PSYCHOLOGICAL CORRELATES AND PREDICTORS OF PROBLEMATIC SMARTPHONE USE AMONG FEMALE UNIVERSITY STUDENTS DURING THE COVID-19 PANDEMIC

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Abstract:
Research objective: Increasing interest in new technological advances, in this case smartphones, brings about an increasing scale of their usage, which in many cases exceeds the boundaries of common use and becomes problematic. The period of restrictions caused by COVID-19 is a variable causing an increase of social media usage across age groups. Based on a theoretical analysis, we have defined the main objective of a questionnaire study, which is to measure the way and size of problematic usage of smartphones among female university undergraduates, including the attributes of phobic and addictive usage. In order to cover the matter in a wider context, another objective of this study emerged, which was to explore the connection between the size and method of smartphone use and some other concepts, such as the fear of missing out and satisfaction with life. The third objective we introduced was a regression model of observed variables with problematic smartphone use behaviour as a dependant variable. Method: The research study comprised 988 female undergraduates in the age range of 19 – 56 (M = 22.8; SD = 5.31; IQR = 3) Data were collected between January and March 2021 using the platform Google Forms, combining random selection and Snowball Techniques. Smartphone Usage Scale (SUS) containing 11 items was used to map the usage frequency of particular smartphone functions. Another method used was the scale Problematic Use of Mobile phones with 20 items to determine the size of problematic smartphone usage, in this case of phobic character. The new phenomenon associated with excessive usage of smartphones, Fear of Missing Out (FoMO), was determined by the same scale containing 10 items. Problematic smartphone usage is also connected with the trait anxiety, which was measured by the second scale of State-Trait Anxiety Inventory (STAI X-2). In order to cover the biggest possible spectrum of digital behaviour, we also used the methods of addictive character. The method Smartphone Addiction Scale (SAS) is a questionnaire discovering problematic smartphone usage and the questionnaire Internet Addiction Test (IAT), which aims to measure the characteristics connected with excessive Internet usage. Descriptive analysis, correlation analysis and linear regression were conducted in IBM SPSS 26. Results: The most commonly used smartphone functions were text/instant messaging services (M = 4.74, SD = .525) and social network applications (M = 4.33, SD = .864), followed by the category music/podcasts/radio (M = 3.91, SD = 1.142). The three most frequently used social network applications were Facebook (76.1%), Instagram (75.5%) and Messenger (34.1%). Three strongest correlations were measured at nomophobia (measured by PUMP) and smartphone addiction (measured by SAS) with a very strong correlation r = .819. Smartphone and Internet addictions (measured by IAT) showed strong correlation r = .776 and nomophobia and Internet addiction showed strong correlation, as well r = .771. Multiple linear regression was calculated to predict problematic smartphone use behaviour (SAS) based on scores of smartphone usage (SUS), problematic use of mobile phones (PUMP), internet addiction (IAT), fear of missing out and satisfaction with life.
out (FoMo), state anxiety (STAI-X1), trait anxiety (STAI-X2) and satisfaction with life (SWLS). A significant regression equation was found (F (7,941) = 380.660, p < .001) with $R^2 = .740$. This model predicts 74% of smartphone addiction measured by Smartphone Addiction Scale. Significant predictors of problematic smartphone use behaviour are smartphone usage ($β = .065$, $p < .001$, CI [.196, .628]), problematic use of mobile phones ($β = .503$, $p < .001$, CI [1.130, 1.403]), internet addiction ($β = .343$, $p < .001$, CI [.705, .962]), and fear of missing out ($β = .085$, $p < .001$, CI [.247, .690]). Discussion: All in all, the participants of our study mostly reached the scores in the range of common usage. In conformity with foreign studies, the results of size and ways of smartphone use show dominance in chatting and communication applications among female university undergraduates. In the given research sample, the leading social network applications were those of Facebook. The application TikTok does not correspond with the foreign trends in our study group, which might be explained by the absence of adolescent participants and the formulation of the given question. The age and satisfaction with life correlate negatively with the observed variables, and appear to be certain protective factors against problematic use of smartphones and social networks. State anxiety and trait anxiety show positive correlations with the observed variables of smartphone and network usage. However, as predictors of problematic smartphone use behaviour, they were not significant. The strongest predictors showed to be problematic use of mobile phones (PUMP) and internet addiction (IAT). The limitations of this study were the absence of representativeness of the research sample, the collection of data during pandemic COVID-19, and the solely, self-evaluation methods.

Key words: Smartphones. Social networks. Problematic smartphone use. Problematic use of mobile phones. Smartphone addiction. Fear of missing out. COVID-19.

Introduction

There is no doubt about the biggest invention of modern times. Due to its attractiveness and convenience, it is used by most people in developed as well as developing countries (Takao et al., 2009). We are talking about a relatively new technical achievement, the smartphone. Before these mobile devices could justify their name, they had to go through a technical revolution, which contributed to the transformation of mobile device ecosystems into today’s user-friendly and attractive smartphones (Islam-Want, 2014).

