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The Impact of Nomophobia: Exploring the Interplay Between Loneliness, Smartphone Usage, Self-control, Emotion Regulation, and Spiritual Meaningfulness in an Indonesian Context

Triantoro Safaria[1] · Nofrans Eka Saputra[2] · Diana Putri Arini[3]

Abstract

Nomophobia is characterized as an irrational fear or anxiety that arises when one is unable to use, contact, communicate, or access mobile phones. Previous research on nomophobia has been conducted mainly through an exploratory approach. Few studies have tested the theoretical model of nomophobia through a confirmatory analysis approach. Thus, this research contributes to filling the existing gap by testing a theoretical model of nomophobia. This cross-sectional study was conducted in Yogyakarta, Palembang, and Jambi, Indonesia. We used purposive sampling to recruit 689 students from various levels in those three cities to participate in this study. Specifically, the participants consisted of junior high school students ($n = 245$, 35.5%), high school students ($n = 235$, 34.2%), and college students ($n = 209$, 30.3%). Among them, 380 (55.2%) were women, and 309 (44.8%) were men. We used questionnaires to measure nomophobia, emotion regulation, self-control, spiritual meaningfulness, loneliness, and smartphone use. Data were analyzed using the structural equation model (SEM) analysis. Our findings revealed that emotional regulation, spiritual meaningfulness, and self-control had significant indirect effects on nomophobia. Furthermore, the intensity of smartphone use is a significant mediator that increases nomophobia in this model. Furthermore, the intensity of smartphone use is a significant mediator in this fit model. Future research should explore interventions that enhance emotional regulation, spiritual meaningfulness, and self-control to reduce nomophobia. Additionally, examining the specific mechanisms through which smartphone use mediates this relationship could provide deeper insights. Implementing educational programs on mindful smartphone usage and developing strategies to balance digital engagement may also prove beneficial.

Keywords Nomophobia · Emotion regulation · Self-control · Spiritual meaningfulness · Loneliness · Smartphone use intensity · Indonesia

Introduction

Nomophobia, a term for the anxiety and fear of being without a smartphone, has been recognized as a condition that can impact individuals' psychological well-being (King et al., 2010; Lee, 2014; SecurEnvoy, 2012). It is assessed through questions that gauge how much anxiety, discomfort, and other negative emotions people feel when they cannot use their phones. This issue was first identified in a 2008 study by the British Post Office, which aimed to explore smartphone users' anxiety (SecurEnvoy, 2012). The research, which included 2100 participants, later revealed that about 53% of smartphone users are affected by nomophobia (Mail Online, 2008). Nomophobia is found in 25.46 to 70.76% of individuals in both developed and developing countries, with young adults being the most affected group (Jahrami et al., 2023; Ozdemir et al., 2018). Among students, the condition impacts between 18.5% and 73% (Dixit et al., 2010; Kaur et al., 2015; Liu et al., 2022).

Numerous prior studies have demonstrated that nomophobia is associated with panic disorder (King et al., 2010), as well as reduced levels of happiness, loneliness, and self-esteem issues (Ozdemir et al., 2018; Dai et al., 2021), particularly among young individuals (Gutiérrez-Puertas et al., 2016; Ramos-Soler et al., 2017). Moreover, nomophobia has been linked to various

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mental health issues, including depression, anxiety, anger, aggressiveness, and nervousness (Darvishi et al., 2019; Durak, 2018; Kuscu et al., 2020), as well as stress and sleep problems caused by excessive smartphone use (Darvishi et al., 2019; Kaviani et al., 2020; Yildirim et al., 2016; Rodriguez-Garcia et al., 2020). Additionally, nomophobia is significantly correlated with problematic and prohibited smartphone use, including dangerous behaviors such as using a smartphone while driving (Kaviani et al., 2020), and has been associated with medical and psychosocial disorders, including physical injuries (Liu et al., 2022) and broader mental health disorders (King et al., 2013; King et al., 2014). It was also found that extroverts with deficits in awareness, attention, emotional stability, and self-esteem were more likely to suffer from nomophobia (Argumosa-Villar et al., 2017; Arpaci et al., 2017; Arpaci, 2019).

However, given that nomophobia is a relatively recent topic of study in psychology (Kaviani et al., 2020; Yildirim et al., 2016), some research has explored its association with other mental illness, including anxiety disorders. The current study examined loneliness and smartphone use as mediators of self-control, emotion regulation, and spiritual meaningfulness on nomophobia through structural equation model (SEM) analysis.

Theoretical Framework

The theoretical basis for current study can be explained through the self-regulation deficit model. (Stinson et al., 2008; Wagner, et al., 2013; Ownsworth et al., 2002; Rudolph et al., 2013). The self-regulation deficit model suggests that nomophobia arises due to deficits in self-regulation, whereby individuals fail to control their impulses, emotions, stress, and insecure feelings and compensate for or escape from those conditions to smartphones (Tangney et al., 2004). This theory posits that nomophobic behaviors serve as a coping mechanism for individuals who experience negative emotions or stress and that nomophobic behavior can be understood as a maladaptive attempt to self-regulate.

The self-regulation deficit model suggests that individuals who experience higher levels of stress or negative emotions may be more likely to engage in compulsive smartphone use as a way of coping (Ownsworth et al., 2002; Rudolph et al., 2013). This may in turn lead to an increased risk of nomophobia, as individuals become increasingly dependent on their smartphones to regulate their emotions and cope with stress. Individuals who struggle to regulate their smartphone use may continue to engage with their phones despite negative consequences such as poor sleep, decreased productivity, or social isolation (Bian & Leung, 2015).

Emotional Regulation and Nomophobia

Effective emotion regulation has a significant impact on both well-being and social relationships (Webb et al., 2018; Cameron et al., 2017). Emotion regulation involves the ability to manage and control one's emotions, cope with stress, and regulate mood. It is evaluated by assessing an individual's ability to modify one or more components of their emotional response, including the type, intensity, duration, and quality of emotion. These modifications can occur automatically or through conscious effort, and they aim to influence the process of generating emotions (Mauss et al., 2006; Gross et al., 2011).

However, maladaptive emotion regulation harms individuals (Gruber et al., 2011; Parrott, 1993; Salovey & Mayer, 1990). For example, when an individual's anger is unstoppable toward someone, he hates could lead him to commit violent acts (murder, molestation). Thus, emotions can be said to be maladaptive when they are expressed incorrectly, appear incorrectly, or occur at an excessive level. At such times, individuals need adaptive emotion regulation (Gross, 2011; 2007; 2006). According to self-regulation deficit model theory, deficits in controlling urges and negative emotions are identified as the root cause of nomophobic behavior. Individuals experiencing deficits in self-emotion regulation to compensate for perceived pressure and stress by excessively using their smartphones. This leads to a state where the inability to use smartphones triggers fear and anxiety.

Self-control and Nomophobia

Self-control is a crucial aspect of the self and a key determinant of success in life, according to Baumeister et al. (2007). It helps individuals understand the nature and function of the self and contributes to their mental health, as noted by Geng et al. (2021), Servidio (2021), and Tangney et al. (2004). Research has also shown that individuals with high self-control tend to achieve greater academic performance, display better adjustment, have greater self-esteem, report fewer instances of psychopathology, engage in less alcohol abuse and binge eating, establish secure attachments, and foster better relationships and interpersonal skills. These findings are supported by studies conducted by Tangney et al. (2004), Baumeister et al. (2007), and Güner and Demir (2021).

