PROBLEMATIC SMARTPHONE USE AND COGNITIVE FAILURES. AN EXPLORATIVE STUDY AMONG FREE DIFFERENT GENERATIONS (X, Y, Z)

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ABSTRACT

The present study focuses on smartphone overuse and on problematic behaviors related to it, investigating possible differences at the intergenerational level among the variables considered. Through the administration of self-report questionnaires, the perception of smartphone distraction, smartphone problematic use, phubbing, and cognitive failures were surveyed. Two hundred and twenty subjects took part in the research. The participants, aged between 18 and 57, were divided by generation Z, Y and Z, according to Ristiyono, classification (2022). Data analysis was carried out through the application of Spearman's rho was used to analyze correlations between subscales. The Kruskal-Wallis test was invectively used to analyze differences between participants. The results confirm our hypotheses showing positive correlations between perceptions of smartphone distraction, phubbing behavior, smartphone problematic use, and cognitive failures, and a significant difference was found between generations in perceptions of all variables considered. Generation Z (18-26 years) shows the highest scores in almost all subscales examined.

KEYWORDS

Smartphone Distraction, Overuse, Phubbing, Cognitive Failures, Intergeneration

1. INTRODUCTION

Among the current modern technologies, smartphones have become the main communication tools used in everyday life. When mobile phones were equipped with an internet connection, they became 'smartphones', something more than simple telephone devices, real tools used to manage many activities of daily life (Çizmeci, 2017).

With the widespread use of smartphones, some problems, both cognitive and social, have emerged. Indeed, despite the numerous benefits that smartphones confer, there are reasons to believe that smartphone overuse might be associated with quality of life (Demir & Sümer, 2019) and various negative outcomes (Mascia et al., 2020; Bonfiglio et al., 2020), such as phubbing (Tomczyk & Selmanagic-Lizde, 2018; 2022) or a negative impact on users' cognitive abilities, including thinking, remembering, paying attention and regulating emotion (Wilmer et al., 2017). Accordingly, it is important to understand this phenomenon and to analyse its characteristics because the literature shows that prolonged smartphone use and, above all, overuse can have negative consequences in the case of problematic use, dangerous situations, and ordinary circumstances due to the distractions that smartphones present, even when not in use. It is necessary to recognise that while the advent of technology has changed the rhythms and ways of living our daily lives, technological progress has imposed and dictated revolutions in all areas of our lives. This is extremely true for younger people who were born into a technological environment and who continue to be immersed in it. To better understand how this phenomenon is distributed at the intergenerational level in particular, this work will start with classifications made by Ristinovo (2022) among three generations: Gen-X (people born between 1965 and 1979), Gen-Y (people 1980 and 1994), and Gen-Z (people born between 1995 and 2000). Distinctions have been found in the use of technology between generations (Volkom et al., 2014), especially considering that the

above-mentioned generations were differently equipped with new technologies. The differences in the use of technology may depend on several factors, such as the continuous development of the newest technology or the fact that those born with new technologies have less fear of new technologies than older generations. Bröhl et al. (2018) find disparities in the use of devices between technology generations, showing that the smartphone is the most popular device in the 19–36 age group. Moreover, the older generation lacks several skills that should have supported the shift to new digital technology (Fortunati et al., 2019). However, digital technologies by different generations must be considered nonlinear and non-progressive (Taipale et al., 2018). Notably, younger generations are more powerful digitally but more dependent on technology (Fortunati et al., 2019).

2. PROBLEMATIC SMARTPHONE USE

Certainly, the use of smartphones should not be demonised precisely because they represent an indispensable life and communication tool for everyone. The aspect that must be recognised is, therefore, not their use, but their overuse. In this paper, we focus mainly on four aspects related to this overuse: smartphone distraction, phubbing, problematic smartphone uses and increased cognitive failures.

