



The Impact of Smartphone Use on the Psychosocial Wellness of College Students

Anthony Faiola¹(✉), Haleh Vatani¹, and Preethi Srinivas²

¹ University of Illinois at Chicago, Chicago, IL 60612, USA
faiola@iupui.edu, hvatan2@uic.edu

² Regenstrief Institute, Indianapolis, IN 46202, USA
presrini@umail.iu.edu

Abstract. Researchers suggest that excessive smartphone use is correlated with negative psychosocial effects, particularly among younger adults—causing feelings of isolation, depression/anxiety, and restlessness. This pilot study on psychosocial wellness, of 22 college students—measured the impact of smartphone use on emotion/mood, dependency, addiction, purpose of life, social communications, and self-consciousness. For our data analysis, we measured frequency with conversion percentages (of 35 questions) using a seven-point Likert-scale of strongly disagree-to-strongly agree, while averaging the scores of each question group pertaining to each hypothesis. While only 22% agreed they were addicted to smartphone use, 68% reported constantly checking their smartphone, with 57% agreeing that they were smartphone dependent. The majority agreed that smartphone use increased anxiety, stress, and feelings of impatience, if their phone was not with them. While the majority agreed that the smartphone is their primary means of communication, 90% agreed that nothing is more fun than using their smartphone.

Keywords: Psychosocial · Self-consciousness · Mood · Emotion
Smartphones

1 Introduction

For centuries, human artifacts of cultural mediation evolved from clubs to hammers to machines of the industrial age [1] During the past few decades, we observed the emergence in development of information technology and electronic tools. However, technology has never become so indistinguishably interwoven within the development of human consciousness until recently. In the last two decades the use of information technology—particularly, the use of smartphones in the recent years has been observed to alter a range of psychosocial conditions. New smartphone applications (apps) continue to arrive on the market, offering a variety of useful tools for staying connected, exploring social media, doing business, playing games, and listening or watching audio/videos. As such, the intertwining nature of technology is having a profound effect on our interpersonal relationships and activities in the world—particularly among the college-age population [2].

Along with the television penetration rate (98%), from 1950 to 2000, by 2000 there was an 80% penetration of computers and cell phones in US—and by 2003, computers

had penetrated 75% of US homes with children, with 63% having access to the Internet [3]. By 2010, Americans spent 1.3 trillion hours on seeking for information, an average of over 12 h per day. [4] This includes the consumption of over 10,845 trillion words translating to 100,500 words per person daily, with the majority of the time being spent seeking information on the Internet [5]. Consequently, the statistics illustrate an extreme change in the way humans interact with and process information.

The exponential use of smartphones in 2007, showed the next stage in excessive and dependent use of technology. Currently, 90% of North Americans possess mobile phones, where about 70% of those are smartphones [6]. As part of everyday life, smartphones provide direct access to people through voice calls, text messages, and support social interaction with a range of networks, such as Facebook and Twitter. As a psychological tool extending the way we distribute information and reinforce personal relationships [7], researchers have defined the smartphone as a type of “*affective technology*,” [8, 9]—linking it to the “emotional” human condition [10, 11] and the means to connect to those around us.

Currently, 98% of college students have a mobile phone, and evidence suggest that daily usage exceeds four hours per day—occurring in a diversity of settings [12, 13]. For example, researchers have demonstrated that texting among college students is so frequent (due to its convenience, speed, and facelessness), that participants exhibited a significant degree of disinhibition and inattention to their immediate social environment or interpersonal relationship [14]. Consequently, considering the diverse use and impact that smartphones have on contemporary human life, particularly young adults, it is expected that an array of behaviors might be observed among this cohort.

In this paper, we introduce our findings of a pilot study on the impact of smartphones on the psychosocial wellness of college students. As such, we measured the impact of smartphone use on emotion and mood, dependency, addiction, purpose of life, social communications, and self-consciousness of college students.

