

Empirical study of factors affecting college students' problematic smartphone usage during the global pandemic

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Abstract

The increase in the frequency, duration and dependence of individuals using smartphones in the last decade has resulted in a phenomenon of mental health disorders in the form of problematic smartphone usage. This study aims to analyze the causes of problematic smartphone usage based on the conditions of Fear of Missing Out (FOMO), loneliness, virtual presence, and future time perspectives. This study uses a quantitative approach through survey methods and uses a cross-sectional study method and post-positivism assumptions to look at the factors that cause dependent variables. In this study, 597 students were involved, with 290 males (48.57%) and 307 females (51.43%). Path analysis was used in the analysis of this study to determine the impact of the direct and indirect effects of exogenous variables on endogenous variables. Path analysis is also used in mapping and testing the hypotheses that make up the model. The study results show that the virtual presence, loneliness, and future time perspective variables impact individuals' emergence of FOMO conditions, which in turn contributes to the formation of problematic smartphone usage. The study of the direct and indirect relationships of the variables is discussed.

Keywords: problematic smartphone usage, global pandemic, fear of missing out

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Introduction

The degree to which people are dependent on mobile phones technology has reached the point where it is impossible to conceive of either one existing without the other (Peterka-Bonetta, Sindermann, Elhai, & Montag, 2021; Sawaya, Sano, Nakamura, & Isohara, 2022; S. Y. Sohn, Rees, Wildridge, Kalk, & Carter, 2021; Tsz Wah, 2022). People use their mobile phones for a wide variety of reasons, including the need to look up information pertinent to their day-to-day activities, the desire to take part media social platforms relationship, and the need to look up information relating to their own personal health (Ardi, Hidayat, Ifdil, Guspriadi, & Fauziyyah, 2021; Ardi, Ifdil, & Maysitoh, 2020; Ardi, Neviyarni, & Daharnis, 2019; L. Li, Wang, & Wang, 2022; Mac Cárthaigh, Perry, & Griffin, 2022; Massar et al., 2021; S. Y. Sohn et al., 2021; Tsz Wah, 2022; Wang, Li, Ding, & Chen, 2022). When the COVID-19 epidemic broke out in early 2020, inhabitants of various countries throughout the globe, including Indonesia, were unexpectedly obliged to stay inside their houses due to lockdown regulations. It was possible for people who are familiar with using technology as well as people who are not familiar with using technology to access a variety of services, including health care, mostly but not entirely through remote mobile applications (Kliesener, Meigen, Kiess, & Poulain, 2022; Mahalingham, Howell, & Clarke, 2022; Massar et al., 2021; Mokhtarina, Torkamani, Farmani, Biglarian, & Gabel, 2022).

Because the smartphone has become so interwoven in the lives of many people, many consider it as a necessary piece of technology that, if absent, would make it hard to operate regularly in day-to-day activities. The smartphone can provide several access to individual activities, such as news, health services, basic life support, remote access for education and many more (Abo-Ali et al., 2022; Alshakhsi et al., 2022; Ardi, Eseadi, & Guspriadi, 2022; Friedrichs, Turner, & Allen, 2022; Geyer, Ellis, Shaw, & Davidson, 2022). One

of these benefits is that the use of smartphones offers a variety of benefits. An rise in the regularity of using social media is an additional advantage, which may aid in the preservation of existing relationships as well as the construction of new ones (Andrade et al., 2020; Cho et al., 2021; Elhai & Contractor, 2018; Grant, Lust, & Chamberlain, 2019; Nakayama, Ueno, Mihara, Kitayuguchi, & Higuchi, 2020). The use of Facebook is a good illustration of this point. On the other hand, there is widespread agreement that the use of a smartphone, which is also a medium through which one may get trustworthy information, is connected to a number of unfavorable consequences. The overuse of mobile devices may lead to undesirable health effects such as addiction if the gadgets are used excessively (Baker-Sparr et al., 2018; Fabio, Stracuzzi, & Lo Faro, 2022; Nakayama et al., 2020; Pivetta, Harkin, Billieux, Kanjo, & Kuss, 2019; Schmuck, 2020; Winkler, Kim, Kardash, & Belic, 2019). Addiction refers to dependence condition that also characterized by the inability to stop participating in activities such as online gaming, interactions, etc. Addiction is characterized not only by dependence on drug substances, but also by the inability to stop participating in activities like these. Excessive usage of mobile devices has been linked to a variety of adverse health effects, including addiction. Addicts typically continue to participate in behaviors and symptoms that are connected with bad health consequences and symptoms that have a negative influence on both mental and physical health despite the fact that they have acquired these behaviors and symptoms that have grown compulsive over time (Cambra, Díaz, Martínez, & González, 2020; Mangot, Murthy, Kshirsagar, Deshmukh, & Tembe, 2018; Xu et al., 2019; Zhang, Zuck, Porter, & Tsafir, 2019).

