Original Article

Toward an Integrated Framework for Examining the Addictive use of Smartphones among Young Adults

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Abstract

Introduction: Despite the growing concern over addictive smartphone use among young adults, there is a lack of understanding of the specific mechanisms underlying this phenomenon. This study aims to fill this gap by integrating the stimulus-organism-response–cognitive-adaptive-normative model to examine the drivers of habitual smartphone behavior and addictive use and the role of habitual behavior as a mediator. **Methods:** A quantitative method employing a purposive sampling technique was used to collect self-administered online questionnaires between May and August 2016 from 705 young adults (aged 17–30 years) in Malaysia. Partial least squares structural equation modeling was used. **Results:** Convenience (β =0.256, t = 5.993, $P < 0.001$), social needs (β =0.349, t = 8.661, $P < 0.001$), and social influence (β =0.108, t = 3.108, $P < 0.01$) are positively associated with habitual behavior. However, convenience (β =0.041, t = 0.997) and social needs (β = −0.027, t = 0.682) are not associated with addictive use, even though social influence (β =0.195, t = 5.116, $P < 0.001$) did significantly influenced addictive use. Furthermore, habitual behavior is an extremely strong determinant of addictive use (β =0.505, t = 13.837, $P < 0.001$). The results also indicated that habitual behavior partially mediated the relationship between the drivers and addictive use. **Conclusion:** This study emphasizes the importance of the drivers (i.e., convenience, social needs, and social influence) in shaping habitual behavior and addictive use so that policies can promote responsible and healthy smartphone use among young adults.

Keywords: *Addictive smartphone use, cognitive-adaptive-normative model, stimulus-organism-response framework, young adults*

Introduction

Smartphones have become an indispensable part of life, especially among young adults in Malaysia, who are among the most frequent users of these devices.[1] With 23.3 million Facebook users as of 2022, young adults make up 17.6% of total users, ranking Malaysia third in smartphone addiction among 24 countries.[2] Addictive smartphone use affects 69% of young adult users, with 48% reporting that they cannot stop using their devices for even 1 day.[2]

Excessive smartphone use among young adults can lead to addictive behavior, negatively impacting their social, psychological, and physical well-being.[3] This compulsive usage can decrease productivity,[4] mental health,[5] emotional feelings,[6] sleep disorders,[7] and academic performance.[8] Despite the growing literature on the drivers of these behaviors, their relationship with habitual behavior and addictive use among young adults is not fully explored. Therefore, the current study aims to address these gaps by integrating the stimulus-organism-response (SOR) framework and cognitive-adaptive-normative (CAN) model to explore the drivers of habitual smartphone behavior and addictive smartphone use and the role of habitual smartphone behavior as a mediator.

In this research, the SOR framework proposed by Mehrabian and Russell[9] explains how various stimuli, such as convenience, social needs, and social influence, can affect young adults' internal processes-habitual smartphone behavior (i.e., organism), leading to addictive smartphone use (i.e., response). As for the CAN model,[10] this study would be able to provide a comprehensive and deeper understanding of the underlying mechanism of addictive smartphone use, specifically how convenience, social needs, and social influence (i.e., the CAN drivers) influence both habitual smartphone behavior and addictive smartphone use among young

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adults. Hence, in the context of this study, the SOR-CAN framework has been integrated and applied.

This study focuses on the relationship between convenience, social needs, and social influence in predicting young adults' smartphone behaviors and usage. Convenience plays a crucial role as a cognitive driver in shaping habitual smartphone behavior and the development of addictive smartphone use. Young adults who perceive smartphones as convenient are likelier to engage in convenient behavior.[11] On the other hand, social needs are a determinant factor in the affective dimension of the integrated model, influencing young adults' habitual smartphone behavior and addictive use. Research has shown that young adults with social anxiety, loneliness, or lower self-esteem are likelier to become addicted to smartphones. Social influence is a critical factor in the normative dimension of the SOR-CAN integrated framework, affecting behavior and addictive smartphone use. Research has shown that individuals who perceive higher levels of social pressure to use their phones in specific ways are more likely to lead to habitual behavior and become addicted.[12] Habitual smartphone behavior, which refers to regular and automatic actions responding to situational cues,[13] can contribute to developing smartphone addiction among young adults.[13] A study found that habitual behavior was a significant mediator in the relationship between cognitive and affective factors and smartphone addiction.[14] Thus, this study's SOR-CAN framework suggests that habitual behavior (i.e., organism) can mediate the relationship between stimulus (such as convenience, social needs, and social influence) and response (such as addictive use).

