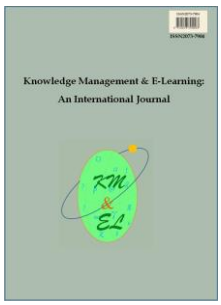
Knowledge Management & E-Learning, Vol.15, No.4. Dec 2023

Fear of missing out, smartphone addiction and academic performance: Smartphone obstacles and positive affect as moderators

Nidhya Balasubramanian
Loyola College, Chennai, India
Satyanarayana Parayitam
University of Massachusetts Dartmouth, USA



Knowledge Management & E-Learning: An International Journal (KM&EL)
ISSN 2073-7904

Recommended citation:
Balasubramanian, N., & Parayitam, S. (2023). Fear of missing out, smartphone addiction and academic performance: Smartphone obstacles and positive affect as moderators. *Knowledge Management & E-Learning*, *15*(4), 614–642. https://doi.org/10.34105/j.kmel.2023.15.035

Knowledge Management & E-Learning, 15(4), 614–642

Fear of missing out, smartphone addiction and academic performance: Smartphone obstacles and positive affect as moderators

Nidhya Balasubramanian

Department of Visual Communication
Loyola College, Chennai, India
E-mail: nidhya@loyolacollege.edu

Satyanarayana Parayitam*

Department of Management and Marketing
Charlton College of Business
University of Massachusetts Dartmouth, USA
E-mail: sparayitam@umassd.edu

*Corresponding author

Abstract: As smartphones have become effective substitutes for laptops and desktops, smartphone users have been increasing at astronomical proportions. Smartphones have emerged as a valuable tool to communicate with others and constantly keep themselves abreast of what is happening in the world. This may result in a behavioral change called the 'fear of missing out' (FOMO), a phenomenon labeled as a form of social anxiety. The present study aims to investigate the consequences of FOMO on smartphone addiction (SPA) and students' academic performance in educational institutions. A conceptual model was developed, and hypotheses were tested by collecting data from 98 students from an educational institution in the southern part of India. The regression results of Hayes's PROCESS macros indicate: (i) FOMO is (a) negatively associated with academic performance, and (b) positively associated with SPA, (ii) SPA is negatively related to academic performance, (iii) Positive Affect (PA) positively predicts academic performance, (iv) Negative Affect (NA) negatively predicts academic performance. The results also support smartphone obstacles moderating the relationship between SPA and academic performance. The three-way interaction between SPA, smartphone obstacles, and PA influencing academic performance is supported in this study. The implications for theory and practice are discussed.

Keywords: FOMO; Smartphone addiction (SPA); Positive affect; Negative affect; Academic performance

Biographical notes: Nidhya Balasubramanian is an Assistant Professor and coordinator in the Department of Visual Communication, Loyola College, Chennai, India. She has more than 11 years of academic experience 3 years of industry experience and. She has completed her post-graduation in Visual Communication and Ph. D in Communication. She has keen interest in new media research. She authored a book 'New Literacy for Neo-Millennials' Her primary research areas are New Literacy Practices, Smartphone addiction among students and Internet Addiction Disorder-Psychological, Sociological Wellbeing of students. Her research has been published in Global Knowledge

Memory and Communication. Professor Nidhya Balasubramanian can be contacted at nidhya@loyolacollege.edu

Satyanarayana Parayitam is a Professor of Strategic Management in Charlton College of Business, University of Massachusetts Dartmouth. His research focuses on cognitive, affective conflict and interpersonal trust in strategic decision-making processes. His research has been published in the Journal of Management, International Journal of Conflict Management, Management Research Review, Journal of Business Research, Journal of World Business, Journal of Strategic Marketing, Personnel Review, Journal of Marketing Theory and Practice, International Journal of Knowledge Management, Journal of Strategy and Management, Journal of Advances in Management Research, Chinese Management Studies, Computers in Human Behavior, Behaviour & Information Technology; Journal of Spirituality, Religion and Management;, Asia Pacific Journal of Management Research and Innovation; Journal of Knowledge Management; International Journal of Knowledge Management; Journal of Global Fashion Marketing, Knowledge Process and Management Journal, Quality and Quantity, Tourism and Hospitality Research, Global Business Review, FIIB Business Review, International Journal of Yoga - Philosophy, Psychology and Parapsychology, Ayurveda Journal of Health, IIM Kozhikode Society & Management Review, Journal of Sustainable Finance & Investment, The Learning Organization, Global Knowledge, Memory and Communication, and Leadership and Organizational Development Journal.

1. Introduction

The technological revolution has resulted in the phenomenal growth of smart and mobile phones worldwide. In fact, because of convenience and portability, smartphones have become a gadget that everyone carries. In addition, smartphones gained importance because of their multiple functions: web browsing, social networking, playing games, taking photos with in-built cameras, e-buying, engaging in banking transactions, GPS navigation while traveling, etc. (Lei et al., 2020; Nayak, 2018). According to Statista, the total number of mobile devices worldwide is around 15 billion, and it is estimated to reach 18.22 billion by 2025 (O'Dea, 2021). As Harris and Cooper (2019) mentioned, "The U.S. Supreme Court has ruled that a mobile phone is an integral part of a person, an extension of her or his personality" (Harris & Cooper, 2019).

A growing body of research in the recent past has focused on the antecedents and consequences of using smartphones (Brunborg et al., 2011; Sunday et al., 2021). Most researchers have studied the adverse effects of the overuse of smart and mobile phones and contend it is a type of behavioral addiction (Kim et al., 2019; Panova et al., 2020; Wilcockson et al., 2019). Some researchers reported that excessive use of smartphones adversely affects personal relationships between friends and academic performance (Lin et al., 2021; Seo et al., 2016).

While excessive use of smartphones has potential problems, extant research also pointed out positive outcomes when used carefully and optimally. Some researchers argue that using smartphones by students and faculty is essential to enhancing learning (Norries et al., 2011). Extant research documented the importance and use of smartphones by students in the learning process (Pullen et al., 2015; Payne et al., 2012; Bidin & Ziden, 2013; Sha et al., 2012; Tandon et al., 2021; Wang et al., 2009). In the healthcare industry, smartphones are used to communicate with others and are helpful in

health promotion and monitoring patients' health (Fjeldsoe et al., 2009; Sunday et al., 2021). In addition, it is widely recognized that portability, convenience, and multifunctional applications make smartphones an effective substitute for desktops (Harris et al., 2020; Wang et al., 2018).

As individuals are getting accustomed to depending on smartphones for several activities: e-shopping, searching for information, playing games, e-banking, checking and sending emails, chatting with friends and others through social media, etc., one dysfunctional outcome of such overdependence is the Fear of Missing Out (FOMO) (Tandon et al., 2021). FOMO is one type of behavioral addiction and is often considered the dark side of social media (Dhir et al., 2019; Salo et al., 2018). Although instructors do not allow the students to use smartphones in classrooms, in distance education, smartphones play a significant role in learning (Tagoe & Abakah, 2014; Tuncay, 2016; Valk et al., 2010).

While smartphones have enormous advantages in advancing academic learning, there are some disadvantages in distracting the teaching and taking away some productive time of students if they get addicted to smartphones. Though FOMO and smartphone use in the academic environment has been exhaustive, little is known about the boundary conditions whereby FOMO does not adversely affect academic performance. The present study aims to bridge the gap by identifying potential mediators and moderators that minimize the negative effect of FOMO. Most importantly, the role of SPA, obstacles associated with the use of smartphones, positive affect, and negative affect in influencing academic performance of students in educational institutions will be investigated in this research.

The rationale for this study stems from a recently conducted meta-analysis by Tandon et al. (2021) who indicated that research on FOMO and SPA is scarce "in Asia, South America, and Africa where the social media penetration was higher than the global average" (Tandon et al., 2021: p. 795). Further, the research has been diverse and scattered, and most of the studies focused on demographic variables (such as gender and income). Researchers in education and psychology contend that students' academic success largely depends on socioeconomic status, parents' educational background, students' intelligence, and genetic factors (Rimfeld et al., 2018; von Stumm et al., 2020; Talsma et al., 2019). Despite this, research on SPA and FOMO has been very sparse particularly in developing countries such as India.

This research is based on the framework of self-determination theory (Deci & Ryan, 1985), according to which individuals continuously engage in social media to gratify their psychological needs:

- Autonomy (i.e., the degree to which an individual has the freedom to choose whatever he wants).
- Competence (i.e., the degree to which an individual reacts to the events in the environment).
- Relatedness (the degree to which an individual maintains a relationship with others).

When these psychological needs are not met, they feel dissatisfied. Individuals experience social anxiety (Dossey, 2014) and perceive social exclusion if they are not engaged in continuous conversation with others (Wang et al., 2018). They find a fruitful alternative in terms of engaging in smartphone heavily and once they get addicted, they

feel the fear of missing out (FOMO)when they are away from the smartphone. In the subsequent sections, we explain FOMO and SPA.

1.1. FOMO and SPA

According to Przybylski et al. (2013), "FOMO defined as a pervasive apprehension that others might be having rewarding experience from which one is absent; FOMO is characterized by the desire to stay continuously connected with what others are doing" (p.1841). Turkle (2011) has pointed out earlier that the strong desire to stay continuously with others may lead to adverse outcomes, and this what exactly how FOMO develops.

Though FOMO is positively associated with maintaining connectivity with friends, peers, and others, most the researchers consider FOMO as addictive behavior and have several adverse outcomes: emotional instability, anxiety, neuroticism, adversely affected social well-being (Elhai et al., 2020; Holte & Ferraro, 2020; Wolniewicz et al., 2020). In addition, studies reveal that when young college students have increasingly used the smartphone their academic performance declined (Gerosa et al., 2022; Ifeanyi & Chukwuere, 2018; Lei et al., 2020; Shakoor et al., 2021). Despite extensive research, a relatively small number of studies investigated the positive side and opposing sides of using smartphones by students. In addition to serving the needs of individuals by providing a means of web browsing, playing games, enjoyment, networking, and e-buying, the most important use of smartphones is the utilization in the academic environment. Though some researchers argue that smartphones have a deleterious effect on the academic performance of students (Kibona & Mgaya, 2015), others say that the use of smartphones improves learning, especially in a digital environment, where students would be able to download the lecture materials and engage in collaborative learning by performing group projects (Cano, 2012; Emerson & Berge, 2018; Mokoena, 2012; Tulenko & Bailey, 2013).

Despite the potential benefits of smartphone usage, overuse of smartphones have dysfunctional outcomes such as anxiety and depression (Elhai et al., 2020; Turgeman et al., 2020), poor academic performance because of multitasking and distraction in the classroom (Baert et al., 2020; Dietz & Henrich, 2014; Junco & Cotten, 2011). Because of the adverse effects, abstinence from the use of smartphones is preferred by some individuals (Wilcockson et al., 2019). However, some evidence shows that SPA increases anxiety (Eide et al., 2018).