On the world market we can encounter operational systems iOS, Android, Symbian, Microsoft Windows, RIM or BlackBerry. Two of these platforms are outstanding thanks to their different approach and popularity. These are the operational systems iOS from Apple and the Android OS from Google (Goadrich–Rogers, 2011). iOS is used by 15.2 % of users whereas Android is preferred by 81.1 % of consumers (Islam-Want, 2014). According to the newly published statistical data Digital 2021, the world population comprised 7.8 billion people at the beginning of 2021. However, the data about the users differ. For example, according to Kemp (2021), the number of users reached 5.22 billion, which equals 66 % of the world population, whereas O’Dea (2021) states a significantly higher number of more than 6 billion smartphone users. Based on the statistics from the second quarter of the last year (Iqbal, 2020), we recorded a big influence of the pandemic, COVID-19, on the usage of smartphone and its available applications. The most frequent reasons for using smartphones were: everyday jobs; finding entertainment; and the effort to stay in contact with family and friends. Only the smartphones with the operational system Android alone recorded a 40 % increase in usage.

The popularity of the mobile internet is increasing proportionally to the popularity of smartphones. More than a half of the world-wide web operations belong to the mobile internet (Clement, 2020). Currently, the Internet is used by 4.66 billion people from all over the world; social network alone is used by 4.2 billion people. The number of social media consumers equals 53 % of today’s world’s population. Statistical analysis points to the outbreak of pandemic, COVID-19, as a variable causing the increase in social media usage by 13 %. It is
remarkable, though, that in spite of significant changes in digital behaviour, caused by the world-wide pandemic, the users themselves cannot see any changes when self-reflecting on the usage of smartphones and social networking, and in their opinion they spend the same amount of time consuming the online world as before. An average internet user spends nearly seven hours a day online. If we assume that adults spend seven/eight hours a day sleeping, it means we spend roughly 42 % of our time online when we are awake (Kemp, 2021). Concerning the population of the Czech Republic, the results are slightly different. In January 2021 the Czech Republic comprised 10.75 million inhabitants, of which 9.43 million people use an Internet connection. Social media is currently used by 7.39 million Czech inhabitants, which shows an increase of 480,000 users in one year. In total, social media is used by 69 % of our population (Kemp, 2021). According to the statistics GlobalWebIndex, the average time of using social media is 2 hours 22 minutes a day. The data comes from the first quarter of 2020, so we can assume that this number increased during the remaining months of 2020 (Iqbal, 2020).

The market with Internet applications also experienced a constant increasing trend. The most frequently downloaded applications of the decade between 2010-2019 are the big 4 of the Facebook company, comprising the applications Facebook, Messenger, WhatsApp and Instagram (Iqbal, 2020). The respondents of our study also confirmed this fact. Most probably, the platforms Messenger and WhatsApp gained their popularity thanks to a type of online communication, which offers their users so-called instant messaging, which means transmission in real time (Tankovska, 2021).

The consequences of problematic usage of smartphones and social network

Despite the indisputable benefits of smartphones, we view their problematic or excessive usage as a constantly growing problem. (Amiri et al., 2020). This trend is becoming visible also among university undergraduates, as they are the part of population that masters technologies most quickly (Smith et al., 2011). Problematic usage of smartphones can be defined as a compulsive usage (Horwood-Anglim, 2018), demonstrated by an inability to regulate it sufficiently (Billieux, 2012). This gradually leads to the disruptions of everyday functioning, which reflects itself in productivity, physical health, emotional well-being and in the field of social relationships (Horwood-Anglim, 2018).

According to Demir-Sumer (2019), with an increasing interest in smartphones it is important to study their effects on people’s health. The results of a study by Demirci et al. (2015) that particularly targeted university undergraduates show a positive correlation between the amount of smartphone usage, measured by Smartphone Addiction scale (SAS), also used in our study, and the levels of anxiety and depression. Measuring stress, anxiety and depression levels in correlation with smartphone usage among university undergraduates became the research objective of some other authors, specifically Visnjic et al. (2018). Their results also imply the intensity and the way of using smartphones as a factor that can have a causal connection to the deterioration of students’ mental health.

Problematic usage of smartphones threatens not only our mental but also our physical well-being. Headaches can occur which according to Demirci et al. (2016) are assumed to be connected with excessive usage of smartphones. Whereas complaints about headaches significantly positively correlated with the size of problematic smartphone use behaviour, it was also connected with higher frequency and the duration of headaches as a result of excessive smartphone usage. Despite the fact that the following study by Uttarwar et al. (2020) did not
confirm the direct link between smartphone usage and increased occurrence of headaches, the group of smartphone users took more painkillers to ease headaches with less effect than the group of non-smartphone users.

