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Psychometric properties of the smartphone addiction proneness scale in a sample of Malaysian adolescents

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ABSTRACT

The aim of this study was to examine the psychometric properties of the 15-item smartphone addiction proneness scale (SAPS) among a sample of Malaysian adolescents. The gathered data were subjected to exploratory and confirmatory factor analysis. There were 922 secondary school students involved in this study. The exploratory factor analysis extracted a three-factor solution for SAPS. These factors were named disturbance of adaptive functions, withdrawal and tolerance. Results from confirmatory factor analysis also indicated that the three-factor structure fits well with the data. The internal consistency of the scale was found to be good. The positive and moderately strong correlation between SAPS and three widely adopted criterion variables (depression, loneliness and boredom proneness) supported the concurrent validity of SAPS. The results of this study showed that the SAPS is a reliable and valid instrument for identifying problematic smartphone use among Malaysian adolescents.

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1. INTRODUCTION

The increasing use of smartphones has brought about significant changes in people's daily lives. People's lives are improved in various ways because of the availability of smartphones. For instance, a smartphone can increase productivity by allowing mobile access to various organizational tools, such as reminders, calendars, email and informational web searches.

Since adolescents are the first generation to have grown up surrounded by multiple forms of high-tech media, smartphone ownership has become practically common in their lives. Umpteen number of researches carried out on adolescents worldwide have discovered that they view smartphones as an integral part of survival [1] and consider a smartphone as their second self [2]. In Malaysia, according to the data from the Malaysian Communications and Multimedia Commission [3], the majority of children in Malaysia have smartphones by the age of 12, with the youngest participants being five years old. National Health and Morbidity Survey [4] also reported that 29% of the active internet users in the 13-17 age range were addicted to the internet and smartphones were the most prevalent device (94%) used.

Problematic smartphone use (PSU) is a term that refers to the pathological use of mobile devices that causes significant disruption in users' daily life [5]. Compared to adults, adolescents are prone to developing problematic smartphone use due to the constant pressure to keep up and be accepted by their peers [6]. Adolescents with poor self-control are also prone to use their smartphone excessively [7]. In Malaysia, Abdullah [8] identified 51.9% of the secondary school students in her study were in the high

smartphone user group. Although there is no consensus on the methodology to study the construct of problematic smartphone use [9], [10], problematic smartphone use has been categorized by some researchers as a behavioral addiction that focuses on the human-smartphone interactions [5].

There have been reports of negative effects associated with problematic smartphone use in the physiological, psychological, social and personal safety domains. Problematic smartphone use has been shown in prior studies to have adverse effects on one's physical health such as musculoskeletal problems [11] and eyesight loss, as well as mental health issues [12], poor academic performance [13], poor interpersonal relations [14] and delinquency [15].

Aside from the fundamental symptoms, other psychological factors such as depression, loneliness and boredom proneness are also associated with problematic smartphone use. According to Davis' cognitive-behavioral model of problematic internet use, lonely people have distorted self-perceptions, become less satisfied and have a strong aversion to the actual world [16]. Adolescents may use their smartphones to connect to the virtual world, temporarily alleviating their loneliness. Various instant communication applications available on smartphones also offer a less stressful environment for people who are anxious in face-to-face social interactions to maintain social relationships [17]. However, individuals who rely heavily on a smartphone for social connections may increase PSU risk [18], [19].

Smartphone users who are suffering from depressive symptoms may also use their devices as a coping mechanism to ease their unpleasant symptoms [20]. Uncontrolled habitual technology use because of a depressed mood can increase problematic use tendencies. Depressed individuals may utilize their smartphone to cope and divert their focus away from their negative affects by engaging in numerous online entertainment services. Nonetheless, using a smartphone to alleviate depressive symptoms without addressing the root cause of depression might increase smartphone use and develop problematic smartphone use [20].

Media like Internet/web surfing and computer/video games have largely superseded other social activities among young adolescents nowadays. Most adolescents' leisure time is occupied by these media use [21]. Bored adolescents tend to seek external stimulation to alleviate boredom. Therefore, they may spend more time and resources on the internet (or via smartphones), which may lead to problematic behaviors such as PSU [22]-[24].