Study hypothesis

Figure 1 depicts the research model with the following hypotheses: (H1a) convenience is positively associated with habitual smartphone behavior; (H1b) convenience is positively associated with addictive smartphone use; (H2a) social needs are positively associated with habitual smartphone behavior; (H2b) social needs are positively associated with addictive smartphone use; (H3a) social influence is positively associated with habitual smartphone behavior; (H3b) social influence is positively associated with addictive smartphone use; (H4) habitual smartphone behavior is positively associated with addictive smartphone use; (H5a) habitual smartphone behavior mediates the relationship between convenience and addictive smartphone use; (H5b) habitual smartphone behavior mediates the relationship between social needs and addictive smartphone use; and (H5c) habitual smartphone behavior mediates the relationship between social influence and addictive smartphone use. This study's objectives are threefold: (RO1) to determine the CAN drivers (i.e., convenience, social needs, and social influence) influencing young adults' habitual smartphone behavior; (RO2) to explore the

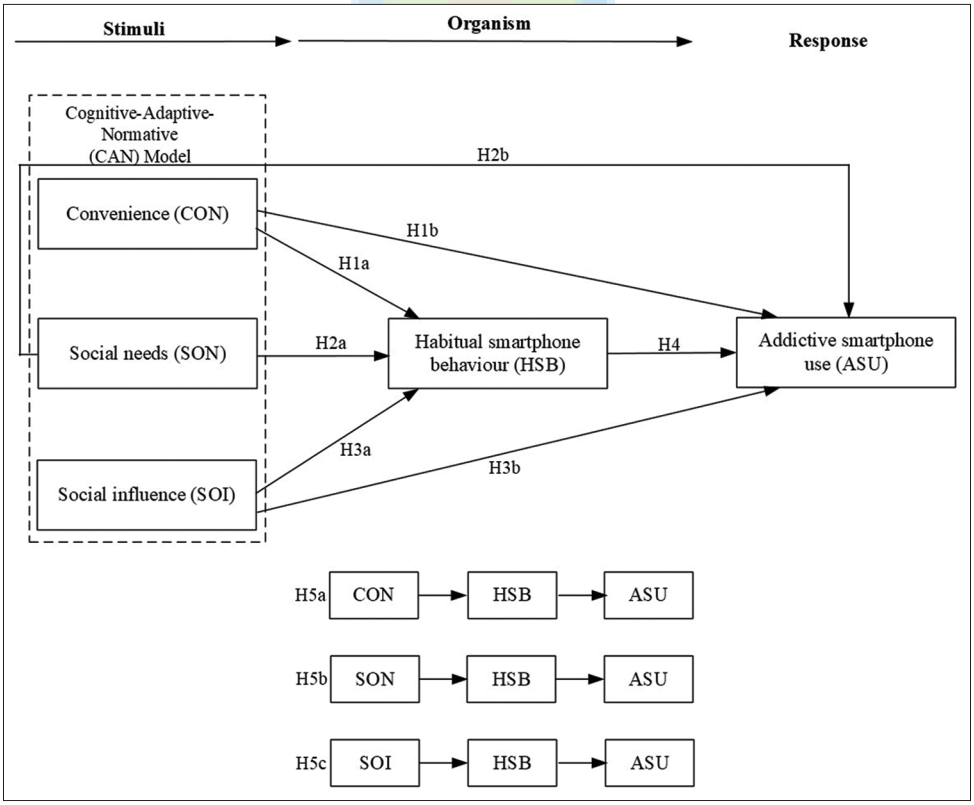

Figure 1: The stimulus-organism-response–cognitive-adaptive-normative research model developed for this study. CAN: Cognitive-adaptive-normative, SONs: Social needs, SOI: Social influence, CON: Convenience, HSB: Habitual smartphone behavior, ASU: Addictive smartphone use

CAN drivers (i.e., convenience, social needs, and social influence) affecting young adults' addictive smartphone use; and (RO3) to examine the mediating role of habitual smartphone behavior in the relationship between CAN drivers and addictive smartphone use among young adults by integrating the SOR framework.