2 Excessive Use and Psychosocial Development

With the recent increase in smartphone adoption [15] and dependence [16] studies continue to identify related neuro-psychological and neuro-social effects of using smartphones. A range of psychiatric disorders leading to abnormal or anti-socio- psychology including: Attention Deficit Hyperactivity Disorder (ADHD), weakening of cognitive focus and shallower thinking skills, reduction of creativity and problem solving skills, a lowered ability to filter out extraneous information, adverse effects upon psychosocial development, hyperactivity and behavioral problems, feelings of isolation, depression, anxiety and restlessness, and an inability to form meaningful and long-lasting relationships, are now confirmed to be correlated with excessive use of smartphones [17].

Research suggests that the brain’s contact with external neurological disruptions can transform the course of its development, causing disastrous results, specifically for children and young adults [18, 19]. Recent studies confirm psychiatric disorders in children are correlated with excessive use of and addiction to computer games, as well as the general use of the Internet [20]. Negative outcomes for young adults elicits from an

overuse of smartphones, such as sleep deprivation and obesity [21]. Additionally, studies convey excessive use of gaming technologies led to a form of neural rewiring [22], particularly, structural deviations due to exposure to divergent sensory experiences in ways that weaken cognitive focus, resulting in shallower thinking skills. Studies have also shown that the extreme use of the Internet instigated potential adverse effects upon the psychosocial development of adolescents [23]. Such affects have been adversely associated with notable behavioral and social maladjustment, with other outcomes showing hyperactivity and conduct problems. Additional studies show that the forming of meaningful relationships via social media was difficult to establish compared to those in the real world [24]. Online activity did not create lasting friendships, but rather resulted in long-lasting non-casual social connections, while at the same time created weakening real-world relationships.

In the context of Internet use, researchers also characterized extreme or “excessive use” as “poorly controlled preoccupations, urges, or behaviors regarding computer use and Internet access that lead to impairment or distress” (p. 117) [25]. Related to these effects are neural changes in the brain, particularly, structural deviations due to exposure to divergent sensory experiences—particularly on children and adolescents [26]. More significant are recent studies using MRI technology that show the effects of brain activation patterns on middle age adults during Internet searching. These findings indicate that online searching appears much more stimulating than reading from traditional substrates—demonstrating that sensory-rich experiences increase activity of the visual cortices [27]. This suggests that research participants have a significant sensory-rich experience, while searching online that increases activity in the visual brain regions. Outcomes have suggested the potential for negative brain and behavioral effects, including impaired attention and addiction. All in all, these studies provide support for the continued neural alternation that is impacting individuals on many levels, which is most strenuous.

Finally, the use of smartphones is a crucial part of our daily living, however, studies show that the younger population, especially college students, have been using smartphones excessively more than other populations [28–30]. Such use includes a variety of different activities such as texting, emailing, and engaging social media networks [31]. Such findings suggest that the increased use of interactive media, may cause feelings of isolation, depression, anxiety and restlessness—including feeling of anxiety when people are separated from their smartphones [32].

3 Flow Theory and Consciousness

Researchers argue that the experience of “flow” is an emotional condition related to excessive behavior [33]. In such a state, an emotional bond is formed between the psychological and chemical mechanisms of the brain, which occurs through the repeated experience of flow [34, 35]. For example, smartphone users may produce the same self-centric experiences as online gamers—in which their “awareness” of the surroundings disappear from consciousness [36]. Strikingly, Csikszentmihalyi observed that flow was correlated to the loss of self-consciousness. Here, consciousness is a state of

psychological immersion often accompanied by positive emotions, where time disappears and the sense of self is lost [37].

Related to “intrinsic motivation”, Csikszentmihalyi states that “flow” is a technical term connected to mood and consciousness, a concept related to daily activities and their direct experiences of positive feelings [38, 39]. Through studies that observed technological usage in the 1990s, flow theory was directly applied to the analysis of user experience when seeking information from online sources, with an additional focus on understanding the relation between skill levels and the tendency of experiencing flow [39].