Smartphone distraction

One aspect often highlighted regarding this topic is how distraction could be a direct consequence of problematic or excessive smartphone use. In general, distraction is considered a functional strategy in emotion regulation (Throuvala et al., 2021), but the distractions created by smartphone overuse represent a problem in many contexts because smartphones interfere with professional performance, both within academic and work settings. Smartphones also seem to interfere with everyday behaviour, both because they divide attention and make people less aware of their actions or surroundings (Busch & McCarthy, 2021). Much literature (Choi et al., 2021) correlates distraction and attentional resources, and this association is even more pronounced in smartphone overuse distractions and the attentional resources deployed (Mendoza et al., 2018). There is evidence that excessive distractions affect cognitive processes, such as memory (Ward et al., 2017) and human interactions (Dwyer et al., 2018). Other studies have pointed out that smartphone distractions can be considered a predictor of excessive and problematic smartphone use (Cha & Seo, 2018).

Phubbing

Some people continue to interact with their smartphones even in the presence of others, causing feelings of rejection or abandonment from partners and friends, a phenomenon called 'phubbing'. 'Phubbing' is defined as ignoring people with whom one has a face-to-face relationship to deal with smartphones. This behaviour can become a paradox, as individuals disconnect from face-to-face interactions to satisfy their need for social connections using technology and not physical presence (Pivetta et al., 2019). The phenomenon of phubbing particularly affects teenagers and young people. The main problem lies in its impact on the social relationships of individuals (Garrido et al., 2021). Phubbing is also associated with difficulties in attention, distractibility and attention-related cognitive errors (Sansevere & Ward, 2021). Other studies have underscored an association between phubbing and smartphone addiction (Isrofin & Munawaroh, 2021).

Problematic smartphone use

According to the compensatory internet use theory promulgated by Kardefelt-Winther (2014), the excessive problematic use of smartphones represents a regulatory strategy to reduce negative emotions (Montag et al., 2021). Smartphone use can distract people, it can cause physical problems, such as neck and shoulder pain, headaches and problems with the posture assumed while using it, as well as hand dysfunction. Smartphone use is associated with poor physical fitness and poor school and university performance. Smartphone overuse is also linked to problems such as cravings and abstinence symptoms such as anxiety and depression.

There is indeed a similarity between problematic smartphone use and overuse and addicts' physical and psychological symptoms. Although several studies have identified the negative effects contributing to the use of the terminology 'smartphone addiction' (Panova & Carbonell, 2018; Bonfiglio et al., 2022; Bonfiglio et al., 2022), in this study, we do not consider smartphone overuse an addiction.

Cognitive failures

Cognitive failures are small errors reported by clinical and non-clinical individuals during daily life; such errors cause a brief interruption in the regular course of an action that can be either physical or mental or small lapses in cognitive control (Broadbent et al., 1982; Carrigan & Barkus, 2016). There is an increasing number of contributions to the literature that support a close association between the heightened perception of one's

own cognitive failures and smartphone overuse (Tanil & Yong, 2020). This evidence is especially noteworthy because some authors report more cognitive failures among younger people. 'Cognitive failures' refer to specific domains of errors such as attention, perception, memory, thinking and executive functions (Carrigan & Barkus, 2016).

3. THE RESEARCH

3.1 Aim and Hypotheses

On the basis of literature taken into account, the following hypothesis have guided our study:

H1. There are correlations among the perception of smartphone distraction, phubbing behavior, smartphone addiction and cognitive failures.

H2. There is a significant difference among generations (X, Y, Z) in the perception of smartphone distraction, phubbing behavior, smartphone addiction and cognitive failures.

3.2 Participants

An on-line survey was sent using a list of contacts of the authors. We used two lists of subjects (students and workers) each of 500 subjects. The surveys were sent through August and September 2022. Two hundred and Twenty-seventy subjects responded to the survey, 8 of which were deleted because of age range and 44 because they did not complete the entire battery. Two-hundred and twenty subjects were finally retained. The mean age of participants was 32.95 (SD=10.29). Subjects were divided in three categories according to the generational age (Ristiyono, 2022). Participants aged from 18 to 26 years were referred to Generation Z (Gen_Z; n=82; mean age=22.3; SD=2.13). Subjects aged from 27 to 41 years were referred to Generation Y (Gen_Y; n=83; mean age=34.1; SD=4.1). Those ages from 42 to 57 year belonged to the Generation X (Gen_X; n=55; mean age=47; SD=4.6).

