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ORIGINAL ARTICLE

The Impact of Smartphone Addiction, Phubbing, and Fear of Missing Out on Social Co-operation and Life Satisfaction Among University Students

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Abstract
The pervasive use of digital devices has profoundly impacted social relationships and interpersonal interactions. The present study explored the associations between the fear of missing out (FoMO), smartphone addiction (SPA), and phubbing with social cooperation and life satisfaction. The associations between FoMO, SPA, phubbing, social cooperation, and life satisfaction were examined within the self-determination theory framework among university students in Türkiye. The study was conducted among 640 university students in Türkiye, which is relevant given the importance that collectivist cultures place on social connectedness and face-to-face interactions. Using structural equation modeling, the study found strong positive relationships between FoMO, SPA, and phubbing. The study specifically hypothesized and found that FoMO correlated with increased phubbing via SPA, which was associated with disrupted face-to-face interactions. The results also showed that phubbing negatively correlated with social cooperation and life satisfaction, indicating a weaker link between these two factors. Moreover, social cooperation was strongly associated with life satisfaction, highlighting the importance of social cooperation for individual life satisfaction. The findings suggest that promoting social activities and face-to-face interactions may help mitigate the associations between phubbing, SPA, and their potential adverse outcomes.

Keywords Smartphone addiction · Phubbing · Fear of missing out · Social co-operation · Life satisfaction

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Digitalization has profoundly affected the internet and mobile devices worldwide (Boczkowski et al., 2021). In 2023, internet users worldwide reached 5.4 billion, corresponding to 67% of the world's population (International Telecommunication Union—ITU, 2023). Moreover, there are 4.76 billion social media users globally, accounting for nearly 60% of the world's population (DataReportal, 2023).

Digitalization has caused new behavioral patterns in individuals' social relationships. Using smartphones in environments where individuals spend time together is associated with perceived lower social relationship quality (Kırcaburun et al., 2020). Young people are significantly affected by digitalization, which can have significant psychological and social consequences (Korte, 2020; Perez-Escolar & Canet, 2023; Zhang & Han, 2023). In its most problematic form, excessive smartphone use may lead to what some have termed 'smartphone addiction' (Kuem et al., 2021).

The widespread use of social media platforms (arguably the most used smartphone applications) appears to be closely associated with the prevalence of smartphone addiction (SPA), which has become a significant issue in the study of interpersonal relationships (Kuss & Griffiths, 2017). Repetitive and pleasurable smartphone-related behaviors can gradually lead to addictive tendencies among a minority of individuals (Kato et al., 2023). One notable consequence of SPA is the emergence of a behavior known as 'phubbing'. Short for 'phone snubbing', phubbing prioritizes smartphone use over direct, in-person interactions, often neglecting those physically present (Sun & Yoon, 2023; Zarate et al., 2023). This behavior highlights the potential social and relational costs of excessive smartphone use (Chotpitayasunondh & Douglas, 2018; Duradoni et al., 2023; Karadağ et al., 2015). This behavior, strongly associated with SPA, has become a critical issue in social relationships. Studies indicate that phubbing is associated with reduced face-to-face communication, interpersonal trust, and cooperation (Knausenberger et al., 2022; Pesch et al., 2024).

Fear of missing out (FoMO), common among university students, refers to the anxiety of missing out on social media activities and is associated with increased phubbing (Eitan & Gazit, 2023; Talan et al., 2024). FoMO can drive excessive smartphone use, diminishing face-to-face interactions and reducing life satisfaction (Soraci et al., 2025). It reflects a fear of missing out on rewarding experiences and can lead to a compulsive need to stay connected (Zhang & Han, 2023). Research has shown a strong association between FoMO and SPA (Tufan et al., 2024). Studies confirm that those with high FoMO use smartphones excessively, especially for social media and gaming (Karadağ et al., 2015). This behavior can lead to 'phubbing', where individuals neglect their social surroundings for their smartphones, weakening relationships (Fang et al., 2020; Franchina et al., 2018). Additionally, FoMO has been associated with negative psychological effects such as stress, anxiety, and depression, causing lower satisfaction because individuals focus on potential missed activities, further impacting life satisfaction (Balta et al., 2020; Karadağ et al., 2015; Kircaburun et al., 2020; Roberts & David, 2016).

Previous studies have examined the associations between FoMO, smartphone addiction, and phubbing. Elhai et al. (2016) investigated the association between smartphone use and FoMO, as well as the association between smartphone use and anxiety/depression levels among labor market employees in the USA ($N = 303$). They found that elevated FoMO among employees was associated with SPA. FoMO has been found to correlate with heightened symptoms of anxiety and depression. In their literature review, Elhai et al. (2021) noted a positive association between FoMO and SPA, indicating that SPA was associated with a heightened desire to be online and increased phubbing among individuals. Balta et al. (2020) examined the relationships between neuroticism, FoMO, and phubbing

among university students in Türkiye (N= 628) and the mediating role of smartphone addiction in these relationships. They found that neuroticism was associated with higher levels of FoMO and that smartphone addiction was associated with greater phubbing. Bajwa et al. (2023) studied how FoMO relates to smartphone addiction and phubbing in a collectivistic culture, focusing on university students in Pakistan. (N= 794). Bajwa et al. (2023) found that loneliness increased smartphone addiction and phubbing by enhancing individuals' tendency to seek digital interaction.