The self-motivating features of flow, exemplifies the appealing nature of smartphones and the users’ captivation with such an artifact. The attentive focus allows for a deeper understanding between consciousness and flow, which gives way to a heightened user experience of absorption, enjoyment, and interest [40]. In addition to several studies that have examined emotion and cognitive changes related to mood management, human-to-human and social communication [41–43], the matter of excessive use of smartphones on consciousness or awareness of the world have been increasingly recognized [44, 45]. As such, we argue that researchers should continue to explore the psychological dimensions of what makes social media usage so motivating [46, 47], specifically the impact of the excessive use of smartphones of social engagement.

3.1 Research Question

While psychologists propose possible reasons for smartphone addiction owing to its ability to alter mood and trigger enjoyable feelings [48], it is not fully known if repetition of use is correlated to other negative effects that impact psychosocial development. For this reason, we were compelled to ask what the effects of smartphone use are (among college students), on a variety of psychological domains—such as the (1) emotion/mood, (2) dependency, (3) addiction, (4) purpose of life, (5) social communication, and (6) self-consciousness. From this question, focused on six areas of inquiry, we arrived at seven hypotheses. Table 1 aligns the six topics with the seven hypotheses, with the number of questions asked in each category. The questions can be found in Appendix A.

Table 1. Research topics areas with hypotheses and number of questions.

Topic		Hypotheses	Ques.
<i>Among college students:</i>			
1	Emotion/Mood	H1: Smartphone use significantly impacts stress and anxiety. H2: Smartphone use significantly impacts mood or feelings.	1–8
2	Dependency	H3: There is a strong dependency upon smartphones.	9–15
3	Addiction	H4: There is a strong degree of addiction to smartphones.	16–22
4	Purpose of Life	H5: Smartphone use significantly impacts their personal life.	23–25
5	Social Communications	H6: Smartphones are the main form of communication and information gathering.	26–28
6	Self- Consciousness	H7: Smartphone usage increases self- consciousness.	29–35

Note: See Appendix A for list of 35 questions

4 Methods

4.1 Participants

A convenience sample of 22 full-time and part-time graduate students (63/36% male/female) from the Indiana University School of Informatics (mean age = 26), were recruited for this research study during Spring 2014. All students were part of a graduate level introductory course in informatics. The student participants formed a cohort with diverse ethnicity, age and gender.

4.2 Data Collection

To provide additional insight into the findings of the author's past study on the impact of smartphone use [49], they performed an online post-study pilot questionnaire. (Findings from this study have not been previously reported.) Participants completed the online survey based on their daily experiences using smartphones. The questionnaire consisted of 72 questions, divided into three sections:

1. Smartphone usage—questions regarding quantities of smartphone use and usage time of texting, phone calls, game-play, social media use, etc.
2. Smartphone daily experiences—the largest group of questions, with six subsections, each using a seven-point Likert-scale.
3. Demographics—questions related to Gender, Nationality, Age, and Years of smartphone use, cellphone use, and PC/Laptop use.

Figure 1 shows the online survey interface with the seven-point Likert scale—from: Strongly Disagree (1) to Strongly Agree (7).

Smartphone Daily Experiences

Please respond to the following questions as honestly as possible. There are NO right or wrong answers. Also, please respond to each question independently, not allowing your previous responses to influence the remaining.

Please respond to the following questions by selecting one of the seven options:

- 1 Strongly Disagree
- 2 Somewhat Disagree
- 3 Disagree
- 4 Neutral
- 5 Agree
- 6 Somewhat Agree
- 7 Strongly Agree

Personal feelings/emotions

I feel pleasant or excited while using my smartphone.

↓

I feel calm while using my smartphone.

↓

Using my smartphone allows me to be more in touch with my feelings.

↓

I am able to get rid of stress while using my smartphone.