3.3 Instruments

The *Mobile Phone Problematic Use Scale* (MPPUS, Bianchi and Phillips, 2005) has been designed for adult populations to assess problematic smartphone use. The version used for this study is in the process of validation in the Italian population by some authors of this paper. It includes 24 questions and two subscales covering the issues of tolerance, escape from other problems and craving (MPPUS_EC), withdrawal and negative life consequences (MMPUS_WN), in the areas of social, familial, work, and financial difficulties. Example questions included items such as: “I lose sleep due to the time I spend on my mobile phone”, or “My productivity has decreased as a direct result of the time I spend on the mobile phone.”, or “I have been told that I spend too much time on my mobile phone”. All items are measured on a scale ranging from “not true at all” (1) to “extremely true” (10). The higher the score, the more problematic the use of the smartphone. The questionnaire has reported a Cronbach’s alpha of .93, demonstrating a high level of internal consistency. Scales scores have been calculated as a mean of items after summing the responses for each dimension.

The *Generic Scale of Phubbing* (GSP, Chotpitayasunondh and Douglas, 2018) is a 15-item questionnaire aiming to evaluate the degree to which individuals engage in phubbing behavior. Four subscales can be calculated: Nomophobia (GSP_NO), Interpersonal Conflict (GSP_IC), Self-Isolation (GSP_SI), and Problem Acknowledgement (GSP_PA). Examples of items are “I cannot stand leaving my phone alone” and “I pay attention to my phone for longer than I intend to do so”. All items are measured on a scale ranging from “never” (1) to “always” (7). Scores have been calculated by summing all item responses. A higher score reflects greater engagement in phubbing behavior. Authors reported a Cronbach alpha ranging between .85 and .23.

The *Smartphone Distraction Scale* (SDS, Throuvala et al., 2021) is a 16-item questionnaire aimed to evaluate the distraction of a subject due to social media content. It includes four dimensions: attention and impulsiveness (SDS_AI), online vigilance (SDS_OV), multitasking (SDS_MU) and emotion regulation SDS (SDS_ER). Examples of items are: “I often talk to others while checking what’s on my phone” or “Using my phone distracts me from doing unpleasant things”. It uses a 5-point scale, from “almost never” (1) to “almost

always" (5), and the higher the score, the more distracted the subject. Authors reported a Cronbach alpha ranging from .74 to .84. Scales scores have been calculated as a sum of items.

The *Cognitive Failures Questionnaire* (CFQ; Broadbent, Cooper, FitzGerald, & Parkes, 1982) is a questionnaire aimed to measure cognitive function. The CFQ asks 25 questions about experience mistakes and cognitive errors in everyday life. Wallace et al., (2001) reported a four-scale structure of the questionnaire with the following dimensions: Memory (CFQ_M), Distractibility (CFQ_D), Blunders (CFQ_B), and (memory for) Names (CFQ_N).

Examples of items are: "Do you fail to notice signposts on the road?" or "Do you daydream when you ought to be listening to something?". Participants indicate the frequency of experiencing these errors on a scale ranging from "never" (0) to "very often" (4). Total possible CFQ scores range from 0 to 100. Higher CFQ scores indicate greater cognitive failures. Scales scores have been calculated as a mean of items after summing the responses for each dimension.

3.4 Data Analysis

A preliminary data screening and cleaning was performed to detect missing or invalid data. The demographic characteristics of the participants were analyzed against the collected data from each of the subscales. Visual inspection of the data (i.e., Q-Q plot), Skewness, Kurtosi and Shapiro-Wilk test were used to analyze the departure from normality of each subscale measure. Because all the assumptions for normality distribution of the data were violated, Spearman's rho was used to analyze correlations between subscales. Moreover, the Mann-Whitney U test was used to analyze differences between participants.

