JOURNAL OF SOCIAL MEDIA RESEARCH

JSOMER

Journal of Social Media Research (JSOMER)

Editorial Board

Aim and Scope

Journal of Social Media Research (JSOMER) is a multidisciplinary, blind peer-reviewed, open access, free of charge, international scientific academic journal published twice a year (June, December) focusing on the social, cultural, educational, psychological, economic, technological, and sociological dimensions of social media. JSOMER is an interdisciplinary journal with a broad scope that includes social sciences, humanities, arts, health, medicine, psychiatry, psychology, computational social sciences, artificial intelligence, and natural sciences, focusing on, or related to social media. We are pleased to publish current and innovative research articles, reviews and argumentative essays focusing on social media. Articles published in JSOMER are expected to raise issues related to social media in various fields, open discussions about these issues, and propose different methods to address these issues or solve related problems. It is also hoped that the papers published in JSOMER will provide a basis for current debates on various areas of social media and guide innovative research and practice. JSOMER welcomes a variety of theoretical paradigms and methodologies and considers this as a scientific enrichment. JSOMER aims to contribute to scientific accumulation by including original and qualified studies written by academic standards, copyrights, and ethical rules and to be among the first reference sources for those doing research in the field of social media.

"Researchers who want to publish their works in JSOMER are required to be aware that;

• the research studies they submit are in any form of quantitative, qualitative, or mixed-method research;

• meta-analyses, systematic reviews, literature analyses, meta-synthesis studies, book reviews, and brief reports can be sent to JSOMER for reviewing and publication.

• JSOMER is published in English only (full text)."

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The countries of the authors contributed to this issue (in alphabetical order):
China, Germany, Greece, Hong Kong, Sweden, Taiwan, Türkiye, and the USA.

Editorial

A multidisciplinary perspective on social media research: Journal of Social Media Research (JSOMER)

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Social media has a rapidly widening impact on individuals' and societies' lives. With its psychological, cultural, economic, and technological dimensions, social media has become a dynamic force that both shapes individuals' daily lives and paves the way for social transformations on a global scale. In this context, the need for scientific studies that address social media from an interdisciplinary perspective is essential and needs attention. Therefore, the number and quality of scientific works have increased drastically in recent decades. This drastic change also necessitates additional means or channels, including periodicals, to publish/share newly produced scientific knowledge/information. Based on this need, we are excited to launch the Journal of Social Media Research (JSOMER) to respond to the need to understand social media thoroughly and diversely. Now, the first issue of the JSOMER is published. Coming to existence after prolonged exhaustive efforts, JSOMER is expected to contribute as much as possible to fill the need mentioned above. It is also likely that the papers published in JSOMER will raise issues related to social media in various field areas, open up discussions about those issues, and suggest different methods of handling or solving the related problems. Further, we hope that the studies published in JSOMER will provide the basis for timely discussions on the various areas of social media research and give direction to innovative research and practices.

JSOMER was established to support inclusive, innovative, and critical approaches to social media research. JSOMER is an interdisciplinary journal with a broad scope that includes *social sciences, humanities, arts, health, medicine, psychiatry, psychology, computational social sciences, artificial intelligence, and natural sciences*, focusing on or related to social media. JSOMER will publish current and innovative research articles, reviews, and argumentative essays focusing on social media. Articles published in JSOMER are expected to raise

issues related to social media in various fields, open discussions about these issues, and propose different methods to address these issues or solve related problems. It is also hoped that the papers published in JSOMER will provide a basis for current debates on various areas of social media and guide innovative research and practice. JSOMER welcomes a variety of theoretical paradigms and methodologies and considers this a scientific enrichment. JSOMER aims to contribute to scientific accumulation by including original and qualified studies written by academic standards, copyrights, and ethical rules and to be among the first reference sources for those doing research in the field of social media.

Our first issue has five research articles. "Problematic smartphone use, depression symptoms, and fear of missing out: Can reasons for smartphone use mediate the relationship? A longitudinal approach" is contributed by a qualified research team from Germany (Jan Stirnberg, Jürgen Margraf, Lena-Marie Precht, and Julia Brailovskaia). In their longitudinal study, the authors investigated whether reasons for smartphone use, such as "seeking positive emotions" and "avoiding negative emotions," can mediate the relationship between symptoms of depression, fear of missing out (FOMO), and problematic smartphone use (PSU). The results of the study conducted with German participants with an average age of 28.88 years revealed that the relationship between psychopathological phenomena (depression symptoms, FOMO) and PSU might depend on the reasons for smartphone use ("seeking positive emotions," "avoiding negative emotions"). This longitudinal study emphasizes the importance of the underlying reasons for smartphone use. The information obtained in the research supports the understanding of the mechanisms that may contribute to the development of PSU.

Association between problematic social media use and physical activity: the mediating roles of nomophobia and the tendency to avoid physical activity" by Dr. Huang and colleagues (Femke Geusens, Hsing-Fen Tu, Xavier C. C. Fung, Chao-Ying Chen). The authors examined nomophobia and physical activity avoidance as underlying factors potentially explaining the association between problematic social media use (PSMU) and physical activity among Taiwanese young adults. The results indicated that PSMU may be associated with lower physical activity through nomophobia and physical activity avoidance. It can be said that this study has the potential to draw attention to the adverse effects of PSMU on physical health.

The article "Exploration of the Association between Social Media Addiction, self-esteem, self-compassion, and Loneliness" by Dr. Eirini Marina Mitropoulou was conducted with 426 Greek adults. The study revealed a positive relationship between loneliness and social media use. It noted that as self-compassion increases, social media use decreases. In the fourth article of our first issue, Ali Gökalp and his colleagues adapted the social media fatigue scale to Turkish culture with Turkish pre-service teachers (M_{age}=21.75). In line with the validity studies of the Turkish version of the scale, they concluded that the original structure was confirmed in Turkish culture. The three-factor structure of the Turkish version of the social media fatigue scale has satisfactory psychometric properties in both internal and external validity. Social media fatigue has become a phenomenon that attracts more attention every day. This phenomenon, which emerged as an indirect result of excessive and intensive use of social media, indicates that users cannot give up social media very quickly despite experiencing social media fatigue.

The last article of our first issue is "Pathways to Social Media Addiction: Examining its Prevalence and Predictive Factors among Ghanaian Youths" by Dr. Ahorsu. In this study, Dr. Ahorsu examined the prevalence of social media addiction, pathways to social media addiction, and predictive factors among Ghanaian youth. He shed light on the associations of social media addiction with variables such as gaming disorder, internet gaming disorder, smartphone app-based addiction, nomophobia, stress, anxiety, and depression. The results revealed prevalence rates of social media addiction (12.3%), gaming disorder (3.7%), internet gaming disorder (3.1%), smartphone app-based addiction (29.1%), nomophobia (49.6%), stress (26%), anxiety (62.1%) and depression (49%) among Ghanaian youth. Smartphone app-based addiction was found to have direct effects on social media addiction and indirect effects on gaming disorder and nomophobia. In addition, the direct effects of smartphone app-based addiction on gaming disorder, internet gaming disorder, nomophobia, stress, anxiety, and depression were emphasized.

Our editorial team is committed to ensuring the publication of quality and innovative research while adhering to ethical standards. However, we hope that our journal will function not only as a publishing tool but also as a scientific community where social media researchers can interact with each other. We want to take this opportunity to thank all our authors, reviewers, and readers for being with us on this journey. We sincerely believe this first issue of our journal will bring new life into social media research. We invite you to contribute to this critical scientific dialog and community.

Problematic smartphone use, depression symptoms, and fear of missing out: Can reasons for smartphone use mediate the relationship? A longitudinal approach

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Abstract

In the present longitudinal study, we investigated whether reasons for smartphone use, such as "search for positive emotions" and "escape from negative emotions," can mediate the relationship between depression symptoms, fear of missing out (FOMO), and problematic smartphone use (PSU). In total, 309 smartphone users from Germany (M_{age} = 28.88, SD_{age} = 12.53) completed the longitudinal study's online survey at two measurement time points (baseline, T1; 10-month follow-up, T2). "Escape from negative emotions" at T1 partly mediated the positive association between depression symptoms at T1 and PSU at T2. "Search for positive emotions" at T1 partly mediated the relationship between FOMO at T1 and PSU at T2. The present results showed that the relationship between psychopathological phenomena (depression symptoms, FOMO) and PSU could depend on reasons for smartphone use ("search for positive emotions," "escape from negative emotions"). This stresses the importance of motives underlying smartphone use. The knowledge gained supports the understanding of mechanisms that could contribute to the development of PSU.

1. Introduction

Smartphone use has become a crucial part of daily life worldwide over the past 15 years. It enables accessible, fast, cost-effective communication, receiving news, organizing, and facilitating processes. Smartphone use can contribute to work processes (Bian et al., 2020) and education (Ubben et al., 2023). However, there is also evidence that smartphone use may become "problematic," which means that individuals show symptoms similar to substance-related dependencies such as withdrawal, craving, or failure to fulfill social or work-related tasks (Billieux et al., 2015). Billieux (2012) defined problematic smartphone use (PSU) as the incapacity to regulate one's smartphone use, leading to negative consequences. This behavior can cause lower work efficiency and productivity (Duke & Montag, 2017) and decrease life satisfaction and well-being (Fischer-Grote et al., 2020). Children and young people seem affected, leading to future concerns about psychological and economic well-being (Sohn et al., 2019). PSU is also associated with parental phubbing, which means that parents ignore children who are focused on their phones (Wang et al., 2023). Considering potential triggering factors, negative affectivity has been found to predict social media use and the development of PSU positively; moreover, it negatively predicted psychological well-being (Sanchez-Fernandes & Borda-Mas, 2023).

Despite its adverse effects, PSU has not yet been acknowledged as an official diagnosis in the International Classification of Diseases and Related Health Problems (ICD-11; World Health Organization, 2018). Thus, understanding the predisposing and triggering conditions of PSU is still necessary to offer adequate prevention and treatment options. Until now, research lacks evidence of effective therapeutic interventions to handle PSU (Liu et al., 2022). Available research has already shown that PSU is positively associated with certain psychopathological phenomena such as depression and anxiety symptoms (Elhai et al., 2017; Rozgonjuk et al., 2018) as well as fear of missing out (FOMO) (Wolniewicz et al., 2018). FOMO is the constant will to stay informed about other people's doings and the anxiety to miss rewarding experiences they might have (Przybylski et al., 2013). FOMO is positively connected with social connection (Roberts & David, 2019) but also with sleep deprivation, loss of productivity, and focus (Hayran & Anik, 2021). Younger people, singles, and those with greater social comparison inclinations are significantly affected (Eitan & Gazit, 2024). Nevertheless, whether and how far the above factors are mediated by further variables, such as reasons for smartphone use, has not been investigated.

Smartphones may be used for various reasons, such as social media, news reading, or social influence (Busch et al., 2021). Other reasons might be from a willingness to cope with daily living and technological affinity (Seifert & Schelling, 2015) to alleviating boredom, habituation, and feeling secure while away from familiar settings (Fullwood et al., 2007). Other studies have revealed that users are afraid of missing messages or have difficulties in self-regulation (Yang et al., 2021). Previous research has shown that more depressed people, people with higher FOMO and PSU, tend to escape from negative emotions while using their smartphones (Stirnberg et al., 2024). Similar results have been found by Kim and colleagues (2017).

Reasons for other problematic patterns of behavior, such as alcohol use, have been investigated a long time ago (Cooper et al., 1995). The authors found out that people consume alcohol mainly to regulate positive and negative emotions. These reasons have not been applied to PSU yet. Nonetheless, it might be expected that the development of PSU can be associated with reasons for smartphone use, such as "search for positive emotions" or "escape from negative emotions," as well as psychopathological phenomena such as depression symptoms and FOMO. These associations are further explored in this study better to understand the predisposing and triggering conditions of PSU.

2. Method

2.1. Research Design

In the present study, we investigate the potential mediating role of smartphone use and the reasons for the association between psychopathological phenomena such as depression symptoms and FOMO and PSU with a longitudinal design—two measurement points (T1 and T2) with a 10-month interval. The longitudinal design is chosen to understand experiences across time and to identify facilitators and inhibitors of PSU (Tuthill et al., 2020). Table 1 gives an overview of the four hypotheses. Recent cross-sectional studies have demonstrated a positive association between depressive symptoms and problematic smartphone use (Arrivillaga et al., 2023; Carter et al., 2024). Therefore, a positive relationship between PSU (T2) and depression symptoms (T1) is expected in the current study (Hypothesis 1a).

Table 1. Hypotheses and expected direction of correlation

	PSU (T2)
(1a) depression symptoms (T1)	r > .000
(1b) "escape from negative emotions" (T1)	r > .000
(1c) FOMO (T1)	r > .000
(1d) "Search for positive emotions" (T1)	r > .000

Notes. T1 = first measurement, T2 = second measurement, r = correlation coefficient

Hypothesis 1b states that PSU (T2) positively correlates with "escape from negative emotions" (T1). This hypothesis is based upon recent results from Arrivillaga and colleagues (2023), who found a positive association between PSU and higher impulse control dysregulation.

In a recent study, a positive link between PSU and FOMO has been found for a single-time measurement (Wang et al., 2023). In this study, we explore this correlation over a 10-month interval. Thus, PSU (T2) is hypothesized to positively correlate with FOMO (T1) (Hypothesis 1c). Lastly, it is hypothesized that PSU (T2) positively correlates with the "search for positive emotions" (T1) (Hypothesis 1d). This hypothesis is based upon existing research stating that PSU is predicted by reward responsiveness (Kwak & Kim, 2023) and is also associated with emotion dysregulation and psychological distress (Squires et al., 2021). Again, these results have not yet been investigated using longitudinal data.

The following two research questions are investigated in the present longitudinal study:

Research Question (RQ) 1: Can "escape from negative emotions" at T1 as a reason for smartphone use mediates the relationship between depression at T1 and problematic smartphone use at T2?

RQ2: Can "search for positive emotions" at T1 as a reason for smartphone use mediate the relationship between FOMO at T1 and problematic smartphone use at T2?

2.2. Participants, Procedure, and Ethical Considerations

The present study is characterized by a longitudinal design. Data was assessed in September 2021 (= T1) and June 2022 (= T2). At T1, individuals were invited by e-mail to participate in the first online survey. All of them were current or former students of a large university in the Ruhr region in Germany and had provided consent to be contacted for research purposes. They could participate voluntarily and were not compensated. The requirement to participate was possessing a smartphone and its daily use. At T2, participants who had finished the first survey were contacted again via e-mail to participate in the second online survey.

Both surveys were completed by 309 participants (78% women; M_{age} (SD_{age}) = 28.88 (12.53), range: 18-80). Frequency distribution by age group shows an asymmetric, right-skewed distribution. Two-thirds (67%) of the participants were students, 27% were employees, and 6% were unemployed or retired. The responsible Ethics Committee approved the implementation of the present study. All participants were instructed correctly and gave informed consent online. An a priori power analysis (G*Power program, version 3.1) was conducted, which showed that the sample size is sufficient for valid results (power > .80, α = .05, effect size f^2 = 0.15; cf., Mayr et al., 2007).

2.3. Measures

Depression symptoms. The German version (Nilges & Essau, 2015) of the depression subscale of the Depression Anxiety Stress Scales 21 (DASS-21; Lovibond & Lovibond, 1995) was used to assess depression symptoms with seven items (e.g., "I could not seem to experience any positive feeling at all"). Items were rated on a 4-point Likert-type scale (0 = did not apply to me at all, 3 = applied to me very much or most of the time). The current scale reliability at T1 was α = .90.

Reasons for smartphone use. Following Stirnberg et al. (2024), participants rated how often they use their smartphone to search for positive emotions and how often they use it to escape negative emotions ("How often do you use your smartphone to search for positive emotions?" ("How often do you use your smartphone to escape from negative emotions?") on a 5-point Likert-type scale (1 = very rarely, 5 = very often).

Problematic smartphone use. The short version of the Bergen Social Media Addiction Scale (BSMAS; original version: Andreassen et al., 2017; German language version: Brailovskaia et al., 2020) includes six items to assess addictive social media use. Following Brailovskaia et al. (2023), the term "social media" was replaced

by "smartphone" (e.g., "I spend a lot of time thinking about smartphones or planning how to use it") in the current study. Items were rated on a 5-point Likert-type scale (1 = very rarely, 5 = very often). The higher the sum score, the higher the level of problematic smartphone use. The current scale reliability at T2 was α = .85.

Fear of missing out. The level of FOMO was measured by the ten items of the Fear of Missing Out Scale (original version: Przybylski et al., 2013; German language version: Rozgonjuk et al., 2020). Items were rated on a 5-point Likert-type scale (1 = not at all true of me, 5 = extremely true of me) (e.g., "I fear others have more rewarding experiences than me"). High sum scores indicate a high level of FOMO. The current scale reliability at T1 was α = .84.

2.4. Data Analysis

SPSS 27 and the macro PROCESS version 3.5.3 (Hayes & Rockwood, 2020) were used for statistical analyses. First, descriptive statistics were run. Second, bivariate zero-order correlations between the variables were calculated to assess their relationship. Third, two mediation models (PROCESS: model 4) were calculated. In the first model, depression symptoms at T1 served as the predictor, the smartphone use reason "escape from negative emotions" at T1 served as the mediator, and PSU at T2 served as the outcome. In the second model, FOMO at T1 was used as the predictor, the smartphone used reason "search for positive emotions" at T1 as the mediator, and PSU at T2 as the outcome. Age and gender were included as covariates in both models. In both mediation models, the total effect (c) referred to the relationship between predictor and outcome, the path of the predictor to the mediator was referred to as a, and the path of a mediator to the outcome as b. The indirect effect (ab) was described by the combined effect of paths a and b. Path c' represented the direct effect of the predictor on outcome after including the mediator in the model. The bootstrapping procedure (sample of 10.000) assessed the mediation effect and provided percentile bootstrap confidence intervals (95% CI).

3. Results

3.1 Descriptive Analysis

The descriptive statistics of the investigated variables and their correlations are shown in Table 2. Depression symptoms at T1 were significantly positively correlated with PSU at T2 and with "escape from negative emotions" at T1. "Escape from negative emotions" at T1 was significantly positively correlated with PSU at T2. FOMO at T1 was significantly positively correlated with the "search for positive emotions" at T1 and PSU at T2. "Search for positive emotions" at T1 was significantly positively correlated with PSU at T2 (see Table 2).

Table 2. Descriptive statistics and correlations of the investigated variables.