Although empirical studies have reported the mediating role of smartphone addiction between FoMO and phubbing, research on this specific mediating relationship remains limited. For example, Franchina et al. (2018) conducted a study among Flemish teenagers in Belgium (i.e., in an individualistic culture) (N= 2663), providing preliminary evidence supporting SPA's potential mediating role. Therefore, the present cross-sectional study examined whether SPA mediated the relationship between FoMO and phubbing to provide a better understanding of how smartphone use relates to individuals' social cooperation and life satisfaction, contributing significantly to the literature.

On the other hand, FoMO is negatively associated with social cooperation (Sultan, 2021). While social cooperation allows individuals to establish harmonious and supportive interactions, it is an important variable because it also plays a decisive role in life satisfaction (Deci & Ryan, 2008; Dong et al., 2023; Xu & Choi, 2023). The present study also examined the relationship between FoMO and social cooperation and the mediating role of phubbing in this relationship. Investigating this relationship is necessary to understand the factors underlying the adverse effects of FoMO on social cooperation. The literature shows that phubbing negatively affects interpersonal relationships and social bonds (Maftei & Măirean, 2023; Sun & Samp, 2022). As far as the present authors are aware, no previous study has examined the direct or indirect relationships between FoMO and SC. Because phubbing is negatively associated with social bonds and life satisfaction and interrupts social interactions due to individuals using their smartphones (Dwyer et al., 2018; Kılıman et al., 2024; Tarigan et al., 2024), FoMO may mediate the relationship between phubbing and social cooperation. A better understanding of FoMO's role and the negative interaction with social collaboration would contribute to explaining this relationship, which is currently missing in the extant literature.

Some recent studies have examined how FoMO interacts with individuals' life satisfaction through phubbing. In a study with university students, Gao et al. (2023) reported that FoMO, often observed in excessive smartphone use, was associated with increased phubbing and perceptions of lower life satisfaction among Chinese college students (N= 1032). Other studies conducted with university students have shown that FoMO is associated with the need to constantly stay up-to-date with social media activities and peers' online posts, and this appears to reduce individuals' life satisfaction by triggering phubbing (Eitan & Gazit, 2023; Wang et al., 2023a, b). These findings in the literature confirm the mediating role of FoMO on life satisfaction through phubbing and show that this relationship has significant social consequences, as was reported in a study among young adults in Türkiye (N= 423) (Balta et al., 2020).

Türkiye's unique cultural and geographical position as a bridge between Eastern and Western values provides a distinctive perspective for studies examining social cooperation. Collectivist cultures are not exclusive to Türkiye. For instance, extensive research on SPA has been conducted in some Asian countries with collectivist cultures. However, Türkiye's uniqueness stems from its role as a bridge between Eastern and Western cultures, making it an ideal context for examining the universal aspects of collectivist cultures within a distinct socio-cultural framework. Türkiye's socio-cultural structure differs from other collectivist

cultures by offering a dynamic interplay of modernization and traditional values. While previous studies have primarily focused on the general consequences of these interactions (Elhai et al., 2016; Kuss & Griffiths, 2017; Przybylski et al., 2013), the present study provides novel and detailed insights into the adverse effects of FoMO and SPA in relation to social cooperation.

In the present study, the relationship between social cooperation and life satisfaction was interpreted within a collectivist cultural context, emphasizing the theoretical influence of this context due to the higher value placed on social cooperation. Therefore, the present study contributes to the literature by elaborating on the negative interactions of FoMO, SPA, and phubbing in interpersonal relationships, particularly in the context of university students. The findings fill a critical gap in the literature by enhancing understanding of the relationships between behaviors such as FoMO, phubbing, SPA, individuals' social cooperation, and life satisfaction. Moreover, the present study examined the relationships between FoMO, SPA, and phubbing, as well as their interactions with social cooperation and life satisfaction, from the perspective of self-determination theory (SDT) (Eitan & Gazit, 2023; Przybylski et al., 2013). More specifically, it explored the associations between FoMO, SPA, phubbing, social cooperation, and life satisfaction within a holistic model.

FoMO, Smartphone Addiction, Phubbing, Social Cooperation, and Life Satisfaction

Because SDT is concerned with how the satisfaction of individuals' psychological needs affects their motivation (Duradoni et al., 2023), it is a suitable theory for explaining the relationships between FoMO, SPA, phubbing, social cooperation, and life satisfaction. Ryan and Deci (2000) argue that SDT seriously impacts individuals' behaviors and life satisfaction while meeting basic psychological needs such as autonomy, competence, and relatedness. Przybylski et al. (2013) asserted that FoMO is associated with individuals' difficulties fulfilling their relatedness needs. In this context, FoMO may be indirectly linked to SPA by increasing individuals' use of social media.