Several scholars have investigated the relationship between SPA and academic performance, and most findings support a negative relationship (Yildiz Durak, 2019; Li et al., 2015; Longnecker, 2017; Rozgonjuk et al., 2019). Some of the plausible reasons for adverse consequences of SPA include (i) distraction of attention by students (Bugeja, 2007; Dietz & Henrich, 2014), (ii) in-class text messaging (Wei & Wang, 2010), (iii) multitasking, i.e., listening to lectures and engaging in other tasks using a mobile phone (Ellis et al., 2011), and (iv) checking social media websites like Facebook (Junco & Cotten, 2011). On the other hand, a few studies documented the positive effect of SPA, mainly when mobile phones were used for educational purposes (Tessier, 2013; Lau, 2017).

1.2. Positive affect (PA) and negative affect (NA)

Individuals are influenced both by positive emotions and negative emotions. Positive emotions (examples: excitement, enthusiasm, dedication) motivate individuals to have

positive look at the situations and perform better. Negative emotions (such as: anger, frustration, guilty, upset) will have negative impact on behavior and outcomes (Pressman & Cohen, 2005; Spindler et al., 2009). PANAS scale developed by Watson et al. (1988) consists of the emotional states individuals undergo. Past researchers found that increase in PA is positively related to social functioning and increase in NA has harmed social functioning of individuals (Sanmartín et al., 2018). The present study attempts to bridge the gap by studying the impact of FOMO, PA, NA on SPA and academic performance in educational institutions in a developing country (India). This study attempts to answer the following research questions (RQ).

RQ1: How is academic performance affected by FOMO, positive affect, negative affect, and SPA?

RQ2: How does SPA mediate between FOMO and academic performance?

RQ3: How do smartphone obstacles and positive affect moderate the relationship between SPA and academic performance?

This study makes five essential contributions to FOMO and smartphone addiction literature. First, in an academic setting, students use smartphones extensively for learning purposes and engage in conversation with others in social media, gaming, and entertainment. Therefore, getting addicted to smartphone use may result in FOMO that has dysfunctional consequences of low academic performance. Second, the findings suggest that FOMO results in SPA, which hinders students' academic performance. Therefore, it is vital to have a self-regulatory mechanism to restrict the use of smartphones productively. Third, once the younger generation, such as students, get addicted to smartphone use, they constantly check smartphones, irrespective of time and place. When individuals get addicted, restrictions on the use of smartphones may result in withdrawal symptoms (anxiety and unpleasantness), and individuals may find difficulty abstaining from the use of smartphones. Third, when students abstain from using smartphones, academic performance increases, albeit stress and anxiety increase for SPA. Fourth, Positive and Negative affect on performance suggest that students use smartphones for learning (downloading the class material, watching education-related videos, recording lectures, completing the assignments by using a smartphone to fetch relevant information, etc.). Fourth, the Negative affect indicates that excessive use of smartphones may cause distraction in class, texting while attending lectures, and using a smartphone for non-academic purposes most of the time would adversely affect academic performance. Fifth, obstacles associated with the use of smartphone moderates the relationship between SPA and academic performance. Obstacles are poor network, the screen's small size, freezing at times of learning, incompatibility of the system for browsing, etc. would significantly hamper performance. However, this study highlights the importance of Positive to mitigate the adverse effect of obstacles in using smartphones on academic performance. Finally, the simple conceptual model developed and tested underscores the boundary conditions for increasing academic performance through two moderators: smartphone problems and Positive.

2. Conceptual model and hypotheses development

We developed a conceptual model involving the variables: FOMO, SPA, smartphone obstacles, Positive, Negative affect, and academic performance. The conceptual model is presented in Fig. 1.

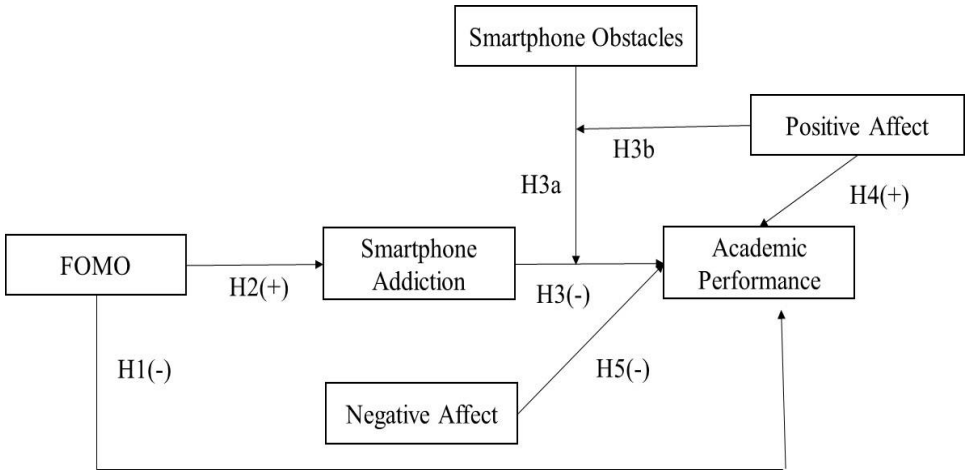


Fig. 1. Conceptual model

2.1. FOMO and academic performance

One of the significant negative outcomes of FOMO is poor academic performance (Lemay et al., 2019). Przybylski et al. (2013), in their study conducted on 87 first undergraduate students, found that FOMO is positively related to distracted learning because students used to see Facebook during the lectures. In a recently completed study on 150 students in Pakistan, researchers found that smartphones in classrooms resulted in poor academic performance (Shakoor et al., 2021). Because of FOMO, students continuously use smartphones in all places, including classrooms. Extant research reported multitasking (Hossain & Ahmed, 2016; Lepp et al., 2015; Lemay et al., 2019). Text messaging and calling others during the classes (Hong et al., 2012; Jacobsen & Forste, 2011) are negatively associated with students' grade point average (GPA) in North America, Taiwan, Asia, and Europe. In a survey of 536 students, researchers found that excessive use of smartphones has the potential risk of lowering students' academic performance and suggested restricted use of smartphones in classrooms (Ng et al., 2017). A study conducted among students in Oman university, researchers found negative relationship between FOMO and academic performance (Qutishat & Sharour, 2019). Thus, based on available empirical evidence, we offer the following hypothesis:

H1: FOMO is negatively related to academic performance

2.2. FOMO and SPA

As FOMO is considered an addictive behavior and individuals are in "a state of limbo that may arise from deficiencies in psychological needs (competence, relatedness, autonomy), which are integral components of self-determination" (Tandon et al., 2021; p. 794), and individuals continuously strive to connect with others through various social media platforms (Hadlington & Scase, 2018). Therefore, the individuals who perceive FOMO are more likely to get addicted to the smartphone. A typical lifestyle of college students includes, in addition to completing academic assignments, engaging in conversation with friends, playing games, and exchanging opinions and ideas. In this process, smartphones play a vital role in serving as an essential tool (Dai et al., 2021).

The more the students engage in these activities, the more likely they feel that they miss out on something by getting disconnected from it.

Researchers operationalized SPA in different ways—excessive use (Chen et al., 2016), compulsive use (Kim & Byrne, 2011), heavy use (Lee, 2014), overuse (Lee et al., 2017)—but one common denominator in all these operationalizations is heavy dependence of individuals on a smartphone (Rozgonjuk et al., 2019). After conducting a meta-analysis, Sunday et al. (2021) conceptualize SPA "as a condition where the use of smartphone has fulfilled a deep need (dependency, habitual, and addictive behavior) to the extent that the individual has difficulty conducting basic activities of daily life without the concurrent use of a smartphone, and as such caused neglect of other aspects of one's life." (Sunday et al., 2021; p. 2). SPA is thus a type of behavioral addiction (Shambare et al., 2012), and a critical precursor for SPA is that individuals may fear that they will miss something out when they are away from their mobile. Though SPA is a form of psychopathological disorder, a positive relationship between FOMO and SPA is expected, depending on the personality types of individuals (Blackwell et al., 2017). Based on available abundant empirical evidence and logos, we offer the following hypothesis:

H2: FOMO is positively related to SPA

2.3. SPA and academic performance

Extant research reported that SPA is negatively related to educational outcomes such as academic performance and the well-being of individuals (Lee et al., 2015; Samaha & Hawi, 2016). Several experimental studies reported a negative impact of SPA on academic performance because they represent a potential source of distraction to students' engaged learning (Beland & Murphy, 2016; Felisoni & Godoi, 2018; Waite et al., 2018). In addition, there is growing evidence that SPA is a psychopathological phenomenon with deleterious consequences (Cho & Lee, 2015; Harris et al., 2020; Tossell et al., 2015). In a study conducted on 496 students, the researchers found that increased use of cell phones in classrooms harms students' GPA (Lepp et al., 2015). Based on abundant empirical evidence, we offer the following hypothesis:

H3: SPA is negatively related to academic performance

2.4. Positive affect, negative affect, and academic performance

Positive and Negative affect are concerned with the mood of individuals. Positive affect is related to the expression of excitement, alertness, inspiration, and determination of individuals. Individuals in the Positive state tend to use smartphones for productive uses. For instance, individuals who exhibit positive moods tend to use smartphones to record lectures, complete assignments, search for information related to classroom material, group work, and download material to facilitate performing well in academics. Several researchers reported the positive affect of smartphone use on solving complex problems given by teachers and assisting the students in fostering online learning (Cano, 2012; Ejubovic & Puska, 2019; Ifeanyi & Chukwuere, 2018; Mokoena, 2012). However, in a recently conducted meta-analytic study consisting of 44 studies from 16 countries, with a total sample of 147,943, it was found that overuse of smartphones harms academic performance (Sunday et al., 2021).