In light of the growing concern about adolescents' smartphone use, it is critical to develop an instrument that can assess the conditions and levels of PSU to protect them from the adverse effects of PSU. Although several measures have been developed to assess problematic smartphone use, none has emerged as the "gold standard". Smartphone addiction proneness scale (SAPS) created by *Kim et al.* [25] is one of the instruments that measure problematic smartphone use among adolescents. The preliminary validation of the SAPS yielded four factors that constitute the core elements of problematic smartphone usage. Disturbance of adaptive functions (five items), virtual life orientation (two items), withdrawal (four items) and tolerance (four items) are the four factors of SAPS. The SAPS has been validated in South Korea, demonstrating its high psychometric properties [2], [25]. However, the SAPS has not been validated for use with adolescents sample in Malaysia. Given that the SAPS was initially developed and validated in South Korea, it needs to be validated among Malaysian adolescents before it can continue to be used in this population to measure their PSU.

To address this need, this study aimed to determine if the SAPS is a suitable tool for measuring problematic smartphone use among adolescents in Malaysia. The structural validity and reliability of the three-factor SAPS model structures were investigated in order to attain this goal. In addition, the concurrent validity of the SAPS is examined in relation to three crucial psychological risk factors of PSU, namely depression, loneliness and boredom proneness. In Malaysian context, the current study is the first attempt to bridge the knowledge gap in this area by providing essential information. It should be noted that Malaysian adolescents refer to adolescents as individuals between ages 10 and 19 [26]. They are specifically a validation sample of interest, as the research on PSU among Malaysian adolescents is limited. Much of the research has focused on young adults like university students [27]-[29]. In view of this, this study is sought to contribute to the development of a more systematic validation of the multidimensional nature of the SAPS by focusing solely on adolescents in Malaysia.

2. RESEARCH METHOD

Secondary schools students in Form 1, 2 and 4 were recruited for this study. Form 3 students were excluded from this study as they were required to pass the Form 3 assessment. Initially, a total of 1,076 students were recruited. However, 154 students were omitted from this study because they did not finish the survey. The final sample comprised 922 students ranging in age from 13 to 17 years old (M_{age}=14.16, SD=1.26; 64% female). The study population was literate and willing to complete the survey forms.

Multistage cluster sampling method was used to randomly select 8 schools among 41 secondary schools in Johor Bahru, Malaysia. At first, the city was divided into 4 geographical sections based on the

Department of Education in Johor Bahru. Then, by using a random number table, two schools were randomly selected from each section. Hence, 8 schools were randomly selected from the 4 locations. Classes and students were recruited by using the cluster sampling method. In the presence of the researcher, students completed the paper-and-pencils surveys during their classes. Students' written informed consent was obtained prior to data collection. Permission from the institution and Education Planning and Research Division (EPRD) from the Ministry of Education Malaysia were also obtained to comply with ethical considerations in conducting this study (KPM.600-3/2/3-eras (11130)).

The Smartphone Addiction Proneness Scale (SAPS) developed by Kim *et al.* [25] was used to measure the severity of PSU among secondary school students. It was developed based on past literature on mobile phone addiction, digital media addiction and mobile phone addiction. The preliminary SAPS scale was administered to 795 South Korean elementary, middle and high school students. Based on the results of the reliability tests, the final 15 items were chosen. Using the translation and back-translation procedures, the original version of SAPS was translated into the Malay language. In this study, the questionnaire was presented in both English and Malay language, and it was modified to be a 1-10 rating scale.