Self-control is the capacity to manage one's behavior and impulses, measured by assessing an individual's ability to resist temptation, delay gratification, and control their impulses. It involves consciously and intentionally withholding or overriding a response to facilitate more constructive

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behavior in line with moral values, social expectations, and long-term goals (Baumeister et al., 2007; Tangney et al., 2004). Effective self-control can assist individuals in managing their use of smartphones and the internet, avoiding addictive behaviors associated with them, and prioritizing activities that align with their future success in life (Baumeister et al., 2007; Güner & Demir, 2021). Adequate self-control can also help individuals manage their time efficiently by prioritizing essential tasks and setting aside less important tasks (Adler, 2015; Servidio, 2021; Vohs & Faber, 2007).

Studies have revealed that individuals with inadequate self-control experience more problems with impulse control, including overeating, drug and alcohol abuse, crime and violence, sexually impulsive behavior, overspending, unwanted pregnancy, and smoking (Baumeister et al., 2007; Tangney et al., 2004; Vohs & Faber, 2007). Self-control is also associated with emotional problems, school underachievement, lack of persistence, and relationship issues (Baumeister et al., 2007; Tangney et al., 2004; Vohs & Faber, 2007). Moffitt et al.'s (2011) study of a cohort of 1000 children from birth to 32 years of age showed that adequate self-control predicts physical health, personal finances, substance dependence, and criminal offending outcomes. Similarly, a study of 500 sibling pairs in the same cohort demonstrated that siblings with lower self-control had worse outcomes. Furthermore, Güner and Demir (2021) reported a significant negative relationship between self-control and nomophobia and between self-control and smartphone addiction, while Qiufeng et al. (2021) reported a link between self-control and smartphone addiction.

Spiritual Meaningfulness and Nomophobia

According to Sheldrake (2013), spirituality involves a conscious effort to integrate life through self-transcendence toward a higher power, as perceived by the individual. On the other hand, Thorensen (1998) describes spirituality as a transcendent relationship between a person and the Supreme Being. Unlike religion, spirituality is not confined to a particular set of beliefs or practices but rather encompasses broader ideas that provide meaning to life and foster self-awareness (Horton & Luna, 2016). In contrast, religiosity refers to an organized system of beliefs, practices, rituals, and symbols that individuals follow as part of their faith (Thorensen, 1998). Thus, it can be inferred that spirituality encompasses a wider range of aspects and dimensions than religiosity, which primarily involves individual adherence and belief in their religion's teachings.

Therefore, spiritual meaningfulness refers to the subjective experience of finding meaning and purpose in life through spirituality or religion. It is measured using items that assess the extent to which individuals feel connected to greater power, find comfort in religious or spiritual beliefs, and feel a sense of purpose in life.

Previous research shows that individuals often use spirituality and religion as positive coping strategies for overcoming difficult situations (Pergament, 2007). Positive spiritual coping strategies (e.g., spiritual support, positive religious reframing of stressors, and spiritual connectedness) are significantly associated with individuals' mental health and psychological well-being (Phillips & Stein, 2007; Pieper, 2004). Other studies have shown that spiritual-religious adolescents have a lower risk of engaging in negative behaviors such as cyberbullying, gambling, alcohol consumption, drug abuse, and casual sex (Casey et al., 2011; Debnam et al., 2017; Kinanti, & Hartati, 2017; Landor et al., 2011).

More specifically, positive spiritual coping strategies were correlated with reductions in depression and anxiety (Olson et al., 2012). Using positive coping strategies combined with religious teachings about the sin of suicide encourages and protects individuals from attempted suicide (Rosmarin et al., 2013). Positive spiritual coping strategies are also associated with better social relationships, individual mental health, and quality of life (Ramirez et al., 2012). Positive religious coping is a predictor of posttraumatic growth (experience of positive change after trauma) after cardiac surgery (Ai et al., 2013), as well as in veteran cancer survivors (Trevino et al., 2012).

Several previous studies have confirmed the role of spirituality in the use of problematic communication technologies such as the internet and smartphones. In one study from Shim (2019), it was found that adolescents who have low spiritual well-being are at greater risk of smartphone addiction. Rahmati (2017) reported a negative correlation between spirituality and IA. Moreover, Grubbs et al. (2017) found that internet pornography addiction was a strong predictor of religious and spiritual struggles among teens. A study conducted by Buctot (2020) revealed a significant positive relationship between nomophobia and spiritual health. Ekşi and Kardaş (2017) stated that spirituality is an adaptive and motivating power that becomes an individual's buffer when facing pressure and stress. Opatz (1986) confirmed that individuals who have high spiritual well-being are able to balance and harmonize their inner world and the outer world. For this reason, it can be hypothesized that spiritual meaningfulness influences nomophobia.

Loneliness and Nomophobia

Loneliness is a subjective feeling when individuals feel alone (Dai et al., 2021). Sometimes this feeling of loneliness occurs when the individual is in a crowd. Loneliness refers to the subjective experience of social isolation and dissatisfaction with one's social relationships (Hwang et al., 2020; Russell et al., 1980; Yu et al., 2020). It is measured

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using items that assess the extent to which individuals feel disconnected from others and lack companionship. Feelings of loneliness are often followed by boredom, emptiness, and meaninglessness.

When individuals are haunted by overwhelming feelings of loneliness, they seek ways to alleviate those feelings. One of the ways they do so is by finding comfort in using their smartphones. As a result, they make their smartphones a source of relief from the torment of loneliness, making it the sole object capable of alleviating their loneliness. This, in turn, triggers fear and anxiety when individuals are unable to use their smartphones. These symptoms are the primary characteristics of the disorder of nomophobia.

Several previous studies have shown that loneliness is correlated with physical and mental health (Heffner et al., 2011; Hwang et al., 2020; Kuiper et al., 2015; Yu et al., 2020), depression (Leigh-Hunt et al., 2017), suicide (Lee et al., 2019), decreased cognitive capacity (Xia & Li, 2018), and decreased sleep quality (Kobayashi & Steptoe, 2018). Loneliness has implications for the quality of one's psychological well-being by disrupting one's ability to function optimally. Loneliness is associated with clinical diseases (e.g., stroke and cardiovascular disease) and is also a predictor of psychological symptoms such as depression, stress, and anxiety (Yanguas et al., 2018). Previous research has shown a positive correlation between loneliness and nomophobia (Jeste, Lee, & Cacioppo, 2020); the greater the individual's loneliness is, the greater the tendency to experience nomophobia (Dai et al., 2021; Ozdemir et al., 2018). People who feel lonely are more likely to use smartphones for social purposes, tending to use social media platforms as an addictive behavior (Enez et al., 2016; Kim et al., 2009). However, several past studies (Skues et al., 2016) have shown that loneliness is not a significant predictor of internet use problems. Therefore, further investigations and explorations are needed in this regard.