On the other hand, Negative affect is related to hostility, nervousness, guilt feeling, and irritability. Often Negative affect leads to the use of smartphones for non-

academic purposes, significantly influencing academic performance. While optimum use of smartphones is reflected in positive affect, excessive use (overuse) reflects negative affect. Positive affect has been documented in some studies (Sha et al., 2012; Wang et al., 2009). On the other hand, several studies have shown negative affect (Baert et al., 2020; Grant et al., 2019). Based on the available empirical evidence, we offer the following hypotheses:

H4: Positive affect is positively related to academic performance

H5: Negative affect is negatively related to academic performance

2.5. Moderation hypotheses

2.5.1. Smartphone Obstacles as a first moderator

As smartphone use has become universal among college students in educational institutions, it would be necessary to highlight the problems associated with the use of smartphones. Especially in developing countries such as India, the obstacles include interruptions in internet connectivity and frequent power cut problems during the summer season. Another obstacle may have to freeze the smartphone screen. The screen's small size may not be comfortable to read for a long time. In a study conducted in India, a survey of 544 students from India, Gopal et al. (2021) reported that students faced obstacles or problems of limited internet access and disturbance due to low signals that seriously hampered their learning. Although in developed countries like the USA, UK, Japan, and Germany, students do not face such problems encountered by students in developing countries. Because of a global pandemic, most universities and colleges shifted from the traditional in-class, face-to-face to web-based system of education requiring uninterrupted internet access so that students can engage in learning (Maqableh et al., 2021). A recently conducted study found that students' smartphone applications in blended learning encountered obstacles (Sari, 2019). In a study conducted on 108 university students in Jordan, the obstacles identified by students include the need for regular battery charge, lack of compatibility with software applications, difficulty in typing the data because of the small size of the screen, lack of training to use smartphones, etc. (Alwraikat, 2017). When SPA hurts academic performance, the obstacles are more likely to further the hamper academic performance. The greater the number of obstacles students face in smartphone use, the more likely their academic performance falls. Thus, based on the available direct negative impact of obstacles in smartphone use by students, we offer the following exploratory moderation hypothesis:

H3a: Smartphone obstacles moderate the relationship between SPA and academic performance

2.5.2. Positive affect as a second moderator

As the negative effect of SPA on academic performance was well documented in the literature, the obstacles in smartphone use further increase the strength of the negative relationship between SPA and academic performance. Positive Affect exhibited by students is more likely to reduce the ill-effects of SPA. The alertness, enthusiasm, inspiration, and determination, which indicate Positive Affect, would help the students using a smartphone to focus on the positive side of the coin. Based on psychological and behavioral dimensions, Dai et al. (2021) identified four distant groups of individuals:

hypo-connected antagonists, balanced majority, hyper-connected enthusiasts, and indulgent zealots. The hypo-connected antagonists are goal-oriented and utilize smartphone productivity, whereas the balanced majority spend most of their time listening to music, playing games, and social networking. The hyper-connected enthusiasts entertain themselves by playing TikTok, watching movies, etc.; the indulgent zealots spend most of their time on smartphones and suffer from problematic smartphone use (PSU). (Dai et al., 2021; Duke & Montag, 2017; Vahedi & Saiphoo, 2018; Sahu et al., 2019).

In this study, we argue that individuals who are high on Positive Affect tend to make optimum use of smartphones for academic purposes and are goal-directed like hypo-connected antagonists. The behavioral and psychological dimension of Positive Affect helps students reduce the negative impact of SPA and obstacles of the smartphone by their determination to achieve academic goals. Based on the positive outcomes of PA, we offer the following exploratory moderated moderated-mediation hypothesis:

H3b: Positive affect moderates the moderated relationship between SPA and smart phone obstacles and academic performance

3. Method

3.1. Sample

Data for this research is from the students from educational institutions in the southern part of India. Respondents were students pursuing courses in visual communication and animation from the same college. For this study, we assembled all the respondents in a room, confiscated their mobile phones from 9 am to 5 pm, and asked them to fill out the survey instrument that elicits information about the FOMO. The purpose of confiscating mobile telephones is to see how the respondents are addicted to smartphones. It is not an experimental study where we do manipulation checks and isolate the control groups and treatment groups. Like in any survey-research, we distributed the survey. The only difference is that we wanted to let the respondents have an experience of keeping themselves away from smartphones so that the answers provide a realistic understanding of whether the respondents face the fear of missing out.

The respondents consist of 75 (76.5%) male and 23 (23.5%) female. As far as age is concerned, 6(6.1%) were 17 years; 43(43.9%) were 18 years; 35(35.7%) were 19 years; 11(11.2%) were 20 years, and 3(3.1%) were 21 years. Regarding the time spent on the internet, 8(31.6%) spent between 30 minutes and 1 hour; 31(31.6%) spent between 1 hour to 3 hours; 33(33.7%) spent between 3-6 hours, and 36(26.5%) spend more than 6 hours.

3.2. Measures

The constructs used in this research are derived from well-established sources in the literature. The indicators for the constructs are measured on a Likert five-point scale (‘1’ = strongly disagree; ‘5’ = strongly agree).

The FOMO was measured with 25 items from Hato (2013). The reliability coefficient (Cronbach’s alpha) of FOMO was 0.83. Smartphone Addiction (SPA) was measured with 15 items of the Smart Phone Withdrawal Scale developed by Eide et al (2018). We sed reverse coded the items to represent addiction. The reliability coefficient of SPA was 0.94. Smart phone obstacles were measured with 8 items developed by

Darko-Adjei (2019). Positive affect was measured with ten items and Negative affect were measured with ten items from PANAS twenty-item scale of Watson et al (1988). The Cronbach's alpha for positive affect was 0.73 and for Negative affect was 0.81.

Academic Performance was measured with six items from Darko-Adjei (2019), and the reliability coefficient was 0.85. The rationale for measuring the performance subjectively is to see the effect of FOMO and SPA on perceived academic performance. We followed previous researchers who used survey-based subjective measures to assess academic performance (Gopal et al., 2021; Wilson et al., 1997; Shakoor et al., 2021). It should be noted that objective performance measures in terms of grade point average may be because of various factors. It would be difficult to tease out other variables affecting the performance. So, perceived academic performance is expected to tap into the effect of SPA on academic performance.

All the constructs and the indicators were mentioned in the Appendix I.

4. Analysis and results

4.1. Descriptive Statistics, multicollinearity, and common method variance

The means, standard deviations, and zero-order correlations are mentioned in Table 1.

Table 1
Descriptive statistics: Means, standard deviations, and zero-order correlations

	Mean	SD	1	2	3	4	5	6
1. FOMO	3.82	0.76	1					
2. SPA	3.92	0.92	0.37***	1				
3. Smartphone obstacles	3.26	0.82	-0.11	-0.03	1			
4. Positive affect	3.84	0.69	-0.14	0.11	0.26***	1		
5. Negative affect	2.51	1.10	0.18	0.07	0.029	-0.22*	1	
6. Academic performance	3.90	0.74	-0.23*	-0.14	0.27*	0.55***	-0.35***	1

Note. *** $p < 0.01$; * $p < 0.05$.

The preliminary analysis of correlation matrix reveals that highest correlation was 0.55 (between positive affect and academic performance) and the lowest correlation was -0.22 (between positive affect and negative affect). Since the correlations between the variables were less than 0.75, multicollinearity is not a problem with the data (Tsui et al., 1995). We also assessed multicollinearity by observing the variance inflation factor (VIF) for the variables and found that these values were less than 5, suggesting that multicollinearity is not a problem in this study (Montgomery et al., 2012).

We checked for common method variance by performing Harman's single-factor as suggested by Podsakoff et al. (2003). Harman's single-factor analysis explained 22.52 percent of variance (less than the threshold of 50 percent) and hence common method variance is not a problem with the data. Further, we also used 'latent factor method' and calculated inner VIF values for each of the constructs. If the VIF values exceed 3.3, the data indicates existence of pathological collinearity, and the model is inferred to be contaminated by common method variance (Kock, 2015). In this study, we found that the inner VIF values were less than 3.3, thus suggesting that the model is freed from the common method bias.

4.2. Hypothesis testing

In this study, appropriate statistical tools were used which are consistent with the other researchers (D'Souza et al., 2023; Goel et al., 2022; Singh et al., 2022). We used Model 4 of Hayes (2018) PROCESS macros to test H1-H3 and presented the results in Table 2.

Table 2
Testing H1, H2, and H3

	DV = Academic performance				DV = Smartphone addiction (SPA) **H2**				DV = Academic performance			
	Step 1				Step 2				Step 3			
	Coeff	*se*	*t*	*p*	Coeff	*se*	*t*	*p*	Coeff	*se*	*t*	*p*
Constant	4.7511	0.3783	12.5579	0.0000	2.3779	0.3916	6.0729	0.0000	4.2726	0.4376	9.7629	0.0000
FOMO H1	**-0.2218**	**0.0973**	**-2.2806**	**0.0248**	**0.4378**	**0.1007**	**4.3495**	**0.0000**	-0.3099	0.1046	-2.9621	0.0039
SPA H3									**-0.2012**	**0.0970**	**-2.0752**	**0.0407**
R-square	0.051				0.164				0.14			
F	5.20				18.69				15.47			
*df*1	1				1				2			
*df*2	96				96				95			
p	.025				.0000				.0099			
Total effect												
			Total Effect		*se*	*t*	*p*	LLCI	ULCI			
			-0.2218		0.0973	-2.2806	0.0248	-0.4149	-0.0288			
Direct Effect												
			Direct Effect		*se*	*t*	*p*	LLCI	ULCI			
FOMO → Academic performance			-0.3099		0.1046	-2.9621	0.0039	-0.5177	-0.1022			
Bootstrapping indirect effect (To verify mediation)												
			Indirect effect		BOOT se	BOOT LLCI	BOOT ULCI					
FOMO → SPA→Academic performance			0.0881(0.4378 x 0.2012 = 0.0881)		0.0702	-0.0151	0.2556					

Note. N = 98. Boot LLCI, Boot ULCI = Bootstrapping lower limit confidence interval, upper limit confidence interval. The results were based on 20,000 bootstrapping samples [$p < .05$]. It is recommended to use four decimal digits because some values may be very close to zero.

Table 2 (step 1) shows the regression results of the effect of FOMO on academic performance. The regression coefficient of FOMO on academic performance was negative and significant (β = - 0.222, t = - 2.28; $p < 0.05$). The results based on 20,000 bootstrap samples reveal that 95 percent bias-corrected confidence intervals were (LLCI = -0.4149; ULCI = -0.0288), and zero was not contained in the intervals. These results support H1 that FOMO is negatively related to academic performance.

Hypothesis 2 posits that FOMO is positively related to SPA. As shown in Step 2 (Table 2), the regression coefficient of FOMO on SPA was positive and significant (β = 0.437; t = 4.34; $p < .001$). Since zero was not contained in the 95 percent BCCI confidence intervals [LLCI = 0.2380; ULCI = 0.6377], the results support H2.

Hypothesis 3 proposes that SPA is negatively related to academic performance. As shown in Step 3 (Table 2) the regression coefficient of SPA on academic performance was positive and significant (β = - 0.201; t = - 2.075; $p < 0.05$), and BCCI [LLCI = - 0.4146; ULCI = 0.0319]. These results support H3.

To test whether SPA mediates the relationship between FOMO and academic performance, though not hypothesized in this study, the indirect effect must be checked. The indirect effect of FOMO on academic performance was 0.0881 [Boot se = 0.0702; Boot LLCI = - 0.0151; Boot ULCI = 0.2556]. Since 'zero' zero was contained in the Boot LLCI and Boot ULCI, the results do not support the mediation of SPA.

To double check the results, we verified the total effect (- 0.2218), which is a total of direct effect (- 0.3099) and indirect effect (0.0881). The indirect effect is a product of regression coefficient FOMO on SPA (0.4378) and regression coefficient of SPA on academic performance (0.2012) [i.e. (0.4378 x 0.2012 = 0.0881]. The total effect, therefore, is (-0.3099 + 0.0881 = - 0.2218). The indirect effect of FOMO →SPA → academic performance was not significant, and hence the results reveal that SPA does not mediate the relationship between FOMO and academic performance.