	M (SD)	Min-Max	(1)	(2)	(3)	(4)	(5)
(1) Depression at T1	4.64 (4.61)	0-21	-	.477	.337	.298	.317
(2) Escape from negative emotions at T1	2.22 (1.20)	1-5		-	.543	.452	.596
(3) Search for positive emotions at T1	2.78 (1.04)	1-5			-	.415	.392
(4) FOMO at T1	24.42 (7.40)	10-45				-	.540
(5) Problematic smartphone use at T2	13.58 (5.09)	6-29					-

Notes. N = 309; M = mean, SD = standard deviation, Min = Minimum, Max = Maximum. All correlations were significant at the 0.001 level.

3.2. Findings of Mediation Analyses

The first mediation analysis showed that "escape from negative emotions" at T1 partly mediated the positive association between depression symptoms at T1 and PSU at T2. The primary relationship between depression symptoms at T1 and PSU at T2 was significant (total effect, c: p <.001). The link between depression symptoms at T1 and "escape from negative emotions" at T1 was also significant (path a: p <.001). The relationship between "escape from negative emotions" at T1 and PSU at T2 was also significant (path b: p < .001). The indirect effect (ab) was significant (b = .186, SE = .041 95% CI [.111, .269]). The relationship between depression symptoms at T1 and PSU at T2 was still significant after the inclusion of "escape from negative emotions" at T1 in the model (direct effect c': p = .035). However, the total effect was higher than the direct effect (see Figure 1).
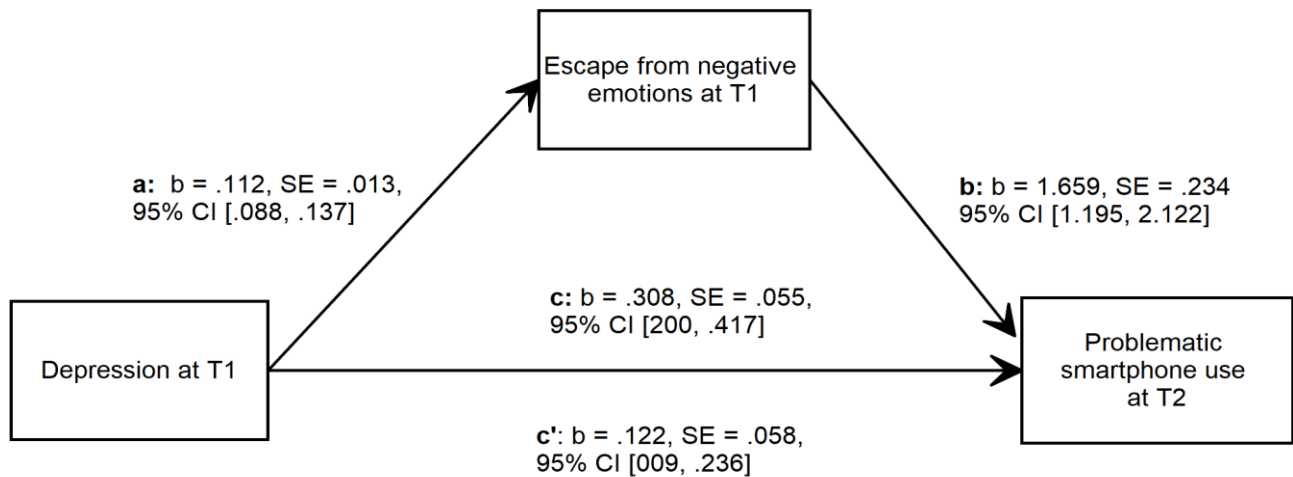
Figure 1. The mediation model includes depression at T1 (predictor), escape from negative emotions at T1 (mediator), and problematic smartphone use at T2 (outcome). *Notes. N = 309; c = total effect, c' = direct effect; b: standardized regression coefficient, SE: standard error, CI: confidence interval.*

According to the second mediation analysis, "search for positive emotions" at T1 partly mediated the relationship between FOMO at T1 and PSU at T2. The primary relationship between FOMO at T1 and PSU at T2 was significant (total effect, *c*: *p* < .001). The link between FOMO at T1 and "search for positive emotions" at T1 was also significant (path *a*: *p* < .001). The relationship between "search for positive emotions" at T1 and PSU at T2 was also significant (path *b*: *p* = .001). The indirect effect (*ab*) was also significant (*b* = .036, SE = .014, 95% CI [.012, .068]). The link between FOMO at T1 and PSU at T2 was significant after the inclusion of "search for positive emotions" at T1 in the model (direct effect *c'*: *p* < .001). The total effect was higher than the direct effect (see Figure 2).
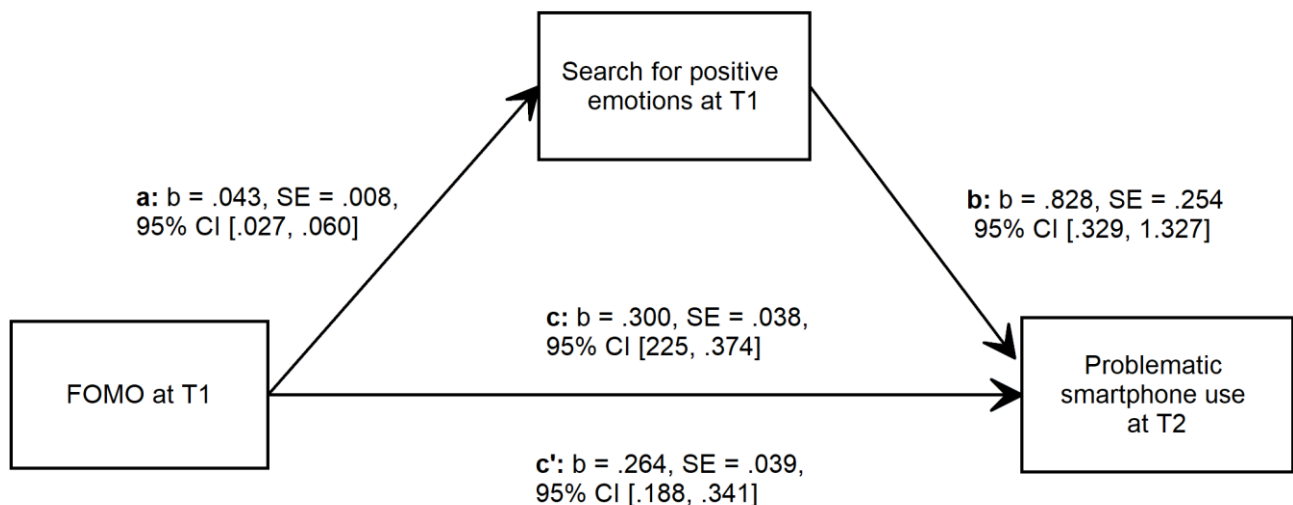
Figure 2. The mediation model includes FOMO at T1 (predictor), search for positive emotions at T1 (mediator), and problematic smartphone use at T2 (outcome). Notes. N = 309; c = total effect, c' = direct effect; b: standardized regression coefficient, SE: standard error, CI: confidence interval.

4. Discussion

Smartphone usage is omnipresent and on the rise. PSU has been shown to have an impact on people's mental health. This longitudinal study has focused on its links with psychopathological phenomena and reasons for smartphone use. People with difficulties regulating emotions are at higher risk of developing PSU (Horwood & Anglim, 2021; Squires et al., 2021). PSU is positively associated with mental health problems, alcohol consumption, impulsivity, and low academic performance (Grant et al., 2019). Little is known about potential antecedents apart from loneliness and deficits in self-regulation (Mahapatra, 2019).

4.1. Relationship between Depression Symptoms and Problematic Smartphone Use

The significantly positive correlation between depression symptoms (T1) and problematic smartphone use (T2) goes along with previous research (Cheng & Meng, 2021; Elhai et al., 2020) and can be explained by the maladaptive emotion regulation system in depressed people (Ho et al., 2014; Young et al., 2019). Participants who were more depressed at T1 showed more problematic smartphone use at T2. Hypothesis 1a can be confirmed.

The significantly positive relationship between "escape from negative emotions" (T1) and problematic smartphone use (T2) also goes along with the former results (Wei et al., 2021). It helps to understand the importance of smartphone use when considering the development and treatment of PSU. Participants who used their smartphone to "escape from negative emotions" at T1 showed more problematic smartphone use 10 months later. Hypothesis 1b has also been confirmed. In former research, a positive link between PSU and escapism has been found (Akyol et al., 2021), which is the result of the present study. In a recent study, it has been demonstrated that about half of one's smartphone use may be for emotion regulation (Shi et al., 2023).

The significantly positive link between FOMO (T1) and PSU (T2) means that people afraid of missing out tend to develop a more problematic smartphone use pattern 10 months later. This result confirms Hypothesis 1c. In a former study, FOMO was shown to predict PSU (Tugtekin et al., 2020). Other research confirmed the positive association between FOMO and PSU (Hudecek et al., 2023; Elhai et al., 2016).

A significantly positive correlation between the "search for positive emotions" at T1 and PSU (T2) has been found. Participants who used their smartphone to feel positive developed a more problematic smartphone use behavior 10 months later. This finding goes with operant conditioning (Skinner, 1971): Positive emotions make people feel better, a rewarding result of the individual's behavior. Thus, the behavior is shown more frequently. This finding is in accordance with former research, which has shown that people use their smartphones to get rewarded, validated, and pleasured (Mostyn et al., 2024). Hypothesis 1d is also confirmed.

4.2. Research Questions 1-2

The partly mediated positive association between depression symptoms (T1) and problematic smartphone use (T2) by the mediator variable "escape from negative emotions" as a reason for smartphone use means that even without the inclusion of the mediator variable, depression symptoms (T1) are positively linked with problematic smartphone use (T2). This goes along with existing research (Elhai et al., 2020; Jin et al., 2021; Pereira et al., 2020). Interestingly, in this study, the longitudinal link between depression symptoms (T1) and problematic smartphone use (T2) that is partly mediated by "escape from negative emotions" as a reason for smartphone use is shown.

Similarly, fear of missing out (T1) and problematic smartphone use (T2) stay positively correlated, whether "search for positive emotions" as a reason for smartphone use is included in the mediation model or not (partial mediation). Former research has shown the predictive effect of FOMO on problematic smartphone use (Gezgin, 2018). In the present study, this link remains positive if people use their smartphone to "search for positive emotions" as a reason for smartphone use. The mediator variable can explain some variance of the positive effect in the model. This contributes to the new finding that there seems to be a longitudinal association between FOMO and problematic smartphone use. This can help consider another potential risk factor for the development of PSU, especially for people who use their smartphone to "search for positive emotions."

4.3. Study Impact and Contribution

First, our results help to understand that depression symptoms might be considered a predominating risk factor for the development of PSU, mainly if people use their smartphones to escape from negative emotions. This determination can help to improve existing treatment plans for depression symptoms (for example, to investigate depressive people's reasons for smartphone use and use intensity) as well as to prevent further development of PSU. In this field, future research should also focus on protective factors within depressive people that make them more resistant to the development of PSU.

Second, we showed a longitudinal positive association between FOMO (T1) and problematic smartphone use (T2). This can help consider another potential risk factor for developing PSU, especially for people who use their smartphones to "search for positive emotions." Consequently, our study underlines that it is essential to include the investigation of FOMO and reasons for smartphone use when assessing and diagnosing PSU. This contributes to the former research of Ryding and Kuss (2020) on the assessment of PSU. Third, despite the partial mediation effects, the importance of assessing reasons for smartphone use at an early stage (T1) is

stressed by this study to better understand the potential development of PSU (T2). This goes along with previous research (Stirnberg et al., 2024).

4.3. Limitations

Despite the study's novel and practically relevant features, some limitations should be considered when interpreting the present findings. Since all four Hypotheses (1a-d) have been investigated by correlation analysis, the results cannot be interpreted causally. Further experimental research is needed. Since we conducted a longitudinal design, confounding intrapersonal variables might have arisen over time and are difficult to control (Streeter et al., 2017). It is doubtful whether results can be generalized since two-thirds of our participants were students and three-quarters were female. In an upcoming study, it is desirable to assess other age groups and realize a more balanced gender ratio. Data were collected in Germany only. Expanding this study to different countries to examine similarities and differences would be interesting. Despite the anonymous online setting, people might have answered in a socially desirable manner, especially regarding questions about mental health (Henderson et al., 2012). It would also be essential to assess people who are already affected by a psychological disorder to see whether there are differences between those two groups. In this study, it has not been differentiated between participants with psychological disorders and those without. Due to the response format of a self-report, answers might have been influenced by the same-source bias (Conway & Lance, 2010). We tried to minimize its effect with adequate study length and proper measurements. Future research could include other means of assessment, such as interviews or behavior observations.

5. Conclusion & Practical Implications

In conclusion, PSU is associated with specific antecedents such as depressive symptoms, FOMO, and emotionally regulating reasons for smartphone use over 10 months. The present results are in line with the findings of other studies that focused on problematic substance use, e.g., alcohol (Hammerton et al., 2023; Riordan et al., 2023) or problematic media consumption (e.g., gaming). The present results can help detect the development of psychopathological phenomena early and offer adequate prevention and treatment options. This seems necessary in times of rising costs in economic and health systems due to psychological disorders. Our results highlight the importance of future research on this topic, including probable experimental designs, clinical trials, and suitable prevention and treatment programs. What is more, the practical implications of our study include raising awareness of the potential risks of smartphone overuse and the need for early school-implemented education on "healthy" smartphone use. Csibi et al. (2021) demonstrated that preschool children and young adults are at risk for developing PSU. Future research could pursue a pathway to a potential sweet spot of smartphone use associated with certain intrapersonal features such as personality traits and mental health status.

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Association between problematic social media use and physical activity: the mediating roles of nomophobia and the tendency to avoid physical activity

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Highlights

- Insufficient physical activity is now a global issue.
- Problematic social media use (PSMU) has no direct association with physical activity
- Nomophobia and physical activity avoidance were significantly related.
- PSMU was associated with physical activity via the mediation of nomophobia and physical activity avoidance.

Abstract

Insufficient physical activity is now a global pandemic. Problematic social media use (PSMU) has been reported to be associated with physical activity levels, and nomophobia can be one of the co-existing psychological conditions of PSMU. Additionally, physical activity avoidance has been reported to be associated with lower physical activity levels. Therefore, the present study examined nomophobia and physical activity avoidance as underlying factors potentially explaining the association between PSMU and physical activity among Taiwanese young adults. A cross-sectional online survey comprising the Bergen Social Media Addiction Scale (BSMAS), Nomophobia Questionnaire (NMPQ), Tendency to Avoid Physical Activity and Sport Scale (TAPAS), and International Physical Activity Questionnaire – short form (IPAQ-SF) was completed by 885 participants (36% male, mean age = 28.8 ± 6.06 years) between September and December 2023. The structural equational modeling results indicated a negative direct association between PSMU and physical activity (standardized coefficient [β] = 0.040, ρ = 0.004). PSMU was also associated with higher nomophobia (β = 0.601, ρ < 0.001), which was associated with higher physical activity avoidance (β = 0.354, ρ < 0.001), which negatively correlated to physical activity (β = -0.114, ρ < 0.001). Moreover, the association between PSMU and physical activity was significantly mediated through the sequence of nomophobia and PA avoidance (β = -0.024, 95% bootstrap confidence interval = -0.071, -0.024). The results suggested that PSMU may be associated with lower physical activity through the mediation of nomophobia and physical activity avoidance. Corresponding strategies may aim to reduce PSMU and enhance physical activity engagement. Other approaches, such as motivational interviewing or cognitive behavioral therapy, can be adopted to reduce nomophobia and physical activity avoidance, thereby improving the individuals' physical activity participation.

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1. Introduction

Insufficient physical activity (PA) has become a global health concern (Haseler et al., 2022). The World Health Organization suggests that adults engage in at least 150 minutes of moderate PA or at least 75 minutes of vigorous PA per week (World Health Organization, 2020). However, one in four adults does not meet the recommended PA levels (World Health Organization, 2022). The global decline in PA levels across different age groups has become widespread, leading to potential increases in future health expenditures (Duijvestijn et al., 2023). Regular PA is well-documented for its benefits, including improvements in mental health and sleep quality and reductions in the risks of cardiovascular diseases and certain cancers (Haseler et al., 2022). Conversely, insufficient PA is linked to obesity, metabolic disorders such as type 2 diabetes or hypertension (Duijvestijn et al., 2023; Haseler et al., 2022), and higher all-cause mortality rates (Duijvestijn et al., 2023). Therefore, research is urgently needed to investigate factors influencing PA engagement.

Social media use (SMU) is a potential contributor to sedentariness (Alley et al., 2017), with a complex association with PA. Social media has become an integral part of modern society, enhancing access to the world through instant information and real-time communication. It allows individuals to connect with others and frequently receive updates. Building on theories such as the Uses and Gratification Theory (Ruggiero, 2000) and the Media System Dependency Theory (Ball-Rokeach, 1998), it has been shown that a minority of users may develop problematic social media use (PSMU). PMSU is characterized by excessive social media use, leading to negative consequences such as psychological distress (Huang et al., 2023) and insomnia (Lin et al., 2021), and may impair individuals' ability to fulfill daily responsibilities, including regular PA (Andreassen, 2015; Blackwell et al., 2017). However, previous research has shown mixed results, including negative (Ardesch et al., 2023), positive (Huang et al., 2022; Shimoga et al., 2019), and no associations between PMSU and PA (Yılmaz et al., 2023). This calls for more attention to potential mediators that could explain these mixed results.

A psychological condition that frequently accompanies PSMU is nomophobia (King et al., 2010; King et al., 2013; Lin et al., 2021). Nomophobia is a sense of discomfort or anxiety caused by not having access to one's virtual communication device (e.g., smartphone or laptop) (King et al., 2010; King et al., 2013; Yildirim et al., 2015). Building on the Media System Dependency Theory (Ball-Rokeach, 1998), the more functions a medium provides (e.g., instant updates, entertainment, or communication opportunities), the greater the users' dependency. Several recent studies reported associations between SMU and nomophobia (Ayar et al., 2018; Khan et al., 2021; Lin et al., 2021). For instance, individuals with social phobia may prefer virtual interactions to avoid face-to-face communication (King et al., 2013), potentially leading to a dependency on their devices and subsequently developing nomophobia (King et al., 2013; Yildirim et al., 2015). Similar to PSMU, previous studies on the relationship between nomophobia and PA have produced contradictory results, reporting negative (Torlak et al., 2022), positive (Liu et al., 2022), and no associations (Demircioğlu et al., 2023), which may be attributed to the types of apps the individuals used or the psychological context behind nomophobia (e.g., avoidant trait).