Methods

Participants and setting

Young adults from Malaysia (aged 17–30 years) who own and use smartphones make up the targeted respondents. The data collection was conducted between May and August 2016. After excluding data that did not meet the screening criteria, 705 usable records were obtained.

Sample size estimation

Based on power analysis made using the G*Power software with the following settings: effect size (f^2) = 0.15 (medium), alpha (α) = 0.05, number of predictors = 3, and the power was set at 0.8, the current research model requires a minimum sample size of 77. As a result, this study's sample size, i.e., 705, was more than the estimated size required for partial least squares structural equation modeling (PLS-SEM).

Measures

The constructs in this study [see Table 1] were adapted from various pieces of literature and were measured by multiple items: convenience (CON) consisted of 5 items;[15] social needs (SON) consisted of 4 items;[16] social influence (SOI) is having 4 items;[17] habitual smartphone behavior (HSB) consists of 6 items;[18] and addictive smartphone obsession use consists of 4 items.[19] Altogether, 23 items were identified and rated in this study. A 7-point Likert-type scale was determined as "strongly agree (7)," "agree (6)," "slightly agree (5)," "neutral (4)," "slightly disagree (3)," "disagree (2)," and "strongly disagree (1)."

Procedures

In meeting the outlined research objectives (i.e., RO1, RO2, and RO3), a quantitative method using self-administered questionnaires was employed to collect data by utilizing the purposive sampling technique. This online survey method guarantees that the sample accurately reflects the population of interest and better comprehends the underlying origins of addictive smartphone usage among young adults (aged 17–30 years) in Malaysia. All the participants were from communities in Cyberjaya, Selangor, which is an important hub for Malaysia's Multimedia Super Corridor. Besides,

Table 1: Measurement model assessment

Construct	Item	Factor loading	CA	CR	AVE
EMI	EMI1: Using a smartphone would allow me to accomplish tasks more quickly	0.741	0.845	0.889	0.617
	EMI2: Using a smartphone helps save time	0.729			
	EMI3: I would prefer carrying my smartphone rather than my laptop	0.793			
	EMI4: Having a smartphone is like having a smartphone and a computer together	0.833			
	EMI5: A smartphone enables me to receive information anywhere I go	0.825			
SON	SON1: I use a smartphone to stay connected with friends and family through social networking sites (e.g., Facebook)	0.816	0.827	0.885	0.659
	SON2: It is easy for me to observe other's happenings (e.g., friend's activities) by using my smartphone	0.812			
	SON3: I use my smartphone to catch up with friends and relatives	0.849			
	SON4: My smartphone allows me to stay connected with those I care about	0.769			
SOI	SOI1: IT is important that my friends like the brand of smartphone I am using	0.707	0.813	0.877	0.641
	SOI2: The pressure from friends and family will likely influence my smartphone usage	0.817			
	SOI3: I would buy a smartphone if it helped me fit in with my social group better	0.829			
	SOI4: I would be susceptible (capable) to being persuaded into using a smartphone if I had low self-esteem	0.842			
HSB	HMB1: Smartphone usage is part of my daily routine (procedure)	0.812	0.918	0.937	0.714
	HMB2: Checking my smartphone is becoming a habit	0.884			
	HMB3: I use my smartphone automatically	0.892			
	HMB4: It is a habit to use my smartphone	0.909			
	HMB5: My smartphone is part of my life	0.846			
	HMB6: When I need to complete a certain task, I will use my smartphone since it is an obvious choice	0.710			
ASU	AMU1: I get agitated (stressed) when my smartphone is not in sight	0.796	0.861	0.905	0.706
	AMU2: I get nervous when my phone's battery is almost exhausted	0.798			
	AMU3: I spend more time than I should on my smartphone	0.886			
	AMU4: I find that I am spending more and more time on my smartphone	0.877			

EMI: Emotional instability, SON: Social needs, SOI: Social influence, HSB: Habitual smartphone behavior, ASU: Addictive smartphone use, CA: Cronbach's alpha, CR: Compositve reliability, AVE: Average variance extracted

they belong to a generation that has grown up with smartphones as pervasive technology and are more likely to use their phones in harmful ways.

Ethical considerations

The Ethics Committee of the Technology Transfer Office provided research ethical clearance (reference number: BA0132016) to conduct the survey. To safeguard respondents' confidentiality and to fully disclose the survey's objective, written consent was documented during data collection.