On this matter, the following trend is significant – the increasing usage of new technologies, including virtual communication, is bringing about the gradual changes in everyday habits and behaviour of individuals (King et al., 2013). This aspect can be called a problematic use of mobile phones and is monitored in our study. It is related to the term nomophobia, which was created from the words ‘No Mobile Phone Phobia’, and expresses the fear of being separated from or having no access to a mobile phone (Bragazzi-Del Puente, 2014; Farooqui et al., 2018; King et al., 2010). King et al. (2010) is not the only one who considers nomophobia to be the result of advances in new technologies and the current modern world (Yildirim-Correia, 2015). It is the product of human interaction with communication and information technologies, especially smartphones (Yildirim-Correia, 2015), which is characterized by discomfort and anxiety (Farooqui et al., 2018). According to Nie et al. (2020), most probably anxiety connected with the separation from their mobile phone will not be relieved by using an alternative communication device. The typical symptoms of nomophobia are restlessness, anxiety, trembling, perspiration, changes in breathing, disorientation and tachycardia. Due to the common character of these symptoms, it can be really difficult to recognize nomophobia. Despite the fact that nomophobia is not a diagnosed illness, it often ranks among social phobias, social anxiety, anxiety and panic disorders (Bhattacharya et al., 2019).

It is obvious from the presented information that the principal factor influencing our mental and physical health, including our everyday functioning, habits and behaviour might be the problematic smartphone use behaviour. For this reason, we placed this phenomenon at the centre of our attention as a dependant variable in a model we offer for a more profound understanding of the correlations between the observed concepts.

Without having to talk directly about the addiction or phobia, we can find other related negative aspects connected with the use of smartphone and social networks. One of such aspects associated with anxiety and pervasive fear is a fear of missing out.

Fear of Missing Out

We live in a time of information technology and social network supremacy that offers us easier access to information and connects us with families and friends. However, apart from the benefits, we can see digital overload resulting in the phenomenon Fear of Missing Out. This phenomenon, described by the acronym FoMO, is a pervasive fear that others are going through a more interesting experience and inspiring moments while oneself is not present, and is therefore ‘missing’ something (Przybylski et al., 2013). Particularly social network sites have become the fertile soil for this phenomenon, which it is deepening even further (Krejci, 2019). The inner unrest it creates can lead an individual to running from one activity to another, and in more extreme cases to the inability to enjoy the present moment (Elhai et al., 2016).

Fear of missing out is not only associated with the field of mental health. Apart from discovered connections of FoMO with symptoms of depressions and increased anxiety, it proved itself, together with need for touch, to be a predictor of maladaptive usage of the mobile device (Elhai et al., 2016; Wolniewicz et al., 2018). Traditional studies of using smartphones in connection with depressions and anxiety were linked by other authors (Wolniewicz et al., 2020), who enlarged their research area by the mediating variable, which is the boredom proneness and its
connection to FoMO. Based on the results of this study, FoMO appeared to be a mediator between the inclination to boredom and problematic usage of smartphones.

Fear of Missing Out is also related to the performance of university undergraduates. Some individuals with higher level of FoMO are assumed to incline to more frequent reaction and interaction with the contents of received notifications on the account of other activities. The results of the study of a sample of 316 American undergraduates state the correlation between FoMo and disruptions of activities due to received notifications as well as the usage of less effective and superficial learning strategies (Rozgonjuk et al., 2019). Very similar results were shown by Alt and Boniel-Nissim (2018), who aimed their research at studying the links between FoMo, deep and superficial learning strategies, and problematic usage of internet (PIU). Even here the suppositions proved correct, and the analysis confirmed the positive correlation between superficial learning, Fear of Missing Out, and problematic internet use.

All the above mentioned concepts are connected in a different way not only with mental and physical health but also with satisfaction with life, as such. While a lot of partial aspects of quality of life or life satisfaction have already been mentioned, in the search for particular correlations our study focused on a global assessment of the quality of one’s own life.

Main objectives
Based on theoretical analysis, we defined the main objective of the questionnaire study to be a measure of the ways and size of problematic usage of smartphones among female undergraduates, including the attributes of phobic and addictive usage. In order to cover the matter in a wider context, a second objective of this study emerged, which is to explore the connection between the size and ways of smartphone use and other concepts such as Fear of Missing Out and Satisfaction with Life. Thirdly, we will introduce the regression model of observed variables with problematic smartphone use behaviour as a dependant variable.

Method

Sample
The research group of the questionnaire study comprised of 988 female university undergraduates, ages ranging between 19 and 56 (M = 22.80; SD = 5.31; IQR = 3). 537 students were affiliated to Ostrava University (54.1 %), 176 students to Palacky University in Olomouc (17.7 %) and the rest to Veterinary University in Brno (N = 97). When asked about the level of education, 661 respondents (66.6 %) stated bachelor’s degree, 307 students (30.9 %) master’s degree, 14 (1.4 %) doctorate degree and 6 (1.1 %) another degree (e.g., pedagogical minimum).

Measures
The questionnaire set consisted of seven adopted self-evaluation methods, which are going to be described respectively. Also, the participants were asked about various socio-demographical data such as their age, the name of their university, faculty, the highest level of education and the smartphone operational system they use. They were also asked how they evaluate the severity of their use of smartphones and social network. When answering the questions, they could choose from an 11-point scale of a Linkert type from ‘0 – not at all’ to ’10 – maximum’. All questionnaires and inventories used in the study are described in the following paragraphs.
Smartphone Usage Scale (SUS) – is the method of finding the frequency of usage of 11 different smartphone functions. The respondents choose from a 6-point Likert scale from ‘never’ to ‘very often’. Czech translation of the scale was carried out in a frame of diploma work by Mgr. Ondrej Glaser (2018). Five translators worked independently on the translation of the method. Our study reached Cronbach’s alpha $\alpha = .6$.

