | <.001 | .044 |
| | Browsing | 0.71 | >.05 | .001 |
| | Country by sex | Messaging | 0.54 | >.05 | .001 |
| | Posting social content | 3.42 | <.05 | .010 |
| | Reading social content | 1.69 | >.05 | .004 |
| | Playing | 13.13 | <.001 | .025 |
| | Browsing | 1.94 | >.05 | .004 |

| Table 4. Tests of between-subjects effects for the factors country and sex on anxiety, depression and problematic mobile phone use (CERM). |
| Source | Variable | F | p | \( \eta^2 \) |
| Country | Anxiety | 9.11 | .000 | .028 |
| | Depression | 16.96 | .000 | .032 |
| | CERM | 9.69 | .000 | .016 |
| | Anxiety | .05 | 8.21 | .000 |
| | Depression | 2.93 | .087 | .003 |
| | CERM | 3.04 | .081 | .003 |
| Sex | Anxiety | 3.70 | .025 | .007 |
| | Depression | 1.18 | .307 | .002 |
| | CERM | 1.69 | .185 | .003 |

| Table 5. Results of the stepwise regression analyses for the different countries. |
| Dependent variable | \( R^2 \) | Predictor variables | \( \beta \) | t value | P value | \( R^2 \) | Predictor variables | \( \beta \) | t Value | P value | \( R^2 \) | Predictor variables | \( \beta \) | t Value | P value |
| Anxiety | .144 | Reading social content | −.14 | −2.60 | .009 | .207 | Browsing | .12 | 2.06 | .040 | .178 | CERM | .357 | 6.00 | .000 |
| | | Game Playing | .13 | 2.71 | .007 | CERM | .44 | 7.59 | .000 |
| | | CERM | .33 | 6.85 | .000 |
| Depression | .064 | Messaging | .14 | 2.70 | .007 | .057 | Message-ing | .18 | 3.08 | .002 | .056 | Game Play | −.18 | −2.85 | .005 |

Postingsocial content | −.14 | −.225 | .025 |

Note: Only significant effects are shown.
mood when users do not engage, leading them to engage in order to relieve it. All of their suggested pathways are common in the use of social media. Lower but still significant correlations were found between problematic mobile phone use and age (negative), and with the uses of messaging and browsing the Internet.

The only use with which problematic mobile phone was not correlated was playing games. This may be because users who are frequent game players are not necessarily problematic smartphone users; their attachment is to the games regardless of the device used to access them. This could be a case of distinguishing between the activity and the platform used to access it (Panova and Carbonell 2018).

(2) Is problematic mobile phone use different between countries?

Spain had the lowest scores on CERM, significantly lower than both the US and the Colombian samples, as well as the lowest scores on anxiety. Spanish participants also had the highest scores on the use of messaging, which is consistent with the findings of the cross-cultural study by Lopez-Fernandez et al. (2017). In our cultural analysis we defined the Spanish sample as ‘community-oriented’ because the Spanish participants are from a densely populated Mediterranean city where face-to-face interactions with peers, family members and friends are frequent. This may suggest that active engagement with one’s social circle by direct contact such as via messaging or face-to-face interaction (as opposed to passive engagement, like scrolling through social media) may be a protective factor against anxiety and depression (Oberst et al. 2017).

(3) Do people from different countries use the smartphone in different ways?

In the total sample, the most common uses on the smartphone were: 1. Messaging, 2. Reading social content, and 3. Browsing the Internet, and this ranking was the same in all the countries, illustrating similar smartphone practices across cultures. However, some differences in use were found, consistent with other recent cross-cultural ICT research that has identified differences in use of ICTs between countries (Laconi et al. 2018; Lopez-Fernandez et al. 2017). The first difference was that Colombian participants posted social content more frequently and played games more frequently (especially Colombian males) than participants in the other two countries. A possible reason for this is that smartphone penetration in Colombia was much lower than in the other two countries (In 2016, smartphone penetration was 34.4% in Colombia (Nixon 2017) whereas it was 72% in the United States and 71% in Spain (Poushter 2016)), therefore higher smartphone engagement may have existed in part due to a novelty effect.

Another difference found is that Spanish participants messaged much more frequently than participants in the other two countries (75% of Spanish participants reported that they message almost every time they pick up the phone as compared to 55.2% of Colombian participants and 45.2% of US participants). This is consistent with previous cross-cultural research that has found Southern European countries to utilise messaging functions more intensively than other countries (Lopez-Fernandez et al. 2017).