It has been suggested that FoMO is associated with individuals' increased need to stay online, which may coincide with reduced face-to-face interaction and behaviors such as phubbing in environments where individuals come together (Bajwa et al., 2023; Talan et al., 2024). Chotpitayasunondh and Douglas (2016) explain phubbing as a situation in which individuals try to satisfy their social relationships and belonging needs through smartphone use. They state that individuals who phub meet their social relationship and belonging needs through digital environments rather than face-to-face interactions, weakening the quality of social relationships. It has also been stated that individuals' social cooperation and life satisfaction are positively associated with satisfying their relatedness needs (Deci & Ryan, 2008; Gao et al., 2023). In this respect, SDT provides a solid theoretical basis for understanding the complex relationships between the variables used in the present study.

From the SDT perspective, FoMO, a concept related to the need for relatedness, is associated with individuals' anxiety about missing things going on in their social environment (Bacaksız et al., 2023; Li et al., 2022). If individuals cannot meet their social relationship needs, their stress and anxiety levels may increase (Gupta & Sharma, 2021). In order to meet their unmet social relationship needs, individuals tend to spend more time on social media applications, and the easiest way to access these platforms is through smartphones

(Fabris et al., 2024). Therefore, participating in social media platforms becomes critical for individuals with FoMO (Tandon et al., 2022). The effort to meet social relationship needs in virtual environments is associated with negative emotional states such as stress and anxiety, and may coincide with the development of SPA among individuals (Abu Khait et al., 2024; Barreda-Ángeles & Hartmann, 2022).

The literature suggests that FoMO is associated with higher levels of SPA (Paul et al., 2024; Safdar Bajwa et al., 2023; Servidio, 2021; Talan et al., 2024; Tandon et al., 2022). Moreover, studies suggest that FoMO is associated with higher levels of phubbing and is negatively related to social interactions between individuals (Bajwa et al., 2023; Li et al., 2022; Talan et al., 2024). Additionally, some research has shown that SPA mediates the association between phubbing and FoMO (Elhai et al., 2020; Franchina et al., 2018). Elhai et al. (2021) reported that FoMO had a positive and significant relationship with SPA. They also reported that because SPA appears to increase the need for individuals to be online on social media platforms, it leads to an increase in phubbing by creating some negative situations, such as distraction in face-to-face interactions. Servidio (2021) reported that FoMO is associated with social media addiction and SPA, which may increase phubbing (N= 277). Servidio's (2021) study was critical in confirming the mediating role of SPA between FoMO and phubbing. According to Franchina et al. (2018), SPA associated with FoMO was associated with individuals directing their attention to their smartphones during face-to-face interactions, which was associated with phubbing (N= 405). The findings suggest that SPA may play a significant role in the relationship between FoMO and phubbing.

Because phubbing is associated with weaker social relationships in individuals' real lives, it is also associated with lower levels of life satisfaction (Çikrikçi et al., 2019; Sun & Wong, 2024) because individuals' need for social relationships and belonging will not be adequately met (Kardefelt-Winther, 2014). In their study of Facebook users, Błachnio and Przepiórka (2018) showed that low levels of FoMO were negatively related to life satisfaction. It has also been reported that phubbing is associated with poorer social relationships and lower perceived life satisfaction (Parmaksız, 2021; Sun & Wong, 2024). Indeed, Parmaksız (2021) found that phubbing had a negative association with life satisfaction and a positive association with depression symptoms among adults in Türkiye (N= 756). Therefore, it was hypothesized that FoMO would be negatively associated with life satisfaction through phubbing (see study hypotheses below). Likewise, from the SDT perspective, considering that FoMO's failure to meet individuals' basic psychological needs may weaken the social bond and cooperation between individuals, it was hypothesized that the adverse effects mediated by phubbing may occur similarly on social cooperation (see study hypotheses below).

FoMO appears to be associated with reduced face-to-face interactions and perceived relationship quality, alongside higher dependence on social media platforms through smartphones (Li et al., 2022; Sultan, 2021). It may also decrease the capacity for social cooperation (Li et al., 2022; Sultan, 2021). Social cooperation depends on trust, mutual interaction, and the quality of relationships (Czernek-Marszałek et al., 2023). FoMO requires individuals to be constantly present in the digital environment with the fear of missing out at any moment. This increases the tendency to put online interactions ahead of face-to-face interactions in social relationships (Harrison-Walker & Mead, 2024; Przybylski et al., 2013). Some studies have reported an association between FoMO and increased phubbing, which, in turn, appears to correlate with weaker social relationships. (Gao et al., 2023; Li et al., 2023; Paul et al., 2024). Solid relationships and the quality of interaction between individuals are essential for social cooperation (Lin et al., 2023).

Based on SDT and empirical studies, it was hypothesized that (i) fear of missing out would be positively associated with SPA (H_1); (ii) fear of missing out would be positively associated with phubbing (H_2); (iii) fear of missing out would be positively associated with social cooperation (H_3); (iv) SPA would be positively associated with phubbing (H_4); (v) phubbing would be negatively associated with social cooperation (H_5); (vi) SPA would be negatively associated with life satisfaction (H_6); (vii) phubbing would be negatively associated with life satisfaction (H_7); (viii) social cooperation would be positively associated with life satisfaction, and (ix) SPA (H_{8a}), phubbing (H_{8b}), and social cooperation (H_{8c}) would mediate the relationship between fear of missing out and life satisfaction.