Internet Addiction Scale (IAT) – Internet Addiction Test by Young (2016) is a 20-item questionnaire designed for regular Internet users. Its aim is to measure the characteristics and behaviour connected with its excessive use. Each item has an option of a 5-point Likert scale from ‘0 – never’ to ‘5 – always’. In addition, the questionnaire has 6 subscales: 1. Importance; 2. Excessive usage; 3. Negligence of duty; 4. Anticipation; 5. Insufficient control; 6. Negligence of social life (Dolejs et al., 2018). Young (2016) distinguished four levels of seriousness concerning the overuse of the Internet. An individual can reach a maximum score of 100 points while the interval from 0 to 30 reflects a common level of using the Internet. The interval between 31 and 49 implies a moderate level of Internet usage. If an individual attains between 50 to 79 points, it means a medium stage of addiction. A score of 80 to 100 points means a strong addiction. The Czech translation of IAT was done by Dolejs and Sucha (2017). In a presented study the value Cronbach’s alpha is $\alpha = .892$.

Smartphone Addiction Scale (SAS) – Smartphone Addiction Scale (Kwon, Lee et al., 2013) is a method focusing on problematic use of smartphones. The scale SAS is based on criteria of addiction to the Internet created by Kimberly S. Young. These must be taken into consideration when creating a criteria of addiction to the smartphone. The questionnaire consists of 47 items divided into 6 subscales, with the answer options of a 7-point Likert scale from ‘0 – strongly disagree’ to ‘6 – strongly agree’. The gross score is counted. The subscales are 1. Daily-life disturbance; 2. Positive anticipation; 3. Withdrawal; 4. Cyberspace-oriented relationship; 5. Overuse; 6. Tolerance. Based on the factor analysis, the number of original items was consequently reduced to 33, while the original version had the values of inner consistency of Cronbach alfa $\alpha = .967$ (Kwon, Kim, et al., 2013). The Czech version of the scale originated from multiple back translations by Jiri Stiple with a student grant in the Philosophical Faculty of Charles University. The value Cronbach’s alpha reached $\alpha = .936$ in our study.

Fear of Missing Out (FoMO) – originally, this scale consisted of 32 items that were supposed to reflect the worries and anxiety that people can go through in connection with the need to be in contact with the events happening in their extended social circles. To maximize the sensitivity of the method to all levels of fear of missing out, the authors identified 10 items, which represent the final version of the questionnaire. The final scale demonstrates the optimal inner consistency alfa $\alpha = .87$. The answers are put down on a 5-point scale of Likert type in a range from ‘Agree’ to ‘Disagree’ (Przybylski et al., 2013). The Czech version comes from a diploma work by Glaser (2018) and it reached the value of inner consistency alpha $\alpha = .704$.

Problematic Use of Mobile Phones (PUMP) – The authors Merlo et al. (2013) developed the scale Problematic Use of Mobile Phones in order to identify the symptoms of nomophobia. The items of the questionnaire were created on the base of qualitative interviews with people who considered themselves to be addicted to their smartphones as well as the criteria of disorders of using addictive substances according to DSM-IV. Originally, there were 69 items, which were reduced to 20 in a final version of the scale after its revision according to DSM-V. Respondents could select answer options from a 5-point scale, ranging from ‘1 – strongly disagree’ to ‘5 – strongly agree’. The maximum score is 100, the borderline of 62 points being considered the starting symptom of nomophobia. People scoring between 50 – 61 points are
considered to be in a risky range (Benkovsky, 2017). However, based on the final score of the questionnaire it is not possible to determine clinically whether a respondent suffers from nomophobia (Merlo et al., 2013). Scale PUMP was translated into the Czech language by technique of back translation by two independent translators for the purpose of bachelor work by Bc. Peter Benkovsky (2017). The value of inner consistency in this study is $\alpha = .888$.

**State-Trait Anxiety Inventory (STAI)** – this method by Spielberg et al. (quote. according to Hunt et al., 2018) was used to measure the symptoms of anxiety. It consists of two independent scales to measure the present state of anxiety (X-1), comprising the items for discovering the feelings of tension, fear, worries and nervousness and the inclination to anxiety (X-2). Both scales offer 20 statements with the answer options from a 4-point Likert scale. In case of scale X-1 the range is from ‘1 – Not at all’ to ‘4 – Very’. X-2 scale offers the options from ‘1-Hardly ever’ to ‘4-Almost always’. Inventory STAI is standardised and was used in official translation and the values of inner consistency measured in the study reached $\alpha = .935$ (X-1) and $\alpha = .925$ (X-2).

**Satisfaction With Life Scale (SWLS)** – the Scale of Satisfaction with Life (Diener et al., 1985) finds out an individual’s evaluation of their global quality of life. The original 48 item scale was reduced to 10 after factor analysis. The high semantic similarity of some items resulted in leaving out some, so the final version of SWLS only comprises 5 items, with the answer options from ‘1 – Strongly disagree’ to ‘7 – Strongly agree’. It is a one-dimensional questionnaire resulting in the calculation of a rough (gross) score. The average score of respondents of the standardized study was 13.5 points (SD = 6.43). The correlation with personality questionnaire showed a positive correlation of SWLS with the level of self-confidence -54; sociability -20; and activity -.80, and negative correlation with neuroticism -.48, emotionality -.25 and impulsiveness -.03. We used Czech translation by Lewis, Shevlin, Smekal and Dorahy (1999). The value Cronbach’s alpha in a presented study is $\alpha = .879$.