Among the various factors that may affect PA, the tendency to avoid PA (i.e., PA avoidance) has recently been proposed (Bevan et al., 2022) and investigated in several studies (Huang et al., 2024; Saffari et al., 2024; Yi et al., 2024). PA avoidance refers to avoiding exercise or sports activities for fear of being judged or perceived. Individuals concerned about their physical appearance or abilities may feel stressed when performing PA in public, thus developing a tendency to avoid such scenarios (Bevan et al., 2022; Yi et al., 2024). Several studies have examined the impact of PA avoidance on individuals' PA engagement and reported significant negative associations or mediation effects, suggesting that PA avoidance may reduce PA levels (Huang et al., 2024; Saffari et al., 2024; Yi et al., 2024).

Currently, the relationship between PSMU, nomophobia, and PA avoidance is less investigated. In addition, to the best of the present authors' knowledge, the collective influence of these factors on PA levels has not yet been investigated. Given the inconsistent results found in the association between PSMU and PA, further investigation is warranted to clarify the underlying mechanisms and develop corresponding strategies to improve PA levels. The link between PMSU and nomophobia is clear and established, as is the link between PA avoidance and PA engagement. However, the link between nomophobia and PA avoidance is less clear. Therefore, the present study proposes to investigate the associations between PSMU, nomophobia, PA avoidance, and PA level (see Figure 1 for the hypothetical model). We hypothesize that (i) PSMU has a direct effect on PA, though the direction is unknown due to the mixed results in prior research, (ii) significant positive associations exist between nomophobia and PA avoidance, and (iii) nomophobia and PA avoidance significantly mediate the association between PSMU and PA.
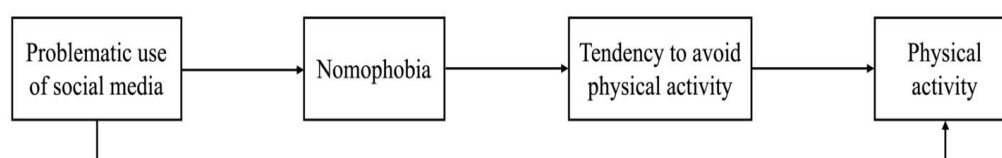
Figure 1. Proposed Model of Present Study.

2. Method

2.1. Participants, Procedure, and Ethical Considerations

This cross-sectional study used convenience and snowball sampling to recruit participants via an online survey created with SurveyMonkey. The survey was distributed between September and December 2023 among Taiwanese young adults. Participants were eligible if they (i) were aged between 20 and 40 years and (ii) had at least one active social media account. Additionally, participants were encouraged to share the survey with others who met these criteria.

The study adhered to the ethical standards of the 1964 Declaration of Helsinki. All participants provided informed consent before participating. The first page of the online survey displayed the informed consent form, and by clicking 'agree,' participants proceeded to the survey questions; clicking 'no' ended the survey immediately, preventing further access. The National Cheng Kung University Human Research Ethics Committee approved the study on July 11, 2023 (approval number: NCKU HREC-E-111-563-2). Two questions regarding the birth year and the current social media platforms were included to check for eligibility. Responses that did not meet the eligibility were removed. Participants who completed the survey received 200 New Taiwan dollars (approximately 6 US dollars) as compensation for their time. During the study period, 1211 participants accessed the online survey. Of these, 211 terminated the survey early, 38 completed it twice, and 75 did not meet the inclusion criteria (i.e., indicated their age under 20 or had no activated social media account). In addition, 2 participants reported unreasonable daily time spent on smartphones (i.e., 23 and 24 hours per day). Consequently, data from 885 participants were included in the final analysis.

2.2. Measures

Demographic variables, including age, sex, height, and weight (used to calculate body mass index), as well as daily time spent on smartphones and outdoor activities, were measured. Additionally, four measures were used to assess the variables of interest: PSMU, nomophobia, PA avoidance, and PA level.

2.2.1. Bergen Social Media Addiction Scale (BSMAS)

The Bergen Social Media Additional Scale (BSMAS), developed by Andreassen et al. (2017), assessed individuals' social media addiction levels. It comprises six items rated on a five-point Likert-like scale (1 = seldom; 5 = very often), resulting in a total score ranging from 6 to 30. Higher scores indicate a higher level of social media addiction. An example item is "*You feel an urge to use social media more and more*". The Chinese version of the BSMAS has demonstrated robust psychometric properties (Chen et al., 2020; Leung et al., 2020) and showed strong internal consistency in the present study (Cronbach's α = 0.900).

2.2.2. Nomophobia Questionnaire (NMPQ)

The Nomophobia Questionnaire (NMPQ), developed by Yildirim et al. (2015), was used to evaluate individuals' fear of being without access to their smartphones. It consists of 20 items rated on a seven-point Likert-like scale (1 = strongly disagree; 7 = strongly agree), resulting in a total score ranging from 20 to 140. Higher scores indicate a higher level of fear associated with lacking access to one's smartphone. An example item is "*Running out of battery on my smartphone would scare me*." The Chinese version of the NMPQ has demonstrated satisfactory psychometric properties (Gao et al., 2020) and showed excellent internal consistency in the present study (α = 0.962).

2.2.3. Tendency to Avoid Physical Activity and Sport Scale (TAPAS)

The Tendency to Avoid Physical Activity and Sport (TAPAS), developed by Bevan et al. (2022), assessed individuals' tendency to avoid engaging in PA, exercise, or sports. It comprises ten items rated on a five-point Likert-like scale (1 = strongly disagree; 5 = strongly agree), resulting in a total score ranging from 10 to 50. Higher scores indicate a higher tendency to avoid participating in any form of PA. An example item is "I *worry about participating in sports because I do not like how my body looks when playing sports*." The Chinese version of the TAPAS has demonstrated robust psychometric properties (Fan et al., 2023; Lin et al., 2024; Saffari et al., 2023) and showed excellent internal consistency in the present study (α = 0.948).

2.2.4. International Physical Activity Questionnaire – short form (IPAQ-SF)

The International Physical Activity Questionnaire (IPAQ), developed by Craig et al. (2003) and the IPAQ Research Committee (2005), was used to assess individuals' PA levels over the past week. It comprises seven items investigating time spent on several levels of PA (i.e., vigorous, moderate, walking, and sitting). Vigorous PA, moderate PA, and walking consisted of two questions each, one measuring frequency (e.g., During the last 7 days, how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?), the other measuring time spent on the activity (e.g., How much time did you usually spend doing vigorous physical activities on one of those days?). For sitting, individuals were asked how much time they spent sitting in the past week. The Chinese version of the IPAQ-SF has demonstrated adequate psychometric properties (Deng et al., 2008; Macfarlane et al., 2007).

In the current study, the time spent on each level of PA was calculated and summed to represent participants' weekly PA level. Weekly frequency multiplied by the time spent on each PA level was further multiplied by its corresponding metabolic equivalents (METs) (8 METs for vigorous activities, 4 METs for moderate activities, 3.3 METs for walking, and 1 METs for sitting) to generate the total weekly PA level in the unit of METs*minutes. Higher scores indicate a higher PA level over the past week.

2.3. Data Analysis

Data was summarized using descriptive analysis, and correlations between variables were calculated using Pearson's correlation coefficient. Structural equation modeling (SEM) with the diagonally weighted least squares estimator was used to examine the model fit. Age and sex were controlled for as covariates. Four fit indices, including comparative fit index (CFI), Tucker–Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean squared residual (SRMR), were employed to examine the supportiveness of the model. Acceptable fit was determined by CFI and TLI values above 0.95 and RMSEA and SRMR below 0.06 and 0.08, respectively (Bentler, 1990; Hu et al., 1999). After confirming that the model was supported, the associations between study variables were determined using the standardized coefficient (β). To test the mediation effects, 599 bootstrapping resamples were used (Wilcox, 2010). A mediation effect was considered significant if the 95% bootstrap confidence interval (CI) did not include 0 (Ramachandran et al., 2020). SEM was performed using the lavaan package (Rosseel, 2012) in R version 4.2.1 (The R Development Core Team, 2022). Descriptive analysis and Pearson's correlation were conducted using SPSS 29.0 (IBM). A significance level of $p < 0.05$ was set for all analyses.

2.3.1. Sample size estimation

Given that SEM was the primary statistical analysis method used in the present study, the following rule of thumb was applied: (i) 10 participants per variable and (ii) a minimum sample size of 100 to 200 participants to estimate the sample size for SEM (Wolf et al., 2013). However, considering the bootstrapping method used to evaluate the indirect effect, a sample size of at least 500 participants was suggested to avoid Type I error (Newsom, 2023). Therefore, a minimum of 500 participants was determined as the sample size for the present study.

3. Results

Participants' characteristics are presented in Table 1 with the score of four measures and the range demonstrated. Of the 885 participants, 36.0% were male (n = 319), with a mean age of 28.8 years (SD = 6.06) and an average daily smartphone usage of 5.21 hours (SD = 2.88). The correlation between targeted variables is shown in Table 2. Daily time spent on the smartphone was significantly correlated with BSMAS (r = 0.237, p

< 0.001), NMPQ (r = 0.213, ρ < 0.001), and TAPAS (r = 0.180, ρ < 0.001), but not with IPAQ (r = -0.048, ρ = 0.156). Conversely, daily time spent on outdoor activity was negatively correlated with NMPQ (r = -0.078, ρ = 0.020) and TAPAS (r = -0.092, ρ = 0.006) and positively correlated with IPAQ (r = 0.342, ρ < 0.001), but not BSMAS (r = 0.048, ρ = 0.157). Moreover, significant correlations were observed among the four measures (|r| = 0.098 to 0.519), except between BSMAS and IPAQ (r = 0.030, ρ = 0.375).

Table 1. Baseline Characteristics of Participants (n=885)

Variable	n (%) or Mean ± SD	Minimum	Maximum
Age (years)	28.8 ± 6.06	20	40
Sex (male)	319 (36.0)	-	-
BMI (kg/m^2)	22.82 ± 4.00	14.69	48.67
Smartphone time (hours per day)	5.21 ± 2.88	1	19
Outdoor time (hours per day)	1.80 ± 2.20	0	20
BSMAS (range: 6-30)	14.38 ± 5.19	6	30
NMPQ (range: 20-140)	90.50 ± 25.73	20	140
TAPAS (range: 5-50)	25.31 ± 9.71	10	50
IPAQ (MET*minutes)	3138.21 ± 2940.96	0	15912

BMI, Body Mass Index; BSMAS, Bergen Social Media Addiction Scale; NMPQ, Nomophobia Questionnaire; TAPAS, Tendency to Avoid Physical Activity and Sport Scale; IPAQ, International Physical Activity Questionnaire.

Table 2. Correlation between Study Variables (n= 885)

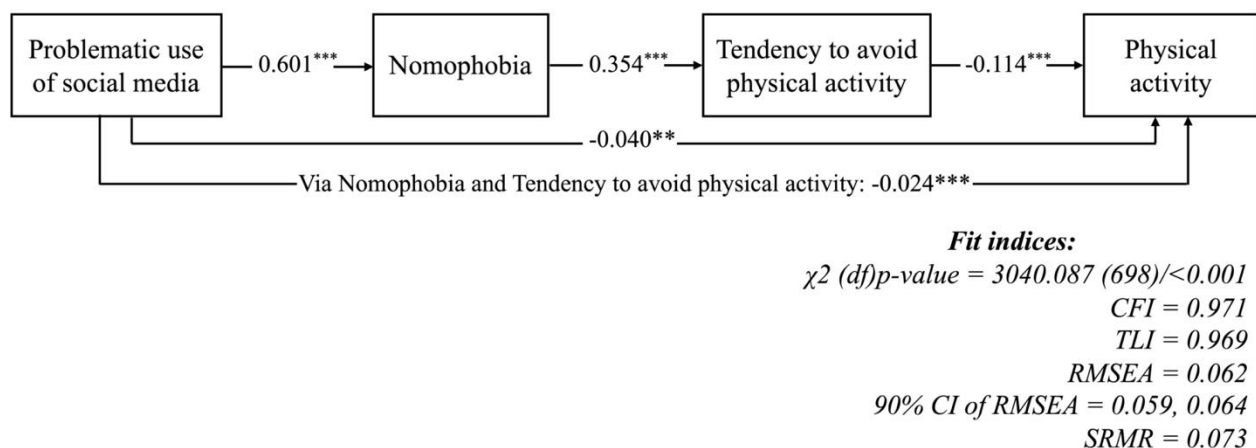|	1	2	3	4	5	6	7	8	9
[1] Age	-								
[2] Sex	**-0.140** **(<0.001)**	-							
[3] BMI	**0.136** **(<0.001)**	**-0.201** **(<0.001)**	-						
[4] Smartphone time	-0.039 (0.249)	**0.076** **(0.024)**	0.036 (0.281)	-					
[5] Outdoor time	-0.043 (0.206)	**-0.079** **(0.018)**	-0.027 (0.420)	0.058 (0.084)	-				
[6] BSMAS	-0.027 (0.426)	0.057 (0.091)	**-0.075** **(0.025)**	**0.237** **(<0.001)**	0.048 (0.157)	-			
[7] NMPQ	0.015 (0.650)	0.051 (0.131)	0.005 (0.887)	**0.213** **(<0.001)**	**-0.078** **(0.020)**	**0.519** **(<0.001)**	-		
[8] TAPAS	0.017 (0.621)	**0.128** **(<0.001)**	**0.235** **(<0.001)**	**0.180** **(<0.001)**	**-0.092** **(0.006)**	**0.350** **(<0.001)**	**0.309** **(<0.001)**	-	
[9] IPAQ	-0.028 (0.404)	-0.060 (0.073)	-0.033 (0.324)	-0.048 (0.156)	**0.342** **(<0.001)**	0.030 (0.375)	**-0.123** **(<0.001)**	**-0.101** **(0.003)**	-

BMI, Body Mass Index; BSMAS, Bergen Social Media Addiction Scale; NMPQ, Nomophobia Questionnaire; TAPAS, Tendency to Avoid Physical Activity and Sport Scale; IPAQ, International Physical Activity Questionnaire. Significance is shown in bold; p-value is shown in parentheses.

The proposed model demonstrated a good fit to the data, as indicated by all four indices from SEM (CFI = 0.971, TLI = 0.969, RMSEA = 0.062, and SRMR = 0.073; see Figure 2). The associations between variables were further examined using the significant standardized coefficients (β). In line with the hypothesis (i), a significant direct association was found between PSMU and PA level (β = -0.040, ρ = 0.004) (ii) nomophobia was positively associated with PSMU (β = 0.601, ρ < 0.001), and PA avoidance (β = 0.354, ρ < 0.001). PA avoidance was also negatively associated with PA level (β = -0.114, ρ < 0.001). Finally, confirming hypothesis (iii), a significant indirect association was found between PSMU and PA via the sequential mediation of nomophobia and PA avoidance (unstandardized coefficient (SE) = -0.084 (0.026), β = -0.024, 95% bootstrap confidence interval = -0.071, -0.024). This means that higher levels of PSMU are indirectly associated with lower levels of PA via greater nomophobia and PA avoidance, whereby nomophobia precedes PA avoidance.

Fit indices:
χ2 (df)p-value = 3040.087 (698)/<0.001
CFI = 0.971
TLI = 0.969
RMSEA = 0.062
90% CI of RMSEA = 0.059, 0.064
SRMR = 0.073

Figure 2. Results of Structural Equation Modeling.

Notes. CFI, comparative fit index; TLI, Tucker-Lewis index; RMSEA, root mean square error of approximation; SRMR, standardized root mean squared residual. Data was presented using standardized coefficients. Solid lines indicate significant associations, and the dashed line indicates non-significant associations. ** $p < 0.01$; ***$p < 0.001$.

4. Discussion

The present study investigated the association between PSMU, nomophobia, PA avoidance, and PA levels among Taiwanese young adults. Our results suggested a direct association between PSMU and PA. In addition, higher levels of PSMU may result in lower PA levels through increased nomophobia and a higher PA avoidance tendency.

The significant negative direct association between PSMU and PA is consistent with a previous cross-sectional study (Ardesch et al., 2023). However, the finding contradicts results from a longitudinal study which reported a positive association (Huang et al., 2022), and two other cross-sectional studies which reported positive (Shimoga et al., 2019) and non-significant associations (Yılmaz et al., 2023) between PSMU and PA. Shimoga et al. (2019) reported that SMU was positively associated with vigorous PA among physically active individuals but negatively associated with vigorous PA among physically inactive (sedentary) individuals. Moreover, they found that individuals with medium-level SMU had the highest level of PA, which suggests that the association between PSMU and PA may not be a simple linear one. Therefore, future research should explore the factors influencing how SMU affects PA levels to uncover the underlying mechanism between PSMU and PA and determine the optimal level of SMU. Potential areas of investigation include the amount of time spent on social media, types of social media platforms (e.g., YouTube vs. WhatsApp), purposes of using social media (e.g., communication, entertainment, or searching information), and usage habits (e.g., active users or passive users, creators or viewers).

A novel finding of this study is the significant positive association between nomophobia and PA avoidance, which aligns with findings from one previous study (Liu et al., 2022). This finding offers new insights into how SMU may affect PA levels. One previous study reported an association between nomophobia and social appearance anxiety, suggesting that individuals with anxiety about their appearance tend to use social media to hide their identities, leading to a dependency on mobile devices and causing nomophobia (Ayar et al., 2018). Furthermore, the concept of TAPAS was also developed building on weight stigma research (the discrimination or devaluation from others due to one's weight), assuming that individuals concerned about their weight might avoid public PA to escape judgment about their physical appearance (Bevan et al., 2022). These findings suggest that nomophobia and PA avoidance share a common underlying concern related to physical appearance. This notion is further supported by studies reporting associations between nomophobia and internalized weight stigma (Liu et al., 2022) and between TAPAS and weight stigma (Huang et al., 2024). Future studies may consider including factors such as 'weight stigma' or 'physical appearance concerns' when investigating the mechanisms involving nomophobia and PA avoidance.

Another plausible assumption that may explain the association between nomophobia and PA avoidance is the psychological status of 'anxiety.' A quantitative study reported that while exercise generally has an anxiolytic effect, individuals with anxiety-related disorders tend to avoid PA (Mason et al., 2019). Specifically, individuals with anxiety-related disorders (e.g., obsessive-compulsive disorder, post-traumatic stress disorder, or specific phobia that may include nomophobia) may experience anxiety related to PA, such as unpleasant past

exercise experiences or adverse responses to the physical sensations associated with exercise. In these cases, the anxiety provoked by the thought of engaging in PA can lead to a tendency to avoid it altogether (Farris et al., 2020; Mason et al., 2023). For these individuals, the perceived negative aspects of PA may outweigh the potential benefits, making PA avoidance a temporary relief from their anxiety (Mason et al., 2019). Furthermore, nomophobia has been associated with social anxiety (Khan et al., 2021), which is associated with social avoidance (Wong et al., 2016) and could extend to PA avoidance (Horenstein et al., 2021). Considering the role of anxiety in both nomophobia and PA avoidance, cognitive behavioral techniques could be investigated as potential interventions to reduce PA avoidance caused by anxiety (Mason et al., 2023). The potential additive effects of nomophobia on PA avoidance warrant further exploration to understand these dynamics better.