The Intensity of Smartphone Use and Nomophobia

The intensity of smartphone use refers to the extent of individuals' engagement with their smartphones, including both the frequency and duration of use (Gutiérrez-Puertas et al., 2019). Previous studies have shown that smartphone use frequency and duration are strongly correlated with nomophobia (Kara et al., 2019; Arpaci et al., 2022; Durak, 2018; Dongre et al., 2017). The longer the duration of smartphone use, the stronger the tendency toward nomophobia. In addition, the more frequent the use of smartphones is, the stronger the tendency toward nomophobia (Dongre et al., 2017; Kara et al., 2019). Excessive use of smartphones has an impact on decreased academic achievement and work productivity (Ozdemir et al., 2018), creates a strong dependence on smartphones (Gutiérrez-Puertas et al., 2019), and

triggers distraction during academic learning and laboratory practicum activities (Aguilera-Manrique et al., 2018; Mendoza et al., 2018). According to operant conditioning theory, the frequency and duration of smartphone use are related to enjoyment and reward (Dragoi & Staddon, 1999; Skinner, 1984, 1985). Operant conditioning theory postulates that a behavior, if performed, that produces pleasure is likely to be repeated (Dragoi & Staddon, 1999; Gatzounis et al., 2012; Kirsch et al., 2004; Skinner, 1984, 1985). This repetition will eventually result in dependence and addiction (Dragoi, 1997; Dragoi & Staddon, 1999; Gatzounis et al., 2012; Kirsch et al., 2004; Logan, 1913; Skinner, 1984). Because individuals always want to feel and obtain the same pleasure repeatedly, it eventually becomes an obsessive and addictive behavior.

The hypotheses of this study are as follows.

Hypothesis 1: There is a significant indirect negative relationship between emotion regulation and nomophobia.
Hypothesis 2: There is a significant negative relationship between emotion regulation and the intensity of smartphone use.
Hypothesis 3: There is a significant indirect negative relationship between self-control and nomophobia.
Hypothesis 4: There is a significant negative relationship between self-control and the intensity of smartphone use.
Hypothesis 5: There is a significant indirect negative relationship between spiritual meaningfulness and nomophobia.
Hypothesis 6: There is a significant negative relationship between spiritual meaningfulness and the intensity of smartphone use.
Hypothesis 7: There is a significant direct positive relationship between loneliness and nomophobia.
Hypothesis 8: There is a significant direct positive relationship between the intensity of smartphone use and nomophobia.
Hypothesis 9: Smartphone usage mediates the relationship between emotion regulation, self-control, and spiritual meaningfulness with nomophobia.
Hypothesis 10: Loneliness mediates the relationship between emotion regulation, self-control, and spiritual meaningfulness with nomophobia.
Hypothesis 11: There is a significant direct positive relationship between emotion regulation and nomophobia.
Hypothesis 12: There is a significant direct positive relationship between self-control and nomophobia.
Hypothesis 13: There is a significant direct positive relationship between spiritual meaningfulness and nomophobia.
Hypothesis 14: The proposed model, which posits that the role of self-control, emotion regulation, and spiritual mean-

ingfulness on nomophobia is mediated by loneliness and smartphone usage, shows a good fit with the empirical data.

Current Research

By employing a structural equation modeling (SEM) approach, this study sought to explore the relationships between self-control, emotion regulation, and spiritual meaningfulness mediated by loneliness and smartphone use and nomophobia. SEM allows for a simultaneous examination of multiple variables and their interconnections, providing a more sophisticated and nuanced analysis compared to previous studies.

Furthermore, the study's focus on junior high school students, senior high school students, and college students from three different cities in Indonesia adds to the novelty and generalizability of the findings. Understanding how nomophobia and its potential mediators manifest in diverse age groups and cultural settings can contribute to the development of targeted interventions and strategies to address nomophobia-related issues.

Additionally, while most studies on nomophobia are correlational and some have explored its mediation model, this topic remains limited in exploration. Specifically, self-control, emotion regulation, and spiritual meaningfulness in relation to loneliness and smartphone use as mediators of nomophobia have not been extensively studied through SEM analysis, particularly in the context of Indonesia. Previous studies have primarily treated loneliness and smartphone use as independent variables directly linked to nomophobia. However, there is a theoretical explanation that suggests that loneliness and smartphone use could play crucial roles as mediator variables (Dai et al., 2021; Jeste et al., 2020). Self-regulation deficit model theory becomes the basis for this mediator model (Bian & Leung, 2015; Dragoi & Staddon, 1999; Tangney et al., 2004). Therefore, this research aims to fill this knowledge gap by investigating the mediated model of nomophobia, contributing valuable insights to the field.

Method

Participants

This cross-sectional study was carried out in Yogyakarta, Palembang, and Jambi, Indonesia. The study participants included junior high school, senior high school, and college students from these three cities. The total number of respondents in this study was 704; 15 (2.13%) respondents did not complete the questionnaire, and 689 respondents were included. The respondents were 245 junior high school students (35.5%), 235 senior high school students (34.2%), and 209 college students (30.3%). Among the participants,

380 (55.2%) were women, and 309 (44.8%) were men. The average age of the respondents was 17 years (SD = 3.4).

Informed consent was gathered before the respondents agreed to participate in this study. All respondents were involved voluntarily without coercion. Permission to collect data was obtained from the parent, school, and university. A purposive sampling technique was applied to obtain the data. As a token of appreciation, all participants were given ballpoint pens immediately after they completed the questionnaire. The data were collected for two months, beginning in June 2022 and ending in July 2022.

Measurement

Nomophobia

Nomophobia questionnaire (NMPQ) has been developed to assess the dimensions of nomophobia (Yildirim & Correia, 2015). In developing the questionnaire, Yildirim and Correia (2015) described four NMPQ factors using factor analysis (EFA). The varimax rotation approach used principal component analysis (PCA) to test the correlation between factors. From this PCA, it was found that the four factors were "unable to communicate," "lost connection," "unable to access information," and "giving up convenient." In this scale modification, the process of back-to-back translation and adjustment of item sentences is carried out. The adaptation of the measurement tool from English to Indonesian in this study is follow the International Test Commission (ITC) guidelines (ITC, 2017a, b). Scores were distributed as follows: "strongly agree" was given a score of 4, "agree" received a score of 3, "disagree" was assigned a score of 2, and "strongly disagree" got a score of 1. For unfavorable items, the scores were reversed. The example of the items as follows: "I would feel anxious because I could not instantly communicate with my family and friends," "I would be nervous because I would be disconnected from my online identity," "I would feel uncomfortable without constant access to information through my smartphone," "If I did not have a data signal or could not connect to Wi-Fi, then I would constantly check to see if I had a signal or could find a Wi-Fi network." We used seventeen items of NMPQ in this study. The total item correlation of the nomophobia scale ranged between 0.311 and 0.775. The Cronbach's alpha coefficient is 0.855.

Loneliness

Loneliness was measured using the R-UCLA Loneliness Scale (Russell et al., 1980). It consists of two factors: social other and intimate other. We performed a back-to-back translation during the adaptation process using two experts

who were fluent in English. The adaptation of the measurement tool from English to Indonesian in this study follows the International Test Commission (ITC) guidelines (ITC, 2017a, b). Each item has four alternative responses: never, rarely, sometimes, and often. Examples of items used are "I feel isolated from other people," "I often feel lonely," and "No one cares about me." We used eight items of loneliness questionnaire in this study. The total item correlation of the loneliness scale was between 0.336 and 0.637. Cronbach's alpha coefficient of the scale is 0.891.