Method

Ethics

Approval for the study was obtained through the first author's university Social and Human Sciences Ethics Committee (Protocol code: 535; Approval date: December 6, 2023). Participants provided their written informed consent and were told their participation was voluntary. It was emphasized that they could decline or withdraw at any time.

Participants and Procedure

Participants were students recruited from a public university for several reasons. University students are highly engaged with technology, particularly smartphones, and often experience FoMO, phubbing, and SPA (Bajwa et al., 2023), as well as experiencing higher levels of FoMO, phubbing, and SPA (Fang et al., 2020; Li et al., 2022; Liu & Ma, 2020). Students were selected using a convenience sample to observe the effects of these variables. This demographic is also ideal for investigating these factors because students maintain active social lives and place high importance on relationship satisfaction. Their diverse backgrounds also contribute to the study's relevance. Finally, existing literature on similar studies (Bajwa et al., 2023; Liu & Ma, 2020; Sun & Wong, 2024) allows for meaningful comparisons, enriching the understanding of FoMO, phubbing, SPA, social cooperation, and life satisfaction.

The authors distributed a 'pen-and-paper' survey to students in the public university classroom at the Faculty of Economics and Administrative Sciences to collect the data. Data were gathered through surveys administered to students throughout the course, with collection occurring at its conclusion. The total student population at the time of the study was 4043. During the data collection phase, 1312 students were enrolled in the course. Surveys were completed by 643 students who opted to participate in the research. However, 23 participants did not pass the attention checks leading to the exclusion of their responses (i.e., there was an item which said *"I think the prophecies in 'The Simpsons' are true"*. Participants were asked to select the option *"I do not agree"* in response to this item. Those who did not select this option were removed from the analysis). Consequently, the final sample comprised 640 participants, yielding a response rate of 49%. Among these participants, 54.7% identified as female and 45.3% as male. Age distribution showed that 55.6% were aged between 21 and 24 years, 37.3% were aged 17 to 20 years, and 7.1% were 25 years or older. Regarding academic standing, 28.9% were first-year students, 13.6% were second-year students, 30.6% were third-year students, and 26.9% were

fourth-year students. The average daily internet use reported by participants was 4.14 h, with a standard deviation of 1.93.

Measures

The Fear of Missing Out Scale (FoMOS), initially developed by Przybylski et al. (2013) and later adapted by Wegmann et al. (2017), includes a Turkish version validated by Gokler et al. (2016) and was used to assess FoMO. The scale comprises two distinct subscales: trait FoMO and state FoMO. For the present study, only the state FoMO subscale was used, which consists of seven items rated using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). An example item from this subscale is *"I am continuously online to not miss out on anything."* The total scores on the scale range from 10 to 50, with higher scores reflecting a greater level of FoMO. The internal consistency of the subscale is the present study 0.86 (Cronbach's alpha).

The Smartphone Addiction Scale (SAS), developed by Kwon et al. (2013), and adapted into Turkish by Noyan et al. (2015), was used to assess SPA. The scale comprises ten items associated with a single factor, with responses rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). An example item from the scale is *"Feeling impatient and fretful when I am not holding my smartphone."* The total scores on the scale range from 10 to 50, with higher scores signifying an increased risk of SPA. The scale's internal consistency in the present study was 0.90 (Cronbach alpha).

The Phubbing Scale, developed by Karadağ et al. (2015) and later shortened by Stevic and Matthes (2023), was used to assess phubbing. The authors translated the shortened version into Turkish, adhering to the adaptation guidelines established by Hambleton and Patsula (1999). The scale comprises six items rated on a five-point Likert scale (1 = strongly disagree, and 5 = strongly agree). An example item is *"My eyes start wandering on my phone when I am together with others."* The total scores on the scale range from 6 to 30, with higher scores indicating a greater tendency towards phubbing. The internal consistency of the scale in the present study was 89 (Cronbach's alpha).

The six-item Social Cooperation Scale (SCS) developed by Stibe and Cugelman (2019) has a single-factor structure and was used to assess social cooperation. The authors translated the scale into Turkish, adhering to the adaptation guidelines established by Hambleton and Patsula (1999). More specifically, the authors translated the original scale into Turkish, and two different linguistic experts separately conducted a back-translation. The original and back-translated versions were then compared by the authors to identify inconsistencies. This process continued until inconsistencies were eliminated. Following this, two domain-specific experts ensured both linguistic accuracy and contextual relevance. Pilot testing was then conducted with 25 academics from management disciplines to assess clarity, consistency, and cultural appropriateness.

The six items are: (1) *"I do not like to collaborate with people (reverse coded)"*, (2) *"I enjoy collaborating with people"*, (3) *"I like to co-create with others"*, (4) *"I like to build things with other people"*, (5) *"I avoid invitations to collaborate with people"* (reverse coded), and (6) *"I enjoy working with other people, rather than working alone."* Items are rated on a five-point Likert scale (1 = never, 5 = always). The total scale scores range from 6 to 30, and higher scores indicate greater social cooperation. An exploratory factor analysis (EFA) was performed to assess the adapted scale using the principal components model and varimax rotation. The EFA results for the Turkish version indicated that six items accounted for 59.40% of the variance, reflecting a single dimension. All factor loadings

exceeded the critical threshold of 0.50, with values of 0.78, 0.83, 0.73, 0.73, and 0.70. The scale's internal consistency in the present study was 0.86 (Cronbach alpha).