- ✓ Strongly Disagree
- Disagree
- Somewhat Disagree
- Neutral
- Somewhat Agree
- Agree
- Strongly Agree

Fig. 1. Depicts online survey interface.

4.3 Data Analysis

For the reporting of our findings (for this paper), our analysis of the data was executed in three phases. In the first phase we focused on section two (as noted) but narrowed our analysis to only 35 of the 60 questions related to the participants smartphone daily experiences. After our preliminary analysis of the data, we determined that cleaning the data was necessary, i.e., those data points that might be disconnected with the effect that we were trying to isolate—thus allowing us to maintain our focus on those selected topics of interest. We did not observe any obviously erroneous data due to a mistake during data collection or reporting. Also, for this reporting, we are not reporting on participant smartphone usage or demographics—section one and three. After phase one, phase two of our analysis consisted of appropriately aligning the remaining questions

under those subsections with their related hypotheses. Phase three consisted of a revised analysis of the 35 questions.

For our data analysis, we measured frequency (within the seven Likert degrees), with conversion percentages—from the scale of strongly disagree to strongly agree. We first averaged the scores of each question, according to the responses from the 22 participants. This was followed by averaging those frequency scores that pertained specifically to each of the hypotheses. As such, we could determine to what degree or percentage the overall response was—within the range of responses from strongly disagree to strongly agree. For example, under hypothesis one, “Smartphone use significantly impacts stress and anxiety,” there are four questions that provided frequencies, with a total overall score of 52.27%. This frequency score conveys the degree to which the participants agreed with the stated hypothesis—that the use of their smartphone causes stress and anxiety in their daily life.

5 Results

As noted, the 35 questions were grouped according to their respective hypotheses. As such, we re-state the hypothesis, along with the frequency percentage, and any relevant findings.

H1: Smartphone Use Significantly Impacts Stress and Anxiety

Analyzing the responses of four questions revealed that 52.27% of participants agreed that their anxiety level increases with smartphone use. Added to this percentage is the fact that 72.73% of the participants stated that they feel impatient and fretful when they are not holding their smartphone in hand.

H2: Smartphone Use Significantly Impacts Mood or Feelings

Analyzing the responses of four questions revealed that the negative impact of smartphone use on mood was reported by 60.23% of college students. Impacting this overall score is the fact that 77.27% of participants stated that when they use their smartphone they are enabled to be more in touch with their feelings—while only 45.45% said that feel calm while using their smartphone.

H3: There is a Strong Dependency Upon Smartphones

Analyzing the responses of seven questions, revealed that 57.27% of college students consider themselves dependent on their smartphone. The most influential factors contributing to their dependency were that 72.73% of the students felt safe and secure when they had their smartphones in their possession, while 63.64% had difficulty with going through their daily life without their smartphone in their possession.

H4: There is a Strong Degree of Addiction to Smartphones

Although 68% of participants reported constantly checking their smartphone for different purposes and 63% agreed it was very difficult to live their daily life without their cellphone (note above), only 30.52% of college students agreed (overall of seven questions) that they were addicted to their cellphones. In this section of seven question,

the question that received the lowest score (at 22.73%) was: “I believe I am addicted or have an abnormal dependency on my smartphone.”

H5: Smartphone Use Significantly Impacts Their Personal Life. (Positively)

Analyzing the responses of three questions, our findings revealed that smartphone use improves purpose of life among college students at 59.09%—including its positive impact on their personal life by giving them greater values and helping them to be successful. Among this group of three questions, “believing that nothing is more fun than using my smartphone,” received a score of 90.91%, the highest percentage of any of the 35 questions.

H6: Smartphones are the Main Form of Communication and Information Gathering

Analyzing the responses of three questions, we observed that smartphones are considered as the main form of communication by 66.67% of the participants and the main tool for finding information by 72.73%, rather than ask others to help them.