Researchers are divided on whether or not it is appropriate to use the word "addiction" in reference to mobile phone use (Dai, Tai, & Ni, 2021; Fook, Narasuman, Aziz, Mustafa, & Han, 2021; Hawi, Samaha, & Griffiths, 2019; Horwood & Anglim, 2019; Jo et al., 2020). However, the fact that the term "addiction" can be linked to behaviors such as excessive television watching or internet browsing, it could reference to using smartphone in problematic ways (Pancani, Preti, & Riva, 2020; Peker, Nebloğlu, & Ödemış, 2019; Pivetta et al., 2019). According to the findings of a number of studies, there are several impact due to problematic smartphone user, which is psychological disorders, sleep disturbance, economic issues, loneliness, fear of mission our and many condition that relate to mental health problems (Fabio et al., 2022; Horwood, Anglim, & Mallawaarachchi, 2021; Jahrami et al., 2021; Kumar et al., 2022; S. J. Lee et al., 2022).

A significant number of individuals all around the world have been using their cellphones at alarmingly high rates in recent years, and this trend has been driven not just by the widespread influence of social networks but also by other factors as well (Panagiotidi & Overton, 2022; Rautela & Sharma, 2022; Sawaya et al., 2022). Individuals are able to engage in social activities using computers or cellphones, track their actions within virtual communities, and connect with other people thanks to the existence of social networks. These networks also satisfy cultural and social demands (Andrade et al., 2023; Mokhtarinia et al., 2022; Rautela & Sharma, 2022; Tsz Wah, 2022). Users of social media platforms like Facebook, Twitter, and Instagram are more likely to exhibit addictive behaviors as a direct result of the rise in the prevalence of these platforms throughout the world (Fabio et al., 2022; Geyer et al., 2022; L. Li et al., 2022).

The continuous COVID-19 pandemic has led in significant modifications in the personal routines of a great number of individuals, as well as improvements in their general health (Hnamte, Phurailatpam, & Laishram, 2022; Kumar et al., 2022; Mokhtarinia et al., 2022). Because of the preventative measures taken by the government, people were left with no option but to conduct their regular, day-to-day activities, like as shopping, online rather than in person. This was due to the fact that the government took steps to halt the spread of the virus. There was opposition from certain individuals to this development (Jeon, Lee, Yoon, & Bhang, 2022; Mac Cárthaigh et al., 2022; Ochs & Sauer, 2022; Proekt, Khoroshikh, Kosheleva, & Lugovaya, 2022; Rautela & Sharma, 2022). Other activities included working from a distant location, learning remotely via the use of online programs such as Zoom Meetings or Microsoft Teams, and giving medical services to patients online. One of the unforeseen effects of living in one place for an extended period of time was the reduction or absence of face-to-face social connection (Mokhtarinia et al., 2022; Sui, Sui, Munn, & Irwin, 2022; Wang et al., 2022). This was done for a number of different reasons. An excessive use of cellphones and social media, particularly but not solely among younger people and young adults, has been related to an increase in the degree of stress and addiction, as well as less sleep hours and inactivity. This is especially true among younger people. Although this has been cited as one of the causes of the recent spike in stress and addiction, it is important to note that it is not the sole one (Marciano & Camerini, 2022; Meier, 2022; Rautela & Sharma, 2022; Sawaya et al., 2022).

In addition, loneliness constantly linked to social media and who experience anxiety whenever they are unable to remain connected at all times due to the discomfort that this causes the loneliness (Chen, Li, & Liu, 2021; N. Li, Fan, Wang, Wang, & Huang, 2022; Stubbe et al., 2021; Zwilling, 2022). They get disconnected as a result, and they pay less attention to topics that aren't related to social media. It has been

shown that an excessive amount of time spent on mobile phones or social media platforms is a major factor in both the total number of hours spent sleeping as well as the quality of sleep that is obtained during those hours. For example, participating in online activities (like chatting) in the hours preceding up to night may induce arousal on several levels, including the emotional, cerebral, and physiological levels (Kim, Jun, Shin, Lim, & Seo, 2018; Larra?aga, Yubero, Ovejero, & Navarro, 2016; Pittman & Reich, 2016). This can make it difficult to fall asleep. The condition of mental health issues due to smartphone usage, it was discovered that one of the modern world's problems, which is already visible in college students as young people. This refers to the anxiety that people experience when they worry that they won't be able to access and take pleasure in the information provided by their mobile phones. The literature does not adequately address the influence that these elements have on the extent of smartphone addiction caused by the COVID-19 epidemic. As a result of this, the objective of this research was to investigate the factors that contribute to problematic smartphone usage, including FOMO, loneliness, virtual presence, and future time perspectives.