4.3. Testing H4, H5, H3a (two-way interaction) and H3b (three-way interaction)

To test H3a, H3b, H4, and H5, we used Model # 18 of Hayes (2018) PROCESS macros and presented the results in Table 3.

Table 3
Testing of H4, H5, H3a (two-way interaction) and Hypothesis 3b (three-way interaction)

	DV = Academic Performance					
Variables	Coeff	*se*	*t*	*p*	LLCI	ULCI
Constant	8.5136	3.3282	2.5580	0.0122	1.8994	15.1278
FOMO	-0.1065	0.0829	-1.2852	0.2021	-0.2712	0.0582
SPA	-3.9942	1.3880	-2.8777	0.0050	-6.7525	-1.2358
Smartphone Obstacles	-1.5713	1.1459	-1.3713	0.1738	-3.8485	0.7059
Positive Affect H4	4.6727	1.3904	3.3606	0.0012	1.9095	7.4359
Negative Affect H5	-0.0678	0.0581	-1.1678	0.2460	-0.1832	0.0476
SPA x Smartphone Obstacles H3a	-1.1342	0.4627	-2.4514	0.0162	-2.0536	-0.2147
SPA x Positive Affect	-0.9278	0.3562	-2.6045	0.0108	-1.6357	-0.2199
Smartphone Obstacles x Positive Affect	-1.1566	0.4424	-2.6147	0.0105	-2.0357	-0.2775
SPA x Smartphone Obstacles x Positive Affect H3b	0.2496	0.1167	2.1395	0.0352	0.0178	0.4814
Negative Affect						
R^2	0.528					
F	10.29					
*df*1	9					
*df*2	88					
p	0.0000					
Index of moderated moderated-mediation						
Index	BOOT SE	BOOT LLCI	BOOT ULCI			
0.1108	0.0768	0.0215	0.3155			
Index of moderated moderated-mediation by Smartphone Obstacles						
Positive Affect	Index	BOOT SE	BOOT LLCI	BOOT ULCI		
Low	-0.1236	0.0671	-0.2861	-0.0244		
Medium	-0.0682	0.0517	-0.1816	0.0252		
High	-0.0128	0.0617	-0.1236	0.1260		

Conditional effects of the focal predictor (Academic Performance) at values of moderators (Smartphone obstacles x Positive Affect)							
Smartphone Obstacles	Positive Affect	Effect	*se*	*t*	*p*	LLCI	ULCI
Low	Low	0.1371	0.0992	1.3812	0.1707	-0.0601	0.3343
Low	Medium	-0.0238	0.1015	-0.2340	0.8155	-0.2255	0.178
Low	High	-0.1846	0.1312	-1.4072	0.1629	-0.4452	0.0761
Medium	Low	-0.1215	0.0820	-1.4818	0.1420	-0.2843	0.0414
Medium	Medium	-0.1664	0.0670	-2.4829	0.0149	-0.2996	-0.0332
Medium	High	-0.2113	0.0901	-2.3465	0.0212	-0.3903	-0.0323
High	Low	-0.3402	0.1296	-2.6253	0.0102	-0.5977	-0.0827
High	Medium	-0.2871	0.0900	-3.1883	0.0020	-0.4660	-0.1081
High	High	-0.2339	0.1181	-1.9816	0.0506	-0.4685	0.0007
Moderator value(s) defining Johnson-Neyman significance region(s)							
			Value	% below		% above	
			3.9103	50.0000		50.0000	

H3a posits that smart phone obstacles moderate the relationship between SPA and academic performance. As shown in Table 3, the beta (i.e., regression coefficient) of the interaction term APA and smart phone obstacles was significant (β SPA x Smart phone obstacles = -1.134; t = -2.4514; $p < 0.05$; Boot LLCI (-2.0536); Boot ULCI (-0.2147). These results support H3a. The visualization of two-way interaction was presented in Fig. 2.

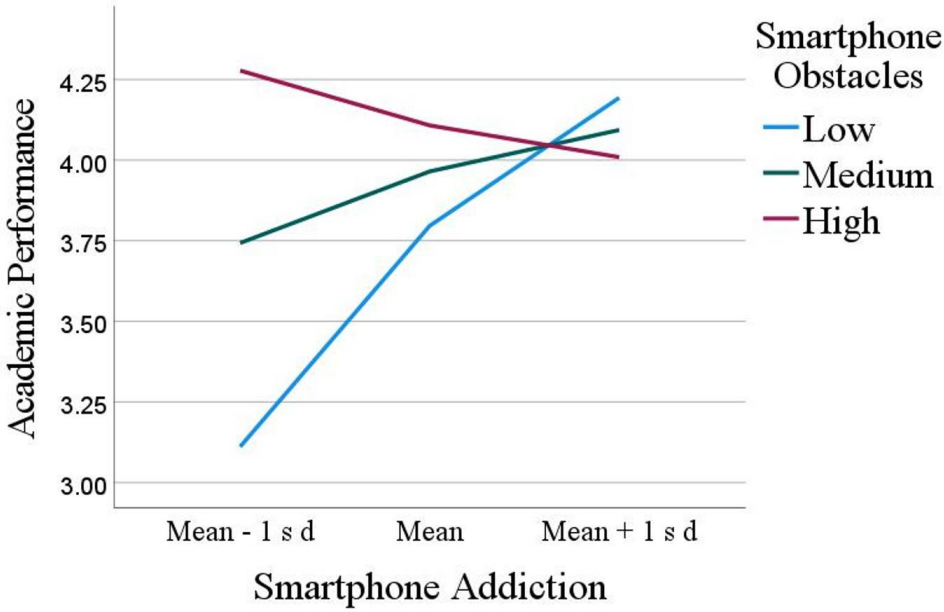


Fig. 2. Smartphone obstacles moderating the relationship between SPA and academic performance

Fig. 2 depicts the relationship between SPA and academic performance at various levels of smart phone obstacles. In the beginning when the SPA was low, performance was high and as the SPA increases, academic performance decreases with increase in

smart phone obstacles whereas academic performance increases when smart phone obstacles are low. The positively sloped curve representing the low level of smart phone obstacles and negatively sloped curve for high level of smart phone obstacles indicate the moderating effect of Smart phone obstacles. These results render support to H3a.

Hypothesis 3b posits that Positive affect (second moderator) and affective commitment (smart phone obstacles) interact with SPA to academic performance. The multiplicative effect of these three variables is called 'three-way interaction'; and the regression coefficient of multiplicative effect is significant (β SPA x Smart phone obstacles x Positive affect = 0.249; t = 2.139; $p < 0.05$). The results, based on 20,000 bootstrap samples, show that the 95% Boot LLCI (0.0178) and Boot ULCI (0.4814) shows significant values (as zero is not contained in the Lower and Upper limits), thus supporting H3b. The interactions model is significant and explains 52.8% variance in academic performance [R^2 = 0.528; F (9,88) = 10.29; $p < 0.001$]. The index of moderated mediation [index = 0.1108; Boot se = 0.0768; Boot LLCI = 0.0215; Boot ULCI = 0.3155] support the H3b. The conditional effects of the focal predictor (Academic Performance) at values of moderators (Smart phone problems x Positive affect) were presented in the bottom of Table 4. Further, the conditional interaction (SPA x Smart phone obstacles) at values of the moderator Z (Positive affect) were presented in Table 4. These results render strong support to H3b.

Table 4
Conditional X*W interaction (SPA x Smartphone Obstacles) at values of the moderator Z (Positive)

Positive Affect	Effect	*se*	*t*	*p*	LLCI	ULCI
1.2857	-0.8132	0.3160	-2.5739	0.0117	-1.4411	-0.1853
1.4714	-0.7669	0.2950	-2.5993	0.0110	-1.3532	-0.1806
1.6571	-0.7205	0.2742	-2.6274	0.0101	-1.2655	-0.1755
1.8429	-0.6742	0.2536	-2.6586	0.0093	-1.1781	-0.1702
2.0286	-0.6278	0.2331	-2.6932	0.0085	-1.0911	-0.1646
2.2143	-0.5815	0.2129	-2.7315	0.0076	-1.0045	-0.1584
2.4000	-0.5351	0.1930	-2.7733	0.0068	-0.9186	-0.1517
2.5857	-0.4888	0.1734	-2.8180	0.0060	-0.8335	-0.1441
2.7714	-0.4424	0.1545	-2.8632	0.0052	-0.7495	-0.1353
2.9571	-0.3961	0.1364	-2.9037	0.0047	-0.6671	-0.1250
3.1429	-0.3497	0.1195	-2.9270	0.0044	-0.5871	-0.1123
3.3286	-0.3034	0.1043	-2.9080	0.0046	-0.5107	-0.0960
3.5143	-0.2570	0.0918	-2.7993	0.0063	-0.4394	-0.0745
3.7000	-0.2106	0.0832	-2.5333	0.0131	-0.3759	-0.0454
3.8857	-0.1643	0.0796	-2.0636	0.0420	-0.3225	-0.0061
3.9103	-0.1581	0.0796	-1.9873	0.0500	-0.3163	0.0000
4.0714	-0.1179	0.0819	-1.4407	0.1532	-0.2806	0.0447
4.2571	-0.0716	0.0895	-0.8002	0.4258	-0.2494	0.1062
4.4429	-0.0252	0.1012	-0.2493	0.8037	-0.2264	0.1759
4.6286	0.0211	0.1159	0.1823	0.8557	-0.2091	0.2514
4.8143	0.0675	0.1324	0.5095	0.6117	-0.1957	0.3307
5.0000	0.1138	0.1503	0.7572	0.4509	-0.1849	0.4126

The pictorial presentation of the three-way interaction was shown in two panels of Fig. 3. The Panel A shows the relationship between SPA and smart phone obstacles at

low values of Positive affect. As shown in Panel A, the lower levels of Positive affect results in decrease in academic performance irrespective of levels of smart phone obstacles. When we observe the relationships in Panel B, which shows the interaction effects of SPA and smart phone obstacles at higher levels of Positive affect, the interaction effect is very significant. High Positive affect combined with low level of smart phone obstacles results in increase in academic performance. These results corroborate the interaction effect and provide support to H3b.