H7: Smartphone Usage Increases Self-consciousness. (Positively)

Analyzing the responses of seven questions, our findings uncovered that 54.55% of participants (overall) indicated that they have a better level of self-consciousness when they use their smartphone. Interestingly, 72.73% agreed that when using their smartphone makes them less aware of the close surroundings—while 63.64% agreed that it is difficult to talk on their phone if they think others are watching them.

6 Discussion

In this study we examined the effects of smartphone use on the psychosocial wellness among college students, with a focus on six psychological domains: emotion/mood, dependency, addiction, purpose of life, social communications, and self-consciousness. Our findings were independent of sex, age group, or level of smartphone usage among our participants. Our study suggests addictive usage behaviors, 68% reporting constantly checking their smartphone, and smartphone dependency, 57% reporting smartphone dependency as well. However, despite these findings, only 22% of participants in our study agreed to have smartphone addiction and dependency.

According to analysis of our survey data, smartphone use increases anxiety and stress level among college students, and our participants agreed they feel impatient if they do not have their phone in their possession. Although we cannot deduce causality in this study, these findings are aligned with the previous research findings that correlate excessive use of smartphones with increased level of anxiety and restlessness.

Another component of our findings suggest smartphones are the main tool for communication and information seeking among college students. As noted, these findings are in agreement with past studies investigating smartphone usage among college students. Taken together, a conclusion that the two most significant smartphone usage patterns among college students are: (1) maintaining social relationships and (2) accessing the online digital information.

The most outstanding finding emerging from our data analysis is the impact of smartphones on the personal life of college students—by more than 90% agreeing on nothing is more fun than using their smartphones. This discovery provides new perceptions into the notion that excessive smartphone use has an individuals' social life. This behavior, we believe, may also suggest that excessive and/or repeated use may promote the experience of pleasure and improvement of mood, but may also lead to an increase in a lack of awareness of the close environment. In the former case, the risk of forming habitual usage and addiction are present.

Regarding limitations to the study—first, the sample size of the study limited our ability to extend our findings inferentially to the greater population of college students. For this reason, we identified it as exploratory in nature, and thus, a pilot study. Other contributing limitations to a small sample might include the narrow characteristics of our participants—drawing upon one class of college students, from one university. We suggest that future studies extend the investigation to be more inclusive of socio-demographics, ethnicity and cultural backgrounds, devices, location, and type of activities.

7 Conclusion

Excessive smartphone use, of any degree, can have physical, psychological and social implications for any individual. However, our findings specifically suggest that college students depend heavily on their smartphones—to a level that if they were not in possess of them, they would not feel secure or in control. While smartphones are their primary mode of communication and information seeking, excessive use may have a significant influence on mood, while increasing the level of stress and anxiety.

In sum, although smartphones can translate into tools that empower and expand one's communication capacity, they may adversely affect psychosocial wellness, as well as disrupt one's accurate sense of consciousness—of both persons and objects around them. Our challenge remains therefore, to not only understand the influence of these mediational technologies, but increasingly to identify those explicit threats to mental and social wellness—leading to the shaping of lives that are positive, productive, and socially engaged.

Acknowledgement. The authors would like to acknowledge the student work of Alexandra Dirico, University of Illinois at Chicago, for her contribution in the development of this paper.

A Appendix

List of research questions provided participants according to topics, with responses according to a seven-point Likert scale.

Emotion and Mood

1. I am able to get rid of stress while using my smartphone.
2. I feel impatient and fretful when I am not holding my smartphone.
3. I sometimes become irritated while using my smartphone.

4. Not having my phone in my possession (at home/outside home) makes me feel nervous/anxious.
5. I feel pleasant or excited while using my smartphone.
6. I feel calm while using my smartphone.
7. Using my smartphone allows me to be more in touch with my feelings.
8. I become depressed or sad if I am not able to use my smartphone.