One more possible explanation for the relationship between nomophobia and PA avoidance is the shared psychological mechanism of 'avoidance.' Research indicates that nomophobia is associated with social anxiety (Khan et al., 2021). Individuals experiencing these social difficulties might use social media as an 'escape' from real-life interactions, leading to a reliance on their devices (Arpaci et al., 2017). Similarly, PA avoidance involves individuals steering clear of PA to avoid negative judgments or devaluation from others (Bevan et al., 2022). Thus, both nomophobia and PA avoidance represent strategies of avoidance aimed at escaping negative experiences. This common thread suggests that these behaviors may stem from underlying avoidant personality traits, though more studies are needed to explore these connections in more detail. Future studies could investigate how individual characteristics such as avoidant personality or fear of negative evaluation contribute to both nomophobia and PA avoidance. Exploring these relationships might reveal more profound insights into how psychological avoidance mechanisms influence behavior in different contexts.

The abovementioned notions may explain the weak association between PA avoidance and PA found in the present study. In other words, weight stigma might not be the only explanatory factor of PA avoidance; both the psychological condition of anxiety and personality traits of avoidance could also play a role in PA avoidance. In addition, Kagawa et al. (2022) reported a positive association between subjective pleasure and PA through decreasing avoidance tendencies, suggesting that PA enjoyment may also influence the tendency of PA avoidance (Bevan et al., 2022). Therefore, the current TAPAS measure could be enhanced by modifying its focus beyond weight stigma. Specifically, future research might benefit from revising TAPAS to encompass a broader range of avoidance-related factors, including anxiety and general avoidant personality traits. These adjustments could improve TAPAS's utility in studies investigating the underlying mechanisms of PA avoidance and provide more comprehensive insights into how different psychological factors contribute to PA behavior.

The current study has several limitations. First, being a cross-sectional study, causality between study variables cannot be inferred. Second, using self-reported measures may introduce research bias, such as recall bias or social-desirability bias, which could affect the accuracy of the responses. Third, the convenience and snowball sampling may cause selection bias due to the lack of geographic information on participants, which may limit the generalizability. Fourth, focusing on general young adults as the study population may limit the external validity and generalizability of the results. Further research should consider including clinically significant populations, such as those with addictive SMU, to explore these mechanisms in a more specific context.

Despite these limitations, the present study proposed a new way of thinking regarding how PSMU may reduce individuals' PA levels through nomophobia and PA avoidance. In addition to strategies aimed at monitoring the time spent on SMU or increasing PA motivation, future research could explore cognitive behavioral techniques or motivational interviewing as methods to mitigate nomophobia and PA avoidance. Additional approaches might also consider interventions focused on reducing anxiety, avoidant personality traits, or weight stigma as additional factors influencing PA behaviors. However, more studies are needed to investigate their roles. Furthermore, these studies could adopt longitudinal effects to assess how these factors interact and better understand their roles in the mechanisms connecting nomophobia and PA avoidance.

5. Conclusion

The present study offers new insights into how PSMU might affect PA levels through the mediating roles of nomophobia and PA avoidance among Taiwanese young adults. The results showed that while PSMU has no direct association with PA levels, it was associated with decreased PA levels via higher nomophobia and PA avoidance. It highlights the need for interventions to reduce PSMU and foster PA. Future research should consider expanding the scope to include psychological factors like anxiety and personal traits such as avoidance, as well as exploring weight stigma's role in current mechanisms. This exploration could provide valuable insights

into the factors contributing to PA avoidance and help develop more effective intervention programs to promote PA and address the impacts of PSMU.

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Exploration of the association between social media addiction, self-esteem, self-compassion and loneliness

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Abstract

Excessive social media use is associated with several adverse psychological outcomes, including psychological distress and lower levels of self-esteem. Research reports that feelings of loneliness enhance social media abuse, with individuals reporting stronger engagement in social media. However, self-esteem and self-compassion, considered complementary constructs, mitigate social media use. This research explores the association between social media and loneliness and how self-esteem and self-compassion may vary. A sample of 426 Greek adults fulfilled the first adapted version of the Social Media Disorder Scale to assess social media addiction, the UCLA loneliness scale, Rosenberg's self-esteem scale, and the Self Compassion Scale. Structural equation modeling was used, along with Analysis of Variance, to estimate the role of demographics in excessive social media use, such as gender, education, age, and the number of followers. Results revealed that self-esteem was not associated with social media use or other behaviors. Loneliness was positively associated with social media use. Alternatively, higher levels of self-compassion were associated with lower social media use. Self-compassion acted as a mediator with individuals feeling loneliness and exhibiting lower levels of social media addiction. Possible explanations, future directions, and factors contributing to the insignificant relationship between self-esteem and social media are discussed.

1. Introduction

Social media has become an increasingly popular activity worldwide for users of all ages and nationalities, and concerns have been raised regarding their maladaptive use (Kuss & Griffiths, 2017). According to Andreassen and Pallesen (2014), social media maladaptive use, or addictive behavior, refers to an individual's excessive need to spend each and every day considerable time and energy on social media. As such, these individuals tend to neglect important aspects of their lives, such as ignoring friends and/or relations, missing important deadlines at work or studies, quitting hobbies to get extra time for engagement in social media, etc. Social media additive behavior has already been associated with many negative consequences for users (Keyte et al., 2021; Kuss et al., 2014; Mitropoulou et al., 2022; Sun & Zhang, 2021). Due to these alarming outcomes, social media addiction is becoming one of the most important health issues worldwide that requires systematic examination.

Research on social media addiction thus far validated significant associations between feelings of isolation, anxiety, and depression (e.g., Cuadrado et al., 2020; Mitropoulou et al., 2022), psychological distress (e.g., Keyte et al., 2021), problematic job performance (Kuss et al., 2014) and other maladaptive behaviors. However, research on social media and self-esteem, namely the individual's subjective value of oneself, remains ambiguous (Cingel et al., 2022). Studies present diverse patterns of small yet significant relations between self-esteem and social media addiction. Most of the research pertains to excessive social media use, which tends to lessen an individual's self-esteem (e.g., Andreassen et al., 2017; Tibber et al., 2020). Some researchers have identified no experimental effects on individuals' time on social media and their self-esteem, even when specific social media platforms were examined (Sherlock & Wagstaff, 2019). Few studies have reported more complex patterns of association between self-esteem and social media (Subrahmanyam et al., 2020). For example, Valkenburg and colleagues (2017) found that social media use (specifically getting feedback from friends) tends to ameliorate the users' self-esteem in the long term. Moreover, Cingel and Olsen (2018) found that although increased use of the Facebook social media platform tends to reveal lower levels of self-esteem to its users, how users report the platform's use seems to excessively ease the negative linear relation between their self-esteem and their social media platform. Nonetheless, self-esteem is an important contributor to individuals' well-being, and its impact on social media is significant in most research. Literature flags a negative relation between self-esteem and social media with non-significant behavioral differentiations daily (Subrahmanyam et al., 2020). Thus, focusing on the same-day effect and examining different behavioral patterns with different characteristics and traits will contribute to our understanding of maladaptive social media use. This research aims to provide new evidence on the relationship between self-esteem and social media by further investigating their relationship with loneliness and self-compassion in Greek adults.

1.1. Social Media Addiction

Although social media use is principally considered non-problematic, additive non-clinical behavioral patterns have also been documented. Despite the increased research interest, there is no consensus on how social media addiction (referenced as SMA) could be determined and which criteria indicate addiction, with researchers usually focusing on similar criteria and theorizing, like Internet Gaming Disorder. The American Psychiatric Association proposed nine behavioral criteria as indicators for determining Internet Gaming Disorder (5th ed.; American Psychiatric Association, 2013). These criteria share common ground with several other addictive behaviors, too, such as drug and alcohol addiction. In like manner, van den Eijnden and colleagues (2016) adopted the nine criteria for defining Internet Gaming Disorder in their research. They proposed that an individual endorses at least five of the nine criteria over a 12-month to be characterized as problematic/additive. These criteria are) the dominance of social media in daily life (preoccupation), 2) the uprising of unpleasant feelings when the user is not able/allowed to use the stimulus (withdrawal), 3) the ever-increasing need to spend more time on social media each day (tolerance), 4) the unsuccessful attempt to control social media usage (persistence), 5) the loss of interest in hobbies and activities, due to the excessive preoccupation with the stimulus (displacement), 6) the continuation of the excessive use of the social media, despite the knowledge of psychosocial problems (continuation), 7) the deception of important others (e.g., family members, friends) regarding the user's daily utility of the stimulus (deception), 8) the use of social media as a mean of relieve negative mood (escape) and finally 9) the loss of significant relationships, jobs and education/career opportunities due to the maladaptive use of the stimulus (problems).

Researchers have developed several measures to assess SMA. Some measures focus on specific social media platforms (e.g., Andreassen et al., 2012), while others focus on a specific nomological network, such as

the Social Media Disorder Scale (SMDS; van den Eijnden et al., 2016). The development of the SMDS is based on the nine criteria indicated by the DSM-V (APA, 2013). Although the SMDS is widely used and tested in different cultures, a Greek adaptation of the measure is not yet validated (Kokka et al., 2022). Such analysis is essential since it verifies whether a construct is recoverable in a set of item scores to a predetermined structure in a different culture (Bandalos & Gerstner, 2016). Therefore, justification for the use of the Greek-SMDS in research is essential.

1.2. Loneliness and Social Media

Loneliness refers to the individuals' feelings of not having a meaningful emotional relationship with significant others from personal or broader social networks, such as close friends, colleagues, and neighbors (Russell, 1996). Loneliness is characterized as a chronic status; individuals often experience loneliness, even when surrounded by friends or family. Feelings of loneliness result in significant deterioration in individuals' psychological well-being (O'Day & Heimberg, 2021). They are a significant predictor of suicidal ideation and behavior, especially among young adults (McClelland et al., 2020). Thus, establishing the association between social media addiction and loneliness seems imperative because both may be seriously harmful to users, especially young ones. Previous research explored the potential causal relations between loneliness and Facebook use. Individuals feeling lonely tend to use social media more often online to compensate for lacking in-person relations. Although loneliness is an important determinant of social media addiction, more research is needed to determine whether social media abuse also predicts loneliness (e.g., O'Day & Heimberg, 2021). Thus, the focus of this research is to examine the association of loneliness to social media and, specifically, whether loneliness triggers increasing online engagement in social media or whether social media is the source of discouraging social comparisons, exacerbating feelings of loneliness in adults. Therefore, it is hypothesized that loneliness will be positively associated with SMA.

1.3. Self-Esteem and Social Media

Self-esteem refers to the individual's perception of their personal worthiness (Rosenberg, 1965). Self-esteem is subjective; it does not necessarily depend on real talent and/or abilities but reflects self-acceptance and self-respect (Andreassen et al., 2017; Cingel et al., 2022). Self-esteem greatly impacts personal growth and has been associated with different types of behaviors and addictions like social media addiction (Moqbel & Kock, 2018).

Nowadays, individuals compare themselves to others through their social networks rapidly and relentlessly, with researchers indicating mixed results. Self-esteem has been linked positively to social media (Valkenburg et al., 2017). Users tend to feel more sociable and accepted by others; they form social relations through their social media profiles, potentially growing strongly as maladaptive in-person relations (e.g., being more addicted to followers than friends). However, most research reports negative associations between self-esteem and social media (e.g., Acar et al., 2022; Cingel et al., 2022). In their meta-analysis, Saiphoo et al. (2020) found small yet significant negative correlations between self-esteem and SMA, with higher levels of SMA associated with lower levels of self-esteem; low self-esteemed individuals tend to overly engage in social media and develop weaker online relationships on platforms, which are perceived as resilient relationships and consequently lead them to problematic social interactions (Barthorpe et al., 2020). However, the association between social media and self-esteem remains sparse, and more research is required to assist our understanding further. Therefore, it is hypothesized that self-esteem will be significantly associated with SMA, yet the direction of their association is not predicted.

1.4. Self-Compassion and Social Media

Self-compassion refers to self-acceptance, namely the understanding, acknowledgment, and transformation of personal suffering through self-kindness, self-acceptance, and mindfulness (Neff, 2003). Self-compassion is defined by three interactive components, each consisting of two opposite facets. The first facet is self-judgment/self-kindness, which refers to the ability to be caring and compassionate to oneself rather than being harsh, angry, and self-critical towards life and people. The second component pertains to common humanity and isolation. Isolated individuals are prone to social distancing and feel unable to cope with personal failure in contrast to individuals who exhibit common humanity and, thus, are considered more socially active and prone to human contact. The third component is mindfulness/over-identification. Mindfulness refers to the

awareness and acceptance of life's challenging experiences in a balanced way. Alternatively, over-identified individuals tend to suppress and/or exaggerate their negative emotions and feelings.

Self-compassion is an overlapping construct of self-esteem since both share nomological similarities and unique features (Muris & Otgaar, 2023). Since self-compassion and self-esteem have been strongly and positively associated, they are used in proactive interventions associated with addictive behaviors, such as problematic mobile phone use (Liu et al., 2020), social media (Mitropoulou et al., 2022) and emotional well-being and shame proneness (Neff, 2003). Individuals exhibiting social media addiction tend to express lower levels of self-compassion and feel less emotionally secure (Mitropoulou et al., 2022). However, self-compassion is also found to act also as a mediator for SMA (e.g., Keyte et al., 2021). Individuals characterized as self-compassionate report less maladaptive behaviors related to social media. Therefore, it is hypothesized that self-compassion will be negatively associated with SMA and loneliness and will mediate the relationship between loneliness and SMA.

1.5. Demographics and Social Media

Social media additive use is consistently more prevalent among women than men; women are more inclined to express problematic behavioral patterns on social networking interaction (Andreassen et al., 2017; Kuss et al., 2014). Research also reports that younger users are more prone to remain constantly active and thus express excessive social media use than older users (Andreassen et al., 2017; Cingel et al., 2022). Finally, the number of followers is perceived as a risk factor for SMA; users becoming more popular on social media tend to experience additive behaviors to a higher degree (Burrow & Rainone, 2017; Longobardi et al., 2020). Therefore, it is hypothesized that gender and number of followers will be positively associated with SMA, while age and education will exhibit a negative relation to SMA.

1.6. Research Objectives

The present study has four objectives. The first is to examine the association between social media, loneliness, self-esteem, and self-compassion; it is proposed that self-esteem will be significantly associated with self-compassion, and both constructs will be negatively associated with loneliness and social media addiction. Second, self-compassion will affect the relationship between loneliness and social media addiction, with stronger associations being found by individuals who exhibit higher levels of self-compassion. Thirdly, this research further aims to explore the psychometric properties of the Greek-SMDS by providing its first systematic adaptation to Greek social media users. Finally, demographic characteristics are examined among SMA and self-esteem to identify whether certain age groups, gender, and/or educational levels are more prone to maladaptive social media use and self-esteem. Such examination is important because it will further enhance our knowledge of the maladaptive social media behaviors among Greek adults.

2. Method

2.1. Item translation

The SMDS items were translated based on the committee translation process (Harkness & Schoua-Glusberg, 1998). This process includes three stages. During the first stage, three bilingual experts translate the original version of the SMDS into Greek in parallel. At a different time, the bilingual experts review both three created adaptations altogether in a meeting and provide consent for the final, unified, and refined version of the scale. During the final stage, a fourth additional bilingual expert acts as the final verifier for the adapted items and adjudicates any potential disagreement that may appear during the meeting that took part in the second stage of the process. The final translated Greek SMDS items that resulted from the committee translation process can be found in Table 1. All nine items are rated with a binomial response process, with yes (having a score of 1) and no (having a score of 0).

2.1. Participants and Procedure

Four hundred and twenty-six (n = 426) participants were recruited via snowball sampling. This cross-sectional research was conducted in Greece, and data collection occurred between July and October 2022. The inclusion required participants to be over 18 years old and to have an active profile account on at least one social media application (e.g., Facebook, Instagram, Viber, Pinterest, etc). Participants reported a mean age of

26 (SD = 8.43), ranging between 18 and 65 years, and 295 (69.2%) were females. The demographic characteristics of the participants are presented in Table 2.

Table 1. Criteria and items of the Social Media Disorder Scale in English and Greek

Item number	Criterion	Item wording English	Item wording Greek
1	Preoccupation	… regularly found that you cannot think of anything else but the moment you will be an use social media again?	…συνειδητοποιούσες συχνά ότι δεν μπορούσες να σκεφτείς κάτι άλλο, παρά τη στιγμή που θα χρησιμοποιήσεις ξανά τα μέσα κοινωνικής δικτύωσης;
2	Tolerance	…regularly felt dissatisfied because you wanted to spend more time on social media?	…ένιωθες συχνά δυσαρεστημένος/η, γιατί ήθελες να αφιερώσεις περισσότερο χρόνο στα μέσα κοινωνικής δικτύωσης;
3	Withdrawal	…often felt bad when you could not use social media?	…ένιωθες συχνά άσχημα επειδή δε μπορούσες να χρησιμοποιήσεις τα μέσα κοινωνικής δικτύωσης;
4	Persistence	…tried to spend less time on social media, but failed?	…προσπάθησες να αφιερώσεις λιγότερο χρόνο στα μέσα κοινωνικής δικτύωσης, αλλά δεν τα κατάφερες;
5	Displacement	…regularly neglected other activities (e.g. hobbies, sport) because you wanted to use social media?	…παραμελούσες συχνά άλλες δραστηριότητες (π.χ. χόμπυ, σπορ) επειδή ήθελες να χρησιμοποιήσεις τα μέσα κοινωνικής δικτύωσης;
6	Problem	…regularly had arguments with others because of your social media use?	…διαφωνούσες συχνά με άλλους εξαιτίας της χρήσης που έκανες με τα μέσα κοινωνικής δικτύωσης;
7	Deception	…regularly lied to your parents of friends about the amount of time you spend on social media?	…έλεγες συχνά ψέματα στους γονείς ή στους φίλους σου για τον χρόνο που αφιέρωνες στα μέσα κοινωνικής δικτύωσης;
8	Escape	…often used social media to escape from negative feelings?	…χρησιμοποιούσες συχνά τα μέσα κοινωνικής δικτύωσης για να ξεφεύγεις από δυσάρεστα συναισθήματα;
9	Conflict	…had serious conflict with your parents, brother(s) or sister(s) because of your social media use?	…είχες σοβαρούς καβγάδες με τους γονείς, τον αδερφό(-ούς), την αδερφή(-ές) σου εξαιτίας της χρήσης των μέσων κοινωνικής δικτύωσης;

Due to the online assessment, missing values and participation rates were not reported. Participants were recruited on a volunteer basis and invited to participate in the research by sharing the online survey link via their social media profiles. The link redirected individuals to the information sheet, and after consent, participants got access to the research questionnaires. The survey took approximately 15 minutes to complete. Ethical approval was granted by the University of Crete Ethics Committee (protocol no. 117/2022).