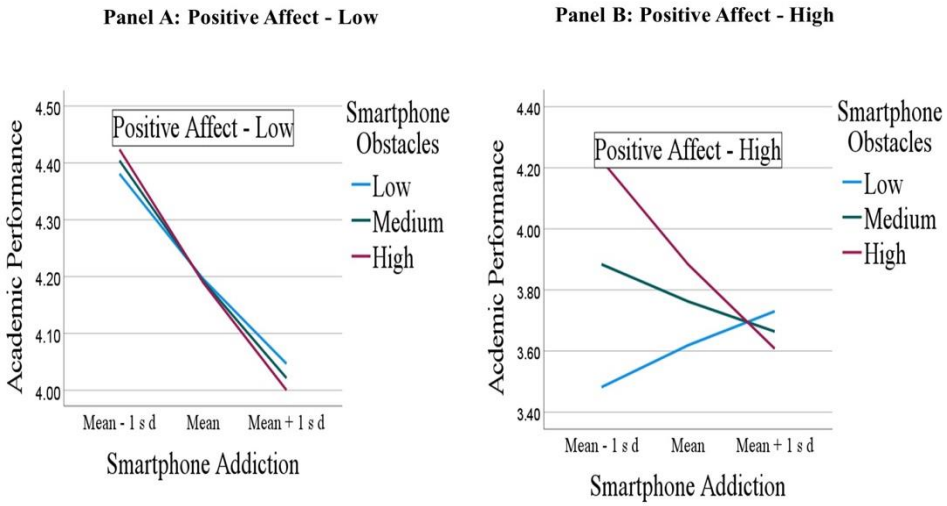


Fig. 3. The effect of interaction between SPA and smartphone obstacles on academic performance at low and high levels of Positive affect

From Table 4, we can see that the regression coefficient of Positive affect on academic performance was positive and significant ($\beta = 4.672$; $t = 3.361$; $p < 0.01$). Since zero was not contained in the 95 percent BCCI confidence intervals [LLCI = 1.9095; ULCI = 7.4359], the results support H5.

The regression coefficient of Negative Affect on academic performance was negative but not significant (β = - 0.0678; t = -1.167; p = 0.246; n.s.). Since zero was contained in the 95 percent BCCI confidence intervals [LLCI = -0.1832; ULCI = 0.0476], the results do not support H6.

4.4. Post-hoc analysis

Though we did not hypothesize the moderating effect of negative affect in the relationship between SPA and academic performance, we conducted post-hoc analysis. The results reveal that the interaction coefficient (β SPA x Negative Affect = 0.180; $t = 2.76$; $p < 0.01$). The results, based on 20,000 bootstrap samples, show that the 95% Boot LLCI (0.0506) and Boot ULCI (0.3096) shows significant values (as zero is not contained in the Lower and Upper limits), thus supporting the moderating effect of negative affect. The interactions model is significant and explains 20% variance in academic performance [$R^2 = 0.20$; F (3,94) = 7.83; $p < 0.001$]. The interaction effect is shown in Fig. 4.

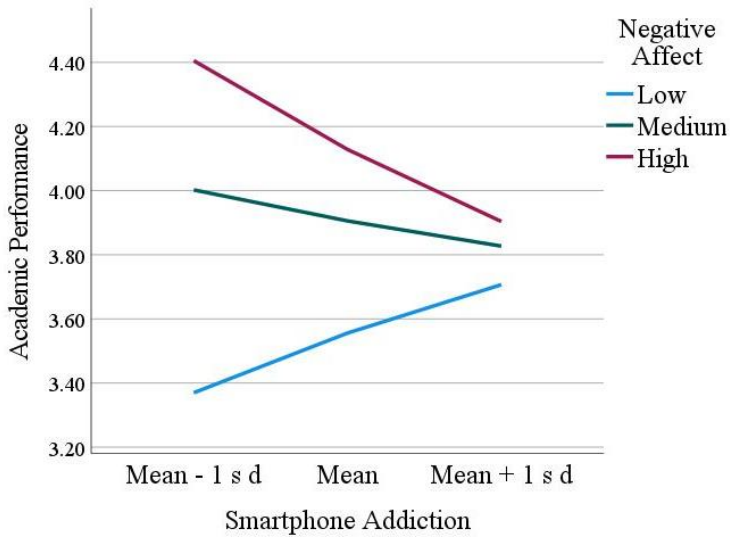


Fig.4. Negative affect moderates the relationship between smartphone addiction and academic performance

As shown in Fig. 4, when the negative affect is high, academic performance falls significantly with increase in SPA whereas academic performance increases when negative affect is low. The moderating effect of negative affect in the relationship between SPA and academic performance is supported.

5. Discussion

This study is a modest attempt to develop a conceptual model and test the hypotheses using Hayes (2018) PROCESS macros.

The results indicate that the FOMO by students in educational institutions has a negative impact on academic performance (Hypothesis 1), which is consistent with the findings from the literature (Malik et al., 2020; Milyavskaya et al., 2018). When individuals get addicted to social networking and use smartphones as a device because of their portability, a stage comes when they feel that they miss out on something significant by not engaging in conversation, it is more likely that they shy away from academic work. Our findings also suggest that FOMO is positively related to SPA (Hypothesis 2), which confirms the results from the majority of the studies (Rozgonjuk et al., 2019). Results also support the negative impact of SPA on academic performance (Hypothesis 3) (Raza et al., 2020).

As individuals differ in their emotional states, we tested the effect of their enthusiasm, determination, interest, and alertness, which indicate Positive affect, and perception of the benefits of a smartphone for academic purposes. This study found that Positive affect positively predicts academic performance (Hypothesis 4). As expected, Negative affect, seen in terms of fear, anxiety, nervousness, and distress, has affected students' academic performance (Hypothesis 5). The finding concurs with the results from previous studies (Grant et al., 2019; Wang et al., 2009).

As far as moderators are concerned, the results support that obstacle associated with smartphone use intensified the negative effect of SPA on academic performance

(Hypothesis 3a). Since no prior studies are available to vouch for this result, the intuitive logic and expected negative association of smartphone obstacles with academic performance. Most importantly, this study supports the role of Positive affect in reducing the negative impact of SPA and smartphone obstacles on academic performance (Hypothesis 3b). Our findings support the hypotheses derived from the conceptual model presented in Fig. 1.

5.1. Theoretical implications

The results from this study have several implications for the literature on smartphone use by the younger generation in general and students in particular. First, the results extend the growing literature on FOMO, which has become a universal phenomenon (Tandon et al., 2021). Students' enormous growth in smartphone use in educational institutions plays a valuable role in academic performance, and excessive use may result in psychopathological outcomes. Unless restricted or self-regulated, continuous use of smartphones for all the activities may eventually make the individuals addicted, resulting in dysfunctional consequences. Second, continued use of smartphones inculcates FOMO, which gives rise to SPA. This study contributes to the growing body of literature on SPA by corroborating early scholars' previous findings and conceptual frameworks (Turgeman et al., 2020). Second, the results suggest that Positive affect has a positive impact and Negative affect hurts academic performance, adding to the existing literature on students' organizational psychology and smartphone addiction.

Third, the recent shift from in-class to web-based teaching-learning resulted in using smartphones by students to complete their projects and assignments, download study materials, and attend lectures. This rapid shift has enabled the students to engage in learning but, at the same time, has resulted in obstacles caused by smartphone use. Especially in developing countries (India), unstable internet connection, periodical power shortages, and incompatible smartphone models have adversely affected academic performance. The result that smartphone obstacles (moderator) intensify the negative impact of SPA on academic performance is a significant contribution to the literature on smartphone addiction and internet use.

Fourth, this study explored the moderating role of Positive affect (second moderator) in influencing the relationship between smartphone obstacles (first moderator) and SPA on academic performance. The support for moderated moderated-mediation, showing three-way interaction, which has been explored for the first time, to the best of our knowledge, is a significant contribution to the literature on FOMO and smartphone use. Finally, the conceptual model showing the complex play of interrelationships between the variables is a novel idea that previous researchers have not investigated.

5.2. Practical implications

The present research has several implications for individuals who continuously use smartphones for several activities. From students' viewpoint, while the smartphone is beneficial, the students make optimum use that contributes to academic excellence. First, excessive use of smartphones may gradually result in FOMO, and unregulated and uncontrolled use of smartphones for multifarious activities may result in psychopathological dysfunction or addiction. This study, therefore, suggests practicing abstinence from the use of smartphones. As some researchers have found a positive association between excessive smartphone use, a form of behavioral addiction, and social anxiety, sudden withdrawal or abstinence from smartphone use may result in depression,

fear, and psychological dissatisfaction. It is, therefore, suggested that individuals do not drag themselves to the point of no return from excessive smartphone use. Second, as Positive affect plays a vital role in reducing the ill-effects of SPA on outcomes, the individuals should exercise excitement, interest, dedication, and determination to make productive use of smartphones. At the same time, as Negative affect has undesirable outcomes, it is suggested that the individuals engage in intervention mechanisms to reduce the negative psychological-emotional state represented by Negative affect.

Apart from the students using a smartphone for academic purposes, the individuals, in general, need to be cautious of the perils of over-dependence on smartphones for conducting their transactions before it takes shape in the form of behavioral addiction, i. e. SPA. When school children use smartphones, parental neglect is essential to prevent them from getting addicted to them. Some recent studies revealed the dangers of parental neglect on the children resulting in dysfunctional consequences in terms of welfare and academic performance (Balasubramanian & Parayitam, 2022; Chidambaram et al., 2023).

We reiterate that students who access smartphones for academic purposes deviate and navigate into other activities, and the addiction starts there. In a recent study, it was found that time spent on different apps on the internet leads to addiction (Balasubramanian & Parayitam, 2023). Access educational materials in gadgets like a laptop desktop computer or a specifically designed device that only include learning management system (LMS) portals, not any other social media apps. To avoid SPA it is recommended that teachers can provide printed materials and books instead of sharing notes in WhatsApp groups, and institutions can make bolder decisions like no smartphones on campus. They can access desktop computers or laptops/college digital library for academic purposes. To sum up, this study cautions the users of smartphones for several activities to restrain from getting addicted to them to avoid harmful consequences.

5.3. Limitations

We need to acknowledge the limitations of this study. First, the conceptual model is tested in the context of India's developing country, and the results from this study can be generalizable across comparable developing countries with similar infrastructure. Second, the small sample may restrict the generalizability, though the survey instrument vouches for internal validity and reliability. However, our literature review revealed that most studies were conducted in experimental settings and involved small samples. In that way, the model is comparable to another research. Third, the focus of this study was on students in educational institutions, though all the people have used smartphones. The latest statistics reveal that over 15 billion smartphones are used worldwide, more than double the population, indicating that several individuals have more than one smartphone. The rapid technological development and digitalization have resulted in mushrooming growth of smartphone users for performing multifarious activities: texting, communicating, listening to music, educational purposes, e-buying, e-banking, and engaging in transactions related to credit cards, etc. Our study focused primarily on the impact of smartphone use in academic settings and ignored many other areas.

Another significant limitation of this study is that respondents' personality traits were not included. Some researchers documented that personality types or traits would influence the effect of FOMO on SPA (Blackwell et al., 2017). We suggest that future researchers see the effect of personality traits on SPA.