Self-Control

The scale to measure self-control was developed by Tangney et al. (2004) and consists of four aspects: regulating thought and emotion, resisting temptation, breaking habits, and maintaining good self-discipline. It consists of four aspects: self-emotion appraisal, regulation of emotions, use of emotion, and others-emotion appraisal. Back-to-back translation was performed during the adaptation process using two experts who were fluent in English. The adaptation of the measurement tool from English to Indonesian in this study follows the International Test Commission (ITC) guidelines (ITC, 2017a, b). Each item has four alternative responses, namely, strongly disagree, disagree, agree, and strongly agree. Some examples of the items include "I am easily carried away by my feelings," "I am good at resisting temptation," "I find it difficult to break bad habits," and "I can work effectively toward long-term goals." We used eleven items of self-control in this study. The total item correlation of the self-control scale ranged between 0.324 and 0.479. The alpha-Cronbach coefficient of this self-control scale = 0.726.

Emotion Regulation

Emotion regulation is measured using the Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004). It consists of six aspects: strategies, nonacceptance, clarity, awareness, goals, and impulses. Back-to-back translation was used in the adaptation process by two experts fluent in English. The adaptation of the measurement tool from English to Indonesian in this study is follow the International Test Commission (ITC) guidelines (ITC, 2017a, b). Each item has four alternative answer options, namely, strongly disagree, disagree, agree, and strongly agree. Examples of items used are "When I am angry, I have difficulty controlling my behavior" and "I pay attention to how I feel." "I am confused about how I feel about how I feel." "When I am angry, it takes me a long time to feel better." We used fifteen items of emotion regulation. The total item correlation of the emotion regulation scale was between 0.275 and 0.679. The alpha-Cronbach coefficient of this emotion regulation scale = 0.609.

Spiritual Meaningfulness

The spiritual scale was developed by researcher. We develop the scale based on Pargament theory of spirituality (2007). The scale consists of two aspects, namely, theistic meaning and spiritual meaning. There are four responses: strongly agree, agree, disagree, and strongly disagree. Examples of items are "I feel a deep spiritual meaning in my life," "I feel a strong connection with the creator," and "I feel my life is meaningful because of my spiritual beliefs." We used ten items of spiritual meaningfulness in this study. The total item correlation of the spiritual meaningfulness scale was between 0.311 and 0.769. The alpha-Cronbach coefficient on this scale = 0.842.

Smartphone Use

To measure smartphone usage among respondents, the researchers created a self-report questionnaire on smartphone usage intensity consisting of two aspects: frequency and duration of screen time. This measure captures both the total duration and frequency of an individual's mobile phone usage, encompassing the time they spend actively engaged with the device and interacting with its screen. These include activities such as browsing the internet, using social media apps, playing games, and watching videos. Response options included "strongly agree," "agree," "disagree," and "strongly disagree." Example items used in the questionnaire include "I cannot count how often I check my phone," "I spend more time playing on my phone than doing other things," and "I spend 12 h a day playing on my phone". We used four items of smartphone use in this study. The total item correlation of the smartphone use scale was between 0.353 and 0.483. The alpha-Cronbach coefficient on this scale = 0.774.

Data Analysis

We conducted path analysis as part of SEM using Amos 11 software. The research team ensured the validity of all the datasets before starting the analysis process. Participants who did not complete the questionnaire were excluded from the sample (15 of 704 respondents (2.13%)). The reasoning behind this exclusion is based on the assumption that participants who did not complete the entire questionnaire may have missing or incomplete data, which could introduce bias or compromise the integrity of the analysis. A multivariate normal distribution was achieved, and the data were examined. We also conducted subgroup analyses based on education level, using path analysis to test the invariance of effects between groups.

Bootstrap Distributions (Default model)

ML discrepancy (implied vs sample) (Default model)