Table 2. Demographic characteristics of participants (*N*= 426)

	N	%	χ^2	*p*
Gender			63.1	< .001
Male	131	30.8		
Female	295	69.2		
Status			722	<.001
University student	260	61		
Employed	113	26.5		
Self-employed	23	5.4		
Unemployed	25	5.9		
Pensioner	5	1.2		
Education			484	<.001
Basic	7	1.6		
Higher	251	58.9		
University graduate	137	32.2		
Msc or PhD	31	7.3		
Number of followers			166	<.001
0-500 followers	165	39.6		
501-1000 followers	159	38.4		
1000-3000 followers	80	22		
>3001 followers	11	3.1		

2.2. Measures

2.2.1. Social Media Addiction

Social media addiction was measured with the Greek-SMDS, which consists of nine self-report items, each associated with a core addiction criterion (van den Eijnden et al., 2016). All items follow a binomial response process (Yes/No) regarding the use of social media within a 12-month period of reference. The results section provides information regarding the adapted measure's validity and reliability.

2.2.2. Loneliness

Loneliness was measured with the short version of the 8-item self-report UCLA Loneliness scale (Hays & DiMatteo, 1987). The measure assesses subjective feelings of loneliness over a period of time. Response categories range from 1 (never) to 4 (often). Internal consistency for the scale was α= .90. Anderson and Malikiosi-Loizos (1992) adapted the scale to Greek.

2.2.3. Self-esteem

Self-esteem was measured with the 10-item self-report scale (Rosenberg, 1965). The measure assesses personal sentiments of self-respect and self-acceptance. Response categories range from 1 (totally disagree) to 5 (totally agree). Internal consistency for the scale was α= .84. The scale is adapted to Greek with internal consistency reliability of α = .82 (Koumi, 1994).

2.2.4. Self-compassion

Self-compassion was measured with the Self-Compassion Scale (SCS), which consists of 26 items, with a 5-point Likert-type response scale from 1 (almost never) to 5 (almost always), distributed into six facets self-kindness (five items; α = .70), self-judgment (five items; α = .77), common humanity (four items; α = .72), isolation (four items; α = .71), mindfulness (four items; α = .72) and over-identification (four items; α = .76). The Greek-SCS has a reliability of α = .87 (Mantzios et al., 2015).

2.4. Data Analysis

Analysis was conducted using Jamovi software (the Jamovi project, 2023). Data normality was evaluated with the Shapiro-Wilk normality test (p values >.05 indicating data normality). CFA was contacted to validate the factor structure of all measures used (McCallum & Austin, 2000). Structural equation modeling was tested next to examine the fit of the proposed structural model. The diagonal weighted least square estimator method was used for the analysis because it exceeds in accuracy regarding another estimator, especially when the sample is small, non-normally distributed, and pertains to few model parameters (DiStefano, 2016). The χ^2 test was assessed by calculating the degrees of freedom (χ^2/df), with a ratio of $\leq$ 2 indicating a good fit. Also, the Comparative Fit Index (CFI) and the Tucker-Lewis Index (TLI) are examined, with values > .90 indicating adequate fit (Byrne, 2016). Also, the Root Mean Square Error of Approximation (RMSEA) and the Standardized Root Mean Residual (SRMR) are estimated, with values < .05 indicating an excellent fit, while values ranging from .05 to .08 indicate a reasonable fit. The normal Bootstrap method was also employed, with 10,000 sample replications, to examine the mediation effect of self-compassion on loneliness and SMA. This method assesses the indirect effects of loneliness (independent variable) on social media addiction (dependent variable) through self-compassion, which is considered the mediator. Self-compassion will have a significant indirect effect if 0 is not included within the intersections of the 95% Confidence Intervals (Preacher & Hayes, 2008). Finally, Analysis of Variance (ANOVA) and Linear Regression Analysis were used to examine the variations between different groups of individuals and to identify potential risk factors. The data and analyses used for this research are available at the open science framework repository at (doi: 10.17632/txr34h8bgs.1).

3. Results

The psychometric properties of the SMDS were initially tested. Research prerequisites were examined prior to analysis. The factor analysis results revealed that the unidimensional model of SMDS did not fit the model adequately. Inspection of the modification indices revealed high associations between item pairs 9-6 and 8-4. However, it was preferred to associate only items 9 and 6 because these items share similar wording and meaning. Implementation of the reported modification improved the fit of the model [χ^2 (26) = 81.4, p< .001, CFI = .902, TLI = .865, SRMR = .048, RMSEA = .071 (CIs .054 - .088)]. Standardized estimates were > .40 for all

items. The internal consistency of the measure was ω = .74. To examine the research hypotheses, correlation coefficients are also examined and presented in Table 3. Results reveal a significant positive association between loneliness and social media and a significant negative relationship between social media and loneliness to age, education, self-judgment, isolation, and over-identification. Interestingly, self-esteem and gender were found to have insignificant associations with SMA, loneliness, and most self-compassion facets.

The full structural equation model was then tested to examine whether self-compassion mediates the link between loneliness and social media. A visual presentation of the model is provided in Figure 1. This proposed meditational model is illustrated to predict social media addiction. The model tests loneliness as the independent variable, social media addiction as the dependent variable, and self-compassion as a potential mediator, suggesting that loneliness will have a significant direct effect on social media addiction and an indirect one through self-compassion. The model revealed a good fit to the data [χ^2 (166) = 403, p< .001, CFI = .902 TLI = .888, SRMR = .058, RMSEA = .058 (CIs .051 - .065)].

Table 3. Correlations between research variables

	Mean	SD	1	2	3	4	5	6	7	8	9
1. SMDS	1.55	1.76	-								
2. UCLA	40.1	8.49	.24***	-							
3. Self-esteem	19.4	7.14	.05	-.05	-						
4. SCS over-identification	10.8	3.51	-.24***	-.35***	-.12*	-					
5. SCS self-kindness	16.6	4.22	-.07	-.33***	.10*	.29***	-				
6. SCS self-judgment	13.7	4.27	-.21***	-.30***	-.07	.60***	.34***	-			
7.SCS common humanity	12.8	3.46	-.05	-.21***	.07	.21***	.59***	.15**	-		
8. SCS isolation	12.7	3.66	-.33***	-.55***	-.02	.58***	.29***	.60***	.46**	-	
9. SCS mindfulness	13.9	3.16	-.09	-.22***	.00	.25***	.62***	.07	.57***	.17***	
10. Gender	-	-	.08	-.03	.02	-.13**	.01	.01	-.02	-.00	-.10*
11. Age	-	-	-.25***	-.08	-.27**	.19***	.12*	.13**	.10*	.14**	.14
12. Educational level	-	-	-.10*	-.14**	-.13**	.13**	.03	.10	.06	.15**	.02
13. Number of followers	878	981	.16**	-.06	-.03	-.03	.03	-.06	.09	-.05	.08

Note. N =426; *p< .05**p< .01, ***p< .001; SMDS = Social Media Disorder Scale; UCLA = Loneliness Scale; SCS = Self-Compassion Scale.

Finally, an ANOVA was conducted to demonstrate the difference between social media and users' age, gender, education, and the number of followers within social media platforms. Results reveal small yet significant differences in age for both self-esteem and social media use. Very young (<25 years old) and middle-aged adults (above 35 years old) report increased feelings of confidence [$F_{(2)}$ = 6.303, ρ = .002, η^2= .03] and spent more time on social media [$F_{(2)}$ = 8.28, ρ<.001, η^2= .04], than adults between 26 to 34 years old. Moreover, significant differences were also found among the number of followers [$F_{(2)}$ = 3.618, ρ = .028, η^2= .02]. Interestingly, only the number of followers is found to be a significant risk factor for exhibiting SMA [$F(8, 405)$= 2.98, ρ =.003; β = 0.17, ρ< .001]. Results suggest that many followers (>3000) constitute the potential risk factor for addictive tendencies to social media. It is also interesting to note that insignificant results have been reported regarding social media users' gender, age, and/or educational level.
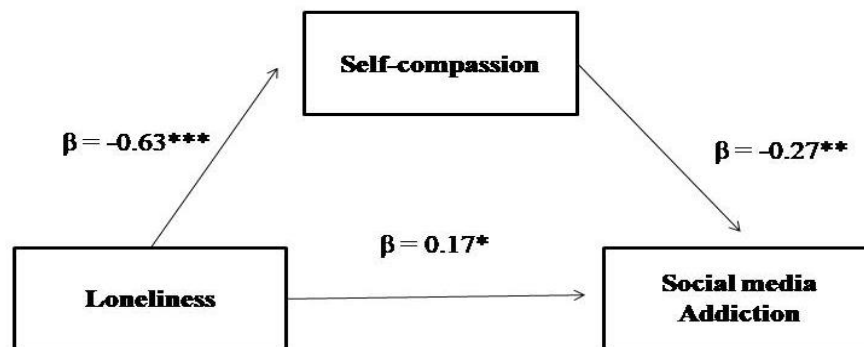
Figure 1. Structural equation model of social media, loneliness, and social-compassion. Notes: * ρ = .041, ** ρ =.002, ***ρ<.001

The factor loadings of the structural equation model were all statistically significant at $\rho<$ .001 and are presented in Table 4. The standardized loadings reveal the magnitude of each variable to its latent variable; the higher the values, the stronger the association between the latent and the observed variables. Results in Table 4 reveal that all negative facets of self-compassion strongly influence the construct. In contrast, all variables of SMDS and loneliness reveal mostly moderate loadings to their designated construct.

Table 4. Standardized and unstandardized loadings for the structural equation model.

Parameter estimates	Unstandardized loadings (SE)	Standardized loadings
1. loneliness → item 2	1.00	.44
2. loneliness → item 3	1.19 (0.15)	.65
3. loneliness → item 9	0.89 (.14)	.41
4. loneliness → item 11	1.39 (.16)	.76
5. loneliness → item 14	1.49 (.17)	.82
6. loneliness → item 15	0.90 (.13)	.48
7. loneliness → item 17	1.40 (.14)	.77
8. loneliness → item 18	1.33 (.16)	.65
9. SCS → over-identification	1.00	.70
12. SCS → self-judgment	1.24 (.10)	.72
13. SCS → isolation	1.28 (.09)	.86
14. SMDS → item 1	1.00	.58
15. SMDS → item 2	0.87 (.10)	.62
16. SMDS → item 3	0.82 (.11)	.48
17. SMDS → item 4	1.19 (.15)	.48
18. SMDS → item 5	0.95 (.12)	.50
19. SMDS → item 6	0.57 (.09)	.38
20. SMDS → item 7	0.58 (.08)	.43
21. SMDS → item 8	1.14 (.16)	.45
22. SMDS → item 9	0.51 (.07)	.40

The tested meditational model predicted the hypothesized relations. The mediation model's results and bootstrap confidence intervals, are presented in Table 5. They reveal that almost all effects do not intersect the value of zero, thus verifying the magnitude of the indirect effect. The exception seems to be the direct effect of loneliness on SMD, which intersects zero and thus reveals a non-significant output. Self-compassion, focusing on the negative facets of the construct, is considered an important mediator for mitigating social media addiction.

Table 5. Mediation of the effect of loneliness by SMD through self-compassion

		b	z	P	95% CI	
Loneliness	Direct to SMD	0.170	1.74	.041	-0.012	0.150
	Indirect to SMD	0.168	2.88	.004	0.025	0.121
	Direct to self-compassion	-0.626	-8.07	<.001	-4.151	-2.524
Self-compassion	Direct to SMD	-0.268	-2.88	.004	-0.036	-0.007

Note. *N*=426, Bootstrap sample size = 10000, CI=confidence interval

4. Discussion

The present study explores the association between loneliness and social media use and their relation to self-compassion. Findings partially confirm our first hypothesis: social media is positively related to loneliness, and both constructs are negatively related to self-compassion, education, and age. However, it is important to note that loneliness represents a trend rather than a statistically significant outcome in this research due to the insignificant outcome of the bootstrap analysis regarding the direct association with SMA. These results further illustrate the complexity of the association between loneliness and social media, supported by previous research. For example, Mao, Fu, and Huang (2023) identified different relationship patterns between loneliness and social media use. Specifically, they found that loneliness is negatively related to the active use of social media. Thus, texting friends, updating personal status, and uploading photos help decrease the subjective emotional experience of loneliness. Alternatively, loneliness insignificantly correlates to the passive way of using social media. These namely behaviors are not necessarily dynamically engaged in communicating with others but rather passively, like browsing other users' profiles and reading comments from third parties. Researchers identified indirect linkages between social media use and loneliness through mediators, such as interpersonal satisfaction and fear of missing out. Similarly, Yang and colleagues (2021) also found that active social media use is negatively related to feelings of loneliness, suggesting that how we engage with social media greatly influences feelings of loneliness in daily life. In this research, the measure used adopts the nine clinical criteria for evaluating addiction, as initially proposed for Internet Gaming Disorder. However, it does not assess the users' active/passive communicative behaviors. Estimating such information would further value our knowledge of SMA to the Greek population, and such practice is proposed for future research.

Moreover, self-esteem is not associated with SMA, as reported in the first hypothesis. Findings reveal a non-significant relation and contradict previous research since most of the literature indicates that SMA is mainly associated with lower levels of self-esteem (Andreassen et al, 2017; Cingel et al., 2022; Saiphoo et al., 2020). Cultural differences could be a rationale for this variation; Greeks could generally be less active and less attached to social media, reducing the social media effect on their mental well-being. However, previous research indicates that Greek adults present similar patterns of social media use, and critical cut-off scores on social media addiction were reached by a relatively low percentage of the Greek sample as reported in different cultures (Mitropoulou et al., 2022).

Non-significant associations between self-esteem and social media use have been reported in the literature (e.g., Kircaburun, 2016). In his meta-analysis, Huang (2022) analyzed the association between social media use and self-esteem and reported variations within research, possibly due to gender differences; SMA and self-esteem correlation was stronger for samples with more male participants than female ones. However, another explanation could be that most researchers (over 50%) use Rosenberg's scale. This measure's psychometric properties remain scrutinized (Schmitt & Allik, 2005). Although the measure is constructed under a unidimensional factor structure model, it exhibits diverse results in several replications, causing researchers to explore alternative models, such as two-factor models, with items grouping into negative and positive factors (Gnambs et al., 2018), bifactor models, comprised by a general self-esteem factor and two specific sub-factors depending on the positive and negative response of the items (Marsh et al., 2010), or finally short-forms scales, aiming at improving the measure's consistency and stability (Monteiro et al., 2022). The challenge remains whether such misfits originate from the measure's incapability to capture the full spectrum of the construct under scrutiny. Another important issue that needs to be specified is whether the model's misfit depends on cultural variations (e.g., Bandalos & Gerstener, 2016; Schmitt & Allik, 2005). The results of the present analysis confirm the misfit of the unidimensional model to the data, thus calling attention to re-examining and/or re-developing a new, improved measure for assessing self-esteem.

To address our second objective, the mediating role of self-compassion was also examined in relation to loneliness and SMA. Findings confirm the second hypothesis: self-compassion mediates the use of social media by individuals perceived as lonely. Exploration of findings through mediation confirmed the relationship between loneliness, social media addiction, and self-compassion; moreover, self-compassion fully explains how it enables a positive relationship. Individuals who acknowledge personal suffering, are compassionate to them and accept life's challenging experiences in a balanced way, mitigate the excessive, addictive use of social media despite and protect their selves even if they are perceived as lonely. Individuals who use social media daily tend to feel lonelier and socially insecure when interacting via social media platforms (Muris & Otgaar, 2023; O'Day & Heimberg, 2021). Users engaging in social media tend to evaluate their behavior negatively, consequently influencing their perceived lack of close in-person relations. These results suggest that interventions promoting

psychological well-being and social media healthy habits must focus on self-compassion to alter the negative impact of social media and loneliness (e.g., Keyte et al., 2021).

This research contributes to the literature in several ways. Initially, it is the first research that examines social media addiction, loneliness, and the mediating role of self-compassion. Intervention programs could focus on self-compassion to enhance psychological well-being and mitigate addictive behaviors. Secondly, it further enhances our knowledge of the complexity of social media use and self-esteem. It highlights the importance of using sound psychometric tools for research and clinical purposes (Kuss & Griffiths, 2017). Research should focus on more complex models to assess the effect of social media on psychological well-being. For example, it may not be the number of followers but the type of interaction one maintains with each one; users interact daily with only a few followers, those of his/her friendly party. Such interaction indicates a more habitual behavior, which may be important in examining the mental well-being of social media users (Bayer et al., 2022). Another important finding is the negative association of social media and the negative facets of self-compassion. Our results align with those of Mitropoulou and colleagues (2022); social media users feel less self-critical and angry, less prone to social distancing, and more able to cope with personal failures since they can control negative emotions and feelings. Finally, findings revealed that adults aged 25 or less and over 35 are more confident and frequent social media users, with significant differences in their number of followers than those aged between 26 and 34.

An important issue that needs to be addressed is how social media use is interpreted. The literature cites several definitions regarding understanding social media's maladaptive behavior, which is referred to as addiction (Andreassen & Pallesen, 2014; Marino et al., 2018; Sun & Zhang, 2021). However, such differences lead to deficiencies in the concept's psychometric assessment. Specific measures assess dispositions and self-perceptions of social media use (Andreassen et al., 2012; van de Eijnden et al., 2016), while other measures focus on the behavioral patterns users express while being active social media (Mao et al., 2023). Such inconsistencies hinder research findings, with variations being identified in several behaviors and attitudes. The assessment of SMA should incorporate a more holistic, integrated approach than merely adopting clinical criteria; emphasis should be given equally to the behavioral patterns expressed by maladaptive users and their personal characteristics and attitudes. Thus, a distinction between ability and trait could benefit research. Specifically, the term ability refers to the specific capacities that help individuals to perform particular tasks or activities. Regarding SMA, active and passive social media use could be identified to elucidate the user's behaviors of communicating with others on social media (like texting directly to friends as opposed to just browsing their personal profile). Moreover, trait refers to the relatively stable characteristics or dispositions that generally influence an individual's behaviors, such as the characteristics that enhance withdrawal symptoms from friends and family due to excessive social media use. Alternative social media models could benefit research more because researchers and clinicians could develop more targeted interventions to help individuals manage their social media use more effectively by addressing the underlying predispositions and the capacities required to cope with potentially addictive behaviors.