Dependency

9. Having my smartphone with me at all times gives me the feeling of safety and security.
10. I feel more comfortable using my smartphone for communication as opposed to other forms of communication.
11. It is very difficult to consider my daily life without having my smartphone.
12. I use my smartphone each day longer than I had intended.
13. I often consider that I should shorten my smartphone use.
14. I feel I waste time when I am on my smartphone more than necessary.
15. I feel I am more in control when using my smartphone.

Addiction

16. I believe I am addicted or have an abnormal dependency on my smartphone.
17. I feel the urge to use my smartphone again immediately after I stopped using it.
18. I cannot bear the thought of not having my smartphone with me at all times.
19. Regardless of the circumstances around me, I would never give up the use of my smartphone.
20. Not being able to use my smartphone would be as painful as losing a friend.
21. I miss planned or anticipated work or responsibilities due to smartphone use.
22. I have my smartphone (and using it) on my mind even when I'm not using it.

Purpose of Life

23. I feel that the use of my smartphone gives greater value to my life.
24. I believe there is nothing more fun to do than use my smartphone.
25. Without my smartphone, I believe I could not be successful in the world.

Social Communications

26. I constantly check my smartphone so I will not miss communication between other people via email, text, Twitter or Facebook, etc.
27. I check social networking sites like Twitter or Facebook right after waking up in the morning or right before going to bed at night.
28. I prefer searching for information that I need by using my smartphone rather than asking people in real time.

Self-consciousness

29. It is hard for me to talk on my smartphone when I think others are watching me.
30. I feel nervous when I am talking on my smartphone in public.
31. I pay attention to my inner feelings when I am using my smartphone.

32. Using my smartphone makes me less aware of my close surroundings.
33. I am often unaware if I am speaking too loudly on my smartphone when I am in public.
34. I often lose track of time when I am using my smartphone.
35. When I am on my smartphone, my attention is only focused on it.

References

1. Ingold, T.: Eight themes in the anthropology of technology. *Soc. Anal.* **41**, 106–138 (1997)
2. Yang, C.C., Brown, B.B., Braun, M.T.: From Facebook to cell calls: layers of electronic intimacy in college students' interpersonal relationships. *New Media Soc.* **16**, 5–23 (2014). <https://doi.org/10.1177/1461444812472486>
3. Basics, T.V.: A Report on the Growth and Scope of Television. Television Bureau of Advertising (2012). <http://www.tvb.org/>
4. Bohn, R.E., Short, J.E.: How Much Information? 2009 Report on American Consumers. University of California, San Diego, Global Information Industry Center (2009). http://hmi.ucsd.edu/pdf/HMI_2009_ConsumerReport_Dec9_2009.pdf
5. Roberts, D.F., Foehr, U.G.: Trends in media use. *Futur. Child.* **18**, 11–37 (2008)
6. Pew Research Center Internet & Technology. Mobile Fact Sheet (2018). <http://www.pewinternet.org/fact-sheet/mobile/>
7. Katz, J.E.: Mainstreamed mobiles in daily life: perspectives and prospects. In: *Handbook of Mobile Communication Studies*, pp. 433–446 (2008). <https://doi.org/10.7551/mitpress/9780262113120.001.0001>
8. Fortunati, L.: *Electronic Emotion: The Mediation of Emotion via Information and Communication Technologies*, pp. 1–31. Peter Lang, Oxford (2009)
9. Silva, S.R.: On emotion and memories: the consumption of mobile phones as 'affective technology'. *Int. Rev. Soc. Res.* **2**, 157–172 (2012). <https://doi.org/10.1515/irsr-2012-0011>
10. Gross, J.J., Thompson, R.A.: *Emotion Regulation: Conceptual Foundations*, pp. 3–24. Guilford Press, New York (2006)
11. Lazarus, R.S.: *Emotion and Adaptation*. Oxford University Press, New York (1991)
12. Smith, A., Rainie, L., Zickuhr, K.: *College students and technology*. Pew Research Center Internet & Technology (2011)
13. Thomée, S., Härenstam, A., Hagberg, M.: Mobile phone use and stress, sleep disturbances, and symptoms of depression among young adults—a prospective cohort study. *BMC Public Health* **11**, 66 (2011). <https://doi.org/10.1186/1471-2458-11-66>
14. Harrison, M.A., Gilmore, A.L.: U txt WHEN? College students' social contexts of text messaging. *Soc. Sci. J.* **49**, 513–518 (2012). <https://doi.org/10.1016/j.sosci.2012.05.003>
15. *The Mobile Consumer: A Global Snapshot*. Nielsen Holdings, New York (2013)
16. Lee, U., Lee, J., Ko, M., Lee, C. et al.: Hooked on smartphones: an exploratory study on smartphone overuse among college students. In: *Proceedings of the 32nd Annual ACM Conference on Human Factors in Computing Systems*, pp. 2327–2336 (2014)
17. Weiss, M.D., Baer, S., Allan, B.A., Saran, K., Schibuk, H.: The screens culture: impact on ADHD. *Atten. Deficit Hyperact. Disord.* **3**, 327–334 (2011)
18. Healy, J.M.: *Endangered Minds: Why Children Dont Think And What We Can Do About I*. Simon and Schuster, New York (2011)
19. Zhou, Y., Lin, F.C., Du, Y.S., Zhao, Z.M., Xu, J.R., Lei, H.: Gray matter abnormalities in Internet addiction: a voxel-based morphometry study. *Eur. J. Radiol.* **79**, 92–95 (2011)