5.4. Future research

This study provides several avenues for future research. First, as Tandon et al. (2021) pointed out, the research on FOMO has been fragmented. There is a need to focus on studies related to understudied areas such as Asia and South Africa, where the growth of smartphone users has been phenomenal. Our research was in the same direction, and we identified only a limited number of variables. It is suggested that future studies may involve additional variables: reliability of the information provided by individuals interacting on social media. These days, even fake news is spread on social media, and individuals spend an enormous amount of time visiting various social media platforms through smartphones. Future studies may include investigating the relationship between loneliness, boredom, family relations, personality factors, and FOMO and smartphone addiction.

Further, as smartphones are used as a communication tool, often, individuals get connected to the internet, leading to internet addiction. It would be interesting to identify the impact of social currency on smartphone addiction. Social currency is emerging as an important area of research in social media, where individuals attempt to exchange information with others in social media, advocate for others, and get identification with groups. Future studies may also involve cross-country comparisons of relationships between FOMO and academic performance.

5.5. Conclusion

Smartphone users have increased astronomical over the last decade, and the smartphone has emerged as a top-notch technological innovation embraced by many worldwide. Smartphones have become an essential part of every individual and throwing a small stone at random into the air falls on an individual owning and using a smartphone. Researchers have explored both the bright and dark sides of smartphone use and found merits and demerits. On the positive side, researchers emphasized the utility of smartphones in academic settings, healthcare, conducting electronic business transactions, and providing entertainment. On the dark side, excessive use of smartphones leads to a psychopathological disorder called smartphone addiction, which is closely related to internet addiction. The present study unfolded the boundary conditions of smartphone use and highlighted the importance of Positive affect in reducing the ill-effects of FOMO on academic performance. Adding to the growing body of knowledge on internet addiction and FOMO, this study concludes that unless the smartphone is used optimally, individuals become addicted to the compulsory use of smartphones. It would be in the interest of individuals using smartphones to draw a line so that it does not lead to psychological and physiological disorders arising from addiction. From students' viewpoint in educational institutions, it would be ideal to use smartphones primarily for academic purposes rather than for non-academic purposes. Finally, overdependence on smartphones eventually gives rise to FOMO further carries into the maladaptive application of the device. We conclude that this study provides insights into understanding the ways to mitigate or reduce the ill effects of smartphone addiction by students in educational institutions.

Author Statement

The authors declare that there is no conflict of interest.

Acknowledgements

The authors would like to thank Professor Maggie M. Wang, the Editor-in-Chief and the anonymous reviewers for their constructive suggestions to the earlier versions of the manuscript.

ORCID

Nidhya Balasubramanian https://orcid.org/0000-0002-6007-8155
Satyanarayana Parayitam https://orcid.org/0000-0001-5565-4413

References

Alwraikat, M. A. (2017). Smartphones as a new paradigm in higher education overcoming obstacles. *International Journal of Interactive Mobile Technologies (iJIM)*, *11*(4), 114–135. https://doi.org/10.3991/ijim.v11i4.6759

Baert, S., Vujic, S., Amez, S., Claeskens, M., Daman, T., Maeckelberghe, A., Omey, E., & De Marez, L. (2020). Smartphone use and academic performance: Correlation or causal relationship? *Kyklos: Jahrbuch Des Instituts Für Geschichte Der Medizin an Der Universität Leipzig*, *73*(1), 22–46. https://doi.org/10.1111/kykl.12214

Balasubramanian, N., & Parayitam, S. (2023). Antecedents and consequences of internet addiction among school and college students: Evidence from India. *Global Knowledge, Memory and Communication*, 72(8/9), 813–834. https://doi.org/10.1108/GKMC-12-2021-0211

Beland, L. P., & Murphy, R. (2016). Ill communication: Technology, distraction & student performance. *Labour Economics*, *41*, 61–76. https://doi.org/10.1016/j.labeco.2016.04.004

Bidin, S., & Ziden, A. A. (2013). Adoption and application of mobile learning in the education industry. *Procedia - Social and Behavioral Sciences*, *90*, 720–729. https://doi.org/10.1016/j.sbspro.2013.07.145

Blackwell, D., Leaman, C., Tramposch, R., Osborne, C., & Liss, M. (2017). Extraversion, neuroticism, attachment style and fear of missing out as predictors of social media use and addiction. *Personality and Individual Differences*, *116*(1), 69–72. https://doi.org/10.1016/j.paid.2017.04.039

Brunborg, G. S., Mentzoni, R. A., Molde, H., Myrseth, H., Skouverøe, K. J. M., Bjorvatn, B., & Pallesen, S. (2011). The relationship between media use in the bedroom, sleep habits and symptoms of insomnia: Media use in the bedroom and sleep. *Journal of Sleep Research*, *20*(4), 569–575. https://doi.org/10.1111/j.1365-2869.2011.00913.x

Bugeja, M. J. (2007). Distractions in the wireless classroom. *The Chronicle of Higher Education*, *53*(21), C1–C4.

Cano, E. V. (2012). Mobile learning with twitter to improve linguistic competence at secondary schools. *New Educational Review*, *29*(3), 134–147.

Chen, J., Liang, Y., Mai, C., Zhong, X., & Qu, C. (2016). General deficit in inhibitory control of excessive smartphone users: Evidence from an event-related potential study. *Frontiers in Psychology*, *7*: 511. https://doi.org/10.3389/fpsyg.2016.00511

Chidambaram, V., Shanmugam, K., & Parayitam, S. (2023). Parental neglect and emotional wellbeing among adolescent students from india: Social network addiction as a mediator and gender as a moderator. *Behaviour & Information Technology*, *42*(7), 869–887. https://doi.org/10.1080/0144929X.2022.2046164

Cho, S., & Lee, E. (2015). Development of a brief instrument to measure smartphone

addiction among nursing students. *CIN: Computers, Informatics, Nursing*, *33*(5), 216–224. https://doi.org/10.1097/CIN.0000000000000132

Dai, C., Tai, Z., & Ni, S. (2021). Smartphone use and psychological well-being among college students in China: A qualitative assessment. *Frontiers in Psychology*, *12*: 708970. https://doi.org/10.3389/fpsyg.2021.708970

Darko-Adjei, N. (2019). The use of effect of smartphones in students' learning activities: Evidence from the university of Ghana, Legon. *Library philosophy and Practice*, 1–37.

Deci, E. L., & Ryan, R. M. (1985). *Intrinsic motivation and self-determination in human behavior*. Plenum Press.

Dhir, A., Kaur, P., Chen, S., & Pallesen, S. (2019). Antecedents and consequences of social media fatigue. *International Journal of Information Management*, *48*(1), 193–202. https://doi.org/10.1016/j.ijinfomgt.2019.05.021

Dietz, S., & Henrich, C. (2014). Texting as a distraction to learning in college students. *Computers in Human Behavior*, *36*, 163–167. https://doi.org/10.1016/j.chb.2014.03.045

Dossey, L. (2014). FOMO, digital dementia, and our dangerous experiment. *Explorations*, *10*(2), 69–73.

D'Souza, G. S., Irudayasamy, F. G., & Parayitam, S. (2023). Emotional exhaustion, emotional intelligence and task performance of employees in educational institutions during COVID 19 global pandemic: A moderated-mediation model. *Personnel Review*, *52*(3), 539–572. https://doi.org/10.1108/PR-03-2021-0215

Duke, É., & Montag, C. (2017). Smartphone addiction, daily interruptions and self-reported productivity. *Addictive Behaviors Reports*, *6*, 90–95. https://doi.org/10.1016/j.abrep.2017.07.002

Eide, T. A., Aarestad, S. H., Andreassen, C. S., Bilder, R. M., & Pallesen, S. (2018). Smartphone restriction and its effect on subjective withdrawal related scores. *Frontiers in Psychology*, *9*: 1444. https://doi.org/10.3389/fpsyg.2018.01444

Ejubovic, A., & Puska, A. (2019). Impact of self-regulated learning on academic performance and satisfaction of students in the online environment. *Knowledge Management & E-Learning*, *11*(3), 345–363. https://doi.org/10.34105/j.kmel.2019.11.018

Elhai, J. D., Gallinari, E. F., Rozgonjuk, D., & Yang, H. (2020). Depression, anxiety and fear of missing out as correlates of social, non-social and problematic smartphone use. *Addictive Behaviors*, *105*: 106335. https://doi.org/10.1016/j.addbeh.2020.106335

Ellis, Y., Daniels, B., & Jauregui, A. (2011). The effect of multitasking on the grade performance of business students. *Research in Higher Education Journal*, *8*(1): 10499.

Emerson, L. C., & Berge, Z. L. (2018). Microlearning: Knowledge management applications and competency-based training in the workplace. *Knowledge Management & E-Learning*, *10*(2), 125–132. https://doi.org/10.34105/j.kmel.2018.10.008

Felisoni, D. D., & Godoi, A. S. (2018). Cell phone usage and academic performance: An experiment. *Computers & Education*, *117*, 175–187. https://doi.org/10.1016/j.compedu.2017.10.006

Fjeldsoe, B. S., Marshall, A. L., & Miller, Y. D. (2009). Behavior change interventions delivered by mobile telephone short-message service. *American Journal of Preventive Medicine*, *36*(2), 165–173. https://doi.org/10.1016/j.amepre.2008.09.040

Gerosa, T., Gui, M., & Büchi, M. (2022). Smartphone use and academic performance: A pervasiveness approach beyond addiction. *Social Science Computer Review*, *40*(6), 1542–1561. https://doi.org/10.1177/08944393211018969

Goel, P., Parayitam, S., Sharma, A., Rana, N. P., & Dwivedi, Y. K. (2022). A moderated mediation model for e-impulse buying tendency, customer satisfaction and intention

to continue e-shopping. *Journal of Business Research*, *142*, 1–16. https://doi.org/10.1016/j.jbusres.2021.12.041

Gopal, R., Singh, V., & Aggarwal, A. (2021). Impact of online classes on the satisfaction and performance of students during the pandemic period of COVID 19. *Education and Information Technologies*, *26*(6), 6923–6947. https://doi.org/10.1007/s10639-021-10523-1

Grant, J. E., Lust, K., & Chamberlain, S. R. (2019). Problematic smartphone use associated with greater alcohol consumption, mental health issues, poorer academic performance, and impulsivity. *Journal of Behavioral Addiction*, *8*(2), 335–342. https://doi.org/10.1556/2006.8.2019.32

Hadlington, L., & Scase, M. O. (2018). End-user frustrations and failures in digital technology: Exploring the role of fear of missing out, Internet addiction and personality. *Heliyon*, *4*(11): e00872. https://doi.org/10.1016/j.heliyon.2018.e00872

Harris, A., & Cooper, M. (2019). Mobile phones: Impacts, challenges, and predictions. *Human Behavior and Emerging Technologies*, *1*(1), 15–17. https://doi.org/10.1002/hbe2.112

Harris, B., Regan, T., Schueler, J., & Fields, S. A. (2020). Problematic mobile phone and smartphone use scales: A systematic review. *Frontiers in Psychology*, *11*: 672. https://doi.org/10.3389/fpsyg.2020.00672

Hato, B.(2013). *Compulsive mobile phone checking behavior out of a fear of missing out: Development, psychometric properties and test-retest reliability of a C-FoMO-scale*. Master's thesis, Tilburg University, Netherlands.