Method

Research Design

This study uses a quantitative approach through survey methods. More specifically, this study uses a cross-sectional study method and post-positivism assumptions to look at the factors that cause dependent variables (Dodescu, Botezat, Constăngioară, & Pop-Cohuț, 2021; Hair Jr et al., 2021). This study applied a simulative design to obtain data for analysis and draw conclusions. This study will examine how virtual presence, loneliness, the fear of missing out (FOMO) and thinking about the future affect how people use their smartphones in ways that cause problems.

Participants

The study involved students from all over Indonesia, who were sampled using a random method and according to inter-island representativeness. In this study, 597 students were involved, with 290 males (48.57%) and 307 females (51.43%). Based on the number of samples used, this meets the criteria for an excellent structural equation modeling path analysis, which means that it can make predictions based on the calculations. For research ethics, respondents first gave permission to fill out the questionnaire through an electronic form.

Data Collection and Data Analysis

In collecting data, a digitally formatted questionnaire is sent to respondents through a link. Respondents were first given information about the purpose of the research and what data was needed. Also, respondents were asked if they would be willing to give data if they signed their consent electronically.

Research data were analyzed using SmartPLS 3.0 software with the consideration of the ability of this analysis to build and analyze measurement models from a predictive perspective in a comprehensive manner. The following consideration is related to a large number of samples to meet the minimum sampling requirements and does not automatically give the sample a normal distribution. The next step is to look into how well the Structural Equation Model (SEM) can explain why models with different variable factors behave the way they do as a whole (Dodescu et al., 2021; Ghozali, 2014).

Path analysis was used in the analysis of this study to determine the impact of the direct and indirect effects of exogenous variables on endogenous variables. Path analysis is also used in mapping and testing the hypotheses that make up the model. In the analysis process, the direct effect between variables is first tested, then the indirect test is carried out, and the mediating variable is determined. The indirect effects must strongly confirm the existence of effects that shape the variables, which are problematic smartphone use, FOMO, loneliness, virtual presence, and future time perspectives.

Ethics Statement

Before taking part in the research, each individual provided their verbal informed permission to be included in the investigation. The research was carried out in accordance with the principles outlined in the Declaration of Helsinki, and the Health Research Ethics Committee at Universitas Negeri Padang in West Sumatra Province, Indonesia, granted their approval to the study's protocol.

Result and Discussion

Model Measurement Analysis

In order to better understand problematic smartphone usage conditions, descriptive data analysis is first carried out. In testing the hypothesis, the model is tested using structural equation modeling with the partial

least squares estimation technique (PLS-SEM). Although PLS-SEM can be applied to research with a small sample, this study still uses 597 samples spread throughout Indonesia. Data analysis was carried out using SmartPLS software with the following steps: (1) conducting instrument validation to assess the reliability and construct validity, (2) testing and analyzing hypotheses in the research model through model validation.

In conducting validation, several steps are carried out. The first step is to evaluate the dependability of indicators in order to obtain variable construct data for the model. In the initial analysis, several indicators with relatively low loadings were found, and the indicators were eliminated from the model. After re-analysis, it was found that all outer loadings in the model were at levels above 0.70, as recommended. Then, the reliability construct was analyzed by applying the basic principles of the PLS-SEM algorithm to composite reliability (CR). The analysis results show that the CR value for each variable is above 0.70 and is declared to meet the requirements of the analysis.

Table 1. The Heterotrait-Monotrait Ratio (HTMT)

	Fear of Missing Out	Future Time Perspective	Loneliness	Problematic Smartphone Usage	Virtual Presence
Fear of Missing Out					
Future Time Perspective	0.141				
Loneliness	0.599	0.059			
Problematic Smartphone Usage	0.588	0.124	0.610		
Virtual Presence	0.415	0.280	0.421	0.566	

In the next step, an analysis of construct validity is carried out using Average Variance Extracted (AVE) to obtain convergent validity. The analysis results show that all AVE values in the variables are above 0.50 according to the recommendation. Next, the constructs' discriminant validity was tested by analyzing cross-loadings and assessing the Fornell-Larcker criterion. The test shows no higher loading indicator than the construct used for testing. The Fornell-Larcker test also shows that the AVE value is higher than the correlation between constructs. The discriminant validity of the instrument was also tested using the newer heterotrait-monotrait ratio (HTMT) with all values below the limit of 0.85.