This study has certain limitations. Initially, data were self-based, and no information was gathered about non-respondents. Self-selection in web-based surveys may negatively influence representativeness, as evident from the participation of young people and women in the present sample (Andreassen et al., 2017). However, the difference in mean scores between men and women may indicate non-skewed associations. Moreover, the research's design is solely cross-sectional. Namely, data are collected from different individuals simultaneously. This type of research is reported to pertain to bias, especially in estimating mediation effects (Maxwell & Cole, 2007). Future research may collect multi-method data by having peers/friends report on the same attitudes and behaviors or collect data from the same individuals across different time periods. Moreover, participants were only from Greece; results may not represent different populations and cultures. The results add to the existing literature by examining the relationship and the mediation effect between social media addiction, loneliness, self-esteem, and self-compassion. Results revealed that although self-esteem is not a protective factor for social media addictive behaviors, the mediating role of self-compassion is evident, and more elaborated patterns of research need to be established to assist individuals in their feelings of loneliness. Strengthening individuals' self-esteem may not act as a potential component in social network addiction interventions targeting adults after all. However, the construction of sound psychometric measures is considered crucial in order to make inferences about social media addictive behaviors.

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Social Media Fatigue Scale: Adaptation to Turkish culture, validity and reliability study

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Highlights

- The Turkish version of SMFS has acceptable psychometric properties regarding internal consistency, concurrent validity, and discriminant validity.
- The Turkish version of SMFS can be considered a valid and reliable measurement tool for assessing social media fatigue in future research.
- The Turkish version of SMFS is significantly positively correlated with privacy concerns and negatively correlated with SNS continuance intention.

Abstract

In the present study, the Social Media Fatigue Scale (SMFS) developed by Zhang et al. (2021) was adapted to Turkish culture, and the scale's psychometric properties were examined. A cross-sectional survey was conducted with 409 Turkish teacher candidates (Mage= 21.75 years, 48.7% female). Confirmatory factor analysis (CFA) was performed to confirm whether the original factor structure of the SMFS was validated in the Turkish version. Then, the heterotrait-monotrait (HTMT) ratio method was used to examine the discriminant validity of the SMFS. In addition, tests of internal consistency, concurrent validity with external criterion measures, and gender differences were conducted. Jeffreys's Amazing Statistics Program (JASP) version 0.18.3 was used for CFA, HTMT ratio, and internal consistency analyses; IBM SPSS version 25.0 was used for the rest of the analyses. The Turkish version of SMFS consists of 15 items and three sub-dimensions, including cognitive experiences (5 items), behavioral experiences (5 items), and emotional experiences (5 items). This result indicated that the original three-dimensional structure was harmonized with Turkish culture. The three-factor structure of the Turkish version of SMFS has satisfactory psychometric properties in both internal and external validity. In addition, the Turkish version of SMFS was found to be valid for measuring social media fatigue. The Turkish version of SMFS has acceptable psychometric properties regarding internal consistency, concurrent validity, and discriminant validity. Accordingly, it can be considered a valid and reliable measurement tool for assessing social media fatigue in future research. The Turkish version of SMFS provides a general framework for comparative analysis of results from different studies.

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1. Introduction

The number and importance of social media platforms have increased rapidly during the last decade due to the widespread use of the internet and mobile devices. According to the Digital 2024 Global Overview Report, 62% of the world's population (5 billion people) are social media users, while this rate is 67% in Türkiye (Republic of Türkiye Ministry of Transport and Infrastructure [MoTI], 2024). Social media is widely praised for enriching user interactions, helping individuals maintain relationships, and managing online impressions (Sheng et al., 2023). However, some problems have emerged due to overuse of social media (Gan et al., 2023). As a result of excessive and compulsive use, social media fatigue (SMF) may occur in social media users (Ravindran et al., 2014). SMF is a condition in which social media users experience mental fatigue after experiencing various technological, informational, and communicative overloads through participation and interaction on social media platforms (Dhir et al., 2018). As a concept, SMF refers to adverse emotional reactions (e.g., fatigue, exhaustion, burnout, frustration, etc.) to activities on social networking sites (Zheng & Ling, 2021). Individuals' exposure to too much information overload by social media services is shown as a risk factor for the emergence of SMF (Lo, 2019). Exposure to different stimulus intensities from many social media services predisposes individuals active in many social media services to experience SMF (Ravindran et al., 2014). It is seen that systematic analyses have been conducted to establish a general framework identifying the factors related to SMF and those that determine its occurrence. Sunil et al. (2022), a comprehensive analysis of recent articles, revealed that SMF was grouped around four framework factors: cognitive, personal and personality, environmental, and social factors. In a systematic review of 40 articles, Zheng and Lin (2021) categorized the drivers of SMF into three main categories. These are environmental-level drivers (media and message features), individual-level drivers (personal attributes, psychological stressors, and behavioral factors), and relational-level drivers. Based on these studies, it can be concluded that the antecedents of SMF are multidimensional and diverse.

The term SMF describes a range of negative emotional reactions to communication, such as indifference, exhaustion, fatigue, and frustration, resulting from activities on social networking platforms (Zheng & Ling, 2021). In recent studies, SMF is often synonymously with social media burnout (Ravindran et al., 2014). Key precursors of SMF include system overload, information overload, and social overload (Fu et al., 2020; Luqman et al., 2017; Yao & Cao, 2017; Zhang et al., 2021). Information overload on social media is a stressor in instant messaging apps, leading to SMF (Dhir et al., 2018). People often feel compelled to be more active on social media to gain acceptance on these platforms. Being active requires them to stay constantly vigilant and respond to notifications (Cao et al., 2020; Kim et al., 2019). Social overload refers to the negative emotions users experience when they feel pressured to keep up with their social media friends' demands and maintain relationships (Cao et al., 2020). SMF occurs when users engage in excessive social interactions and feel overwhelmed by meeting their friends' requests on social media (Cao & Sun, 2018). Excessive exposure to other users' requests on social networking sites has been reported to lead to feeling overwhelmed and fatigued (Harren et al., 2021; Shi et al., 2020). When users perceive that the functions and features provided by social media platforms are overly complex and beyond their needs, this is termed system feature overload (Zheng & Ling, 2021). The root causes of SMF have primarily been explored through the lens of the overload framework (Shin & Shin, 2016). One potential source of overload is social media addiction (Harren et al., 2021; Liu & Ma, 2020). Individuals who use social media excessively may face overwhelming posts, comments, and interaction demands, which can strain their cognitive processing abilities and lead to information overload. Research supports this view, showing that constant connectivity through smartphone-based social networks is linked to information overload, contributing to SMF (Zhang et al., 2016). Moreover, research has demonstrated a positive correlation between social media addiction and SMF (Dhir et al., 2018; Harren et al., 2021; Lin et al., 2021; Liu & Ma, 2020; Luqman et al., 2017). Liu and Ma (2020) found that problematic social media usage significantly contributes to SMF. It has also been highlighted that SMF can result in negative psychological outcomes, such as depression and anxiety, for users and may lead to a potential loss of users for social media platforms (Dhir et al., 2018; Liu & Ma, 2020; Zheng & Ling, 2021). Empirical research has consistently shown that frequent and intensive social media use increases the likelihood of experiencing SMF (Han, 2018; Lin et al., 2021; Luqman et al., 2017).

In the past decade, numerous studies have focused on measuring SMF. The Social Media Fatigue Scale, developed by Lee et al. (2014) for Facebook users, evaluates dimensions such as depersonalization, emotional exhaustion, risk of privacy exposure, and lack of personal accomplishment. This scale, specifically designed for Facebook, includes three items to measure social media fatigue (e.g., "I am frequently overwhelmed by the

amount of information available on FB") (Dhir et al., 2018). Another SMF scale by Maier et al. (2012) includes four constructs—"Social Overload, Satisfaction, Emotional Exhaustion, and Discontinuous Usage Intention"— also tailored to Facebook. Despite the central role of Facebook in these studies, social media landscapes are much broader, encompassing platforms like Instagram, WhatsApp, YouTube, TikTok, WeChat, and X. In Türkiye, Instagram is the most widely used platform, followed by TikTok (MoTI, 2024). Given this diversity, adapting the Social Media Fatigue Scale (SMFS) developed by Zhang et al. (2021) to Turkish culture was considered appropriate. Unlike previous scales, the SMFS evaluates social media fatigue in a more general and multidimensional way, without focusing on any specific platform. It is based on the Limited Capacity Model (LCM) (Zhang et al., 2021), which posits that humans are information processors who need cognitive resources to store, encode, and retrieve the information they receive (Lang, 2006).

The SMFS comprises three sub-dimensions (emotional, behavioral, and cognitive) and 15 items. The cognitive dimension is related to the fact that immersion in information consumes significant mental resources, leading to overload. If individuals remain in this state for an extended period, they may experience feelings of fatigue. The behavioral dimension explains that mental resources are insufficient for memory retrieval due to cognitive overload, leading to memory loss. Finally, the emotional dimension states that mental resources will also be insufficient to control mood due to information overload. As a result, users experiencing social media fatigue will experience negative emotions (Zhang et al., 2021). This study aims to adapt the Social Media Fatigue Scale (SMFS) developed by Zhang et al. (2021) to Turkish culture and evaluate its psychometric properties. Previous research has explored various measures of social media fatigue and burnout (Bright et al., 2015; Dhir et al., 2018; Han, 2018; Lee et al., 2014; Maier et al., 2012). Notably, Han's (2018) Social Media Burnout Scale has already been adapted to Turkish culture (Gündoğan, 2022; Üztemur & Dinç, 2022). The scale with four constructs related to social media fatigue, developed by Maier et al. (2012), was adapted to Turkish culture by Ünal (2019). Additionally, a Polish version of Zhang et al.'s (2021) Social Media Fatigue Scale (SMFS) was created by establishing its latent structure (Świątek et al., 2021). However, to the best of our knowledge, no study has evaluated the Turkish version of the SMFS developed by Zhang et al. (2021). Therefore, this study seeks to adapt the SMFS to Turkish culture, addressing this gap in the literature and providing a valuable tool for researchers to measure social media fatigue among users in Türkiye.

2. Method

2.1. Participants and Recruitment Procedures

The study was conducted on 409 pre-service teachers (48.7% women) studying at different universities in Türkiye. A convenience sampling technique was used to select the participants. Data was collected online via social networking sites (i.e., WhatsApp, Facebook) using Google Forms. All participants provided e-informed consent before taking the online survey (i.e., by pressing an icon indicating that they agreed to participate) and responded anonymously. There is no missing data, as all survey questions were made mandatory. No incentives were given to the participants. The instructions emphasized that there were no right or wrong answers and that each answer reflected the participant's views and beliefs. This research was approved by the Gaziantep University Ethics Committee's Social and Human Sciences Ethics Committee's decision, Ethics Number: 517263, dated 05/08/2024. The data were collected in August 2024 after ethical approval was obtained. Information about the participants is presented in Table 1.

Table 1. Participants' characteristics (N = 409)

	Mean or n	SD or %
Age	21.75	2.25
Gender		
Male	210	51.3%
Female	199	48.7%
Number of social media friends	333.03	176.95
Time on social media use (hours/day)	3.37	1.59

Note. SD = standard deviation

As seen in Table 1, the participants' mean age was M = 21.75 and SD = 2.25 (range = 18-26 years). The participants' mean daily social media usage time was M = 3.37 and SD = 1.59 (range = 1-8 hours/day). The participants' mean number of social media friends is M = 333 and SD = 176.95 (range = 28-800 friends).

2.2. Scale Adaptation Process

The SMFS developed by Zhang et al. (2021), which was adapted to Turkish culture, consists of three sub-dimensions (Cognitive Experiences [5 items], Behavioral Experiences [5 items], Emotional Experiences [5 items]) and 15 items (See Appendix Table 1). The scale's adaptation process was carried out per the principles proposed by Hambleton and Patsula (1999).

Firstly, permission to adapt the scale to Turkish culture was obtained from the scale owner via e-mail. Then, ethical approval was obtained from the Gaziantep University Social Sciences Ethics Committee. After the necessary permissions were obtained, the translation and language validity were tested. For the translation of the scale into Turkish, the English version was sent to three independent linguists who are proficient in both languages and knowledgeable in the field. The Turkish version of the scale was then finalized by adopting the translations that best reflected the true meaning of each item, as determined by a fourth language expert. The original seven-point Likert scale (ranging from 1 [strongly disagree] to 7 [strongly agree]) was retained. Lastly, the scale's construct validity, criterion validity, and reliability were analyzed over 409 participants.

2.3. Measures

Two external criterion measures, which will be introduced in the following section, were used to examine the SMFS's concurrent validity.

2.3.1. Social Network Sites Continuance Intention Scale

The Social Network Sites (SNS) Continuance Intention Scale, developed by Han (2014, 2018), consists of four items rated on a 7-point Likert scale, with responses ranging from 1 (strongly disagree) to 7 (strongly agree). Higher scores on the scale indicate a stronger intention to continue using SNS. The current study assessed the internal consistency reliability, with Cronbach's α and McDonald's ω coefficients reported as 0.77 and 0.78, respectively.

2.3.2. Privacy Concern Scale

The 3-item Privacy Concern Scale (Bright et al., 2015) measured the participants' privacy concern levels. High scores on the scale represent a high level of privacy concern. In the present study, Cronbach's α and McDonald's ω internal consistency coefficients were 0.60 and 0.61, respectively.

2.4. Data Analysis

Confirmatory factor analysis (CFA) was performed to verify whether the original factor structure of the Social Media Fatigue Scale (SMFS) was maintained in the Turkish version. Following this, the heterotrait-monotrait (HTMT) ratio method was employed to assess the discriminant validity of the SMFS. Additionally, tests for internal consistency, concurrent validity with external criterion measures, and gender differences were conducted. The CFA, HTMT ratio, and internal consistency analyses were carried out using Jeffreys's Amazing Statistics Program (JASP) version 0.18.3, while IBM SPSS version 25.0 was utilized for the rest of the analyses.

The SMFS with all its sub-dimensions was analyzed for internal consistency using Cronbach's α and McDonald's ω. According to George and Mallery (2019), values between 0.60 ≤ α and ω < 0.80 in Cronbach's α or McDonald's ω indicate acceptable internal consistency. The following fit indices calculated from CFA were used to describe whether the factor structure of the original scale was confirmed: Tucker-Lewis index (TLI) > 0.9, comparative fit index (CFI) > 0.9, standardized root mean square residual (SRMR) < 0.08, and root mean square error of approximation (RMSEA) < 0.08 (Byrne, 2016). The factor loadings derived from the CFA for the SMFS were then used for the HTMT method, and discriminant validity is supported when an HTMT ratio is lower than 0.85 (Kline, 2023). The SMFS, with all its sub-dimensions, was examined for concurrent validity with relevant measures (i.e., the external criterion measures of the SNS Continuance Intention Scale and Privacy Concern Scale). Pearson correlations (r) were used for concurrent validity. According to Cohen (1998), Pearson correlation coefficients r < 0.30 indicate that low correlations are expected, while coefficients r > 0.30 indicate that moderate or more vigorous correlations are expected. Lastly, the entire SMFS with its sub-dimensions were examined to see if their scores significantly differed in gender groups (i.e., female vs. male). Independent samples t-test was used to compare the differences between males and females.

3. Results

Table 2 presents the CFA results for the SMFS. The three-factor structure of the SMFS was confirmed by the acceptable fit obtained from the CFA fit indices obtained from the sample (i.e., N = 409). The HTMT analysis was applied for discriminant validity. Because the HTMT ratio of factor loadings was less than 0.85, discriminant validity was supported. In addition, the internal consistency of the entire SMFS and all sub-dimensions was calculated and presented in Table 2. The entire SMFS and its sub-dimensions were found to be reliable.

Table 2. Scale properties of the Social Media Fatigue Scale (SMFS)

	SMFS	Cognitive Experiences	Behavioral Experiences	Emotional Experiences
Cronbach's α	.82	.61	.73	.67
McDonald's ω	.83	.62	.73	.68
CFA				
χ^2 (df)	168.81 (83)	--	--	--
p-value	< .001	--	--	--
CFI	.93	--	--	--
TLI	.91	--	--	--
RMSEA	.05	--	--	--
SRMR	.04	--	--	--
HTMT method				
Cognitive Experiences	--	1.00		
Behavioral Experiences	--	.78	1.00	
Emotional Experiences	--	.78	.60	1.00

Note. CFA=confirmatory factor analysis; CFI=comparative fit index; TLI=Tucker-Lewis index; RMSEA=root mean square error of approximation; SRMR=standardized root mean square residual; HTMT= heterotrait-monotrait ratio.

Table 3 presents the correlations between the entire SMFS, its sub-dimensions, the SNS Continuance Intention Scale, and the Privacy Concern Scale. The cognitive and behavioral experiences of all SMFS positively correlate with privacy concerns. Emotional experiences and privacy concerns have a low positive correlation. However, a moderate negative correlation exists between the entire SMFS, behavioral experiences, and SNS continuance intention. Furthermore, a low negative correlation exists between cognitive experiences, emotional experiences, and SNS continuance intention.

Table 3. Concurrent validity of the SMFS

	Pearson correlation with an external criterion measure	
	Privacy concern	**SNS continuance intention**
SMFS	.40	-.33
Cognitive Experiences	.43	-.27
Behavioral Experiences	.31	-.32
Emotional Experiences	.24	-.19

Note. All p <. 01, SNS = social network sites

Table 4 presents the differentiation of SMFS and its sub-dimensions according to gender. The mean scores obtained from SMFS and its sub-dimensions do not differ statistically significantly between genders (p > .05). This finding indicates that the social media fatigue levels of male and female participants are similar.

Table 4. Comparing the SMFS between gender

	Mean (SD) in gender		t (p)
	Male (n =210)	Female (n = 199)	
SMFS	3.64 (.92)	3.65 (.79)	-.07 (.94)
Cognitive Experiences	4.11 (.99)	4.16 (.92)	-.45 (.66)
Behavioral Experiences	2.93 (1.07)	3.05 (.93)	-1.16 (.25)
Emotional Experiences	3.11 (1.09)	2.97 (.99)	1.34 (.18)

Note. SD = Standard Deviation

4. Discussion

The present study conducted a validity and reliability examination of the Turkish version of SMFS. The Turkish version of SMFS consists of 15 items and three sub-dimensions, including cognitive experiences (5 items), behavioral experiences (5 items), and emotional experiences (5 items). This result indicated that the

original three-dimensional structure was harmonized with Turkish culture (See Appendix Table 2). The three-factor structure of the Turkish version of SMFS has satisfactory psychometric properties in both internal and external validity. In addition, the Turkish version of SMFS was found to be valid for measuring social media fatigue.