Hayes, A. F. (2018). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. The Guilford Press.

Holte, A. J., & Ferraro, F. R. (2020). Anxious, bored, and (maybe) missing out: Evaluation of anxiety attachment, boredom proneness, and fear of missing out (FoMO). *Computers in Human Behavior*, *112*: 106465. https://doi.org/10.1016/j.chb.2020.106465

Hong, E. N. C., Hao, L. Z., Kumar, R., Ramendran, C., & Kadiresan, V. (2012). An effectiveness of human resource management practices on employee retention in institute of higher learning: A regression analysis. *International Journal of Business Research and Management*, *3*(2), 60–79.

Hossain, M. E., & Ahmed, S. M. Z. (2016). Academic use of smartphones by university students: A developing country perspective. *The Electronic Library*, *34*(4), 651–665. https://doi.org/10.1108/EL-07-2015-0112

Ifeanyi, I. P., & Chukwuere, J. E. (2018). The impact of using smartphones on the academic performance of undergraduate students. *Knowledge Management & E-Learning*, *10*(3), 290–308. https://doi.org/10.34105/j.kmel.2018.10.017

Jacobsen, W. C., & Forste, R. (2011). The wired generation: Academic and social outcomes of electronic media use among university students. *Cyberpsychology, Behavior, and Social Networking*, *14*(5), 275–280. https://doi.org/10.1089/cyber.2010.0135

Junco, R., & Cotten, S. R. (2011). Perceived academic effects of instant messaging use. *Computers & Education*, *56*(2), 370–378. https://doi.org/10.1016/j.compedu.2010.08.020

Kibona, L., & Mgaya, G. (2015). Smartphones' effects on academic performance of higher learning students. A case of ruaha catholic university – Iringa, Tanzania. *Journal of Multidisciplinary Engineering Science and Technology*, *2*(4), 777–784.

Kim, H. J., Min, J. Y., Kim, H. J., & Min, K. B. (2019). Association between psychological and self-assessed health status and smartphone overuse among Korean college students. *Journal of Mental Health*, *28*(1), 11–16.

https://doi.org/10.1080/09638237.2017.1370641
Kim, S. J., & Byrne, S. (2011). Conceptualizing personal web usage in work contexts: A preliminary framework. *Computers in Human Behavior*, *27*(6), 2271–2283. https://doi.org/10.1016/j.chb.2011.07.006
Kock, N. (2015). Common method bias in PLS-SEM: A full collinearity assessment approach. *International Journal of E-Collaboration*, *11*(1), 1–10. https://doi.org/10.4018/ijec.2015100101
Lau, W. W. F. (2017). Effects of social media usage and social media multitasking on the academic performance of university students. *Computers in Human Behavior*, *68*, 286–291. https://doi.org/10.1016/j.chb.2016.11.043
Lee, E. B. (2014). Facebook use and texting among African American and Hispanic teenagers: An implication for academic performance. *Journal of Black Studies*, *45*(2), 83–101. https://doi.org/10.1177/0021934713519819
Lee, H.-K., Kim, J.-H., Fava, M., Mischoulon, D., Park, J.-H., Shim, E.-J., Lee, E.-H., Lee, J. H., & Jeon, H. J. (2017). Development and validation study of the smartphone overuse screening questionnaire. *Psychiatry Research*, *257*, 352–357. https://doi.org/10.1016/j.psychres.2017.07.074
Lee, J., Cho, B., Kim, Y., & Noh, J. (2015). Smartphone addiction in university students and its implication for learning. In G. Chen, V. Kumar, Kinshuk, R. Huang, & S. C. Kong (Eds.), *Emerging Issues in Smart Learning* (pp. 297–305). Springer.
Lei, L. Y.-C., Ismail, M. A.-A., Mohammad, J. A.-M., & Yusoff, M. S. B. (2020). The relationship of smartphone addiction with psychological distress and neuroticism among university medical students. *BMC Psychology*, *8*(1): 97. https://doi.org/10.1186/s40359-020-00466-6
Lemay, D. J., Doleck, T., & Bazelais, P. (2019). Self-determination, loneliness, fear of missing out, and academic performance. *Knowledge Management & E-Learning*, *11*(4), 485–496. https://doi.org/10.34105/j.kmel.2019.11.025
Lepp, A., Barkley, J. E., & Karpinski, A. C. (2015). The relationship between cell phone use and academic performance in a sample of U.S. college students. *SAGE Open*, *5*(1): 215824401557316. https://doi.org/10.1177/2158244015573169
Li, J., Lepp, A., & Barkley, J. E. (2015). Locus of control and cell phone use: Implications for sleep quality, academic performance, and subjective well-being. *Computers in Human Behavior*, *52*, 450–457. https://doi.org/10.1016/j.chb.2015.06.021
Lin, Y., Liu, Y., Fan, W., Tuunainen, V. K., & Deng, S. (2021). Revisiting the relationship between smartphone use and academic performance: A large-scale study. *Computers in Human Behavior*, *122*: 106835. https://doi.org/10.1016/j.chb.2021.106835
Longnecker, E. M. (2017). *The relationship between smartphone use, symptoms of depression, symptoms of anxiety, and academic performance in college students*. Master's thesis, Iowa State University, USA.
Malik, A., Dhir, A., Kaur, P., & Johri, A. (2020). Correlates of social media fatigue and academic performance decrement: A large cross-sectional study. *Information Technology & People*, *34*(2), 557–580. https://doi.org/10.1108/ITP-06-2019-0289
Maqableh, M., Jaradat, M., & Azzam, A. (2021). Exploring the determinants of students' academic performance at university level: The mediating role of internet usage continuance intention. *Education and Information Technologies*, *26*(4), 4003–4025. https://doi.org/10.1007/s10639-021-10453-y
Milyavskaya, M., Saffran, M., Hope, N., & Koestner, R. (2018). Fear of missing out: Prevalence, dynamics, and consequences of experiencing FOMO. *Motivation and Emotion*, *42*(5), 725–737. https://doi.org/10.1007/s11031-018-9683-5
Mokoena, S. (2012). *Smartphones and regular cellular phones: Assessing their impact on*

students' education at the university of Zululand. Doctoral dissertation, University of Zululand, South Africa.

Montgomery, D. C., Peck, E. A., & Vining, G. G. (2012). *Introduction to linear regression analysis*. Wiley.

Nayak, J. K. (2018). Relationship among smartphone usage, addiction, academic performance and the moderating role of gender: A study of higher education students in India. *Computers & Education*, *123*, 164–173. https://doi.org/10.1016/j.compedu.2018.05.007

Ng, S. F., Hassan, N. S. I. C.,Nor, N. H. M., Malek, N. A. A. (2017). The relationship between smartphone use and academic performance: A case of students in a malaysian tertiary institution. *Malaysian Online Journal of Educational Technology*, *5*(4), 58–70.

Norries, C., Hossain, A., & Soloway, E. (2011). Using smartphones as essential tools for learning: A call to place schools on the right side of the 21st century. *Educational Technology*, *51*(3), 18–25.

O'Dea, S. (2021). *Forecast number of mobile devices worldwide from 2020 to 2025 (in billions)*. Statista. Retrieved from https://www.statista.com/statistics/245501/multiple-mobile-device-ownership-worldwide/

Panova, T., Carbonell, X., Chamarro, A., & Puerta-Cortés, D. X. (2020). Specific smartphone uses and how they relate to anxiety and depression in university students: A cross-cultural perspective. *Behaviour & Information Technology*, *39*(9), 944–956. https://doi.org/10.1080/0144929X.2019.1633405

Payne, K. F. B., Wharrad, H., & Watts, K. (2012). Smartphone and medical related app use among medical students and junior doctors in the United Kingdom (UK): A regional survey. *BMC Medical Informatics and Decision Making*, *12*: 121. https://doi.org/10.1186/1472-6947-12-121

Podsakoff, P., Mackenzie, S., Lee, J., & Podsakoff, N. (2003). Common method biases in behavioral research: A critical review of the literature and recommended remedies. *Journal of Applied Psychology*, *88*(5), 879–903. https://doi.org/10.1037/0021-9010.88.5.879

Pressman, S. D., & Cohen, S. (2005). Does positive affect influence health? *Psychological Bulletin*, *131*(6), 925–971. https://doi.org/10.1037/0033-2909.131.6.925

Przybylski, A. K., Murayama, K., DeHaan, C. R., & Gladwell, V. (2013). Motivational, emotional, and behavioral correlates of fear of missing out. *Computer Human Behavior*, *29*(4), 1841–1848. https://doi.org/10.1016/j.chb.2013.02.014

Pullen, D., J-F, J.-F., Swabey, K., Abadooz, M., & Sing, T. (2015). Malaysian university students' use of mobile phones for study. *Australian Educational Computing*, *30*(1): 4.

Qutishat, M., & Sharour, L. A. (2019). Relationship between fear of missing out and academic performance among Omani university students: A descriptive correlation study. *Oman Medical Journal*, *34*(5), 404–410. https://doi.org/10.5001/omj.2019.75

Raza, S. A., Yousufi, S. Q., Rafi, S. M. T., & Javaid, S. T. (2020). Impact of smartphone addiction on students' academic achievement in higher education institute of Pakistan. *Journal of Education & Social Sciences*, *8*(1): 2. https://doi.org/10.20547/jess0812008101

Rimfeld, K., Malanchini, M., Krapohl, E., Hannigan, L. J., Dale, P. S., & Plomin, R. (2018). The stability of educational achievement across school years is largely explained by genetic factors. *Npj Science of Learning*, *3*(1): 16. https://doi.org/10.1038/s41539-018-0030-0

Rozgonjuk, D., Elhai, J. D., Ryan, T., & Scott, G. G. (2019). Fear of missing out is associated with disrupted activities from receiving smartphone notifications and

surface learning in college students. *Computers & Education*, *140*: 103590. https://doi.org/10.1016/j.compedu.2019.05.016

Sahu, M., Gandhi, S., & Sharma, M. K. (2019). Mobile phone addiction among children and adolescents: A systematic review. *Journal of Addictions Nursing*, *30*(4), 261–268. https://doi.org/10.1097/JAN.0000000000000309

Salo, J., Mantymaki, M., & Islam, A. K. M. N. (2018). The dark side of social media – and fifty shades of grey introduction to the special issue: The dark side of social media. *Internet Research*, *28*(5), 1166–1168. https://doi.org/10.1108/IntR-10-2018-442

Samaha, M., & Hawi, N. S. (2016). Relationships among smartphone addiction, stress, academic performance, and satisfaction with life. *Computers in Human Behavior*, *57*, 321–325. https://doi.org/10.1016/j.chb.2015.12.045

Sanmartín, R., Inglés, C. J., Vicent, M., Gonzálvez, C., Díaz-Herrero, Á., & García-Fernández, J. M. (2018). Positive and negative affect as predictors of social functioning in Spanish children. *PLOS ONE*, *13*(8): e0201698. https://doi.org/10.1371/journal.pone.0201698

Sari, V. D. A. (2019). Z generation towards the use of smartphone application for listening activities in blended-learning. *Research and Innovation in Language Learning*, *2*(3), 196–206.