The short-form UCLA Loneliness Scale (ULS-8) [30] was selected to measure students' loneliness because it is the most frequently employed measure of perceived loneliness. The original 4-point Likert scale of ULS-8 was also modified to be a 10-point rating scale ranging from 1 (never) to 10 (always). Since The Depression, Anxiety and Stress Scale-21 items (DASS-21) was the most widely used measure of depression, it was adapted in this study to measure depressive symptoms among adolescents. The DASS-21 is a set of self-report scales developed by Lovibond and Lovibond [31] for measuring the emotional states of depression, anxiety and stress. Each item was scored on a scale of 1 to 10, with 1 do not apply to me at all and 10 being the most applicable (applied to me much, or most of the time). In this study, the Short Boredom Proneness Scale (BPS-SR) [32] was employed to measure secondary school students' boredom proneness. This instrument is designed to be a one-dimensional measurement. Respondents answered 8 items measuring their trait of boredom. Each item was measured on a 10-point rating scale ranging from 1 (strongly disagree) to 10 (strongly agree).

Several steps were involved in statistical analysis, including (1) exploratory factor analysis (EFA), (2) confirmatory factor analysis (CFA) and (3) measurement of reliability and concurrent validity. These statistical analyses were performed using IBM SPSS Statistics 27 while CFA was conducted using AMOS 26. First, the dataset was randomly divided into two equally sized groups. SAMPLE command in SPSS 27.0 was used to create two random subsamples of approximately 50% of the cases. The first half of the data (n=460) was subjected to EFA. Principal Components Analysis (PCA) with oblique promax rotation was used for components extraction. The number of factors to be extracted was determined by looking at a scree plot in conjunction with the orthodox cut-off of eigenvalues >1. Items were assigned to the factor with the highest factor loading.

The second half of the data (n=462) was used for CFA. Three absolute fit indices were used to evaluate the model fit to the data in CFA, including the root mean square error of approximation (RMSEA), goodness-of-fit index (GFI) and standardized root means square residual (SRMR). Besides, incremental fit indices such as the Tucker-Lewis Index (TLI) and confirmatory fit index (CFI) were also used to find the best factorial solution. A good fit model was indicated by a root mean square error of approximation (RMSEA) value between 0 and .05, while an acceptable fit was indicated by a value between .05 and .08. For the standardized root means square residual (SRMR), values between .05 and .10 are considered acceptable, and values between 0 and .05 are considered a good fit [33]. For the goodness-of-fit index (GFI), Tucker-Lewis Index (TLI) and confirmatory fit index (CFI), it was suggested that the values should be greater than .95 for a good fit and above .90 for acceptable fit [34]. In addition, the chi-square statistic was reported. The psychometric properties of the SAPS were then validated by testing and comparing the structural validity of the three-factor and four-factor models using CFA.

Cronbach's alpha was then employed to determine the internal consistency of each factor. Correlation analyses were performed between the SAPS score, the ULS-8, the DASS-21 and the BPS-SR to examine the concurrent validity of the SAPS.

3. RESULTS AND DISCUSSION

3.1. Exploratory factor analysis (EFA)

The first sub-sample was subjected to the EFA to determine the dimensionality of the SAPS scale. The suitability of the 15-item SAPS data for EFA was confirmed based on the Kaiser-Meyer-Olkin (KMO) value of 0.875 and the statistical significance of Bartlett's test of sphericity (χ^2=4041.07, *df*=105, p<0.001). The EFA of the 15-item revealed three significant factors with eigenvalues greater than 1, accounting for 66.176% of the total variance. Item 6 (Using a smartphone is more enjoyable than spending time with family or friends) was deleted due to a low communality score (>0.2) [35].

The remaining 14-item scale explained a total variance of 69.79%. The obtained three-factor structure was reconfirmed using a scree plot, revealing a definite break after the third component. Additionally, parallel analysis and the minimum average partial test were run and confirmed a three-factor model. As shown in Table 1, the first factor (disturbance of adaptive functions) covered five items that explained 43.21% of the variance and described the negative consequences of overusing smartphones such as neglecting schoolwork and falling school grades or getting poor grades. The second factor (withdrawal) consisted of five items, explaining 15.85% of the variance. This factor was related to negative emotions such as anxiety that emerge when users cannot use their smartphone. The third factor (tolerance) included four items and explained 10.74% of the variance. This factor encompassed items that referred to users facing difficulty stopping using a smartphone and spending a long time on a smartphone to fulfill their satisfaction.