20. Perlow, L.A.: *Sleeping with Your Smartphone: How to Break the 24/7 Habit and Change the Way you Work*. Harvard Business Review Press, Brighton (2012)
21. Whitbourne, S.K.: Your smartphone may be making you... not smart (2011). <https://www.psychologytoday.com/blog/fulfillment-any-age/201110/your-smartphone-may-be-making-you-not-smart>
22. Chirico, D.M.: Building on shifting sand the impact of computer use on neural & cognitive development. *Wald. Educ. Res. Inst. Bull.* **2**, 13 (1998)
23. Kormas, G., Critselis, E., Janikian, M., Kafetzis, D., Tsitsika, A.: Risk factors and psychosocial characteristics of potential problematic and problematic internet use among adolescents: a cross-sectional study. *BMC Public Health* **11**, 595 (2011). <https://doi.org/10.1186/1471-2458-11-595>
24. Lenhart, A., Madden, M.: *Teens, Privacy and Online Social Networks. How teens manage their online identities in the age of MySpace*. Pew Internet & American Life Project Report (2007). http://www.pewinternet.org/~media/Files/Reports/2007/PIP_Teens_Privacy_SNS_Report_Final.pdf
25. Weinstein, A., Lejoyeux, M.: New developments on the neurobiological and pharmacogenetic mechanisms underlying internet and videogame addiction. *Am. J. Addict.* **24**, 117–125 (2015). <https://doi.org/10.1111/ajad.12110>
26. O’Keeffe, G.S., Clarke-Pearson, K.: The impact of social media on children, adolescents, and families. *Pediatrics* **127**, 800–804 (2011). <https://doi.org/10.1542/peds.2011-0054>
27. Small, G.W., Moody, T.D., Siddarth, P., Bookheimer, S.Y.: Your brain on Google: patterns of cerebral activation during internet searching. *Am. J. Geriatr. Psychiatry* **17**, 116–126 (2009). <https://doi.org/10.1097/JGP.0b013e3181953a02>
28. Contractor, A.A., Weiss, N.H., Tull, M.T., Elhai, J.D.: PTSD’s relation with problematic smartphone use: mediating role of impulsivity. *Comput. Hum. Behav.* **75**, 177–183 (2017). <https://doi.org/10.1016/j.chb.2017.05.018>
29. Kim, Y., Jeong, J., Cho, H., Jung, D. et al.: Personality factors predicting smartphone addiction predisposition: behavioral inhibition and activation systems, impulsivity, and self-control. *PLoS One* **11**, e0159788 (2016). <https://doi.org/10.1371/journal.pone.0159788>
30. Roberts, J., Yaya, L., Manolis, C.: The invisible addiction: Cell-phone activities and addiction among male and female college students. *J. Behav. Addict.* **3**, 254–265 (2014). <https://doi.org/10.1556/JBA.3.2014.015>
31. Lin, L., Sidani, J.E., Shensa, A., Radovic, A., et al.: Association between social media use and depression among US young adults. *Depress. Anxiety* **33**, 323–331 (2016). <https://doi.org/10.1002/da.22466>
32. Hartanto, A., Yang, H.: Is the smartphone a smart choice? The effect of smartphone separation on executive functions. *Comput. Hum. Behav.* **64**, 329–336 (2016). <https://doi.org/10.1016/j.chb.2016.07.002>
33. Csikszentmihalyi, M.: *Introduction in Optimal Experience Psychological Studies of Flow Consciousness*. Cambridge University Press, New York (1988)
34. Moneta, G.B., Csikszentmihalyi, M.: The effect of perceived challenges and skills on the quality of subjective experience. *J. Pers.* **64**, 275–310 (1996). <https://doi.org/10.1111/j.1467-6494.1996.tb00512.x>
35. Peifer, C.: Psychophysiological correlates of flow-experience. *Adv. Flow Res.*, 139–164 (2012)
36. Pace, S.: A grounded theory of the flow experiences of Web users. *Int. J. Hum Comput Stud.* **60**, 327–363 (2004). <https://doi.org/10.1016/j.ijhcs.2003.08.005>
37. Csikszentmihalyi, M.: *Flow: The Psychology of Optimal Experience*. Harper & Row, New York (1990)