Seo, D. G., Park, Y., Kim, M. K., & Park, J. (2016). Mobile phone dependency and its impacts on adolescents' social and academic behaviors. *Computers in Human Behavior*, *63*, 282–292. https://doi.org/10.1016/j.chb.2016.05.026

Sha, L., Looi, C. -K., Chen, W., & Zhang, B. H. (2012). Understanding mobile learning from the perspective of self-regulated learning. *Journl of Computer Assisted Learning*, *28*(4), 366–378. https://doi.org/10.1111/j.1365-2729.2011.00461.x

Shakoor, F., Fakhar, A., & Abbas, J. (2021). Impact of smartphones usage on the learning behaviour and academic performance of students: Empirical evidence from Pakistan. *International Journal of Academic Research in Business and Social Sciences*, *11*(2), 862–881. https://doi.org/10.6007/IJARBSS/v11-i2/8902

Shambare, R., Rugimbana, R., & Zhowa, T. (2012). Are mobile phones the 21st century addiction? *African Journal of Business Management*, *6*(2), 573–577.

Singh, A., Patel, A. K., & Parayitam, S. (2022). The relationship between functional theory of attitudes and purchase intention of counterfeit luxury sunglasses: A moderated moderated-mediation conditional model. *Journal of Global Fashion Marketing*, *13*(4), 304–327. https://doi.org/10.1080/20932685.2022.2061554

Spindler, H., Denollet, J., Kruse, C., & Pedersen, S. S. (2009). Positive affect and negative affect correlate differently with distress and health-related quality of life in patients with cardiac conditions: Validation of the danish global mood scale. *Journal of Psychosomatic Research*, *67*(1), 57–65. https://doi.org/10.1016/j.jpsychores.2008.11.003

Sunday, O. J., Adesope, O. O., & Maarhuis, P. L. (2021). The effects of smartphone addiction on learning: A meta-analysis. *Computers in Human Behavior Reports*, *4*: 100114. https://doi.org/10.1016/j.chbr.2021.100114

Tagoe, M., & Abakah, E. (2014). Determining distance education students' readiness for mobile learning at university of Ghana using the theory of planned behavior. *International Journal of Education and Development Using Information and Communication Technology*, *10*(1), 91–106.

Talsma, K., Schüz, B., & Norris, K. (2019). Miscalibration of self-efficacy and academic performance: Self-efficacy ≠ self-fulfilling prophecy. *Learning and Individual Differences*, *69*, 182–195. https://doi.org/10.1016/j.lindif.2018.11.002

Tandon, A., Dhir, A., Almugren, I., AlNemer, G. N., & Mäntymäki, M. (2021). Fear of missing out (FoMO) among social media users: A systematic literature review,

synthesis and framework for future research. *Internet Research*, *31*(3), 782–821. https://doi.org/10.1108/INTR-11-2019-0455

Tessier, J. (2013). Student impressions of academic cell phone use in the classroom. *Journal of College Science Teaching*, *43*(1), 25–29.

Tossell, C., Kortum, P., Shepard, C., Rahmati, A., & Zhong, L. (2015). Exploring smartphone addiction: Insights from long-term telemetric behavioral measures. *International Journal of Interactive Mobile Technologies*, *9*(2), 37–43. https://doi.org/10.3991/ijim.v9i2.4300

Tsui, A. S., Ashford, S. J., Clair, L., & Xin, K. R. (1995). Dealing with discrepant expectations: Response strategies and managerial effectiveness. *Academy of Management Journal*, *38*(6), 1515–1543.

Tulenko, K., & Bailey, R. (2013). Evaluation of spaced education as a learning methodology for in-service training of health workers in Ethiopia. *Knowledge Management & E-Learning*, *5*(3), 223–233. https://doi.org/10.34105/j.kmel.2013.05.016

Tuncay, N. (2016). Smartphones as tools for distance education. *Journal of Educational and Instructional Studies in the World*, *6*(2), 20–30.

Turgeman, L., Hefner, I., Bazon, M., Yehoshua, O., & Weinstein, A. (2020). Studies on the relationship between social anxiety and excessive smartphone use and on the effects of abstinence and sensation seeking on excessive smartphone use. *International Journal of Environmental Research and Public Health*, *17*: 1262. https://doi.org/10.3390/ijerph17041262

Turkle, S. (2011). *Alone together: Why we expect more from technology and less from each other*. Basic Books.

Vahedi, Z., & Saiphoo, A. (2018). The association between smartphone use, stress, and anxiety: A meta-analytic review. *Stress & Health*, *34*(3), 347–358. https://doi.org/10.1002/smi.2805

Valk, J. H., Rashid, A. T., & Elder, L. (2010). Using mobile phones to improve educational outcomes: An analysis of evidence from asia. *The International Review of Research in Open and Distributed Learning*, *11*(1), 117–140. https://doi.org/10.19173/irrodl.v11i1.794

Von Stumm, S., Smith-Woolley, E., Ayorech, Z., McMillan, A., Rimfeld, K., Dale, P. S., & Plomin, R. (2020). Predicting educational achievement from genomic measures and socioeconomic status. *Developmental Science*, *23*(3): e12925. https://doi.org/10.1111/desc.12925

Waite, B. M., Lindberg, R., Ernst, B., Bowman, L. L., & Levine, L. E. (2018). Off-task multitasking, note-taking and lower-and higher-order classroom learning. *Computers & Education*, *120*, 98–111. https://doi.org/10.1016/j.compedu.2018.01.007

Wang, M., Shen, R., Novak, D., & Pan, X. (2009). The impact of mobile learning on students' learning behaviours and performance: Report from a large blended classroom. *British Journal of Educational Technology*, *40*(4), 673–695. https://doi.org/10.1111/j.1467-8535.2008.00846.x

Wang, P., Xie, X., Wang, X., Wang, X., Zhao, F., Chu, X., Nie, J., & Lei, L. (2018). The need to belong and adolescent authentic self-presentation on SNSs: A moderated mediation model involving FoMO and perceived social support. *Personality and Individual Differences*, *128*, 133–138. https://doi.org/10.1016/j.paid.2018.02.035

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology*, *54*(6), 1063–1070. https://doi.org/10.1037/0022-3514.54.6.1063

Wei, F.-Y. F., & Wang, Y. K. (2010). Students' silent messages: Can teacher verbal and

nonverbal immediacy moderate student use of text messaging in class? *Communication Education*, *59*(4), 475–496. https://doi.org/10.1080/03634523.2010.496092

Wilcockson, T. D. W., Osborne, A. M., & Ellis, D. A. (2019). Digital detox: The effect of smartphone abstinence on mood, anxiety, and craving. *Addictive Behaviors*, *99*: 106013. https://doi.org/10.1016/j.addbeh.2019.06.002

Wilson, K. L., Lizzio, A., & Ramsden, P. (1997). The development, validation and application of the course experience questionnaire. *Studies in Higher Education*, *22*(1), 33–53. https://doi.org/10.1080/03075079712331381121

Wolniewicz, C. A., Rozgonjuk, D., & Elhai, J. D. (2020). Boredom proneness and fear of missing out mediate relations between depression and anxiety with problematic smartphone use. *Human Behavior and Emerging Technologies*, *2*(1), 61–70. https://doi.org/10.1002/hbe2.159

Yildiz Durak, H. (2019). Investigation of nomophobia and smartphone addiction predictors among adolescents in turkey: Demographic variables and academic performance. *The Social Science Journal*, *56*(4), 492–517. https://doi.org/10.1016/j.soscij.2018.09.003

Appendix I

FOMO statements (Hato, 2013)
I feel anxious
I get nervous
I fear I will miss out on something
I worry that I might have missed something
I get nervous that I might be missing out on something important
I feel anxious that I might miss a text, call, mail or update etc.
I feel anxious that I might miss a reason see to my text, call, mail or update etc.
I worry that I might miss social updates
I feel anxious that I might be unavailable for a friend or family member who needs me
I worry I may will miss out on fun events
I get nervous that I might miss updates from my friends
I worry I might miss out on funny things happening with my friends
I feel anxious that I might miss a question from a friend (or family)
I worry that my friends might be interacting without me
I worry that I might miss a social invitation
I fear that I might miss a call, text, or other form of message from a family member who's in trouble
I get nervous that I might miss a call, text, or other form of message from a friend or family member who needs me
I am afraid that I might not be available for a friend who urgently needs to contact me
I am afraid that I might not be available for a family member who urgently needs to contact me
I worry I will miss out on important sports news (e.g., new records, achievements, scandals, etc.)
I worry I will miss out on important news
I get nervous that I might be missing out on something important
I feel anxious that I might miss a text, call, mail or update etc.
I feel anxious that I might miss a reason see to my text, call, mail or update etc.
I am afraid that I am left out

Smart Phone Withdrawal Scale (Eide et al., 2018)
I feel depressed right now
My morale is low here and now
I feel worried right now
I feel anxious right now
The only thing I can think about right now is using my smartphone
I miss my smartphone terribly in this moment
I feel an irresistible need to use my smartphone right now
I would like to hold my smartphone in my hand right now
I am irritable right now
I get angry easily in this moment
I have no patience right now
I feel nervous right now
It is difficult to think clearly right now
It is hard to concentrate right now
It is hard to focus on the task at hand right now

Positive and Negative Affect (Watson et al., 1988)

Positive Affect:
Interested, Excited, Strong, Enthusiastic, Proud, Alert, Attentive, Active, Inspired, Determined
Negative Affect:
Distressed Upset Guilty Scared Hostile Irritable Ashamed Nervous Jittery Afraid

Smartphone Obstacles (Noah, 2019)
I fear that I won't have proper internet connectivity for my online classes
The smartphone screen and key sizes makes learning uncomfortable
I fear that smartphone sometimes do not support smartphone browsing
I fear that my smartphone freeze during important learning moments.
I fear that intruding calls may come in during learning
I worry that I cannot access smartphone during power cut
I fear that without WIFI, I cannot access course information online
I worry if I don't have access to Internet

Academic Performance (Noah, 2019)
My Smart phone helps me in improving my academic performance
I use smart phone to complete my assignments that helped me improving my performance
I get above average marks in my classes
The PPT of lectures downloaded into my smart phone helps me in academic performance
Smart phone helps me improving my ability to understand material
I feel confident because the smart phone I use is dependable