(4) Are there sex differences in the manner of smartphone use?

Several sex effects were observed. Females had higher scores than males on reading social content in all three countries and on posting of social content in Spain and the United States, consistent with previous research showing that women use social networking sites more than men (Dufour et al. 2016; Kimbrough et al. 2013; Laconi et al. 2018). Males had higher scores on playing games in all three countries, which was also consistent with previous research showing males to be more active game players than females (Greenberg et al. 2008; Puerta-Cortés et al. 2017).

(5) Is problematic mobile phone use related to higher anxiety and/or depression?

CERM scores were correlated with anxiety scores but not with depression scores. This relationship was also found to be true in the regression analysis, where CERM scores contributed significantly to the variance in anxiety scores in every country but not at all to depression scores. These results are supported by previous research which has found problematic smartphone use to be associated with anxiety (Darcin et al. 2016; Elhai et al. 2016; Hussain, Griffiths, and Sheffield 2017). However, these findings somewhat contradict a previous review of the research (Elhai et al. 2017) which found that studies in this field usually show depression to be related to problematic smartphone use with medium effect sizes and anxiety to be frequently related to problematic smartphone use, but with small effect sizes. In the current study, depression scores were not found to be related to problematic smartphone use in any of the participating countries.
(6) Are any specific smartphone uses more related to anxiety and depression than others?

USA: In the USA, game playing contributed to anxiety scores although it did not do so in either of the other two samples. It is possible that in the USA anxious people seek the distraction of playing games on the phone as an attempt to alleviate negative feelings or situations. Reading social content was a protective use against anxiety in the USA, another finding that did not appear for the other two samples and that was inconsistent with previous research findings showing passive social media use to be connected to anxiety (Shaw et al. 2015).

Going on social networks may be a method of coping with uncomfortable situations that young people in the United States engage in to avoid becoming anxious. For example, in a stressful situation, it may be a common practice in the US to open up Instagram or Facebook and disengage from the experience in order to ward off anxiety (Panova and Lleras 2016). Previous cross-cultural research in this field has reported that American students go on their mobile phones to escape peers’ perception that they were alone or had nobody to communicate with more so than participants from a Latin American and European sample (Leonardi, Leonardi, and Hudson 2006). This behavioural difference may be influenced by the fact that the Spanish and Colombian samples are more community-oriented and therefore have more experience handling social stressors such as novel or uncomfortable social situations; whereas US participants, having had less experiences in unstructured social contexts may feel unprepared to handle them and therefore turn to distractions to avoid the stress that such situations could cause. Further research is required to understand this relationship.

Regarding the USA participants’ depression scores, messaging was the only contributing variable. This could be because, as previous research suggests, messaging is an unsuitable way to manage interpersonal stress (Murdock 2013) and may lead to more stress, confusion and negative emotions. This relationship may also exist because frequent messaging leads to stress due to having to manage various conversations, which makes it more difficult for an individual to be present with and experience their own thoughts and reality (Thomée et al. 2010).

Spain: In Spain, browsing the Internet was the only specific use that contributed to the variance in anxiety scores. This use effect may be for similar reasons as the game playing in the United States; anxious people may be more likely to take out their smartphones and seek soothing entertainment or distraction through games and/or Internet content, however, the distracting activity they choose to engage in may vary according to sociocultural context and culturally-influenced preferences.

Regarding depression scores in Spain, as in the US, messaging was a contributing variable. The use of posting social content showed a protective use against depression scores, whereas it showed no such influence in the other two samples. This could be because frequent posting to social media in the community-oriented Spanish sample is a normalised behaviour for young people who have an active network of social contacts and positive affect. Rosen et al. (2013) similarly found that participants who had more Facebook friends showed fewer clinical symptoms of dysthymia and fewer clinical symptoms of major depression.

Colombia: In Colombia, regarding anxiety scores, no specific smartphone use was a contributing or protective variable. Regarding depression scores, only game playing had a significant role and this role was as a protective factor. This protective role of game playing in depression scores may be explained if we consider that game playing has been found to offer short-term rewards which can improve state of mind (Ryan, Rigby, and Przybylski 2006) and mental health (Jones et al. 2014). Another possible explanation is that participants in the Colombian sample, being community-oriented and new adapters of smartphones, may seek out novel methods like social game play on their devices to cope with stress. A study by Ferguson and Olson (2013) found that social play was more common among stressed gamers and Shen and Williams (2011) found that playing video games with family and/or friends enhances a sense of positive well-being. If social play is an effective manner of coping with stress for some populations, especially those from community-oriented sociocultural environments that are recent adopters of technology, this might explain the protective use of the gaming against depression in the Colombian sample. The novelty effect of the smartphone may also explain why the Colombian sample showed the least influence of specific smartphone uses on mental health scores. The effect of a technology’s novelty in a society and its role in the development of problematic use should be further explored.