Table 2. The Fornell-Larcker Criterion

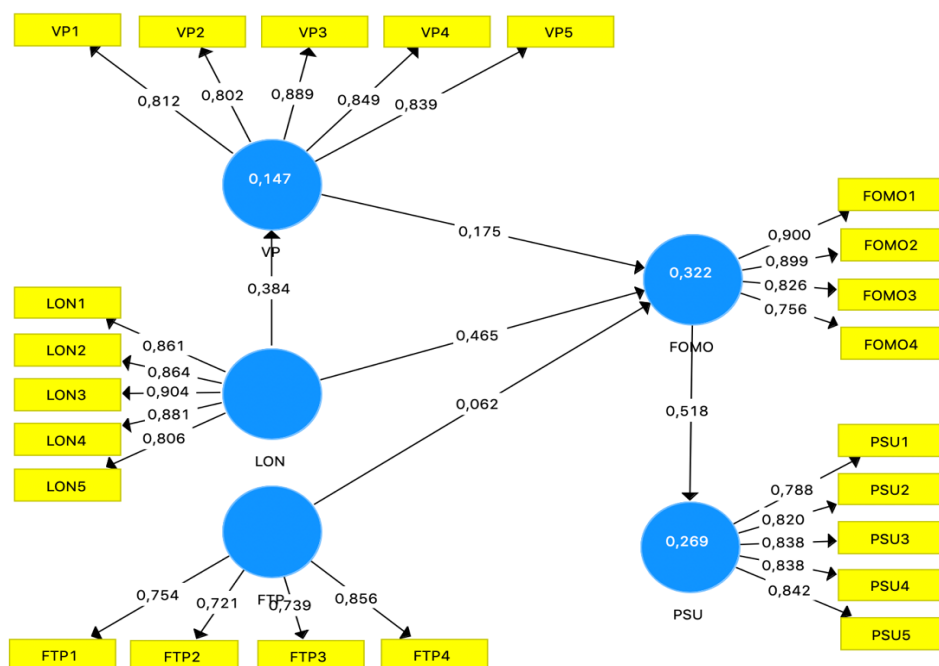
	Fear of Missing Out	Future Time Perspective	Loneliness	Problematic Smartphone Usage	Virtual Presence
Fear of Missing Out	0.847				
Future Time Perspective	0.127	0.770			
Loneliness	0.535	0.045	0.864		
Problematic Smartphone Usage	0.518	0.109	0.550	0.825	
Virtual Presence	0.369	0.249	0.384	0.509	0.839

This study has five latent variables with 23 indicators showing acceptance of convergent and discriminant validity. All indicators that make up the variables show validity with extreme loading values > 0.7 , Cronbach Alpha values > 0.7 , composite reliability > 0.7 , and Average Variance Extracted (AVE) > 0.5 . Table 3 shows the loading factor values of all indicators on the latent variable being > 0.7 ; this means that all indicators show construct values that support the variable.

Table 3. Convergent Validity Testing

	Indicator	Outer Loading	Cronbach Alpha	Composite Reliability	AVE
Fear of Missing Out (FOMO)	FOMO1	0.900	0.867	0.910	0.718
	FOMO2	0.899			
	FOMO3	0.826			
	FOMO4	0.756			
Future Time Perspective (FTP)	FTP1	0.754	0.781	0.853	0.592
	FTP2	0.721			
	FTP3	0.739			
	FTP4	0.856			
Loneliness (LON)	LON1	0.861	0.915	0.936	0.746
	LON2	0.864			
	LON3	0.904			
	LON4	0.881			
	LON5	0.806			
Problematic Smartphone Usage (PSU)	PSU1	0.788	0.883	0.914	0.681
	PSU2	0.820			
	PSU3	0.838			
	PSU4	0.838			
	PSU5	0.842			
Virtual Presence (VP)	VP1	0.812	0.894	0.922	0.703
	VP2	0.802			
	VP3	0.889			
	VP4	0.849			
	VP5	0.839			

Analysis of the hypothesis testing of the model shows that FOMO has a positive and significant impact on PSU with a β coefficient of 0.518 and $p \leq .001$ with an R-value of 0.269. This finding means that the two variables have a correlation that is in the moderate category. Another finding from the tested model is that loneliness impacts virtual presence with an R-value of 0.384. In contrast, loneliness strongly correlates with FOMO, with an R-value of 0.465. The hypothesis testing subheading will explain the strength of the contribution of latent variables in having an impact.