Common method bias

The study used two distinct methods to control common method bias (CMB). In the procedural method, two distinct treatments are used: (1) the measurement items were carefully reviewed before data collection to ensure that they were clear, concise, and detailed and that no confusing or vague terminology was included and (2) by expressly declaring that respondents' privacy was guaranteed at the outset of the survey.[20] As for the statistical approach, this study relied on three techniques: (1) the Harman single-factor test using exploratory factor analysis, resulting in a single factor accounting for 31.5% of the variance; (2) correlations between constructs were checked to ensure that they were below the advised values of 0.90, with results indicating no CMB impact on the questionnaire; and (3) a full collinearity test examined variance inflation factors (VIFs), revealing that no VIF values surpassed the cutoff value of 5. Overall, the test results confirmed that CMB did not pose a significant risk to the research.

Statistical analysis

Using SmartPLS 4, the two-stage model (i.e., measurement and structural models) in the PLS-SEM reporting procedure is presented.

Measurement model

From Table 1, the result shows that all of the indicator loadings meet the requirement of 0.7.[21] Loadings above 0.7 explain that a construct accounts for more than 50% of the variance in its indicators. Composite reliability ranged from 0.875 to 0.938, while the average variance extracted ranged from 0.615 to 0.734. These show that all measurement items and constructs are valid and reliable,[22] thus indicating sufficient convergent validity and reliability.

Next, in assessing the discriminant validity, the heterotrait–monotrait correlation ratio establishes that this study's data set has no discriminant validity problems. All the variable values recorded values below 0.90, as the respondents understand each variable to be distinct.

Structural model

The path analysis was conducted once the measurement model had been validated to examine the stated hypotheses in this study. This analysis used a nonparametric bootstrapping re-sampling procedure using 10,000 re-samples to produce the β and associated *t*-values. A higher re-sampling provides higher accuracy of repeated sampling simulation.[23]

This study also provided the coefficient of determination (R^2), predictive relevance (Q^2), and effect sizes (^{2}) following the recommendation made by Hair.[21] The implication of the cross-validated redundancy index (Q^2) being larger than 0 is that the model can make predictions. In addition, by providing ^{2}, the researcher determined the extent of the impact, which was impossible to decide based only on the *P* value.[24] The explained variance, R^2, or the coefficient of determination on addictive smartphone use, was 0.348. Notably, convenience, social needs, social influence, and habitual smartphone behavior explain 34.8% of the variation in the endogenous variable (addictive smartphone use). In comparison, 30.6% (0.306) of the variance in habitual smartphone behavior was explained by convenience, social needs, and social influence. Thus, with an R^2 value of more than 0.30, this study considers it high.[21] In addition, the value of Stone-Geisser's Q^2 for the model (addictive smartphone use) produced from the blindfolding technique is 0.241, which is higher than 0, showing that the model has predictive relevance.[25]

The standardized root mean square residual (SRMR) criteria were then used to evaluate the model's goodness of fit. SEM-PLS path models should typically provide a value <0.08 to indicate an appropriate approximative model fit.[26] The SRMR score for this study was 0.055, indicating a good model fit.

Results

Based on the results, the respondents consist of 245 (34.8%) males and 460 (65.2%) females. As for their age characteristics, 492 participants are between the ages of 17 and 21 years (69.8%). In comparison, 199 (28.2%) are between 22 and 26 years of age, and the remaining 14 (2.0%) respondents are between 27 and 30 years old. Most of the respondents are Chinese (46.0%), Malay (37.7%), Indians (10.2%), and others (6.1%). Table 2 summarizes the rest of the information regarding their smartphone usage and preferences.

The result of hypothesis testing is shown in Tables 3 and 4. Of the ten hypotheses presented, eight were found to be supported. The results of this study found that convenience, social needs, and social influence are positively associated with habitual smartphone behavior, thus supporting H1a, H2a, and H3a. Similarly, H3b was also supported: social influence is positively associated with addictive smartphone use. However, convenience (H1b) and social needs (H2b) are not supported. As habitual smartphone behavior, it is positively associated with addictive smartphone use, thus supporting H4.