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                161,600     |************
                172,977     |********************
                184,354     |******************
N = 1000        195,731     |******************
Mean = 188,281  207,108     |*************
S. e. = ,869    218,485     |********
                229,861     |******
                241,238     |****
                252,615     |*
                263,992     |*
                275,369     |*
                            |--------------------
```
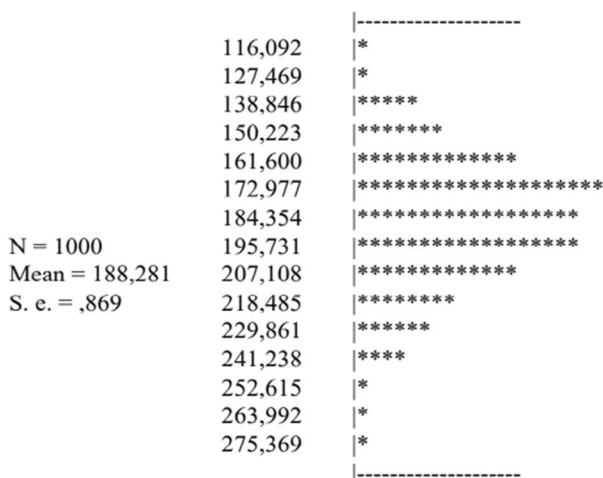
Fig. 1 The distribution of multivariate normality. Alt text: A histogram of data distribution overlaid with a bell-shaped curve indicating multivariate normality. The data exhibit a symmetrical pattern with a peak at the center, suggesting a normal distribution

Ethical Considerations

The study followed the guidelines of the Declaration of Helsinki and was approved by The Research Ethics Committee of Universitas Ahmad Dahlan (Ethics Number: 06071 KEP UAD). The researchers also obtained a data collection permit from the school and university administration. All the informants agreed to participate in this study and signed a voluntary informed consent statement. The anonymity and confidentiality of all participants were guaranteed.

Results

Normality Assumption

Before conducting the SEM (structural equation modeling) test, a multivariate normality assumption test was performed on the data. The results indicated that the data exhibited multivariate normality according to the bootstrapping method. Figure 1 below illustrates the distribution of normality in the research data. Multivariate normality of the data was assessed using the bootstrap method.

Sub-group Path Analysis

The subgroup path analysis conducted across different education levels—college students, senior high school students, and junior high school students—revealed that the relationships between key variables, such as nomophobia,

spirituality, loneliness, smartphone usage, emotion, and self-control, are consistent across these groups. The parameter estimates for each path are nearly identical, with overlapping confidence intervals, indicating that there are no significant differences in how these factors interact based on the education level of the participants. This invariance suggests that the effects observed in the study are stable and do not vary depending on the participants' educational background. As a result, the findings can be interpreted with greater confidence, knowing that they are not significantly influenced by differences in education levels. This consistency across subgroups strengthens the robustness of the study's conclusions and indicates that the observed relationships hold true across different educational contexts. The results of the subgroup path analysis are presented in the Appendix.

The Intercorrelations of Variables

Table 1 shows the intercorrelations between self-control, emotion regulation, spiritual meaningfulness, loneliness, smartphone use, and nomophobia. Self-control has a strong positive correlation with emotion regulation ($r = 0.587$), indicating that individuals with higher levels of self-control tend to have better emotional regulation abilities. There was a nonsignificant positive correlation between self-control and spiritual meaningfulness ($r = -0.032$). Emotion dysregulation showed a weak significant positive correlation with loneliness ($r = 0.109$), suggesting that individuals with higher emotion dysregulation may experience higher levels of loneliness. There was also a strong positive correlation between emotion dysregulation and smartphone use ($r = 0.516$), implying that individuals with stronger emotion dysregulation may engage in excessive smartphone use.

Meanwhile, spiritual meaningfulness had a weak significant negative correlation with loneliness ($r = -0.212$). However, loneliness showed a weak negative correlation with self-control ($r = -0.101$) and a moderate positive correlation with smartphone use ($r = 0.319$). This indicates that individuals with higher levels of loneliness may have lower self-control and tend to engage in more excessive smartphone use. Smartphone use had a weak negative correlation with spiritual meaningfulness ($r = -0.167$). This suggests that individuals who use smartphones excessively may have a lower sense of spiritual meaningfulness.

Nomophobia had nonsignificant correlations with self-control ($r = 0.009$) and with spiritual meaningfulness ($r = 0.031$), but had a significant correlation with emotion dysregulation ($r = 0.127$), and loneliness ($r = 0.270$), and a strong relationship with smartphone use ($r = 0.415$). These significant correlations imply that individuals experiencing higher levels of nomophobia may have higher level of

Table 1 Intercorrelations of all variables

	Nomophobia	Self-control	Emotion dysregulation	Spiritual meaningful	Smartphone use	Loneliness
Nomophobia	1.000					
Self-control	0.009	1.000				
Emotion dysregulation	0.127**	0.587**	1.000			
Spiritual meaningful	0.031	−0.032	−0.244**	1.000		
Smartphone use	0.415**	0.163**	0.516**	−0.167**	1.000	
Loneliness	0.270**	−0.101**	0.109**	−0.212**	0.319**	1.000

$*p < 0.05$; $**p < 0.01$

emotion dysregulation, a higher level of loneliness, and engage in more excessive smartphone use.

Overall, these intercorrelations highlight the relationships between the variables studied. The result suggests that higher levels of emotion regulation and self-control, along with a stronger sense of spiritual meaningfulness, may contribute to lower levels of loneliness and less excessive smartphone use, ultimately reducing the likelihood of experiencing nomophobia.

Measurement Model

Table 1 shows the results of a measurement model that includes six variables: nomophobia, loneliness, smartphone usage, emotion regulation, self-control, and spiritual meaningfulness. For each variable, the table presents the values of Cronbach's alpha, average variance extracted (AVE), and construct reliability.

Overall, the results of the measurement model suggest that the variables are reliable, valid, and accurate at measuring the underlying constructs, with some variation in the strength of the relationships between items within each variable. These results provide support for the use of these variables in subsequent analyses and for making conclusions based on the results of the study.

Structural Model

As part of our first analysis, the model fit measures were used to assess the model's overall goodness of fit. Based on that measure, the model for nomophobia yielded a good fit for the data (CMIN/DF = 1.804; $df = 61$; $p = 0.000$; CFI = 0.954; TLI = 0.944; RMSEA = 0.048). RMSEA stands for the root mean square error of approximation. It is a statistic used to assess the goodness of fit of a model in structural equation modeling (SEM). The RMSEA (root mean square error of approximation) measures the discrepancy between the observed data and the model's predicted values, with lower values indicating better model fit. Typically, an RMSEA value below 0.08 is considered an acceptable fit. GFI stands for the goodness-of-fit index. It is another measure of model

fit in SEM. The GFI quantifies the proportion of variance and covariance explained by the model, with values ranging from 0 to 1. Higher GFI values indicate a better fit, and a GFI of 0.90 or above is generally considered good.