4. FINDINGS

Positive correlations have been found between the perception of smartphone distraction, phubbing behavior, smartphone problematic use and cognitive failures (Table 1) in the all sample. Also CFQ_N did not show correlation with GSP_NO, GSP_IC, GSP_SI, SDS_OV and SDS_MU. Indeed, positive correlations with a coefficient higher than .50 have been found for GSP_NO with SDS_OV and MPPUS_EC; GSP_PA with SDS_AI, SDS_ER and MMPUS_WN;SDS_AI with MPPUS_WN and MPPUS_EC; SDS_OV with MPPUS_WN and MPPUS_EC; SDS_ER with MPPUS_WN and MPPUS_EC; CFQ_D with MPPUS_EC.

Table 1. Spearman's rho correlations between subscales

Subscales	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. GSP_NO														
2. GSP_IC	.412**													
3. GSP_SI	.179**	.423**												
4. GSP_PA	.424**	.312**	.326**											
5. SDS_AI	.370**	.288**	.279**	.686**										
6. SDS_OV	.619**	.453**	.470**	.521**	.593**									
7. SDS_MU	.212**	.309**	.263**	.376**	.365**	.336**								
8. SDS_ER	.299**	.264**	.364**	.504**	.486**	.465**	.435**							
9. CFQ_M	.166*	.133	.292**	.301**	.231**	.233**	.229**	.303**						
10. CFQ_D	.212**	.112	.275**	.338**	.372**	.333**	.252**	.461**	.717**					
11. CFQ_B	.220**	.129	.279**	.336**	.365**	.336**	.284**	.424**	.646**	.751**				
12. CFQ_N	.007	-.027	.142	.196**	.201**	.07	.142	.334**	.495**	.570**	.430**			
13. MPPUS_WN	.333**	.444**	.497**	.560**	.537**	.548**	.373**	.541**	.358**	.434**	.412**	.223**		
14. MPPUS_EC	.648**	.385**	.450**	.643**	.643**	.723**	.462**	.671**	.387**	.501**	.445**	.301**	.677**	

Note: * *p* value =.05; ** *p* value = .001

Legend: GSP_NO = Nomophoby of GSP scale; GSP_IC=Interpersonal Conflict of GSP scale; GSP_SI=Self-Isolation of the GSP scale; GSP_PA=Acknowledgement of GSP scale; SDS_AI=Attention and Impulsiveness of the SDS scale; SDS_OV=Online vigilance of the SDS scale; SDS_MU=Multitasking of the SDS scale; SDS_ER=Emotion Regulation of the SDS scale; CFQ_M=Memory of the CFQ scale; CFQ_D=Distractibility of the CFQ scale; CFQ_B=Blunders of the CFQ scale; CFQ_N=Names of the CFW scale; MPPUS_WN=withdrawal and negative life consequences of the MPPUS scale; MPPUS_EC=escape from other problems and craving of the MPPUS scale.

A Mann-Whitney U test by ranks has been carried out making pairwise comparisons between gen-X with gen-Y, gen-X with gen-Z and gen-Y with gen-Z.

Gen-X VS gen-Y

Significant differences have been found between gen-X and gen-Y using a Mann-Whitney U test as regard GSP_NO (U=1518.5; p=.021), GSP_SI (U=1560.5; p=.018), SDS_AI (U=1317.50; p=.011), SDS_OV (U=1321.50; p=.010), SDS_MU (U=1222.50; p=.002), SDS_ER (U=1015; p=.001), CFQ_M (U=1098; p=.047), CFQ_D (U=991.5; p=.008), CFQ_B (U=1027.50; p=.016), CFQ_N (U=1083; p=.037), MPPUS_WS (U=1105; p=.003) and MPPUS_CE (U=839.5; p=.001). Figure 1 shows the difference between generations as a mean of rank values.