The Satisfaction with Life Scale developed by Diener et al. (1985), and adapted into Turkish by Dagli and Baysal (2016), was used to assess life satisfaction. The scale comprises five items rated on a 5-point Likert scale (1 = totally disagree, 5 = totally agree). An example item is *"In most ways, my life is close to my ideal."* The total scores on the scale range from 5 to 25, and higher scores indicate greater life satisfaction. The scale's internal consistency in the present study was 0.83 (Cronbach alpha).

Data Analysis

The authors conducted a structural equation model (SEM) in AMOS 23.0 to test the model. Figure 1 shows the SEM model and results. The direct and indirect effects of the independent variable on mediators and the dependent variables were examined using maximum likelihood estimation. Five thousand bootstrap samples were applied to calculate confidence intervals for the mediation effect and perform significance testing.

The utilization of self-report instruments can lead to the emergence of common method bias. The common latent factor approach alongside the baseline model was implemented to address this concern. A comparative evaluation of the chi-square statistics for both the baseline and common latent factor models was performed. The baseline model typically represents a more straightforward structure, where observed variables are directly influenced by their respective factors or constructs without accounting for any potential commonality or shared variance. The common latent factor model introduces a common latent variable that captures the shared variance among the observed variables, allowing for a more nuanced understanding of the interplay between different constructs. The model aims

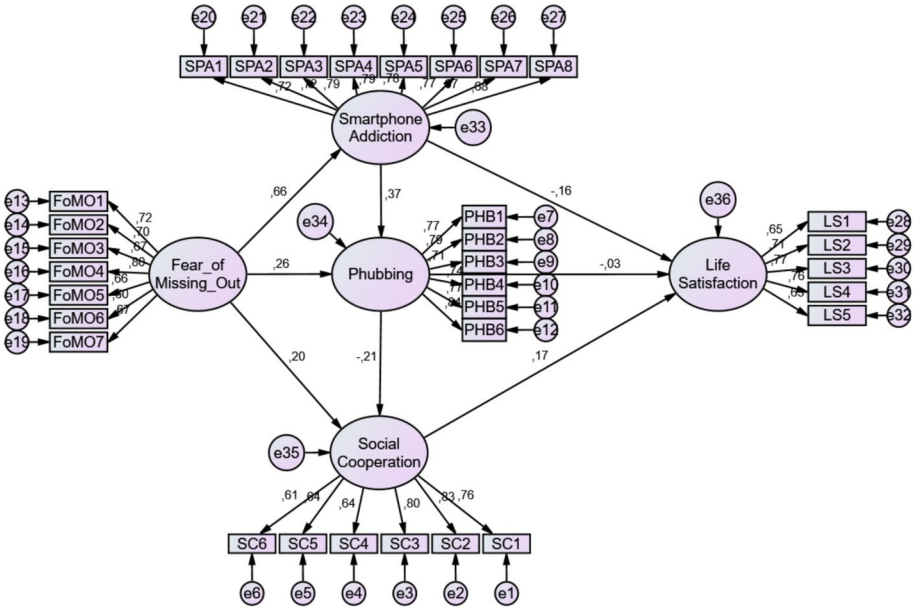

Fig. 1 SEM results

to control measurement error by including a common latent factor and providing a clearer picture of the relationships between constructs.

The results showed that the difference in chi-square values between the two models was not statistically significant, indicating that both of the models maintained invariance [$\Delta\chi^2$ (32) = 39.383, $p > 0.05$]. This chi-square difference indicated a minor discrepancy in model fit between the two models. The common factor did not significantly enhance the model fit nor provide sufficient improvement to justify its use over the simpler baseline model. This result suggests that common method bias did not substantially undermine the validity of the study's results.

Results

Measurement Model Validity and Reliability

The scale items' adherence to a normal distribution was assessed. The skewness (− 0.343 to 0.718) and kurtosis (− 0.528 to 0.409) values fell within the acceptable limits, as outlined by Sposito et al. (1983). To evaluate the convergent and discriminant validity of the measurement model, confirmatory factor analysis (CFA) was employed. The CFA results indicated that the factor loadings for all items ranged from 0.603 to 0.839. Table 1 presents the values for average variance extracted (AVE), composite reliability (CR), Cronbach's alpha, and maximum shared variance (MSV). Except for FoMO and LS, which were close to the threshold at 0.47 and 0.49, all other variables exhibited AVE values exceeding 0.50, confirming acceptable convergent validity for the measures. According to the Fornell and Larcker criterion (1981), the square root of each construct's AVE must surpass the correlations with other constructs. The analysis indicated that the AVE values were more significant than the MSV, thereby providing evidence of discriminant validity for the latent constructs. Additionally, both CR and Cronbach's alpha values, which exceeded 0.70, indicated the reliability of the scales utilized in the present study. The CFA results demonstrated that the measurement model achieved a good fit to the data ($\chi^2(454) = 1080.296$, $\chi^2/df = 2.380$, CFI = 0.937, SRMR = 0.042, RMSEA = 0.046, PClose = 0.948) (Hu & Bentler, 1999).