**Procedure**

The collecting of data was carried out electronically through the platform Google Forms. Due to the fact that the differences in smartphone and social network usage between men and women are quite ambiguous and some studies (Carbonell et al., 2018; Geser, 2006; van Deursen et al., 2015) point to differences in various aspects of digital behaviour, we decided to aim at the population of female undergraduates only. The questionnaire set was distributed through a social network. As our study targeted female university undergraduates, we used the students groups on social network as well as students’ email post(contacts) of Ostrava University. All the methods used in the questionnaire were described in detail above. The choice of the respondents was carried out by random selection in combination with Snowball technique. The statistics software IBM SPSS 26 was used for the data analysis.

**Ethical statement**

The participation in the study was entirely voluntary and without any financial reward. Before filling in the questionnaire, all the respondents were asked for consent in the processing of their personal data. The completion of the questionnaire was not obligatory and could have been terminated at any time. Data were processed in accordance with ethical principles. All personal data were anonymized during their statistical processing.
Results

The analysis comprised the use of descriptive statistics, reliability analysis, Pearson’s correlation and linear regression. Some items were voluntary (scale STAI-X2). The missing information was not substituted but ‘exclude cases listwise’. The analysis used parametric methods since the criteria for their use was met (Field, 2018).

Descriptive statistics

Tables 1, 2 and 3 with descriptive statistics will be presented first. Table 1 shows the summary of average frequency of smartphone application use in the research sample as measured by the self-assessment method Smartphone Usage Scale (SUS).

Table 1

| Frequency of using individual smartphone features (N = 988) |
|-------------------------------------------------------------|
| Smartphone features                                      | M   | SD   |
| 1. Text/instant messaging                                | 4.74 | .525 |
| 2. Social networking sites                               | 4.33 | .864 |
| 3. Music/podcasts/radio                                  | 3.91 | 1.142|
| 4. Internet/websites                                     | 3.85 | .944 |
| 5. Taking pictures or videos                             | 3.65 | .975 |
| 6. Email                                                 | 3.73 | .913 |
| 7. Video and voice calls                                 | 3.63 | 1.012|
| 8. Watching videos/TV/movies                             | 3.12 | 1.224|
| 9. Maps/navigation                                        | 3.1  | .975 |
| 10. Reading books/magazines                               | 2.36 | 1.199|
| 11. Games                                                | 2.15 | 1.148|

Note. M – Mean; SD – Standard deviation; The scale range is 0-6.

It is evident from the Table 1 that texts and chatting (M = 4.74) and social network sites (M = 4.33) reached the highest average frequency out of eleven different smartphone functions. The other nine functions are used with lower frequency (M = <2.15; 3.91>). Table 2 shows and orders social network sites according to their frequency of use within/in our research sample.

Table 2

| Used social network sites within research sample            |
|-------------------------------------------------------------|
| Social site       | N1  | %    | N   |
| 1. Facebook       | 752  | 76.1 |     |
| 2. Instagram      | 746  | 75.5 |     |
| 3. Messenger      | 337  | 34.1 |     |
| 4. Twitter        | 61   | 6.2  |     |
| 5. TikTok         | 54   | 5.5  |     |
| 6. YouTube        | 52   | 5.3  |     |
| 7. WhatsApp       | 46   | 4.7  |     |
| 8. Pinterest      | 32   | 3.2  |     |
| 9. Tumblr         | 11   | 1.1  |     |
| 10. Snapchat      | 10   | 1.0  |     |

Note. N1 – number of users of a particular platform from the research sample; % – relative frequency; N – research sample.
Each participant could choose from 1 to 3 most frequently used social network sites. It is clear from Table 2 that in the Czech Republic Facebook and Instagram were equally dominant in the research sample in the first quarter of 2021, followed by independent communication application Messenger from Facebook. The other social network sites represent rather minor communication platforms, with relatively low frequency of usage from 1% (Snapchat) to 6.2% (Twitter). Table 3 shows descriptive statistics of variables used in the study.

**Table 3**

*Descriptive Statistics*

| Variable                      | N  | M   | SD  | Skewness | Kurtosis | Min | Max |
|-------------------------------|----|-----|-----|----------|----------|-----|-----|
| Age                           | 988| 22.80 | 5.31 | 3.326   | 12.595   | 19  | 56  |
| Severity of use               | 988| 4.36  | 2.30 | .151    | -.570    | 0   | 10  |
| Smartphone usage              | 988| 38.56 | 4.97 | -.110   | .415     | 19  | 55  |
| PUMP                          | 988| 41.07 | 12.45| .405    | -.244    | 20  | 84  |
| Smartphone addiction         | 988| 56.30 | 31.49| .530    | .146     | 0   | 188 |
| Internet addiction            | 988| 22.97 | 12.88| .855    | .936     | 0   | 81  |
| FoMO                          | 988| 26.41 | 5.72 | -.214   | .057     | 10  | 46  |
| STAI_X1                       | 942| 42.73 | 12.38| .333    | -.681    | 20  | 78  |
| STAI_X2                       | 988| 46.57 | 11.41| .092    | -.590    | 21  | 79  |
| Satisfaction with life        | 988| 23.32 | 6.54 | -.391   | -.522    | 5   | 35  |