All fit indices are above their recommended values. Next, the significance of the regression weights was examined for all variables. As shown in Table 2, several hypothetical pathways were significant at the $p < 0.01$ level, except for the effects of loneliness, self-control, emotion regulation, and spiritual meaningfulness on nomophobia. However, emotion regulation, self-control, and spiritual meaningfulness had significant effects on smartphone use intensity. Smartphone use intensity has a significant effect on and is a mediator of nomophobia. This study also revealed that self-control has a significant effect on loneliness. In summary, self-control, emotion regulation, and spiritual meaningfulness indirectly influence nomophobia through the mediation of smartphone use intensity. Table 2 illustrates the regression weights of all variables.

Third, we analyzed the indirect effect of all variables once all antecedent variables' direct and total effects were established. The current hypothesis of the nomophobia model states that self-control, emotion regulation, and spiritual meaningfulness can indirectly affect nomophobia through the intensity of smartphone use. SEM analysis revealed that only the intensity of smartphone use fully mediated nomophobia, while loneliness did not. The results of the SEM analysis show a significant indirect effect of emotion regulation ($\beta = -0.156$, $p < 0.01$), self-control ($\beta = -0.201$,

Table 2 The results of the measurement model

Variable	Cronbach alpha	AVE	Construct reliability
Nomophobia	0.855	0.682	0.856
Loneliness	0.891	0.463	0.711
Smartphone	0.774	0.363	0.646
Emotion	0.609	0.754	0.873
Self-control	0.726	0.318	0.535
Spiritual	0.842	0.668	0.828

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$p < 0.01$), and spiritual meaningfulness on nomophobia ($\beta = 0.102$, $p < 0.010$). Table 3 presents a summary of the standardized indirect effects of all variables.

Significantly greater ($p < 0.05$). Note: *$p < 0.05$. **$p < 0.01$.

A post hoc analysis was conducted to examine whether the relationship between the predictor and outcome was significantly reduced when mediators were introduced into the model since the mediating relationship was significant. According to Holmbeck (2002), post hoc analysis of mediation is crucial to avoid making false conclusions about the relationships between variables. The criterion "descends to nonsignificance" can lead to incorrect conclusions about the data. False negatives and positives can result from this strategy, which assumes that there is mediation when the A-C relationship falls from significant to nonsignificant with the addition of a mediator. However, this is the wrong strategy because there may be no mediation even when the relationship changes from significant to insignificant. On the other hand, mediation may exist, although it appears to be nonsignificant. Therefore, post hoc analysis was used to address these types of biased results. Mediation analysis with post hoc analysis can help ensure that the relationship between the independent and dependent variables is genuinely explained by the mediator and that the indirect effect is statistically significant (Hayes, 2009). Table 4 shows the p values from the results of post hoc analysis using bootstrapping.

Loneliness did not mediate the effects of self-control, spiritual meaningfulness or emotion regulation. The intensity of smartphone uses significantly fully mediated the effects of emotion regulation ($p = 0.015 < 0.05$), self-control ($p = 0.050 < 0.05$) and spiritual meaningfulness ($p = 0.017 < 0.05$) on nomophobia. The post hoc analysis of indirect effects using bootstrapping is presented in Table 5. Meanwhile, figure 2 shows loneliness and smartphone use as mediators of self-control, spiritual meaningfulness, and emotional regulation.

Table 4 The result of the standardized indirect effect

	Emotion regulation	Self-control	Spiritual meaningfulness
Smartphone use	0.000	0.000	0.000
Loneliness	0.000	0.000	0.000
Nomophobia	−0.156*	−0.201*	0.102*

Table 5 The results of post hoc analysis of indirect effects using bootstrapping

	Emotion regulation	Self-control	Spiritual meaningfulness
Smartphone	0.000	0.000	0.000
Loneliness	0.000	0.000	0.000
Nomophobia	0.015*	0.050*	0.017*

Significantly greater ($p < 0.05$). Note: *$p < 0.05$. **$p < 0.01$.

Discussion

This study aimed to examine how self-control, emotion regulation, and spiritual meaningfulness with regard to nomophobia are mediated by loneliness and smartphone use intensity through structural equation model (SEM) analysis. Previous studies have mainly examined the correlation between nomophobia and nomophobia (Adawi et al., 2019; Lee et al., 201; Olivencia-Carrión et al., 2018; Ozdemir et al., 2018; Darvishi, 2019; Argumosa-Villar et al., 2017), and few studies have tested the nomophobia mediation model. The findings from our SEM analysis show that our proposed model was a good fit (hypothesis 14). Loneliness did not significantly mediate the role of self-control, emotion regulation, and spiritual meaningfulness on nomophobia (hypothesis 10).

Table 3 The result of weighted regression

			Estimate	S.E	C.R	P
Dependent variables		**Independent variables**				
Loneliness	<--	Self-control	−0.906	0.165	−5.488	***
Smartphone use	<--	Spiritual meaningfulness	−0.193	0.085	2.262	0.024
Smartphone use	<--	Self-control	−0.405	0.152	−2.663	0.008
Smartphone use	<--	Emotion regulation	−0.214	0.071	−3.002	0.003
Nomophobia	<--	Loneliness	−0.028	0.085	0.328	0.743
Nomophobia	<--	Smartphone usage	−0.698	0.204	3.421	***
Nomophobia	<--	Self-control	−0.021	0.220	−0.097	0.923
Nomophobia	<--	Emotion regulation	−0.117	0.085	1.379	0.168
Nomophobia	<--	Spiritual meaningfulness	−0.007	0.101	−0.069	0.945

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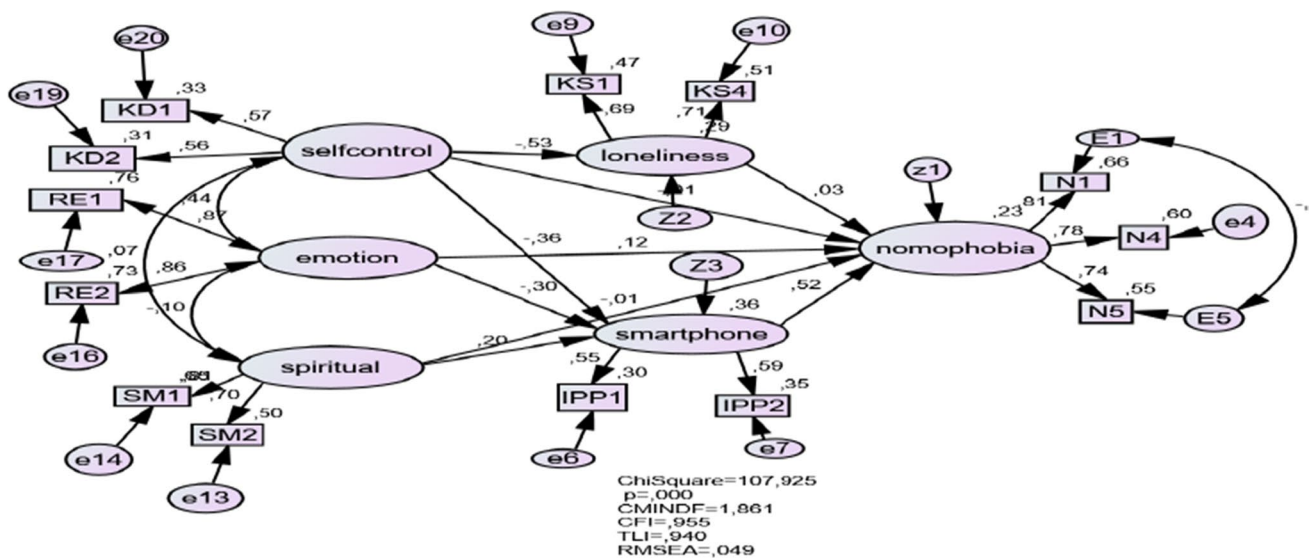Submission ID trn:oid:::1:3286406662

Fig. 2 The results of the nomophobia theoretical model

Smartphone usage did significantly mediate the role of self-control, emotion regulation, and spiritual meaningfulness on nomophobia (hypothesis 9). Emotional regulation and self-control have a significant indirect negative relationship with nomophobia through smartphone use intensity (hypotheses 1 and 3). Spiritual meaningfulness has a significant positive indirect relationship with nomophobia through smartphone use intensity (hypothesis 5). Emotional regulation, self-control, and spiritual meaningfulness have a significant direct effect to smartphone usage (hypotheses 2, 4, 6). Emotional regulation, self-control, and spiritual meaningfulness have not a significant direct effect to nomophobia (hypotheses 11, 12, 13). Loneliness has not significant direct effect to nomophobia (hypothesis 7). Smartphone usage has a significant direct effect to nomophobia (hypothesis 8).

According to the self-regulation deficit model, individuals who have good self-control, emotion regulation, and spiritual meaningfulness are less likely to develop problematic behaviors, such as excessive smartphone use. The self-regulation deficit model proposes that individuals who have poor self-regulation abilities are more likely to develop addictive behaviors, such as substance use or excessive technology use (Tangney et al., 2004). This model suggests that self-regulation involves a set of cognitive and behavioral processes that allow individuals to control their thoughts, emotions, and behaviors to achieve their goals.