38. Csikszentmihalyi, M.: *Finding Flow: The Psychology of Engagement with Everyday Life*. Basic Books, New York (1997)
39. Ryan, R.M., Deci, E.L.: Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *Am. Psychol.* **55**, 68 (2000)
40. Rodriguez-Sanchez, A.M., Schaufeli, W.B., Salanova, M., Cifre, E.: Flow experience among information and communication technology users. *Psychol. Rep.* **102**, 29–39 (2008). <https://doi.org/10.2466/pr0.102.1.29-39>
41. Zillmann, D.: Mood management in the context of selective exposure theory. *Ann. Int. Commun. Assoc.* **23**, 103–123 (2000). <https://doi.org/10.1080/23808985.2000.11678971>
42. Brandon, J.: *Are we losing the emotion from communication. In: Depth Does Relying on Technology Harm Our Senses and Emotions* (2013)
43. Bandura, A.: Social cognitive theory of mass communication. *Media Psychol.* **3**, 265–299 (2001)
44. Turkle, S.: *Alone Together*. Basic Books, New York (2011)
45. Bianchi, A., Phillips, J.G.: Psychological predictors of problem mobile phone use. *CyberPsychology Behav.* **8**, 39–51 (2005). <https://doi.org/10.1089/cpb.2005.8.39>
46. Finneran, C.M., Zhang, P.: Flow in computer-mediated environments: promises and challenges. *Commun. Assoc. Inf. Syst.* **15**, 82–101 (2005)
47. Ghani, J.A., Supnick, R., Rooney, P.: The experience of flow in computer-mediated and in face-to-face groups. *ICIS* **91**, 229–237 (1991)
48. Faiola, A., Newlon, C., Pfaff, M., Smyslova, O.: Correlating the effects of flow and telepresence in virtual worlds: Enhancing our understanding of user behavior in game-based learning. *Comput. Hum. Behav.* **29**, 1113–1121 (2013). <https://doi.org/10.1016/j.chb.2012.10.003>
49. Faiola, A., Srinivas, P., Duffecy, J.: The effects of excessive smartphone use on mood, consciousness, and psychosocial wellness: the sometimes negative side of flow experience, slated. *J. Happiness Stud.* (In Review)