Correlational Analysis

Table 2 shows the variables' means, standard deviations, and correlations. FoMO had a significant positive correlation with SPA ($r = 0.72$, $p < 0.01$), phubbing ($r = 0.56$, $p < 0.01$), and social cooperation ($r = 0.10$, $p < 0.05$), and a significant negative correlation with life satisfaction ($r = -0.12$, $p < 0.01$). Additionally, SPA had a significant positive correlation with phubbing ($r = 0.58$, $p < 0.01$) and life satisfaction ($r = -0.20$, $p <$

Table 1 Composite reliability, average variance extracted, maximum shared variance, and Cronbach's alpha for each scale

Scale	CR	AVE	MSV	Cronbach alpha
Fear of Missing Out Scale	0.864	0.477	0.434	0.863
Smartphone Addiction Scale	0.907	0.549	0.434	0.907
Phubbing Scale	0.898	0.595	0.291	0.895
Social Cooperation Scale	0.863	0.515	0.032	0.861
Satisfaction With Life Scale	0.831	0.497	0.033	0.827

Table 2 The means, standard deviations, and correlation values between the study variables ($N = 640$)

	M	SD	Scale Score Range	Skewness/Kurtosis	1	2	3	4
1. Fear of missing out	2.31	0.70	10–50	0.47/− 0.17	-			
2. Smartphone addiction	2.26	0.77	10–50	0.39/− 0.52	0.72**	-		
3. Phubbing	2.02	0.69	6–30	0.71/0.11	0.56**	0.58**	-	
4. Social cooperation	3.09	0.63	6–30	− 0.34/0.40	0.10*	− 0.02	− 0.12**	-
5. Life satisfaction	2.17	0.59	5–25	− 0.03/− 0.22	− 0.12**	− 0.20**	− 0.16**	0.20**

* $p < 0.05$, ** $p < 0.01$ (two-tailed), skewness standard error = 0.09, kurtosis standard error = 0.19

0.01). Phubbing was significantly and negatively correlated with social cooperation ($r = -0.12$, $p < 0.01$) and LS ($r = -0.16$, $p < 0.01$), while social cooperation had a significant correlation with life satisfaction ($r = 0.20$, $p < 0.01$). Among the variables, only the mean score for social cooperation surpassed the midpoint of 3, whereas phubbing recorded the lowest mean value.

Structural Equation Modeling and Regression Analysis

To evaluate the study model illustrated in Fig. 1, a structural equation modeling (SEM) analysis was performed. The results of the SEM analysis demonstrated a satisfactory fit to the data ($\chi^2[456] = 1082.261$, $\chi^2/df = 2.373$, CFI = 0.937, SRMR = 0.042, RMSEA = 0.046, PClose = 0.954). These statistical indices suggested that the model accurately represented the underlying data characteristics. The findings of the SEM analysis are summarized in Table 3.

The analysis supported all hypotheses except for H_7. The direct effect of FoMO on SPA, phubbing, and social cooperation was significant. While the significant direct effect of SPA on phubbing was positive, life satisfaction was negative. Additionally, the direct impact of phubbing on social cooperation and social cooperation on life satisfaction was significant. Only phubbing's direct impact on life satisfaction was non-significant. The indirect effect of FoMO on phubbing via SPA and FoMO's indirect impact on social cooperation via phubbing were significant. FoMO's indirect effect on life satisfaction was negative and significant. Moreover, SPA's influence on social cooperation through phubbing, as well as phubbing's effect on life satisfaction through social cooperation, were significant, reinforcing the notion of partial mediation across all indirect effects.

Table 3 Results of the structural equation modeling

Path	Coefficient (β)	SE	*p*	95% CI
FoMO → SPA	0.657	0.033	0.002	[0.60, 0.70]
FoMO → Phubbing	0.262	0.066	0.001	[0.16, 0.37]
FoMO → SC	0.196	0.053	0.002	[0.11, 0.28]
SPA → Phubbing	0.368	0.062	0.002	[0.26, 0.46]
SPA → LS	− 0.158	0.059	0.004	[− 0.26, − 0.06]
Phubbing → SC	− 0.206	0.053	0.001	[− 0.30, − 0.12]
Phubbing → LS	− 0.034	0.058	0.615	[− 0.12, 0.06]
SC → LS	0.173	0.052	0.002	[0.09, 0.26]
FoMO → Phubbing (Indirect)	0.242	0.043	0.002	[0.17, 0.31]
FoMO → SC (Indirect)	− 0.104	0.028	0.001	[− 0.15, − 0.06]
FoMO → LS (Indirect)	− 0.105	0.035	0.004	[− 0.15, − 0.04]
SPA → SC (Indirect)	− 0.076	0.023	0.001	[− 0.12, − 0.04]
SPA → LS (Indirect)	− 0.026	0.022	0.211	[− 0.06, 0.01]
Phubbing → LS (Indirect)	− 0.036	0.014	0.001	[− 0.06, − 0.01]

FoMO = Fear of missing out, *SPA* = Smartphone addiction, *SC* = Social cooperation, *LS* = Life satisfaction

Discussion

The results of the present study highlighted the significant relationships between FoMO, SPA, phubbing, social cooperation, and life satisfaction. The positive association between FoMO and SPA aligned with prior research, suggesting that individuals prone to FoMO may use smartphones excessively to avoid missing out on social opportunities (Elhai et al., 2016). This finding reflects literature indicating that FoMO is associated with a higher tendency toward SPA, potentially associated with individuals' desire to maintain digital social relationships (Przybylski et al., 2013; Tandon et al., 2022). However, these relationships require further exploration to establish their broader implications.