Table 1. Factor analysis of the smartphone addiction proneness scale

Communality	Questions	F1-Loading	F2-Loading	F3-Loading
0.734	My examination grades dropped due to excessive smartphone use.	0.876		
0.707	I have a hard time doing what I have planned (study, do homework, or go to afterschool classes) due to using smartphone.	0.863		
0.615	People frequently comment on my excessive smartphone use.	0.750		
0.643	Family or friends complain that I use my smartphone too much.	0.686		
0.712	My smartphone does not distract me from my studies.	0.882		
0.685	When I cannot use a smartphone, I feel like I have lost the entire world.		0.758	
0.741	It would be painful if I am not allowed to use a smartphone.		0.815	
0.797	I get restless and nervous when I am without a smartphone.		0.906	
0.593	I am not anxious even when I am without a smartphone.		0.842	
0.654	I feel panic when I cannot use my smartphone.		0.749	
0.776	I tried to cut down my smartphone usage time, but I failed.			0.885
0.547	I can control my smartphone usage time.			0.718
0.793	Even when I think I should stop, I continue to use my smartphone too much.			0.884
0.775	Spending a lot of time on my smartphone has become a habit.			0.901
	Eigenvalue	6.05	2.22	1.50
	% of the variance explained	43.21	15.85	10.74
	Cronbach's alpha	α=0.87	α=0.89	α=0.88

3.2. Confirmatory factor analysis (CFA)

Confirmatory Factor Analysis (CFA) was performed on the second sample of subjects (n=462) to validate the factor structure identified by EFA. After the analysis, the error covariance between item 1 and item 5 was added, as suggested by the modification indices. The errors of these two items were selected to covariate because both are related to the negative consequences of smartphone overuse on academic grades and learning. The data demonstrated that all fit indices met statistical requirements after accounting for error covariance, showing that the three-factor structure for the 14-item SAPS had a good fit and was structurally valid. The final factorial graphical solution of the 14-item SAPS is shown in Figure 1. The standardized factor loadings ranged from 0.61 to 0.90.

Given the inconsistency of the factor structure results, the three-factor structure in the current study (14 items without item 6) was compared with the results derived from the original study (four-factor structure with 15 items) [25]. Table 2 shows the structure of the 14-item SAPS with three factors in this study fit the data better than the original four-factor structure model.

3.3. Reliability

To determine the reliability of the SAPS scale, internal consistency tests were conducted on the entire sample. The current data produced good values of Cronbach's alpha. The Cronbach's α for the total SAPS scale was 0.904 and the internal consistency coefficients of the three factors were 0.874, 0.893 and 0.884 respectively. The results suggested that SAPS was a reliable instrument for measuring problematic smartphone use among adolescents.

3.4. Concurrent validity

Correlational analysis between the three SAPS factor scores and its three primary psychological risk factors was performed to identify the concurrent validity of the SAPS. The results showed that SAPS had a significant positive and moderately strong correlation with depression, boredom proneness and loneliness (r's ranged from 0.326 to 0.444). The results also demonstrated that all three SAPS subscales correlated with these criterion variables (r's ranged from 0.222 to 418). These associations were all statistically significant ($p<0.01$). As reported in Table 3, both sets of the results were consistent with the results based on existing research, indicating that SAPS is concurrently valid.