Note. M – Mean; SD – Standard deviation; Severity of use – self-evaluated severity of using smartphones and social sites; Smartphone usage – Smartphone Usage Scale; PUMP – Problematic Use of Mobile Phones; Smartphone addiction – Smartphone Addiction Scale; Internet addiction – Internet Addiction Scale; FoMO – Fear of Missing Out; STAI_X1 – State-Trait Anxiety Inventory, Scale X1; STAI_X2 – State-Trait Anxiety Inventory, Scale X2; Satisfaction with life – Satisfaction With Life Scale.

**Correlations**

Table 4 presents a summary of correlations between the observed variables.
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Table 4

Pearson correlations of the observed variables (N = 942)

|                      | Age | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  |
|----------------------|-----|----|----|----|----|----|----|----|----|
| Severity of use      | -226** | 1  |    |    |    |    |    |    |    |
| Smartphone usage     | -.113** | .208** | 1  |    |    |    |    |    |    |
| PUMP                 | -.257** | .595** | .203** | 1  |    |    |    |    |    |
| Smartphone addiction | -.259** | .534** | .276** | .819** | 1  |    |    |    |    |
| Internet addiction   | -.254** | .543** | .264** | .771** | .776** | 1  |    |    |    |
| FoMO                 | -.333** | .392** | .197** | .547** | .534** | .486** | 1  |    |    |
| STAI_X1              | -.191** | .281** | .087** | .363** | .321** | .389** | .340** | 1  |    |
| STAI_X2              | -.244** | .323** | .100** | .445** | .400** | .432** | .416** | .667** | 1  |
| Satisfaction with life | .093** | -.111** | -.045 | -.225** | -.187** | -.242** | -.230** | -.468** | -.596** |

Note. **p < .01; Severity of use – self-evaluated severity of using smartphones and social sites; Smartphone usage – Smartphone Usage Scale; PUMP – Problematic Use of Mobile Phones; Smartphone addiction – Smartphone Addiction Scale; Internet addiction – Internet Addiction Scale; FoMO – Fear of Missing Out; STAI_X1 – State-Trait Anxiety Inventory, Scale X1; STAI_X2 – State-Trait Anxiety Inventory, Scale X2; Satisfaction with life – Satisfaction With Life Scale.

It is obvious from Table 4 that all correlations are significant (except for the correlation between satisfaction with life and extent of smartphone use; r = -.045). All correlations of age with observed variables are negative and are very weak or weak (r = - .113; -.333), except for satisfaction with life; r = .093. The same pattern can be seen in correlation between satisfaction with life and all the other variables (except for age), which show a mostly negative very weak or weak force (r = - .045; -.242). Only state anxiety demonstrates a medium strong (r = -.468) and trait anxiety a medium strong/strong (r = -.596) negative correlation. The three strongest correlations belong to nomophobia (PUMP) and smartphone addiction (SAS) with a very strong correlation r = .819, smartphone and internet addictions (IAT) with a strong correlation r = .776 and nomophobia and internet addiction with a strong correlation r = .771.

Regression

Multiple linear regression was calculated to predict problematic smartphone use behaviour (SAS) based on scores of smartphone usage (SUS), problematic use of mobile phones (PUMP), internet addiction (IAT), fear of missing out (FoMo), state anxiety (STAI-X1), trait anxiety (STAI-X2) and satisfaction with life (SWLS). Significant regression equation was found (F (7,941) = 380.660, p < .001) with R² = .740. This model predicts 74 % of smartphone addiction measured by Smartphone Addiction Scale. Values of Tolerance were in a range from .383 to .921 and VIF ranged from 1.086 to 2.743. Variable age was excluded from the analysis due to high kurtosis.

The following table presents the results of linear regression.
Table 5

Linear regression ($N = 942$)

|                         | Unstandardized Coefficients | Standardized Coefficients | t    | Sig. | 95.0 % Confidence Interval for $\beta$ |
|-------------------------|-----------------------------|---------------------------|------|------|----------------------------------------|
| (Constant)              | -48.653                     |                           | -7.811 | .000 | [-60.877, -36.429]                     |
| Smartphone usage        | .412                        | .065                      | 3.744 | .000 | [0.196, 0.628]                        |
| PUMP                    | 1.266                       | .503                      | 18.233 | .000 | [1.130, 1.403]                        |
| Internet addiction      | .834                        | .343                      | 12.724 | .000 | [0.705, 0.962]                        |
| FoMO                    | .468                        | .085                      | 4.145 | .000 | [0.247, 0.690]                        |
| STAI_X1                 | -.098                       | -.039                     | -1.698 | .090 | [-0.212, 0.015]                       |
| STAI_X2                 | .114                        | .041                      | 1.572 | .116 | [-0.028, 0.256]                       |
| Satisfaction with life  | .190                        | .040                      | 1.894 | .059 | [-0.007, 0.386]                       |

Note. Smartphone usage – Smartphone Usage Scale; PUMP – Problematic Use of Mobile Phones; Internet addiction – Internet Addiction Scale; FoMO – Fear of Missing Out; STAI_X1 – State-Trait Anxiety Inventory, Scale X1 (state anxiety); STAI_X2 – State-Trait Anxiety Inventory, Scale X2 (trait anxiety). Satisfaction with life – Satisfaction With Life Scale.