Mediation analysis

As for the mediation analysis, the findings [Table 4] showed that H5a (β =0.129, t = 5.241, P < 0.001), H5b (β =0.176, t = 7.595, P < 0.001), and H5c (β = 0.055, t = 3.049, P < 0.01) are supported, whereas the direct effect of H1a, H2a, and H3a remains significant. Furthermore, the bootstrapping confidence interval of the indirect effect of H5a (lower limit = 0.083, upper limit = 0.179), H5b (lower limit = 0.133, upper limit = 0.224), and H5c (lower limit = 0.020, upper limit = 0.090) does not straddle a 0, suggesting a mediation effect.

Table 2: Demographic profile of respondents (n=705)

Demographic factor	Values	n (%)
Do you have a mobile (data) plan?	Yes	584 (82.8)
	No	121 (17.2)
Currently subscribing to which mobile network operator?	Hotlink (maxis)	226 (32.1)
	Digi	185 (26.2)
	Yes	9 (1.3)
	Celcom	162 (23.0)
	U Mobile	79 (11.2)
	UniFi Mobile	4 (0.6)
	Others	40 (5.7)
Generally, how much time do you spend on your smartphone in a day? (h)	<1	23 (3.3)
	1–5	305 (43.3)
	6–10	190 (27.0)
	11–15	100 (14.2)
	16–20	54 (7.7)
	>20	33 (4.7)
How often do you use social media?	Not at all	38 (5.4)
	Less than once a week	30 (4.3)
	Once a week	21 (3.0)
	Several times a week	51 (7.2)
	Once a day	72 (10.2)
	Several times a day	493 (69.9)
How often do you use chat/instant messaging?	Not at all	7 (1.0)
	Less than once a week	21 (3.0)
	Once a week	13 (1.8)
	Several times a week	31 (4.4)
	Once a day	29 (4.1)
	Several times a day	604 (85.7)

Discussion

The positive relationship between convenience and habitual smartphone behavior suggests that automatic and unconsciously performed behaviors among young adults are likelier to become habits. Convenience requires less effort, making smartphones more accessible and suitable for various tasks. This result aligns with Lepp *et al.*'s[27] findings, suggesting that smartphones' convenience contributes to habitual behavior.

It has been discovered that convenience does not directly influence addictive smartphone use. These results may be due to differing perceptions of convenience among young adults, leading to variations in the impact of convenience on addictive use. Stress, sleep disturbances, and excessive work demands are suggested by Thomée *et al.*[28] to be more significant predictors of addictive use, as well as social norms and perceived addiction.[29]

The study also found that social needs significantly influence habitual smartphone behavior. Smartphones enable young people to communicate with others, making it easier to meet social demands and increasing the likelihood of developing habitual behavior. As van Deursen *et al.*[6] proposed, this leads to habitual smartphone behavior for social communication and relationship maintenance.

Social needs, however, did not significantly influence addictive smartphone use, which contradicts Kuss *et al.*'s[30] study. This suggests that social needs may be fulfilled through face-to-face interactions or other forms of communication, and young adults may not necessarily turn to phones for these needs.

Next, social influence significantly affects habitual smartphone behavior, providing opportunities for social connection and interaction. Young adults may rely on frequent smartphone use to meet social demands and sustain relationships, reinforcing their behavior and encouraging habit formation. Since they are more inclined to respond to the norms and behaviors within their social circles, thus these individuals are likely to engage in habitual smartphone behavior.[31]

Table 3: Summary of the structural model for IV → DV

	Hypothesis	Path coefficient	95% CIs	SE	t	P	Effect size (f^2)	Supported
H1a	CON → HSB	0.256	0.183–0.323	0.043	5.993***	0.000	0.075	Yes
H1b	CON → ASU	0.041	−0.026–0.108	0.041	0.997	0.159	0.002	No
H2a	SON → HSB	0.349	0.281–0.413	0.040	8.661***	0.000	0.138	Yes
H2b	SON → AMU	−0.027	−0.091–0.037	0.039	0.682	0.248	0.001	No
H3a	SOI → HSB	0.108	0.050–0.164	0.035	3.108**	0.001	0.016	Yes
H3b	SOI → AMU	0.195	0.133–0.258	0.038	5.116***	0.000	0.053	Yes
H4	HSB → AMU	0.505	0.442–0.562	0.036	13.837***	0.000	0.272	Yes

**P<0.01 (2.327), ***P<0.001 (3.092). The analysis is conducted in a one-tailed test. SE: Standard error, CIs: Confidence intervals, CON: Convenience, SON: Social needs, SOI: Social influence, HSB: Habitual smartphone behavior, ASU: Addictive smartphone use