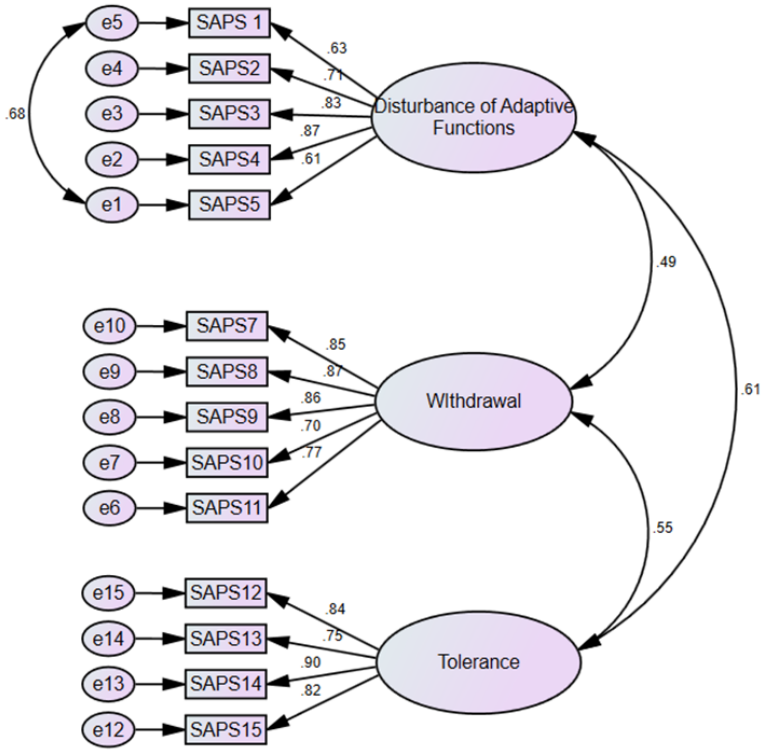

Figure 1. Path diagram for the CFA of the smartphone addiction proneness scale

Table 2. Comparison of fit indices between three-factor structure and four-factor structure SAPS

Model	χ^2	*df*	RMSEA	CFI	TLI	GFI	SRMR
3 Factors	238.35	73	0.07	0.96	0.95	0.93	0.04
4 Factors	507.28	84	0.11	0.90	0.88	0.87	0.06

Table 3. The means, standard deviations and correlations among the scales

	Mean	SD	1	2	3	4	5	6
1. SAPS-Disturbance of adaptive functions	4.86	1.93						
2. SAPS-Withdrawal	4.23	1.99	.374**					
3. SAPS-Tolerance	5.27	2.16	.511**	.490**				
4. SAPS sum score	4.68	1.57	.779**	.795**	.810**			
5. DASS-21	4.13	2.19	.246**	.359**	.350**	.415**		
6. BPS-SR	4.53	2.12	.291**	.337**	.418**	.444**	.799**	
7. ULS-8	4.50	1.85	.222**	.251**	.292**	.326**	.673**	.659**

The smartphone addiction proneness scale (SAPS) was designed to identify problematic smartphone usage behaviors in South Korean adolescents. Although it has been widely used in South Korea, the scale has yet to be validated for use in Malaysian adolescents. Hence, the objective of this study was to investigate the psychometric properties of the SAPS in a sample of Malaysian adolescents.

The findings of the current study are useful in determining the reliability and concurrent validity of the SAPS in a Malaysian sample. The SAPS is reported to have good reliability and the findings were similar to prior validation of this model [25]. SAPS also demonstrated a significant positive and moderately strong correlation with the Depression Anxiety Stress Scale-21 (DASS-21), Short-form UCLA Loneliness Scale (ULS-8) and the Short Boredom Proneness Scale (BPS-SR). Thus, these results support the concurrent validity of the SAPS with three primary psychological risk factors of problematic smartphone use. Consistent with the previous study, the SAPS score was found to have significant and positive associations with depression, loneliness and boredom proneness [17], [20], [24].

The EFA of the SAPS identified a three-factor structure that explained 69.79% of the total variance. According to the CFA of the SAPS, the three-factor model fits the data very well. Interestingly, the results of the current study were inconsistent with the original Korean version of the SAPS scale [25]. Kim *et al.* [25] identified four factors in the original validation study with South Korean adolescents. The original four-factor

SAPS model had a satisfactory model fit. However, based on the five indices of model fit, the three-factor model is regarded as more appropriate for measuring problematic smartphone use among adolescents. The disparity between the two factor models could be due to the differences in culture between Korean and Malaysian samples, but it could be due to a lack of agreement on the signs and symptoms of problematic smartphone use.