The results show that significant predictors of problematic smartphone use behaviour are smartphone usage ($\beta = .065, p < .001$, CI [.196, .628]), problematic of mobile phones ($\beta = .503, p < .001$, CI [.130, 1.403]), internet addiction ($\beta = .343, p < .001$, CI [.705, .962]), and fear of missing out ($\beta = .085, p < .001$, CI [.247, .690]). All regressive coefficients were positive and the force of predictors is as follows in descending order: problematic use of mobile phones (medium strong), internet addiction (weak), fear of missing out (very weak) and smartphone usage (very weak).

The results of regression analysis indicate that the most suitable predictors to determine the extent of smartphone addiction are variables PUMP and IAT. The other variables – self-evaluated severity of use of smartphone and social sites, state anxiety, trait anxiety and satisfaction with life cannot be considered predictors for determination of extent of smartphone addiction.

Discussion

The questionnaire study was aimed at the exploration of the method and size of smartphone use by female undergraduates. We did so using theoretical analysis which showed that particularly among this group, the overuse of smartphones gradually becoming problematic is not at all rare (Smith et al., 2011). As we did not want to limit our study to the aspect of the size of smartphone use only, we tried to include a wider range of the digital environment, which we will deal with later in this study.

In order to have a better view of the method of smartphone use by female undergraduates, we decided to use Smartphone Usage Scale. The results show that text/instant messaging services are the most frequently used smartphone functions, followed by social network applications. It corresponds with the results of the study by Lowe-Calverley and Pontes (2020). However, in order to get the most precise results, they asked their respondents to limit the choice of
preferences to one function only. Despite having only one choice, the preferences still remained the same – communicative and social functions of smartphones were the most commonly used. According to the study by Bianchi and Philips (2005), these preferences of social functions of mobile devices were more frequent in young people and women; this fact being confirmed by current global statistics about smartphone usage (Clement, 2020; Iqbal, 2020; Kemp, 2021). Our study was also aimed at the population of female users in their early adulthood. We were interested in the preferences for specific social networks, and that is why we added to the set of questions by asking about the three most frequently used social networks. Nevertheless, no deviation from the current trends (Iqbal, 2020; Kemp, 2021) was observed – our environment also showed the three dominant applications by Facebook: Facebook (76.1 %), Instagram (75.5 %) and Messenger (34.1 %). Our observation is in conformity with Geser (2006) about women’s inclination to using smartphones primarily for instant communication. A little surprising is the low preference of the TikTok network (5.5 %), which can be put down to excluding the participants in an age category of pubescence and adolescence in the study and also to the way of questioning. The set of questions were aimed at the three most frequent social networks only. It can be assumed that the use of the TikTok network will gradually increase.

Our next aim after basic recognition of smartphone use was to explore the size of its problematic use. Our respondents reached mostly the scores in the range of common smartphone usage, with moderate right-skewed distribution even though they are of a young age (van Deursen et al., 2015) and of female sex (Jeong et al., 2016) and as such they are more inclined to the overuse of mobile devices. Maximum scores obtained by some individuals within the methods of PUMP and IAT showed that they far exceeded the limits of average use and could be classified as starting addictive behaviour. At this point we need to emphasise that we are dealing with self-assessment methods whose aim is not to diagnose the addiction but point out certain tendencies (Merlo al et., 2013). Due to the lack of representativeness of this study, we cannot apply its results to the whole population.

The second aim of this study was correlation analysis carried out in order to understand the relationships between observed variables. However, it does not give us a profound insight into differences between problematic use of phobic (PUMP) and addictive (SAS) character. Although this was not our principal issue, it gave us a lot of thinking space about the reason for this result, which might have been the chosen research design. The questionnaires are closely connected and their resulting scores correlate with each other. When looking at the methods PUMP and SAS, measuring the concepts of nomophobia and smartphone addiction and being dealt with also in other studies (Kwon, Lee et al., 2013; Merlo et al., 2013), we can see a very similar positive, mostly medium-strong to strong correlations (p < .01) with the other variables (except satisfaction with life). However, the question still remains how to set up the research design with methods able to distinguish between phobic and addictive character of problematic use of mobile device. This fact can be the incentive for further research. Positive, most-often medium-strong significant correlations were reached between the methods measuring the size and way of using smartphones (PUMP, IAT, SAS) and other concepts connected with the behaviour in a digital environment (FoMO, STAI). These results are identical to the studies by Desouky and Abu-Zaid (2020).