The overall Social Media Fatigue Scale (SMFS) and its various dimensions were positively correlated with privacy concerns, supporting findings from previous research. For instance, Bright et al. (2015) identified a positive relationship between privacy concerns and social media fatigue, noting that participants with more significant privacy concerns experienced higher levels of SMF. Similarly, Fan et al. (2021) reported that privacy concerns positively predicted SMF, with a coefficient of $\beta = 0.19$ ($p < .01$).

On the other hand, the SMFS and all its dimensions were negatively correlated to continue SNS. This relationship indicates that as participants' social media fatigue increases, their SNS continuance intentions will decrease. It has been observed that users' excessive social, hedonic, and cognitive use of social media causes social media fatigue, which leads to the intention to quit or reduce social media use (Luqman et al., 2017). Research has shown a positive relationship between SMF and excessive social media use (Lian et al., 2018; Zhang et al., 2020). The literature underlines that the factors associated with social media fatigue are multifaceted; environmental (media features and message features) and incredibly individual (personal attributes, psychological stressors, as well as attitudes and behaviors) level factors play an essential role in directing social media fatigue (Zheng & Ling, 2021).

In addition, it was examined whether the construct obtained from the Turkish version of SMFS showed a significant difference according to gender. There was no significant difference between the groups according to gender in the SMFS and its sub-dimensions. In the literature, studies are showing that social media fatigue is positively correlated with gender (Al-Shatti et al., 2022); women are more likely than men to become emotionally exhausted due to social media overload, and men are more likely than women to engage in information withholding behavior in case of emotional exhaustion (Wu & Zheng, 2023). In addition, it has been observed that social media fatigue positively affects the intention to discontinue use, which is significantly stronger among female users (Gan et al., 2023).

As in every research, this research also has limitations. Firstly, Cronbach's α and McDonald's ω internal consistency coefficients were examined in the reliability calculations of the Turkish version of SMFS. Therefore, test-retest reliability assessments should be conducted to determine the short and long-term consistency of the Turkish version of SMFS. Second, the scale was administered to pre-service teachers aged between 18-26 years. The reliability and validity values of the scale can be examined for different ages and groups (e.g., adolescents, middle adults, and seniors).

As a result, the Turkish version of SMFS has acceptable psychometric properties regarding internal consistency, concurrent validity, and discriminant validity. Accordingly, it can be considered a valid and reliable measurement tool for assessing social media fatigue in future research. The Turkish version of SMFS provides a general framework that can be used for comparative analysis of results from different studies.

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Pathways to social media addiction: Examining its prevalence and predictive factors among Ghanaian youths

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Highlights

- Social media addiction prevalence rate is 12.3%.
- Smartphone application-based addiction, directly and indirectly, affects social media addiction.
- Gaming disorder and nomophobia mediate the effect on social media addiction.
- Predictive factors differ between genders for social media addiction.

Abstract

Social media addiction among youths is becoming a pressing public mental health issue in contemporary society due to the devastating consequences on individuals (i.e., perpetrator and victim) and society. This study, therefore, examined the prevalence, pathways to social media addiction, and predictive factors of social media addiction among Ghanaian youths. The present study used a cross-sectional survey design. A total of 488 participants were conveniently selected to respond to measures on social media addiction, gaming disorder, internet gaming disorder, smartphone application-based addiction, nomophobia, stress, anxiety, and depression. Linear regression and Hayes' PROCESS macro were used to analyze the data. The findings revealed the prevalence rates of social media addiction (12.3%), gaming disorder (3.7%), internet gaming disorder (3.1%), smartphone application-based addiction (29.1%), nomophobia (49.6%), stress (26%), anxiety (62.1%), and depression (49%). There was a direct effect of smartphone application-based addiction on social media addiction and indirect effects through gaming disorder and nomophobia. Also, smartphone application-based addiction had direct effects on gaming disorder, internet gaming disorder, nomophobia, stress, anxiety, and depression. However, there was no direct effect of internet gaming disorder, stress, anxiety, and depression on social media addiction. Furthermore, smartphone application-based addiction and nomophobia (specifically, "losing connectedness" and "giving up convenience") significantly predicted social media addiction among the youths in general. Among females, the predictive factors were smartphone application-based addiction, and nomophobia, specifically "losing connectedness" and "not being able to access information," while smartphone application-based addiction, anxiety, and nomophobia, specifically "giving up convenience," were the predictive factors for males. Smartphone application-based addiction and nomophobia play significant roles in social media addiction, and there are at least three pathways to social media addiction among youths. Therefore, counselors and health professionals need to develop educational and preventive programs that focus on digital literacy and healthy technology use among youths.

1. Introduction

Social media addiction among youths is becoming a pressing public mental health issue in contemporary society due to the devastating consequences on individuals (i.e., perpetrator and victim) and society. It is characterized by excessive engagement with social media platforms, significantly disrupting daily functioning and well-being (Andreassen, 2015). Social media addiction is particularly common due to the advancement in technology and media platforms (Cheng et al., 2021). Epidemiological studies indicate that this phenomenon is widespread (across age, sex, and countries—developing and developed—, and cultures—collectivistic and individualist), with an overall pooled prevalence estimate of 24%. However, this can vary based on culture (e.g., 14% and 31% for individualist and collectivistic countries, respectively) or population (e.g., 18.4% for university students) (Casale et al., 2023; Cheng et al., 2021; Salari et al., 2023). Adolescents are one of the most vulnerable groups of people who frequently use and are affected by social media addiction due to their exploratory nature, although they are inexperience in managing stressful situations, including the use of maladaptive coping strategies (Giordano et al., 2023; Khodarahmi et al., 2023; Villanti et al., 2017; Xu et al., 2023). It is reported that those who use social media for more than 3 hours per day may likely develop mental health problems (Riehm et al., 2019). It is, therefore, not surprising that there have been reported associations between social media addiction and mental health conditions among adolescents.

Knowing more about the factors associated with social media addiction and the role it plays in mental health is important to understand and help deal with this addiction fully. There are several predictive factors of social media addiction. These factors include sex, depression, anxiety, stress, self-esteem, smartphone addiction, and fear of missing out (Alfaya et al., 2023; Piko et al., 2024; Shannon et al., 2022; Tunc-Aksan & Akbay, 2019; Zhao et al., 2022) although it may vary from country to country, culture to culture, and developing countries to developed countries (Cheng et al., 2021; Salari et al., 2023). Furthermore, there were significant associations between social media addiction, nomophobia, smartphone application-based addiction, internet gaming disorder, stress, anxiety, and depression (Al-Mamun et al., 2023; Buctot et al., 2020; Chen et al., 2020; Chen et al., 2023; Lin et al., 2019; Shannon et al., 2022; Victor et al., 2024; Zhao et al., 2022). There were other reported relationships between social media addiction, gaming disorder, stress, anxiety, depression, and nomophobia (Awofala & Esealuka, 2021; Aydin & Kuş, 2023; Giordano et al., 2023; Imani et al., 2022; Krishnan & Chew, 2024; Oppong et al., 2022; Yildiz Durak, 2019). However, there are inconsistent results in all these predictors and associations (Idris et al., 2023; Vagka et al., 2024; Zhao et al., 2022). One of the notable inconsistencies is among the sexes. That is, some studies have reported males (Alnjadat et al., 2019; Xuan & Amat, 2021) while others reported females (Ciacchini et al., 2023; Su et al., 2020; Zhao et al., 2022) as a factor predicting social media addiction, yet still, some found sex as not a significant predictor of social media addiction (Kırık et al., 2015; Mahmood et al., 2022; Piko et al., 2024). These inconsistencies suggest a need for country-specific research to examine the factors that predict social media addiction and the influence of social media addiction on mental health.

The above-reviewed literature revealed significant interrelationships between the studied variables, suggesting that there may be several potential pathways (i.e., direct and indirect pathways) to which an individual may develop social media addiction. Also, previous studies have revealed several pathways to social media addiction (Iwatani & Watamura, 2024; Topino et al., 2023), but there is no known study that has reported the pathway to social media addiction from smartphone application-based addiction via gaming disorder, internet gaming disorder, stress, anxiety, depression, and nomophobia. Therefore, this study may reveal additional pathways to social media addiction.

These global findings may not be significantly different from those of the youths in Ghana. Ghanaian youths have been known to use social media on a massive scale with mixed effects (Abdul-Latif et al., 2024; Ocansey et al., 2016). The positive effects of social media include communication, entertainment, creative works, research, self-promotion, impression management, and academic work (Odoom et al., 2024; Kyei-Gyamfi, 2024) while the negative effects included isolation, social anxiety, distraction, poor academic performance, and addiction, (Abdul-Latif et al., 2024; Odoom et al., 2024; Kyei-Gyamfi, 2024; Tetteh & Kankam, 2024). The main issue among Ghanaian youths is the overuse and/or overdependence on social media for entertainment, self-promotion, and impression management facilitated by cheap smartphones and affordable internet, which may lead to addiction. The effects of social media on youths are known, but the predictive factors of social media addiction are not certain, as well as the possible pathways to social media addiction. Therefore, this study intends to examine i) the prevalence of the studied variables, ii) the pathways to social media addiction, and iii) the predictive factors of social media addiction among Ghanaian youths.

2. Method

2.1 Research Design, Participants, Procedure, and Ethical Considerations

The present study used a cross-sectional survey design. The ethics committee of Kwame Nkrumah University of Science and Technology approved this research (approval number CHRPE/AP/612/23). Following this, the research team secured permission from lecturers to recruit students from various departments and schools in the university. The participants were selected from undergraduate and postgraduate programs. They were informed about the study's purpose and procedures. Those interested were provided with a paper-and-pencil survey. Before participating, individuals signed a consent form, ensuring they understood their rights, including confidentiality, anonymity, and the ability to withdraw from the study without repercussions. Surveys, written in English, included questions on demographic characteristics (age and sex) and measures on social media addiction, gaming disorder, internet gaming disorder, smartphone application-based addiction, nomophobia, stress, anxiety, and depression. The measures were selected for their cultural relevance and psychometric reliability within the Ghanaian context. Participants were given adequate time and privacy to complete the survey, with research assistants available to clarify any uncertainties. Surveys were collected on the same day by the research team. Upon completion, participants were thanked for their contribution and allowed to ask questions regarding the study. Data was collected between 19 July and 04 August 2023.

2.2 Measures

2.2.1 Bergen Social Media Addiction Scale (BSMAS)

The BSMAS is a self-administered tool consisting of six items to evaluate the potential for social media addiction, reflecting social media usage over the past 12-month period (Andreassen et al., 2016). Each item is rated on a five-point Likert scale ranging from 1 (very rarely) to 5 (very often). The total score is achieved by summing each item's ratings, with higher scores signifying a higher likelihood of social media addiction. A score of 24 is considered an optimal cut-off point for clinical diagnosis of social media addiction (Luo et al., 2021; Zhao et al., 2022). This cut-off score was, therefore, used to indicate those who can be considered as having social media addiction. Previous studies among Ghanaians have demonstrated that BSMAS has strong psychometric properties (Huang et al., 2024; Oppong et al., 2022).

2.2.2 The Gaming Disorder Test (GDT)

The GDT is a self-assessment tool created to evaluate gaming disorder symptoms over a one-year period, in line with the diagnostic criteria outlined in the eleventh revision of the International Classification of Diseases (ICD-11) (Pontes et al., 2021). It comprises four items that cover aspects such as the ability to control gaming behavior, the priority given to gaming, the persistence of gaming activities, and the experience of significant problems. Each item is rated on a five-point Likert scale, where 1 represents "never" and 5 represents "very often". The total score is achieved by summing each item's ratings, with higher scores reflecting more severe symptoms. A score of 15 is considered an optimal cut-off point for gaming disorder (Islam et al., 2022; Wu et al., 2023). This cut-off score was, therefore, used to indicate those who can be considered as having gaming disorder. A previous study among Ghanaians has demonstrated that GDT has strong psychometric properties (Huang et al., 2024).

2.2.3 Internet Gaming Disorder Scale-Short Form (IGDS9-SF)

The IGDS9-SF is a self-assessment tool intended to evaluate internet gaming disorder over a one-year period, according to the diagnostic criteria outlined in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) (Pontes & Griffiths, 2015). It consists of nine items, each rated on a five-point Likert scale where 1 means "never" and 5 means "very often". The total score is achieved by summing each item's ratings, with higher scores indicating greater severity of internet gaming disorder. A score of 32 is considered an optimal cut-off point for internet gaming disorder (Qin et al., 2020). This cut-off score was, therefore, used to indicate those who can be considered as having internet gaming disorder. A previous study among Ghanaians has demonstrated that the IGDS9-SF has strong psychometric properties (Huang et al., 2024).

2.2.4 Smartphone Application Based Addiction Scale (SABAS)

The SABAS is a self-report tool consisting of six items aimed at evaluating the risk of developing addictions to smartphone applications (Csibi et al., 2016). Each item is rated on a six-point Likert scale, ranging from 1 (strongly disagree) to 6 (strongly agree). The total score is achieved by summing each item's ratings with higher scores suggesting a higher risk of smartphone application-based addiction. A score of 23 is considered an optimal cut-off point for smartphone application-based addiction (Peng et al., 2023). This cut-off score was, therefore, used to indicate those who can be considered as having smartphone application-based addiction. Previous studies among Ghanaians have demonstrated the SABAS to have strong psychometric properties (Huang et al., 2024; Oppong et al., 2022).

2.2.5 Depression Anxiety Stress Scale-21 (DASS-21)

The DASS-21 is a self-administered questionnaire aimed at evaluating psychological distress (and/or depression, anxiety, and stress) experienced over the past week (Lovibond & Lovibond, 1995). The 21 items are rated on a four-point Likert scale, ranging from 0 (did not apply to me at all) to 3 (applied to me very much or most of the time). The total score is achieved by summing each item's ratings and multiplying by two, with higher scores reflecting more significant depression, anxiety, and stress. A score of 10-13, 14-20, 21-27, and 28 and above for mild, moderate, severe, and extremely severe depression, respectively. For anxiety, a score of 8-9, 10-14, 15-19, and 20 and above for mild, moderate, severe, and extremely severe anxiety, respectively. For stress, a score of 15-18, 19-25, 26-33, and 34 and above for mild, moderate, severe, and extremely severe stress respectively (Lovibond & Lovibond, 1995). A previous study among Ghanaians has demonstrated the DASS-21 to have strong psychometric properties (Oppong et al., 2022).

2.2.6 Nomophobia Questionnaire (NMP-Q)

The NMP-Q is a self-assessment tool designed to evaluate the fear of being without a mobile phone (Yildirim & Correia, 2015). It comprises four dimensions, which include i) not being able to communicate (Items 1–4), ii) losing connectedness (Items 5–9), iii) not being able to access information (Items 10–15), and iv) giving up convenience (Items 16–20). Each of the 20 items is rated on a seven-point Likert scale, from 1 (strongly disagree) to 7 (strongly agree). The total score is achieved by summing each item's ratings, with higher scores indicating a greater degree of nomophobia. A score of 73 is considered an optimal cut-off point for nomophobia (Luo et al., 2024). This cut-off score was, therefore, used to indicate those who can be considered as having nomophobia. A previous study among Ghanaians has demonstrated that the NMP-Q has strong psychometric properties (Huang et al., 2024).

2.3 Data analyses

The demographic characteristics of participants were presented using means and standard deviations (M and SD) and frequencies with their percentages (%). Also, the Pearson correlation coefficient (r) was used to examine the relationships between the studied variables. After that, linear regression was used to test the predicting factors for social media addiction. The predictor variables were gaming disorder, internet gaming disorder, smartphone application-based addiction, nomophobia (i.e., not being able to communicate, losing connectedness, not being able to access information, and giving up convenience), and psychological distress (i.e., stress, anxiety, and depression). Furthermore, a mediation analysis was performed using Hayes' PROCESS macro version 4.3 for SPSS (Hayes, 2022). The mediation analysis had smartphone application-based addiction as the predicting variable, gaming disorder, internet gaming disorder, nomophobia, stress, anxiety, and depression as the mediating variables, and social media addiction as the outcome variable (Figure 1). The mediation analysis used model 4 and 5000 bootstrapping resamples. The level of significance was set at 0.05. All these statistical analyses were conducted using SPSS version 29 software (Armonk, NY, USA: IBM Corp.).
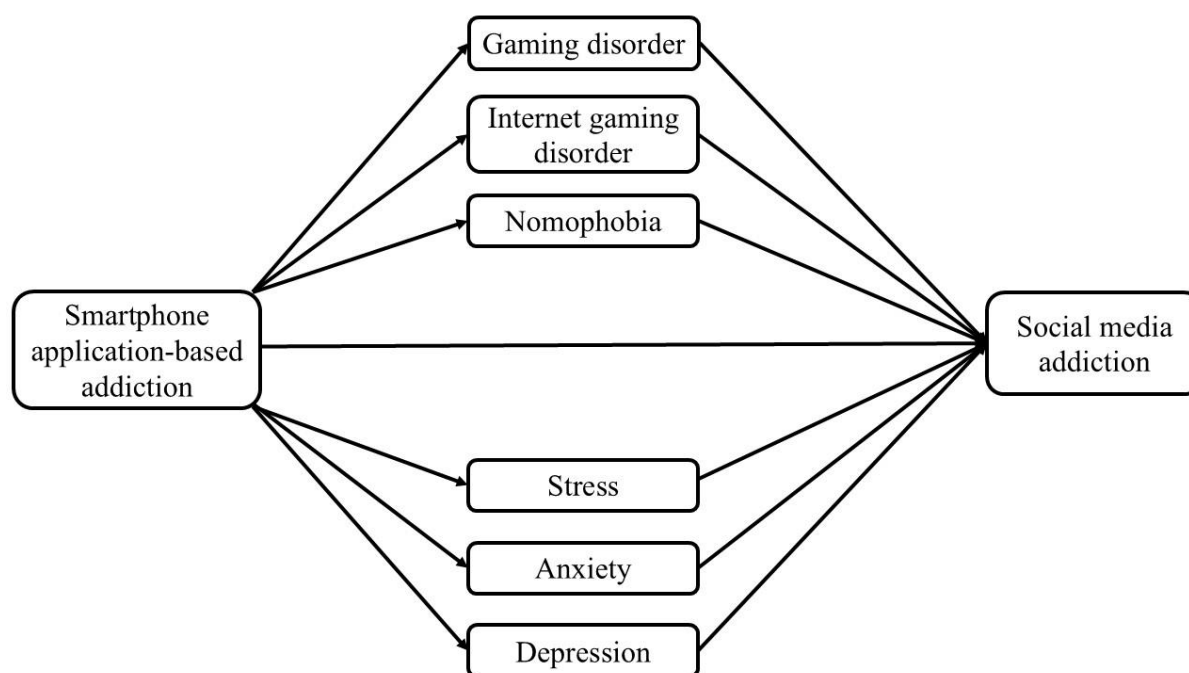
Figure 1. The mediating roles of nomophobia, gaming disorders, stress, anxiety, and depression in the association between smartphone application-based addiction and social media addiction

3. Results

Table 1 shows 488 participants, with females being the majority (n=297, 60.90%) and a mean age of 19.59 years (SD=1.92) for this study. The prevalence rates for social media addiction, gaming disorder, internet gaming disorder, and smartphone application-based addiction were 12.3%, 3.7%, 3.1%, and 29.1%, respectively. The prevalence rates for nomophobia, stress, anxiety, and depression were 49.6%, 26%, 62.1%, and 49% respectively. On average, participants spend more than 6 hours sleeping, 1.64 hours exercising, 2.39 hours gaming, 4.61 hours on social media, and 3.95 hours learning online per day.