In EFA, item 6 (Using a smartphone is more enjoyable than spending time with family or friends) was removed. The participants of this study were adolescents aged between 13 and 17. During adolescence, friendships are extremely crucial. As children enter adolescence, the nature of their peer interactions changes dramatically as they spend more time with their friends of the same age [36]. Adolescent friendship then increasingly expands in terms of commitment, intimacy and acceptance of diversity among friends [37]. Therefore, adolescents enjoy and have a stronger desire to spend time around their teens rather than a smartphone. This indicated that item 6 might not be adapted to adolescents. Moreover, item 6 had a low communality score (>0.2) and factor loading. Hence, this item was removed for the conciseness of the model.

Based on the extracted factor, the first factor was named "disturbance of adaptive functions" which indicates the negative consequences of overusing smartphones. It included three items characterizing that students getting poor grades and neglecting their schoolwork due to smartphone overuse. Another two items illustrate students' inabilities to avoid receiving complaints from friends and family about their excessive smartphone use. Similar to, and in relation to this result, Mahapatra [38] found that family, personal conflicts and poor academic performance are the significant negative consequence of excessive smartphone use.

The second factor "withdrawal" describes the negative emotions such as anxiety, nervousness and panic that emerge when users cannot use their smartphone. This result appeared to be consistent with other prior studies, which provided a relationship between smartphone dependency and increased anxiety [39]. The third factor was named "tolerance". It comprised four items indicating students' inability to stop using a smartphone and reduce their smartphone usage. Adolescents are vulnerable to problematic smartphone use because they are yet to develop self-control in smartphone use [40]. The practicality of the SAPS for adolescents could lead to a better understanding of the psychological mechanisms that underpin problematic smartphone use. Besides, SAPS was found to be a valid and reliable self-reporting questionnaire for identifying problematic smartphone use among Malaysian adolescents in this study.

This study has several limitations. First, there is currently no standard diagnostic tool or instrument to identify when smartphone use becomes a problematic or clinical issue. Although the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) [41] classified gambling disorder and Internet gaming disorder as addictive disorders, additional behavioral addictions such as problematic smartphone use have no accepted diagnostic criteria. Therefore, the proposed diagnostic criteria for problematic smartphone use should be taken with caution.

Second, the current study focused solely on adolescents. Therefore, generalizing the results to other samples may not be warranted. Future research should be conducted on more representative samples to justify the current findings. Another limitation of this study was the samples were recruited from eight secondary schools located in an urban region of Johor Bahru state. The psychometric properties of the SAPS can be studied among active smartphone users using this urban adolescent sample. This sampling technique and the current findings, however, may not be generalized to Malaysian adolescents living in less developed or rural areas. Thus, it is suggested that future researchers should investigate the psychometric properties of the SAPS in samples from less developed areas to see if it is valid among adolescents in these understudied areas.

4. CONCLUSION

Despite the well-documented negative consequences of problematic smartphone use, the absence of standardized measures may limit the scope of relevant investigations. The current study adds to the body of knowledge by assessing the SAPS's validity and reliability among adolescents in Malaysia. The findings revealed that SAPS has good psychometric properties and is useful to measure problematic smartphone use among adolescents in Malaysia. This study is significant because it contributes to cross-cultural research on the SAPS scale while also providing a validated instrument for assessing problematic smartphone use in Malaysia.

REFERENCES

[1] V. Goswami and D. R. Singh, "Impact of mobile phone addiction on adolescents life: A literature review," *International Journal of Home Science*, vol. 2, no. 1, pp. 69-74, 2016.

[2] S.-S. Cha and B.-K. Seo, "Smartphone use and smartphone addiction in middle school students in Korea: Prevalence, social networking service, and game use," *Health Psychology Open*, vol. 5, no. 1, p. 2055102918755046, 2018, doi: 10.1177/2055102918755046.