Several studies have provided support for the self-regulation deficit model. For example, in a study conducted by Shmueli and Prochaska (2012), poor self-regulation abilities were found to be associated with a greater risk of developing addiction to substances such as alcohol or drugs. Similarly, in a study conducted by Billieux et al. (2008), poor self-regulation abilities were found to be associated with a greater risk of developing problematic internet use. Another study has shown that individuals with addiction have altered neural circuitry in regions of the brain that are involved in self-regulation, such as the prefrontal cortex and the striatum (Koob & Volkow, 2010). These brain changes may contribute to difficulties in regulating emotions and impulses, increasing individuals' susceptibility to developing addictive behaviors.

These findings are consistent with the broader literature on emotion regulation and mental health. Poor emotion regulation skills have been linked to a range of mental health problems, including depression and anxiety (Aldao et al., 2010). In contrast, individuals with better emotion regulation skills tend to have better mental health outcomes (Aldao et al., 2010).

While there is limited research specifically examining the relationship between spiritual meaningfulness and smartphone use, there are some relevant findings that may help shed light on this relationship. For instance, a study by Kim and Lee (2018) revealed that individuals

who reported higher levels of spiritual well-being (a related construct) tended to use their smartphones more frequently for religious and spiritual purposes, such as accessing religious texts and apps and participating in online religious communities. Similarly, a study by Lin and Lu (2011) revealed that individuals who reported higher levels of spiritual well-being tended to use their smartphones more frequently for leisure and entertainment purposes.

The results of the current study are consistent with those of previous studies, which revealed a significant negative relationship between self-control and loneliness, smartphone use, and nomophobia. Research by Güner and Demir (2021) revealed a significant negative relationship between self-control and nomophobia and between self-control and smartphone addiction. Qiufeng et al. (2021) reported the effect of self-control on smartphone addiction. Previous research has shown that inadequate self-control is correlated with impulse-control problems, including overeating, drug and alcohol abuse, crime and violence, sexually impulsive behavior, overspending, unwanted pregnancy, and smoking (Baumeister et al., 2007; Tangney et al., 2004; Vohs & Faber, 2007).

This finding of this study found that loneliness did not mediate the relationships among emotion regulation, self-control, spiritual meaningfulness, and nomophobia. it does not confirm the findings of previous studies. Previous research has shown a positive correlation between loneliness and nomophobia (Jeste et al., 2020); the greater the individual's loneliness is, the greater the tendency to experience nomophobia (Dai et al., 2021; Ozdemir et al., 2018). People who feel lonely are more likely to use smartphones for social purposes, tending to use social media platforms as an addictive behavior (Enez et al., 2016; Kim et al., 2009). However, Skues et al.'s study (2016) revealed that loneliness is not a significant predictor of internet use problems.

It is possible that the relationships among emotion regulation, self-control, spiritual meaningfulness, and nomophobia are direct rather than mediated by loneliness. For example, individuals who have higher levels of emotion regulation, self-control, and spiritual meaningfulness may be less likely to experience nomophobia due to their ability to regulate their emotions, prioritize their time and activities, and find meaning and fulfillment outside of their smartphone use.

This finding confirms several previous studies showing that the frequency and duration of smartphone use strongly correlate with nomophobia (Kara et al., 2019:

Arpaci et al., 2022; Durak, 2018; Dongre et al., 2017). The longer the duration of smartphone use, the stronger the tendency toward nomophobia. In addition, the more frequent the use of smartphones is, the stronger the tendency to experience nomophobia (Dongre et al., 2017; Kara et al., 2019). Excessive use of smartphones has an impact on decreased academic achievement and work productivity (Ozdemir et al., 2018), creates a strong dependence on smartphones (Gutiérrez-Puertas et al., 2019), and triggers distraction during academic learning and laboratory practicum activities (Aguilera-Manrique et al., 2018; Mendoza et al., 2018).

It is also worth noting that the current study used a cross-sectional design, which limits the ability to establish causality or directionality of the relationships between the variables. Longitudinal studies that follow individuals over time could help to clarify the temporal relationships between these variables and nomophobia. This study used purposive sampling to recruit participants, which may not be representative of the population of interest; therefore, future studies need to apply probabilistic sampling methods such as random sampling or stratified random sampling. Overall, more research is needed to better understand the complex relationships between emotion regulation, self-control, spiritual meaningfulness, loneliness, and nomophobia and to identify potential mediators and moderators of these relationships.

In considering the study's findings on emotional regulation, spiritual meaningfulness, and self-control in relation to nomophobia, it is important to recognize several additional variables that could influence the results and may not have been evaluated or controlled for in the current research. Individuals with prior diagnoses, such as mood disorders, anxiety, or personality disorders, might experience heightened loneliness or emotional distress, which can influence their smartphone use and nomophobia. These conditions may contribute to an increased reliance on smartphones as a coping mechanism or a source of connection, potentially confounding the relationship between emotional regulation and nomophobia.

Family history of mental health issues or nomophobia may play a role in shaping an individual's susceptibility to these conditions. Similarly, the family environment, including the presence of supportive or dysfunctional relationships, could affect how individuals regulate their emotions and use smartphones. Family dynamics and support systems are critical factors that could influence both emotional regulation and smartphone dependency. Other potentially confounding variables, such as individual differences in personality

traits, stress levels, and social support, might also affect the relationships studied. It is crucial to consider these factors in future research to gain a comprehensive understanding of the dynamics influencing nomophobia.

Addressing these additional variables in future studies could provide a more nuanced understanding of how emotional regulation, spiritual meaningfulness, and self-control interact with nomophobia. By accounting for these potential confounders, researchers can better isolate the effects of the primary variables and develop more targeted interventions for managing smartphone dependency and improving overall well-being.

Conclusion