When searching for potential negative correlations associated with the use of smartphones and social networks, we also focused on satisfaction with life among female undergraduates. As has already been mentioned, overuse of smartphones negatively correlates with increased rate of anxiety, depression and headaches (Bhattacharya et al., 2019; Demirci et al., 2015; Demirci et al., 2016; Visnjic et al., 2018). Our study did not aim at specific undesirable symptoms but
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... on a more general life satisfaction in the concept Satisfaction with Life scale. Negative correlations were measured between satisfaction with life and all the observed variables (except age and smartphone usage). The negative correlations discovered add to the above-mentioned studies about relationships between overuse of smartphones and other negative symptoms. The results of other studies, however, contradict our results, e.g., Samaha and Hawi (2016) did not discover any correlation between SAS and SWLS. Similarly, the same applies to the authors Hawi and Samaha (2017) and Lepp et al. (2014). Choi et al. (2015) implied that smartphone usage did not need to be the aim but more likely a means of including yourself in the addictive activities the smartphone offers. Consequently, not only the purpose but also the contents of smartphone use should be the centre of attention in future studies.

As implied in the previous paragraph, a positive correlation was discovered between the age and satisfaction with life. In contrast, however, the age correlated negatively with all the other concepts. All correlations with age were significant but ranged from very weak to weak, which can be attributed to a small age range and high kurtosis. Nevertheless, we can presume that age is a protective factor from the point of view of problematic use of smartphones and social networks.

The third aim of this study was to discover possible predictors of smartphone use behaviour. The two strongest predictors, problematic use of mobile phones and internet addiction, resulted from regression analysis. In contradiction to the results of some previous studies (Hong et al., 2012; Lee et al., 2014) our research showed that anxiety cannot be considered a predictor of smartphone overuse. The study by Lee et al. (2014) showed that social anxiety was a predictor of compulsive need to use smartphones, the resulting correlation between these concepts being moderated by the sex of a respondent. In our study, anxiety showed a statistically significant correlation with the scale SAS, and is considered by Shen et al. (2021) an important factor influencing the overuse of mobile devices. The question is, to what extent the higher rate of smartphone use and social networks is a compensation mechanism (from escape up to addictive), reducing tension and negative feelings from conscious or subconscious state anxiety. The studies of the above mentioned authors implicate a certain ambiguity about the influence of anxiety, since motivation resulting from anxiety can lead to using smartphones to reduce it on one side, while on the other the user can incline more to overuse of the mobile device (Shen et al., 2021). A very similar situation occurred in the phenomenon Fear of Missing Out, which also positively correlates with all the other chosen concepts of the digital environment. However, it cannot be considered a predictive factor of SAS.

The limitations of this study can be seen primarily in self-evaluating methods that in this case were not combined with other methods enabling us to obtain objective assessment of digital and smartphone behaviour. The collection of data partially coincided with the exam period, which might have resulted in temporal changes in the use of the mobile device in both directions. There is also evidence about the changes of smartphone and social network use being influenced by the COVID-19 pandemic, mostly connected with the increase in their usage (Iqbal, 2020). Another limitation of our study is the absence of domestic data from the period prior to the pandemic. In order to better evaluate the influence of this period on the use of smartphones and social networks, our study should be repeated after the pandemic. Until then, we will not be able to assess its influence, however, we must take it into account as a global intervention variable. The impossibility to obtain the representative research sample also shows an obvious limitation of this study. Focusing on protective and other positive factors connected with the use of smartphones and social networks could be a principal broadening of our work. In the case of possible replication, it would be beneficial to enrich the questionnaire...
set by asking whether the students have part-time jobs while studying or not. This aspect was not taken into consideration in our study, but it could offer another explanation of digital behaviour. Even though the results of our study offered subjective insight into the use of smartphones by the students, they did not show their impact on everyday lives, which means how much time the students spend in a day using smartphones. We consider this information to be important and should be included in further studies. Other suggestions for following works could be expanding the age groups involved (especially adolescence and pubescence) and drawing more attention to qualitative aspects of using smartphones and social networks.

Due to the fact that there have not been many studies mapping the size of problematic use of smartphones among female undergraduates in the Czech environment, we consider it one of the contributions of our work. In addition, we tried to aim at negative accompanying factors associated with smartphone overuse, such as Fear of Missing Out or state and trait anxiety. At the same time, we were interested in general satisfaction with life in correlation with the use of smartphones and social networks. Our study was one of very few dealing with several concepts of the digital environment among the population of Czech female undergraduates. The main contributions of our work in harmony with its aims are a basic quantitative survey about the use of smartphone functions and types of social networks, and the survey about the correlations between the observed concepts, including the proposed regression model offering a more profound insight into the studied matter. As the study results show, communication and social functions are the principal reasons for using smartphones and social networks among female undergraduates. The above-mentioned functions have become even more significant and compensated for the frustration from limited social contact during COVID-19 pandemic. In current times, everyday use of smartphones and social networks by young adults is considered a norm, which does not need to be automatically considered pathological. However, problematic and addictive (or phobic) use of smartphones and social networks carries with it a lower satisfaction with life, increased anxiety and according to the mentioned studies, various everyday difficulties of a mental and physical character. It is good to bear this in mind both for oneself as well as for the circle of people one cares for.
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