The association between FoMO and phubbing indicated that the fear of missing out on online experiences related to individuals showing reduced engagement in face-to-face interactions. This finding supports prior studies suggesting that FoMO is associated with phubbing, which disrupt social interactions (Sun & Samp, 2022; Talan et al., 2024). Understanding these relationships could inform the development of interventions or strategies to reduce phubbing, providing practical applications for the study's findings.

While the present study provides insights into FoMO, SPA, and phubbing within Türkiye's collectivist culture, these findings may also hold relevance for individualist cultures. In such contexts, where autonomy is prioritized, FoMO's effects on social cooperation and life satisfaction could vary. Future research could explore whether these mechanisms operate similarly across cultural settings, thereby enhancing the generalizability of these findings and opening up new avenues for understanding and intervention.

Interestingly, FoMO was only weakly associated with social cooperation. Although FoMO may lead to greater social engagement (Sultan, 2021), negative influences such as SPA and phubbing are associated with diminished social interaction. Future research should explore how these negative influences offset potential positive associations between FoMO and social cooperation. Digital platforms, although convenient, might not adequately substitute for face-to-face interaction.

The strong association between SPA and phubbing suggests that individuals with higher levels of SPA tend to report higher levels of phubbing. Individuals with higher levels of SPA prioritize digital interactions over face-to-face ones, consistent with prior research (Elhai et al., 2020; Franchina et al., 2018). However, further research is needed to understand these nuanced relationships.

The negative association between phubbing and social cooperation suggests that phubbing is associated with weaker interpersonal relationships, lower trust, and reduced commitment. This finding aligns with studies indicating that phubbing disrupts social bonds (Roberts & David, 2016; Sun & Wong, 2024). Future research should investigate these relationships more deeply to clarify their broader implications.

The negative association between SPA and life satisfaction reflects prior research associating SPA with reduced well-being (Samaha & Hawi, 2016; Wang et al., 2023a, b). The positive relationship between social cooperation and life satisfaction demonstrates the importance of meaningful social interactions in enhancing life satisfaction (Deci & Ryan, 2008; Xu & Choi, 2023). These findings emphasize promoting social cooperation to improve well-being.

The proposed model was supported, although no significant relationship was found between phubbing and life satisfaction. While the direct association was not statistically significant, indirect relationships through social cooperation were substantial. Phubbing, by weakening social bonds, may contribute indirectly to reduced life satisfaction (Sun & Wong,

2024). This finding suggests that minimizing phubbing could mitigate its negative impact on overall well-being. Future studies should examine these mediating effects more thoroughly.

The indirect relationships between FoMO and life satisfaction through SPA and phubbing (H_9) highlight the complexity of these dynamics (Sun & Yoon, 2023; Wang et al., 2023a, b). FoMO was associated with increased SPA, which was associated with greater phubbing and diminished social cooperation. These associations highlight the potential value of exploring strategies to minimize FoMO and its related behaviors for fostering healthier social interactions. Future research could further delineate these pathways to develop targeted interventions.

Implications

The present study contributes to self-determination theory (SDT) by examining the relationships between FoMO, SPA, phubbing, social cooperation, and life satisfaction. The finding that FoMO was associated with higher susceptibility to SPA and that SPA was associated with phubbing provides new insights into the literature on digital behaviors (Elhai et al., 2016; Tugtekin et al., 2020). Additionally, the study highlighted the role of SPA as a mediator between FoMO and phubbing, providing further understanding of these complex interactions.

The study suggested that FoMO was associated with increased smartphone use and adverse social and psychological outcomes, such as lower life satisfaction, supporting the few previous studies (Parmaksız, 2021; Sun & Wong, 2024). Additionally, the present study examined both direct and indirect associations between FoMO and social cooperation, and found that phubbing was associated with diminished social bonds. This fills an important gap in the literature regarding the impact of digital behaviors on interpersonal relationships (Gao et al., 2023). The indirect associations between phubbing and life satisfaction through social cooperation highlight the relevance of understanding such mediating pathways (Sun & Wong, 2024).

The study employed the SDT framework to illustrate how FoMO, through SPA and phubbing, is associated with adverse outcomes for psychological health and social interactions. While social cooperation is associated with higher life satisfaction (Deci & Ryan, 2008), this association may be weakened by behaviors such as SPA and phubbing, providing valuable theoretical insights into the interplay between technology use and well-being. The findings highlight the role of cultural context, particularly in Türkiye's collectivist society, where social connectedness is associated with stronger potential links between social cooperation and life satisfaction. Based on this observation, future studies should explore similar dynamics in other cultural settings, offering a broader perspective on how cultural influences are associated with these relationships (Zhang & Han, 2023).