Although game playing in Colombia was positive in the sense that it was a protective factor against depression scores, in the US sample, game playing was negative in the sense that it was a contributing factor to anxiety scores. This different role of game play may be explained by the nature of the gaming behaviour itself. For example, it may be that anxious young people in the more individualist US turn to solitary games to distract themselves from feelings of anxiety. Distraction does not provide any additional stress relief than simply sitting with the stress (Panova and Lleras 2016) and...
avoidance coping has been related to lower mental health in the long run (Blalock and Joiner Jr. 2000; Holahan et al. 2005), however turning to the device as an attempt at coping with stress is common (Kardefelt-Winther 2014; Panova and Lleras 2016). The effect of gaming on mental health might only be positive if done in social contexts, whereas solitary gaming may provide only short-term relief.

These findings about the different effects of specific smartphone uses on mental health in young people from different countries suggests that different values, interests and sociocultural contexts can determine how a particular technology-related behaviour affects the individuals who do it. Also, it is not enough to simply measure something like ‘game play’ or ‘Internet browsing’ as a general category; it is important to understand what kind of game play – e.g. social or solitary – and what kind of browsing – e.g. reading the news or looking through funny websites – is being done in order to understand the effects of the behaviour and its influences on mental health. In some communities, one behaviour may indicate a problem whereas in other communities, it may be adaptive.

All countries: Although there were differences between cultures in the specific smartphone uses and their effects, in all of the countries problematic mobile phone use showed the same relationship with mental health. It had a very significant contributing effect to anxiety in all countries and no influence on depression. We may therefore say that, while specific smartphone uses and their consequences on the user might vary in part depending on cultural context, problematic mobile phone use, as characterised by dependence and over-attachment to the device, may be associated with higher anxiety regardless of culture.

5. Limitations

This study had several limitations. First, this is a cross-sectional study; thus, causal relationships between the variables should be interpreted with caution. Second, this study uses self-report methods for data collection, however participants’ own perceptions of their technology use may not be fully accurate. Third, we aimed to view smartphone use through a multi-cultural perspective and therefore focused on three distinct cultural regions, however this geographical scope is limited and may not have captured some of the most relevant culturally-dependent smartphone usage differences. In addition, we did not account for cultural variation within each sample. Although the Barcelona and Ibagué samples were made up of a vast majority of local participants, the US university had a student base that was more culturally diverse, although the majority of the student body was local. That being said, our cultural analysis was developed to account for homogenous vs heterogeneous communities and this distinction played an important role in the presented theories. Nevertheless, future research in this field should account for within-sample cultural variation. Lastly, the differences we found in our results may be owed to factors apart from culture that were not measured.

6. Conclusions

This study was conducted to explore potential differences in smartphone use and its effects on mental health depending on cultural context. Understanding the influence of certain characteristics of a society on a cultural level can help explain why studies in this field often obtain results that contradict results from other studies done with samples from different countries. Smartphones have become the primary mode of communication and source of information for people around the globe but the usage behaviours of one community of people and the consequences they experience from that use are not universally generalisable. We should therefore take caution when, for example, we are reading results from a study on smartphone use in a European country and applying it to our understanding of smartphone use in an Asian or American country.

Our findings showed different influences of specific smartphone behaviours on mental health scores depending on the sample’s country. In the USA, game playing contributed to anxiety scores and reading social content was a protective use against anxiety scores. Messaging was the only contributing variable in depression scores. In Spain, browsing the Internet was the only specific use that contributed to anxiety scores. The use of posting social content showed a protective use against depression scores and messaging was a contributing variable to depression scores. In Colombia, no specific smartphone use was a contributing variable regarding anxiety scores and only game playing had a significant role in depression scores as a protective factor. Problematic mobile phone use showed a strong relationship with anxiety scores for participants from each of the three different countries whereas it showed no relationship with depression scores in any of the participating countries. Therefore, we can conclude that although some specific uses and their psychological effects might vary depending on sociocultural context, developing problematic use of smartphones may be an indicator of existing psychological problems or may create a risk for the development of future psychological problems for individuals from various sociocultural backgrounds.
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