**Figure 1.** Path Analysis of Model Assessment

Model Fit Analysis

Several types of analysis are carried out to ensure that the developed model meets the requirements of model fit. The first test uses Standardized Root Mean Square Residual (SRMR) by testing differences in the correlation of observed values and matrix models so that this test will produce conditions of differences in observation and estimation correlations. Table 4 shows that the SRMR value is below the required value (0.08), both in the saturated and the estimated models. In this condition, the tested model is in the appropriate category and avoids errors in the model specifications.

Table 4. Quality Indexes Analysis

	Saturated Model	Estimated Model
SRMR	0.051	0.109
d_ULS	0.727	3.306
d_G	0.357	0.432
Chi-Square	1297.223	1475.010
NFI	0.851	0.830
rms_Theta	0.150	

Measurement of the fitness of the developed model is also seen from other model analysis methods such as rms_Theta and NFI values. The rms_Theta test shows a coefficient of 0.150, which indicates the extent to which the residuals from measurements correlate with the estimated value. For this reason, the rms_Theta value must be close to zero to conclude that the model is in a good fit. Based on the research findings, the rms_Theta analysis is very low and shows evidence that the model used in the test is in the fit category.

Structural Model Analysis

To obtain the condition of the predictive power of the structural model, an analysis of each latent variable is carried out using R-Square. Table 5 shows that the problematic smartphone usage variable has an R coefficient of 0.269. This indicates that the PSU condition can be explained by a model variable of 26.9%, especially by the FOMO variable. The FOMO variable has a correlation coefficient R-square of 0.322, meaning that this variable can be explained by its constituent variables of 32.2%. The strength of influence between variables will be explained in the direct and indirect effects subsection.

Table 5. Quality Indexes Analysis

	R Square	R Square Adjusted
Fear of Missing Out	0.322	0.318
Problematic Smartphone Usage	0.269	0.268
Virtual Presence	0.147	0.146

Hypothesis Testing and Path Analysis

The results of the hypothesis testing analysis can be seen in Table 6, where all the hypotheses proposed for testing have met the acceptance criteria, which is below the 0.05 significance level. Based on the table, the model that traces the PSU through FOMO conditions obtains a relatively high path analysis coefficient value (0.518) and a P-value of 0.000. This finding simultaneously proves the first hypothesis that the contribution of FOMO is significant in supporting the occurrence of PSU in college-aged youth.

Furthermore, the direct impact caused by the feeling of individual loneliness also significantly impacts the emergence of PSU behavior. This can be seen from the path analysis coefficient value of 27.6% with a p-value of 0.000. The finding of the impact of loneliness on the PSU reinforces that the feeling of solitude and loneliness experienced by individuals will encourage the misuse of smartphone devices. Nonetheless, virtual presence has a reasonably weak impact on PSU appearance. It can be seen that the virtual presence only contributes 9.1% to the appearance of the PSU.

Table 6. Direct Effect of Path Analysis

Path Analysis	Path Coefficient	SD	T Statistics	P Values	Hypotesis Result
FOMO -> PSU	0.518	0.037	13.837	0.000	H1 Accepted
FTP -> FOMO	0.062	0.031	2.040	0.042	H2 Accepted
FTP -> PSU	0.032	0.016	2.010	0.045	H3 Accepted
LON -> FOMO	0.532	0.034	15.725	0.000	H4 Accepted
LON -> PSU	0.276	0.031	9.039	0.000	H5 Accepted
LON -> VP	0.384	0.041	9.452	0.000	H6 Accepted
VP -> FOMO	0.175	0.042	4.127	0.000	H7 Accepted
VP -> PSU	0.091	0.025	3.685	0.000	H8 Accepted

Another finding that is also a concern is that the loneliness variable significantly impacts the emergence of feelings of FOMO in individuals. The condition of the impact of these variables can be seen in testing the fourth hypothesis with a coefficient value of 0.532 or having an impact of 53.2% in determining the occurrence of FOMO. Almost the same condition also occurs for individuals who experience loneliness, so it impacts the virtual presence carried out when accessing the internet.