Based on the findings presented in the study, several conclusions can be drawn. First, the study suggested that smartphone use intensity serves as a significant mediator in the relationships between emotion regulation, self-control, spiritual meaningfulness, and nomophobia. This indicates that excessive smartphone use may exacerbate feelings of nomophobia, potentially leading to negative outcomes such as decreased productivity and increased dependence on smartphones.

Second, individuals with better self-control and emotion regulation skills are less prone to developing problematic behaviors such as excessive smartphone use and nomophobia. This finding aligns with the self-regulation deficit model, which posits that individuals with poor self-regulation abilities are more susceptible to addictive behaviors.

Third, the study revealed a positive relationship between spiritual meaningfulness and smartphone use, contrary to initial hypotheses. This suggests that smartphones can serve as tools for accessing religious and spiritual content, potentially fostering a sense of community among individuals with higher levels of spiritual well-being.

Additionally, the study indicated that loneliness does not mediate the relationships among emotion regulation, self-control, spiritual meaningfulness, and nomophobia. Instead, the relationship between these variables and nomophobia may be direct, with individuals who possess higher levels of these traits being less likely to experience nomophobia. Finally, the study has limitations such as its cross-sectional design and the use of purposive sampling, which may limit the generalizability of the findings.

Future research employing longitudinal designs and probabilistic sampling methods could provide further insights into the complex relationships between these variables. In conclusion, this study underscores the importance of understanding the interplay between individual factors and smartphone use behaviors in predicting nomophobia, emphasizing the need for targeted interventions to promote healthy smartphone use and mitigate the risk of nomophobia and its associated negative consequences.

Future studies need to explore the psychological mechanisms underlying nomophobia, particularly studies examining the psychological factors associated with comorbidities of nomophobia. Additionally, it is necessary to investigate the prevalence of nomophobia in different demographic groups and contexts. We also advise future research to investigate the predictive factors of nomophobia, which could help identify risk groups and develop prevention strategies to help those groups overcome nomophobia.

Based on this study's findings, several practical applications and recommendations can be made for both the general public and healthcare providers. For the general public, it is essential to promote emotional regulation strategies such as mindfulness, meditation, and cognitive-behavioral techniques to manage emotions and reduce nomophobia by lessening emotional dependence on smartphones. Additionally, engaging in activities that provide spiritual meaning, like community service or spiritual practices, can diminish reliance on smartphones for emotional satisfaction. Developing self-control techniques, such as setting time limits for smartphone use and creating smartphone-free zones, is also crucial. Being mindful of the intensity and purpose of smartphone use can help establish healthier boundaries and reduce its impact on daily life.

For healthcare providers, integrating emotional regulation training into mental health treatment plans can offer patients effective tools for managing emotions and reducing nomophobia. Addressing spiritual well-being in therapeutic settings can help patients explore how spiritual fulfillment might alleviate their dependence on smartphones. Enhancing self-control strategies and providing practical tools for moderating smartphone use should be part of therapeutic interventions. Additionally, evaluating smartphone use patterns during consultations can help tailor recommendations for healthier device habits. Educational programs on the impact of smartphone use on mental health, emphasizing emotional regulation, spiritual meaning, and self-control, can further support individuals in managing their smartphone use effectively.

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Appendix

Table 6 Parameter estimates

Group	Label	Dep	Pred	Estimate	SE	95% confidence intervals Lower	Upper	β	z	p
College students	p1	Nomophobia	Spiritual	0.1696	0.0591	0.0497	0.2812	0.1113	2.868	0.004
	p2	Nomophobia	LONELINESS	0.2090	0.0452	0.1242	0.3004	0.1769	4.623	<0.001
	p3	Nomophobia	Smartphone	0.9495	0.0967	0.7636	1.1381	0.3602	9.824	<0.001
	p4	Nomophobia	Emotion	−0.0814	0.0354	−0.1533	−0.0139	−0.0309	−2.298	0.022
	p5	Nomophobia	Self-control	0.0503	0.0597	−0.0665	0.1709	0.0400	0.842	0.400
	p6	LONELINESS	Self-control	−0.2375	0.0535	−0.3547	−0.1407	−0.2232	−4.441	<0.001
	p7	LONELINESS	Emotion	0.1069	0.0303	0.0462	0.1642	0.0480	3.525	<0.001
	p8	LONELINESS	Spiritual	−0.2631	0.0571	−0.3658	−0.1440	−0.2039	−4.610	<0.001
	p9	Smartphone	Emotion	0.2053	0.0139	0.1790	0.2322	0.2056	14.779	<0.001
	p10	Smartphone	Self-control	−0.1218	0.0263	−0.1669	−0.0687	−0.2554	−4.638	<0.001
	p11	Smartphone	Spiritual	−0.0153	0.0283	−0.0644	0.0463	−0.0265	-0.540	0.589
Senior high school students	p27	Nomophobia	Spiritual	0.1696	0.0591	0.0497	0.2812	0.0911	2.868	0.004
	p28	Nomophobia	LONELINESS	0.2090	0.0452	0.1242	0.3004	0.1498	4.623	<0.001
	p29	Nomophobia	Smartphone	0.9495	0.0967	0.7636	1.1381	0.3360	9.824	<0.001
	p30	Nomophobia	Emotion	−0.0814	0.0354	−0.1533	−0.0139	−0.0264	−2.298	0.022
	p31	Nomophobia	Self-control	0.0503	0.0597	−0.0665	0.1709	0.0283	0.842	0.400
	p32	LONELINESS	Self-control	−0.2375	0.0535	−0.3547	−0.1407	−0.1866	−4.441	<0.001
	p33	LONELINESS	Emotion	0.1069	0.0303	0.0462	0.1642	0.0484	3.525	<0.001
	p34	LONELINESS	Spiritual	−0.2631	0.0571	−0.3658	−0.1440	−0.1971	−4.610	<0.001
	p35	Smartphone	Emotion	0.2053	0.0139	0.1790	0.2322	0.1883	14.779	<0.001
	p36	Smartphone	Self-control	−0.1218	0.0263	−0.1669	−0.0687	−0.1938	−4.638	<0.001
	p37	Smartphone	Spiritual	−0.0153	0.0283	−0.0644	0.0463	-0.0232	−0.540	0.589
Junior high school students	p53	Nomophobia	Spiritual	0.1696	0.0591	0.0497	0.2812	0.1130	2.868	0.004
	p54	Nomophobia	LONELINESS	0.2090	0.0452	0.1242	0.3004	0.2142	4.623	<0.001
	p55	Nomophobia	Smartphone	0.9495	0.0967	0.7636	1.1381	0.5583	9.824	<0.001
	p56	Nomophobia	Emotion	−0.0814	0.0354	−0.1533	−0.0139	−0.1707	-2.298	0.022
	p57	Nomophobia	Self-control	0.0503	0.0597	−0.0665	0.1709	0.0472	0.842	0.400
	p58	LONELINESS	Self-control	−0.2375	0.0535	−0.3547	−0.1407	−0.2176	−4.441	<0.001
	p59	LONELINESS	Emotion	0.1069	0.0303	0.0462	0.1642	0.2188	3.525	<0.001
	p60	LONELINESS	Spiritual	−0.2631	0.0571	-0.3658	−0.1440	−0.1709	−4.610	<0.001
	p61	Smartphone	Emotion	0.2053	0.0139	0.1790	0.2322	0.7327	14.779	<0.001
	p62	Smartphone	Self-control	−0.1218	0.0263	−0.1669	−0.0687	−0.1945	−4.638	<0.001
	p63	Smartphone	Spiritual	−0.0153	0.0283	−0.0644	0.0463	−0.0173	-0.540	0.589

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Path Model

Path Diagrams

Fig. 3 The result of path analysis among college students

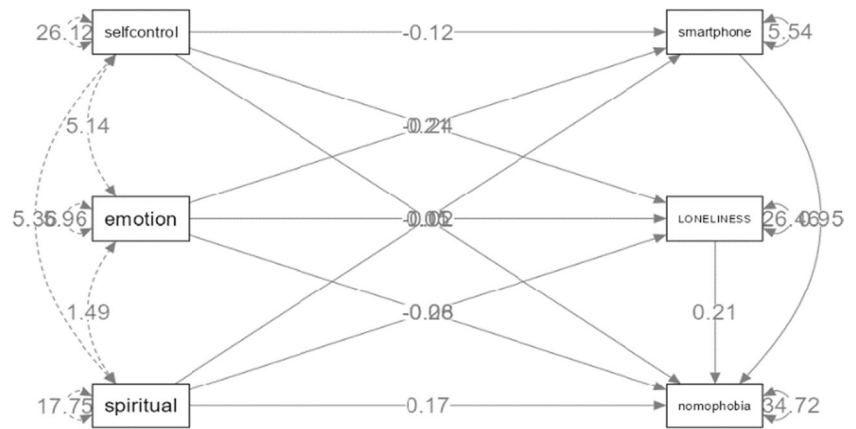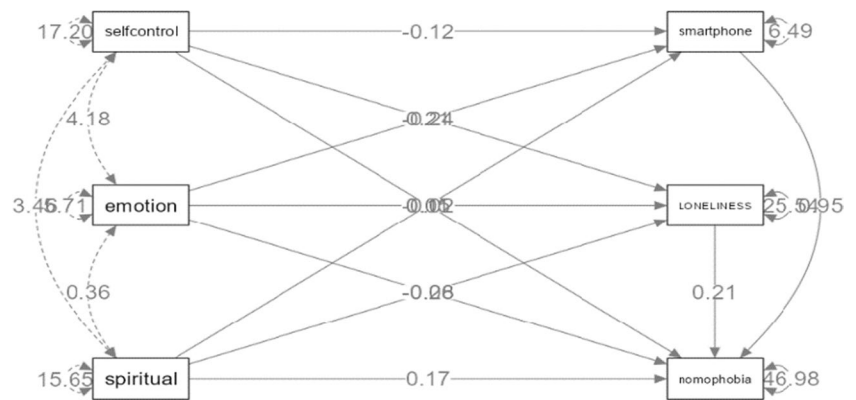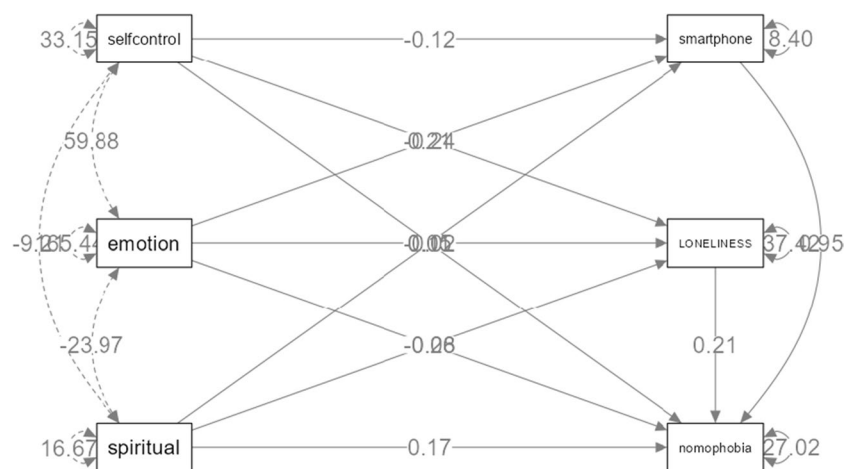**Fig. 4** The result of path analysis among senior high school students

Fig. 5 The result of path analysis among junior high school students

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Declarations

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