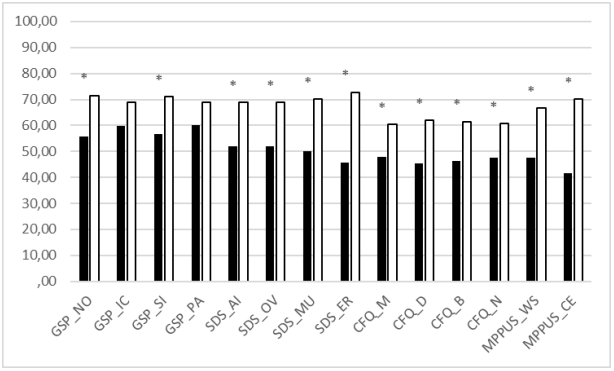

Figure 1. Rank scores between participants divided by gen-X (black bar) and gen-Y (withe bar)

Note: *=significant comparison

Legend: GSP_NO = Nomophoby of GSP scale; GSP_IC=Interpersonal Conflict of GSP scale; GSP_SI=Self-Isolation of the GSP scale; GSP_PA=Acknowledgment of GSP scale; MPPUS_WN=withdrawal and negative life consequences of the MPPUS scale; MPPUS_EC=escape from other problems and craving of the MPPUS scale. Gen_X= generation X; Gen_Y=generation Y; Gen_Z = generation Z; df=degree of freedom, n=numerosity.

Gen-X VS gen-Z

Significant differences have been found between gen-X and gen-Z using a Mann-Whitney U test as regard GSP_SI (U=1473.5; p=.007), GSP_PA (U=1191; p=.001), SDS_AI (U=983; p=.001), SDS_OV (U=1261; p=.012), SDS_MU (U=942.5; p=.001), SDS_ER (U=758; p=.001), CFQ_M (U=858; p=.009), CFQ_D (U=616; p=.001) , CFQ_B (U=617; p=.001), CFQ_N (U=951.5; p=.046), MPPUS_WS (U=687.5; p=.001) and MPPUS_CE (U=585; p=.001). Figure 2 shows the difference between generations as a mean of rank values.

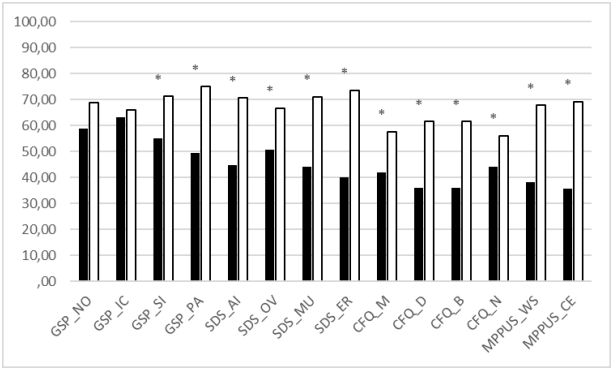

Figure 2. Rank scores between participants divided by gen-X (black bar) and gen-Z (withe bar)

Note: *=significant comparison

Legend: GSP_NO = Nomophoby of GSP scale; GSP_IC=Interpersonal Conflict of GSP scale; GSP_SI=Self-Isolation of the GSP scale; GSP_PA=Acknowledgment of GSP scale; MPPUS_WN=withdrawal and negative life consequences of the MPPUS scale; MPPUS_EC=escape from other problems and craving of the MPPUS scale. Gen_X= generation X; Gen_Y=generation Y; Gen_Z = generation Z; df=degree of freedom, n=numerosity.

Gen-Y VS gen-Z

Significant differences have been found between gen-Y and gen-Z using a Mann-Whitney U test as regard GSP_PA (U=2367<, p<0.006), SDS_AI (U=2266.5; p=.040), CFQ_D (U=1733; p=.034), CFQ_B (U=1723.5; p=.031) and MPPUS_WS (U=1920; p=.020). Figure 3 shows the difference between generations as a mean of rank values.