The present study's findings suggest potential strategies to address FoMO, SPA, and phubbing among university students. Digital literacy training may assist individuals in balancing smartphone use and preventing addictive behaviors (Tandon et al., 2022). Policies limiting smartphone use in educational and workplace settings may be associated with improved face-to-face interactions and stronger social cooperation. Community events promoting social engagement may improve interpersonal relationships and well-being (Xu & Choi, 2023).

Educational institutions might consider implementing workshops and curricula focusing on responsible digital device use and its associations with relationship dynamics. For instance, digital literacy programs could integrate case-based learning, where students

analyze real-world scenarios of smartphone overuse and its impact on relationships. The study also suggests that the associations between FoMO, SPA, and phubbing with social cooperation and life satisfaction may be more pronounced in collectivist societies such as Türkiye. Encouraging community-based activities may support greater social cooperation and perceived life satisfaction (Zhang & Han, 2023).

Limitations

The present study has several limitations that should be acknowledged. First, the study employed a cross-sectional design, assessing participants at a single point in time. This design inherently limits the ability to infer causal relationships or observe changes over time (Spector, 2019). Consequently, the results should be interpreted cautiously, as they only provide a snapshot of the studied variables without capturing potential temporal dynamics.

Second, the sample comprised volunteer students from the Faculty of Economics and Business Administration at a state university selected using convenience sampling. While this approach allowed for efficient data collection, it limits the generalizability of the findings to other student populations or broader demographic groups, both within and outside Türkiye (Henrich et al., 2010). The voluntary nature of participation may have also introduced self-selection bias, potentially favoring students who are more engaged or interested in the subject matter.

Third, the reliance on self-report data introduces potential biases, such as social desirability and recall biases. Participants may have underreported behaviors perceived as socially undesirable, such as excessive smartphone use or phubbing, or misremembered their average time spent on these activities. Despite efforts to mitigate common method bias, such as ensuring participant anonymity and emphasizing honest responses, these biases cannot be totally eliminated (Podsakoff et al., 2003).

Additionally, although adapting psychometric scales to the Turkish cultural context followed rigorous methodological guidelines, subtle cultural differences in how constructs are understood and interpreted may have influenced the findings. This limitation highlights the importance of cross-cultural validation studies to ensure the robustness and applicability of the scales used.

Moreover, the study did not account for external variables that could influence the relationships between FoMO, SPA, phubbing, social cooperation, and life satisfaction. Factors such as socioeconomic status, academic workload, or personality traits (e.g., neuroticism or extraversion) were not included, which could have provided a more comprehensive understanding of the studied phenomena.

Lastly, the study did not assess the potential moderating or mediating roles of other psychological constructs, such as anxiety, stress, or loneliness. The inclusion of such variables could further clarify the mechanisms underlying the observed relationships. Future research should consider incorporating these variables to provide a more nuanced understanding of the dynamics between the studied constructs.

In summary, while the present study provides valuable insights into the relationships between FoMO, SPA, phubbing, social cooperation, and life satisfaction, its limitations highlight the need for further research. Future studies employing longitudinal designs, diverse and representative samples, and more comprehensive variable inclusion are essential to build upon and validate these findings.

Future Research

Future investigations may consider the impact of various psychological factors, including self-esteem, anxiety, and feelings of loneliness, on the relationship between FoMO and SPA. Moreover, examining the moderating influences of personality characteristics, such as extraversion and neuroticism, gender, and age-related differences could yield significant insights into how individuals with diverse temperamental traits perceive the effects of FoMO on their smartphone use and social interactions. Future studies could also investigate how digital platforms may facilitate specific types of cooperation. Longitudinal research would also be useful in assessing the enduring consequences of SPA and phubbing on social cooperation and overall life satisfaction. Additionally, cross-cultural studies could investigate whether these dynamics vary across different cultures, particularly regarding the extent of smartphone use and prevailing social norms surrounding technology.

Conclusions

The present study highlighted the complex interrelationships between FoMO, SPA, phubbing, social cooperation, and life satisfaction. The significant correlations and indirect effects found suggest that FoMO serves as a crucial driver of SPA and phubbing, which, in turn, detrimentally impacts social cooperation and life satisfaction. Although SC appears to act as a buffer by improving life satisfaction, the pervasive influence of phubbing continues to harm social interactions and well-being. The findings highlight the importance of addressing FoMO and SPA through targeted interventions and raising awareness of the social costs associated with phubbing.

Authors Contributions All authors have participated in
(a) conception and design, analysis and interpretation of the data;
(b) drafting the article or revising it critically for important intellectual content;
(c) approval of the final version.

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Data Availability The data that support the findings of the present study are available from the corresponding author upon reasonable request.

Declarations

Informed Consent The study was approved through the Ethics Committee Decision (Protocol code: 535; Approval date: December 6, 2023) from the corresponding author's University Social and Human Sciences Research Ethics Committee. Participants provided their written informed consent and were told their participation was voluntary. It was emphasized that they could decline or withdraw at any time.

Consent to Participate All the authors of this work agree with the content and give their explicit consent to submit it.

Consent for Publication All the participants consented to submit findings for publication.

Conflicts of Interest We have no commercial or financial relationship to disclose. We have no known conflict of interest to disclose. This manuscript has not been submitted to, nor is under review at, another journal or other publishing venue.

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