Table 1. Characteristics of participants (N=488)

Variable	Mean (SD) or N (%)
Age	19.59 (1.92)[a]
Sex (females)	297 (60.90%)[a]
Prevalence of social media addiction	60 (12.3%)
Prevalence of gaming disorder	18 (3.7%)
Prevalence of internet gaming disorder	15 (3.1%)
Prevalence of smartphone application-based addiction	142 (29.1%)
Prevalence of stress	127 (26%)[b]
Prevalence of anxiety	303 (62.1%)[c]
Prevalence of depression	239 (49%)[d]
Prevalence of nomophobia	242 (49.6%)
Time spent (average hours per day) on the following activities	
Sleep (weekday)	6.22 (1.33)
Sleep (weekend and holiday)	7.54 (1.79)
Exercising	1.64 (1.52)
Gaming	2.39 (2.22)
Social media	4.61 (2.77)
Learning online	3.95 (2.61)

Note: [a]Five participants were missing; [b]Mild and above (and n=70, 14.3% for moderate stress, n=28, 5.7% for severe stress, and n=4, 0.8% for extremely severe stress); [c]Mild and above (and n=258, 52.9% for moderate anxiety, n=127, 26.0% for severe anxiety, and n=70, 14.3% for extremely severe anxiety); [d]Mild and above (and n=169, 34.6% for moderate depression, n=55, 11.3% for severe depression, and n=23, 4.7% for extremely severe depression).

Table 2 shows the correlations between the studied variables. There were significant positive correlations between all the studied variables (i.e., gaming disorder, internet gaming disorder, social media addiction, smartphone application-based addiction, stress, anxiety, depression, and nomophobia), with the degree of their relationships ranging from small to large (r= 0.10 – 0.84, ps< 0.05).

Table 2. The correlation matrix between the studied variables (N=488)

		M	SD	1	2	3	4	5	6	7	8
1	Gaming disorder	7.17	3.36	–	0.64***	0.21***	0.23***	0.33***	0.34***	0.33***	0.13***
2	Internet gaming disorder	16.03	6.92		–	0.12**	0.18***	0.34***	0.35***	0.34***	0.10*
3	Social Media Addiction	15.71	5.99			–	0.70***	0.23***	0.25***	0.24***	0.58***
4	Smartphone application-based addiction	18.20	7.65				–	0.25***	0.26***	0.26***	0.61***
5	Stress	10.36	8.29					–	0.84***	0.84***	0.24***
6	Anxiety	10.35	8.31						–	0.83***	0.24***
7	Depression	9.92	8.72							–	0.22***
8	Nomophobia	73.97	35.53								–

*p< 0.05, **p<0.01, ***p<0.001

Table 3. The mediating roles of nomophobia, gaming disorders, stress, anxiety, and depression in the association between smartphone application-based addiction and social media addiction

	Unstand. Coeff.	SE or (Bootstrapping SE)	t-value or (Bootstrapping LLCI)	p-value or (Bootstrapping ULCI)
Total effect of smartphone application-based addiction on social media addiction	0.55	0.03	21.62	<0.001
Direct effect of smartphone application-based addiction on gaming disorder	0.10	0.02	5.20	<0.001
Direct effect of smartphone application-based addiction on internet gaming disorder	0.16	0.04	3.92	<0.001
Direct effect of smartphone application-based addiction on nomophobia	2.83	0.17	16.90	<0.001
Direct effect of smartphone application-based addiction on stress	0.27	0.05	5.62	<0.001
Direct effect of smartphone application-based addiction on anxiety	0.28	0.05	5.88	<0.001
Direct effect of smartphone application-based addiction on depression	0.29	0.05	5.83	<0.001
Direct effect of smartphone application-based addiction on social media addiction	0.42	0.03	13.25	<0.001
Direct effect of gaming disorder on social media addiction	0.15	0.07	1.99	0.047
Direct effect of internet gaming disorder on social media addiction	-0.06	0.04	-1.64	0.103
Direct effect of nomophobia on social media addiction	0.04	0.01	6.16	<0.001
Direct effect of stress on social media addiction	-0.02	0.05	-0.4989	0.618
Direct effect of anxiety on social media addiction	0.05	0.05	1.1228	0.262
Direct effect of depression on social media addiction	0.01	0.04	0.1705	0.865
Indirect effect of smartphone application-based addiction on social media addiction via				
Gaming disorder	0.01	0.01	0.00	0.03
Internet gaming disorder	-0.01	0.01	-0.02	0.00
Nomophobia	0.12	0.02	0.07	0.16
Stress	-0.01	0.01	-0.03	0.02
Anxiety	0.01	0.01	-0.01	0.05
Depression	0.00	0.01	-0.02	0.03
Total indirect effect	0.13	0.02	0.09	0.18

Table 3 shows the results on the mediating roles of nomophobia, gaming disorders, stress, anxiety, and depression in the association between smartphone application-based addiction and social media addiction. From the table, there were direct effects of smartphone application-based addiction on gaming disorder

(unstandardized coefficient = 0.10, ρ < 0.001), internet gaming disorder (unstandardized coefficient = 0.16, ρ < 0.001), nomophobia (unstandardized coefficient = 2.83, ρ < 0.001), stress (unstandardized coefficient = 0.27, ρ < 0.001), anxiety (unstandardized coefficient = 0.28, ρ < 0.001), depression (unstandardized coefficient = 0.29, ρ < 0.001), and social media addiction (unstandardized coefficient = 0.42, ρ < 0.001). There were direct effects of gaming disorder on social media addiction (unstandardized coefficient = 0.15, ρ = 0.047) and nomophobia on social media addiction (unstandardized coefficient = 0.04, ρ < 0.001). Also, only gaming disorder (unstandardized coefficient = 0.01, LLCI = 0.00, ULCI = 0.03) and nomophobia (unstandardized coefficient = 0.12, LLCI = 0.07, ULCI = 0.16) mediated the association between smartphone application-based addiction and social media addiction but not internet gaming disorder (unstandardized coefficient = -0.01, LLCI = -0.02, ULCI = 0.00), stress (unstandardized coefficient = -0.01, LLCI = -0.03, ULCI = 0.02), anxiety (unstandardized coefficient = 0.01, LLCI = -0.01, ULCI = 0.05), and depression (unstandardized coefficient = 0.00, LLCI = -0.02, ULCI = 0.03). Furthermore, there was a significant total effect of smartphone application-based addiction on social media addiction (unstandardized coefficient = 0.55, ρ < 0.001) and a total indirect effect of smartphone application-based addiction on social media addiction (unstandardized coefficient = 0.13, LLCI = 0.09, ULCI = 0.18).

Table 4. Predictive factors of social media addiction among youths in Ghana

Variables	Total Sample				Females				Males			
	B	SE	*B*	*p*	B	SE	*B*	*p*	B	SE	*B*	*p*
Constant	5.63	2.07		0.007	7.72	2.65		0.004	2.16	3.43		0.530
Age	-0.04	0.10	-0.01	0.693	-0.12	0.13	-0.04	0.327	0.10	0.16	0.03	0.537
Sex (male)	-0.05	0.40	-0.01	0.904	–	–	–	–	–	–	–	–
Internet Gaming Disorder	-0.06	0.04	-0.07	0.106	-0.07	0.05	-0.08	0.153	-0.04	0.06	-0.04	0.486
Gaming Disorder	0.13	0.08	0.07	0.090	0.16	0.11	0.08	0.133	0.07	0.11	0.04	0.505
Smartphone Application Based Addiction	0.41	0.03	0.52	<0.001	0.42	0.04	0.52	<0.001	0.39	0.05	0.50	<0.001
Psychological distress	(0.01)	(0.01)	(0.04)	(0.222)	(0.01)	(0.01)	(0.04)	(0.346)	(0.02)	(0.02)	(0.06)	(0.289)
Stress	-0.02	0.05	-0.03	0.646	0.02	0.06	0.03	0.771	-0.09	0.07	-0.12	0.201
Anxiety	0.06	0.05	0.08	0.211	0.01	0.06	0.02	0.813	0.14	0.07	0.18	0.049
Depression	-0.00	0.04	-0.01	0.987	0.01	0.06	0.01	0.927	0.00	0.07	0.00	0.964
Nomophobia	(0.04)	(0.01)	(0.25)	(<0.001)	(0.04)	(0.01)	(0.21)	(<0.001)	(0.06)	(0.01)	(0.33)	(<0.001)
Not able to communicate	0.07	0.04	0.09	0.132	0.09	0.06	0.11	0.153	0.04	0.07	0.05	0.567
Losing connectedness	0.09	0.04	0.15	0.027	0.12	0.05	0.19	0.031	0.03	0.07	0.04	0.718
Not being able to access information	-0.05	0.03	-0.11	0.071	-0.08	0.04	-0.17	0.033	-0.01	0.05	-0.02	0.807
Giving up convenience	0.10	0.03	0.17	0.002	0.07	0.04	0.11	0.108	0.19	0.06	0.30	0.003
R² (Adjusted R²)	55.1% (54.0%)				50.2% (48.3%)				65.3% (63.0%)			
F	47.618***				26.051***				29.032***			

Table 4 shows the predictive factors of social media addiction among youths in Ghana. In general, smartphone application-based addiction (β = 0.52, ρ < 0.001), nomophobia (β = 0.25, ρ < 0.001; specifically, "losing connectedness" [β = 0.15, ρ = 0.027], and "giving up convenience" [β = 0.17, ρ = 0.002]) significantly predicted social media addiction among the youths. Taking sex differences into consideration, smartphone application-based addiction (β = 0.52, ρ < 0.001), and nomophobia (β = 0.21, ρ < 0.001; specifically, "losing connectedness" [β = 0.19, ρ = 0.031], and "not being able to access information" [β = -0.17, ρ = 0.033]) significantly predicted social media addiction among female youths while smartphone application based addiction (β = 0.50, ρ < 0.001), anxiety (β = 0.18, ρ = 0.049), and nomophobia (β = 0.33, ρ < 0.001; specifically,

"giving up convenience" [β = 0.30, ρ = 0.003]) were the factors that significantly predicted social media addiction among male youths. These predictive factors accounted for 55.1% of all possible predictive factors ($F_{(12, 465)}$ = 47.618, ρ < 0.001) for the total sample, 50.2% for females ($F_{(11, 284)}$ = 26.051, ρ < 0.001) and 65.3% for males ($F_{(11, 170)}$ = 29.032, ρ < 0.001). All the other factors were not significant.

4. Discussion

The present study examined the prevalence, pathways to social media addiction, mediating role of social media addiction, and predictive factors of social media addiction among Ghanaian youths. The findings revealed the prevalence rates of social media addiction (12.3%), gaming disorder (3.7%), internet gaming disorder (3.1%), smartphone application-based addiction (29.1%), nomophobia (49.6%), stress (26%), anxiety (62.1%), and depression (49%). These prevalence rates are worth mentioning, especially post-coronavirus disease 2019. These indicate that school counselors need to introduce educative programs that may help to educate and train youths on how to appropriately deal with mental health issues and, more especially, social media and smartphone usage. Furthermore, there were significant relationships between gaming disorder, internet gaming disorder, social media addiction, smartphone application-based addiction, stress, anxiety, depression, and nomophobia, which indicates that as one of these variables increases, the other also increases and vice versa. This affirms the point emphasized earlier that counselors and health experts need to introduce educative programs that may help to educate and train youths on how to deal with mental health issues as they are interrelated appropriately. Previous studies have supported these relationships (Awofala & Esealuka, 2021; Buctot et al., 2020; Chen et al., 2020; Giordano et al., 2023; Imani et al., 2022; Krishnan & Chew, 2024; Oppong et al., 2022; Yildiz Durak, 2019).

The results on pathways to social media addiction revealed that there were three pathways through which an individual with smartphone application-based addiction may influence social media addiction among youths in Ghana. Specifically, smartphone application-based addiction may, directly and indirectly, influence social media addiction through gaming disorder and nomophobia. Thus, there are three possible pathways in this study through which smartphone application-based addiction may influence social media addiction, which further suggests that there are several ways through which an individual may develop social media addiction if that individual has smartphone application-based addiction. These are novel findings. Also, the results revealed that smartphone application-based addiction had a direct influence on gaming disorder, internet gaming disorder, stress, anxiety, depression, and nomophobia, which indicates that there is an urgent need for youths to be educated on the mental health implications of getting addicted to using smartphones. The other variables (i.e., internet gaming disorder, stress, anxiety, and depression) did not directly influence social media addiction. Although some of these findings are consistent with the findings of previous studies (Al-Mamun et al., 2023; Awofala & Esealuka, 2021; Chen et al., 2020; Fazeli et al., 2020; Huang et al., 2024), some also contradict previous studies (Vagka et al., 2024; Zhang et al., 2022), which again calls for country-specific studies to be conducted. These findings, in general, are important and novel in revealing how youths may develop social media addiction.

The predictive factors of social media addiction among youths in Ghana were smartphone application-based addiction and nomophobia ("losing connectedness" and "giving up convenience"). The connection between smartphone application-based addiction and social media addiction is understandable, as the majority of the youths use smartphones with seamless access to a myriad of applications, including social media platforms. As smartphones become an integral part of daily life, habitual use can escalate into addiction. Therefore, interventions promoting healthy smartphone application usage habits and digital literacy could effectively mitigate the risk of addiction. Furthermore, the concept of nomophobia, particularly the fear of "losing connectedness" and "giving up convenience," further elucidates the psychological underpinnings of social media addiction. The fear of being disconnected from one's social network or missing out on important information reinforces compulsive social media use. This finding aligns with the broader understanding of social media as a tool for maintaining social ties and accessing real-time information, crucial aspects of modern social interaction (Garibaldi et al., 2023; Wandi & Andriana, 2021; Wang, 2022). Addressing these fears through cognitive-behavioral approaches could help youths develop healthier relationships with technology. Interventions could focus on enhancing offline social interactions and promoting a balanced lifestyle that values digital and real-world connections. These novel findings are important to youths, counselors, other health experts, and relevant policymakers in mitigating mental health conditions. Some of the results, such as sex, depression, anxiety, and stress, are inconsistent with the findings of previous studies (Alfaya et al., 2023;

Alnjadat et al., 2019; Piko et al., 2024; Shannon et al., 2022; Su et al., 2020; Tunc-Aksan & Akbay, 2019; Zhao et al., 2022).

Additionally, among females, the predictive factors were smartphone application-based addiction, and nomophobia, specifically "losing connectedness" and "not being able to access information," while smartphone application-based addiction, anxiety, and nomophobia, specifically "giving up convenience," were the predictive factors for males. Smartphone application-based addiction and nomophobia are common to both male and female youths. However, females have an extra nomophobia subscale (i.e., "not being able to access information"), while males have a different nomophobia subscale ("giving up convenience"). That is, apart from "losing connectedness", female youths experience discomfort when they are "unable to access information" on their smartphones. In contrast, the only nomophobia distress male youths have is the feeling of giving up the convenience smartphones provide. In addition, increased anxiety levels in males predict their social media addiction. This calls for the need for males to monitor and better manage their anxiety levels so as not to trigger social media addiction. also, the need for counselors and health professionals to appreciate the sex differences on the predictors of social media addiction.

4.1 Implications for Theory and Practice

There are several practical implications to the present study's results. Firstly, there will be a need for school counselors and mental health professionals to develop educational and preventive programs that focus on digital literacy and healthy technology use. These programs should aim to increase awareness about the risks of digital addiction and provide strategies for managing screen time and technology-related stress. Secondly, targeted interventions can focus on specific factors such as nomophobia and smartphone application-based addictions and promoting balanced lifestyles. Cognitive-behavioral approaches could help youths manage their fears of disconnection and develop healthier relationships with technology. Thirdly, the findings provide evidence for policymakers to develop regulations and guidelines that address the mental health implications of digital technology use among youths. These policies could promote responsible smartphone usage and encourage the development of resources and support systems for those struggling with addiction. Fourthly, given the prevalence of anxiety, depression, and stress among youths, mental health services should incorporate assessments of digital addiction as part of routine evaluations. This could facilitate early detection and intervention, reducing the long-term impact of these conditions.

4.2 Limitations and directions for future research

The present study has some limitations. Firstly, using a cross-sectional design limits the ability to infer causality between the variables studied. Therefore, it is recommended that future longitudinal research should be conducted to help establish causal relationships and examine how social media addiction and its predictors evolve. This approach could provide insights into the long-term effects of digital addiction on mental health. Secondly, the reliance on self-report instruments may introduce bias, such as social desirability bias. Participants might underreport or overreport their addiction levels or psychological distress, affecting the accuracy of the findings. To help limit this effect, participants were assured of their rights, including anonymity and confidentiality of the data, and enough space was provided for the participants to complete their survey alone (i.e., privately). Thirdly, the study focused on university students, which may limit the representativeness of all Ghanaian youths. Therefore, researchers should exercise caution in extending the results, especially to non-student populations or youths in different regions or socioeconomic contexts. Also, future studies should include a more diverse sample of Ghanaian youths, incorporating different age groups, educational backgrounds, and geographic locations to enhance the generalizability of the results.

5. Conclusion

The present cross-sectional study examined the prevalence, pathways to social media addiction, and predictive factors of social media addiction among Ghanaian youths. The findings revealed the prevalence rates of social media addiction (12.3%), gaming disorder (3.7%), internet gaming disorder (3.1%), smartphone application-based addiction (29.1%), nomophobia (49.6%), stress (26%), anxiety (62.1%), and depression (49%). Also, there was a direct effect of smartphone application-based addiction on social media addiction and indirect effects through gaming disorder and nomophobia. In addition, smartphone application-based addiction and nomophobia significantly predicted social media addiction among Ghanaian youths. The results have several

important implications for both theory (e.g., integration of digital addiction models and the role of nomophobia in addiction) and practice (e.g., educational and preventive programs, targeted interventions, and policy development). Future studies may focus on longitudinal studies to strengthen the findings on the pathways to social media addiction. Furthermore, a mixed-methods approach, intervention studies, and cross-cultural comparisons may be used in future studies to enhance the understanding of social media addiction, effective treatment, and cultural differences, respectively.

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