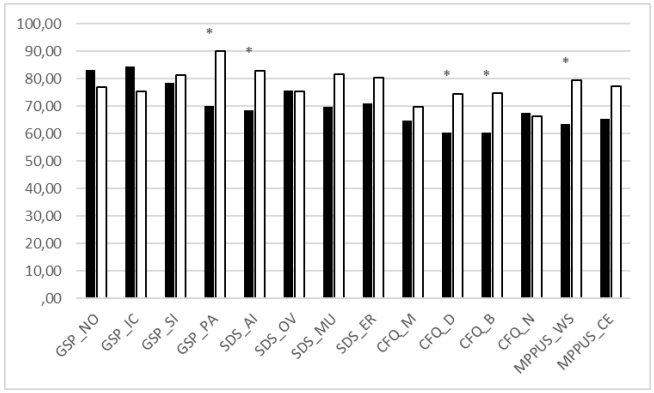

Figure 3. Rank scores between participants divided by gen-Y (black bar) and gen-Z (withe bar)

Note: *=significant comparison
Legend: GSP_NO = Nomophoby of GSP scale; GSP_IC=Interpersonal Conflict of GSP scale; GSP_SI=Self-Isolation of the GSP scale; GSP_PA=Acknowledgment of GSP scale; MPPUS_WN=withdrawal and negative life consequences of the MPPUS scale; MPPUS_EC=escape from other problems and craving of the MPPUS scale. Gen_X= generation X; Gen_Y=generation Y; Gen_Z = generation Z; df=degree of freedom, n=numerosity.

5. DISCUSSION AND CONCLUSION

The present study explored the associations among variables lied to problematic smartphone use. The results have confirmed the association among the variables subscales: smartphone distraction, phubbing, problematic smartphone use and cognitive failures. This study also confirms the hypothesized intergenerational differences. Gen Y perceives to be more phubber, distracted, and with a higher use than Gen Y and Z for all components of GSP, SDS and MPPUS. The surprising finding is shown by the higher perception of the number of cognitive failures by GEN X, i.e., the younger generation. They score higher than the other two generations in the subscales related to measuring memory failures, errors due to distraction, and cognitive errors in general.

It is interesting to note a difference between the various generations, it becomes clear that certain data represent a wake-up call that should not be underestimated due to the possible cognitive and social repercussions. Age and impulsivity are considered predictive factors of problematic smartphone use, younger individuals are therefore those most at risk of problematic smartphone use because they have fewer protective factors (Mitchell & Hussain, 2018). However, all age groups should be monitored for any risks that may arise.

It’s clear the need to educate already from adolescence on the conscious use of smartphone, which has so much potential but also negative aspects. Bearing in mind the importance of choosing the appropriate terminology, being aware of the differences between addiction, use and problematic use; it is useful to inform about the influence that the smartphone exerts on attention, as this can be distracted from the tasks at hand, leading to poor performance, which can also manifest itself in all life's environments. Under this consideration, educational intervention must be combined with specific treatments for this problematic use with the aim to engage and motivate the new generations (more digital) (Bonfiglio et al., 2020; Bonfiglio et al., 2021; Renati et al., 2021). The study findings will help the professionals in the field, but also schools and families towards developing treatments and actions for the adverse effects of smartphone overuse. The intervention measures are important above all to improve mental health and psychological wellbeing, increasing awareness that problematic smartphone use can have both cognitive and relational levels. The study presents some limitations. The first limitation is given using self-report questionnaires. Non-representative, self-selection and non-response bias have not been controlled. We did not draw, for example, a general representative sample to which the survey should be administered and have not included in the sample subjects who have no access to the internet. Stakeholder bias has been controlled avoiding multiple access from the same IP address and

without offering incentives for the compilation (Duda et al., 2010). Then, a larger sample is required to make the results obtained more generalizable. Future studies should aim to recruit samples with specific features, to measure different cognitive processes through diagnostic tools, to validate specific questionnaires in the Italian context, to explore the relationship between addictions and cognitive failure and to deepen the social relationships of the sample surveyed.

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