Table 4: Summary of the structural model for IV → MV → DV (mediation)

	Hypothesis	Indirect effect	95% CI	SE	*t*	*P*	Significant?
H5a	CON → HSB → AMU	0.129	0.083–0.179	0.025	5.241***	0.000	Yes
H5b	SON → HSB → AMU	0.176	0.133–0.224	0.023	7.595***	0.000	Yes
H5c	SOI → HSB → AMU	0.055	0.020–0.090	0.018	3.049**	0.002	Yes

**P<0.01 (2.576), ***P<0.001 (3.291). The analysis is conducted in a two-tailed test. SE: Standard error, CI: Confidence interval, CON: Convenience, SON: Social needs, SOI: Social influence, HSB: Habitual smartphone behavior, ASU: Addictive smartphone use

It is determined that social influence significantly influences young adults' addictive use. Friends and family members hooked to their phones could encourage continuous use by young adults, reinforcing the behavior and hastening addiction onset. This finding supports Kuss *et al.*'s[30] discovery that individuals who perceive their peers' approval of engaging in excessive phone use are more likely also to develop addictive behavior.

The study found that habitual smartphone behavior is a significant predictor of addictive smartphone use, similar to a previous study by Haug.[32] Young adults are prone to habitual behaviors due to their high frequency and intensity of smartphone usage via apps like social media and online games,[33] fulfilling their entertainment and social needs, and leading to addiction. Ultimately, they become more prone to mental health issues because they fear being without their phones.[34]

The SOR-CAN framework developed in this study suggests that interventions and policies to reduce problematic smartphone use should focus on external stimuli that influence behavior, such as convenience, social needs, and social influence. To minimize problematic smartphone use, government policies, health-care professionals, and smartphone manufacturers should focus on these drivers that influence the conduct of young adults. Interventions could include (1) raising public awareness of the negative effects of excessive smartphone usage, i.e., lost productivity, poor sleep, and increased stress; (2) restricting smartphone access in specific circumstances, i.e., during work or study hours or in social contexts when face-to-face interactions are preferred; (3) adopting regulations governing mobile devices – to encourage sensible smartphone use – and app creation – to restrict the time users spent on apps; (4) introducing transparency in marketing procedures by ensuring that users are aware of the potential risks associated with excessive smartphone use; (5) promoting healthy smartphone habits – by developing social media platforms that encourage positive social interactions and discourage excessive use; and (6) introduce interventions to reduce addictive smartphone use by lowering habitual behavior, fostering healthy digital behaviors of smartphone use by offering assistance and advice,[35] such as encouraging breaks during work hours and leisure time.

Limitations

However, this study has some limitations. First, the sample consisted of young adults from a single geographical location, which may limit the generalizability of this research's findings to other age groups or cultural contexts. Second, the current study relied on self-reported measures, which may be subject to bias or social desirability effects. Future research could use more objective smartphone use behavior measures, such as screen time tracking or smartphone addiction scales. In addition, this study focuses on the influence of convenience, social needs, and social influence; nevertheless, future research may consider several other drivers, including individual differences (i.e., personality traits and motivation), emotions (i.e., stress and anxiety), cultural (i.e., norms and values) and societal factors (i.e., urbanization and socioeconomic status).

Conclusion

This study contributes to filling the gap in the literature on smartphone use behavior among young adults by examining the role of convenience, social needs, and social influence in shaping habitual behavior and addictive smartphone use among young adults, using the integrated SOR-CAN model developed for this research. While previous research has identified these factors as necessary in smartphone use, this study provides a more comprehensive analysis of their interplay and specific effects on habitual behavior and addictive smartphone use. Furthermore, this study extends previous research by demonstrating that habitual behavior partially mediates the paths linking convenience, social needs, and social influence on addictive smartphone use. This finding further supports the importance of targeting habitual behavior in interventions promoting healthy smartphone use habits among young adults. To conclude, this study provides valuable insights for researchers, practitioners, and policymakers who seek to encourage healthy smartphone use habits among young adults. This paper can support healthy smartphone habits by giving a more thorough knowledge of the drivers that influence young adults' use of smartphones and identifying possible areas for intervention.

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Conflicts of interest

There are no conflicts of interest.

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