To obtain in-depth analysis results, indirect effect testing is also carried out to see whether there is an intermediate effect between the variables tested and other variables that may have an indirect effect. Based on the test, it can be seen that the loneliness variable has a significant indirect impact of 27.6% on the emergence of PSU with a p-value of 0.000. Even so, the future time perspective does not impact the appearance of the PSU.

Table 7. Indirect Effect of Path Analysis

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (O/STDEV)	P Values
FOMO -> PSU					
FTP -> FOMO					
FTP -> PSU	0.032	0.037	0.018	1.826	0.068
LON -> FOMO	0.067	0.067	0.018	3.811	0.000
LON -> PSU	0.276	0.278	0.031	8.904	0.000
LON -> VP					
VP -> FOMO					
VP -> PSU	0.091	0.090	0.024	3.793	0.000

Discussion

The problem of using smartphones is one of the studies on the impact of technology on mental health disorders (Mosleh, Shudifat, Dalky, Almalik, & Alnajar, 2022; Zhu et al., 2022). According to technology users, this happens in almost all parts of the world at every age level. As discussed in the initial section, internet technology that can be accessed via smartphones is the main issue of technology's impact on individuals' daily lives. In this regard, studying the determinants of interference conditions due to smartphones is an initial initiation in developing possible solutions (Ciasullo, Orciuoli, Douglas, & Palumbo, 2021; Litam, Ausloos, & Harrichand, 2021).

The model developed utilizing partial least squares analysis raises several variables that might become a cluster of phenomena that support the emergence of PSU behavior. For this reason, testing was carried out, and the factors estimated through submitting hypotheses resulted in the model's validity and could be applied to a broader population. In this case, the PSU is indeed caused by the factors arranged in the model. The impact of these variables is illustrated in the model that all variables can determine the occurrence of PSU (Abo-Ali et al., 2022; Horwood et al., 2021; J. Lee & Kim, 2021; Son, Park, & Han, 2021). In this case, the focus is still on FOMO behavior which is the primary variable that determines the occurrence of PSU.

The hypothesis testing is proven and, at the same time, supports previous findings that state that PSU is a multifactorial behavior but is still caused by very complex individual behaviors and feelings (Elhai, Yang, McKay, & Asmundson, 2020; Roig-Vila, Prendes-Espinosa, & Urrea-Solano, 2020; Winkler, Jeromin, Doering, & Barke, 2020; Xie, Zimmerman, Rost, Yin, & Wang, 2020). The research found that PSU is primarily determined by the emergence of feelings of FOMO in individuals, namely when individuals feel that there is something they are missing. They do not follow their social sphere. Individuals who experience FOMO use devices excessively to reduce and release the FOMO phenomena they are experiencing (Arrivillaga, Rey, & Extremera, 2020; Elhai et al., 2020; Horwood & Anglim, 2019; S. Sohn, Rees, Wildridge, Kalk, & Carter, 2019; Tsz Wah, 2022). Nonetheless, FOMO also does not stand separately in impacting PSU; this can be seen from the indirect relationship between feelings of loneliness in determining the emergence of FOMO, which then triggers PSU behavior. It can be interpreted that the feeling of loneliness experienced by individuals and collaborated with the tendency not to want to be left behind in various things carried out in their social sphere will be an essential trigger for the occurrence of PSU.

Another variable that is also a concern is the need for more individual awareness of future perspectives that will trigger PSU. This condition of weak awareness of FTP triggers an individual's inability to cope with smartphone usage, increasing screen time significantly. The virtual presence will also experience an increase through this scheme; even though these two variables have a feeble impact, they are statistically significant. The thing that needs to be underlined is that the existence of PSU is a complex situation that is multifactorial, involves a series of psychological activities, and requires complete handling from various sides (Arrivillaga, Rey, & Extremera, 2022; Poulain, Vogel, Kliesener, & Kiess, 2021; Vezzoli, Zogmaister, & Coen, 2021).

Conclusion

The findings show that problematic smartphone usage is a situation that occurs from various factors. The variables tested show that individuals who experience loneliness, weak future time perspectives, and a virtual presence will have a high enough impact on the emergence of fear of missing out and will eventually trigger problematic smartphone usage in individuals. The situation of individuals who feel afraid of missing the exact moment as their social environment is the main trigger for the emergence of the problematic smartphone usage phenomenon. This condition requires more in-depth follow-up and analysis and involves various other variables not disclosed in this study. In addition, the limitations of this study are that the variables revealed to be the determining factors for problematic smartphone use still need to be comprehensive, along with a variety of other factors that can trigger this problematic behavior.

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