[3] Malaysian Communications and Multimedia Commission. "Handphone Users Survey 2017." [Online]. Available: https://www.mcmc.gov.my/en/resources/statistics/hand-phone-surveys (accessed 10 Dec, 2020).
[4] National Health and Morbidity Survey, *Key Findings from the Adolescent Health and Nutrition Surveys; Infographic Booklet* Kuala Lumpur, 2017. [Online]. Available: http://iku.moh.gov.my/images/IKU/Document/REPORT/NHMS2017/NHMS2017Infographic.pdf.
[5] Y.-H. Lin *et al*., "Proposed diagnostic criteria for smartphone addiction," *PLOS ONE*, vol. 11, no. 11, p. e0163010, 2016, doi: 10.1371/journal.pone.0163010.
[6] J. Lee *et al.*, "Psychological factors associated with smartphone addiction in South Korean adolescents," *The Journal of Early Adolescence*, vol. 38, no. 3, pp. 288-302, 2018, doi: 10.1177/0272431616670751.
[7] J. Du, P. Kerkhof, and G. M. van Koningsbruggen, "Predictors of social media self-control failure: immediate gratifications, habitual checking, ubiquity, and notifications," *Cyberpsychol Behavior Social Networking*, vol. 22, no. 7, pp. 477-485, Jul 2019, doi: 10.1089/cyber.2018.0730.
[8] H. Abdullah, "Relation between smartphone addiction, sleep quality and psychological health among adolescents in Malaysia," *International Journal of Psychosocial Rehabilitation*, vol. 24, pp. 4288-4298, 2020, doi: 10.37200/IJPR/V24I4/PR201535.
[9] J. Billieux, P. Maurage, O. Lopez-Fernandez, D. J. Kuss, and M. D. Griffiths, "Can disordered mobile phone use be considered a behavioral addiction? an update on current evidence and a comprehensive model for future research," *Current Addiction Reports*, vol. 2, no. 2, pp. 156-162, 2015, doi: 10.1007/s40429-015-0054-y.
[10] D. Kardefelt-Winther *et al.*, "How can we conceptualize behavioural addiction without pathologizing common behaviours?," *Addiction*, vol. 112, no. 10, pp. 1709-1715, Oct 2017, doi: 10.1111/add.13763.
[11] J. Fowler and J. Noyes, "A study of the health implications of mobile phone use in 8-14s," *DYNA*, vol. 84, p. 228, 2017, doi: 10.15446/dyna.v84n200.62156.
[12] K. Demirci, M. Akgönül, and A. Akpinar, "Relationship of smartphone use severity with sleep quality, depression, and anxiety in university students," *Journal of Behavioral Addictions*, vol. 4, no. 2, pp. 85-92, Jun 2015, doi: 10.1556/2006.4.2015.010.
[13] M. J. Rebold, T. Sheehan, M. Dirlam, T. Maldonado, and D. O'Donnell, "The impact of cell phone texting on the amount of time spent exercising at different intensities," *Computers in Human Behavior*, vol. 55, pp. 167-171, 2016, doi: 10.1016/j.chb.2015.09.005.
[14] H.-S. Choi, H.-K. Lee, and J.-C. Ha, "The influence of smartphone addiction on mental health, campus life and personal relations - Focusing on K university students," *Journal of the Korean Data and Information Science Society*, vol. 23, no. 5, 2012, doi: 10.7465/jkdi.2012.23.5.1005.
[15] I. Yun, S. G. Kim, and S. Kwon, "Low Self-Control Among South Korean Adolescents: A Test of Gottfredson and Hirschi's Generality Hypothesis," *International Journal of Offender Therapy and Comparative Criminology*, vol. 60, no. 10, pp. 1185-208, Aug 2016, doi: 10.1177/0306624x15574683.
[16] L. Leung, "Loneliness, social support, and preference for online social interaction: the mediating effects of identity experimentation online among children and adolescents," *Chinese Journal of Communication*, vol. 4, no. 4, pp. 381-399, 2011/12/01 2011, doi: 10.1080/17544750.2011.616285.
[17] A. Enez Darcin, S. Kose, C. O. Noyan, S. Nurmedov, O. Yılmaz, and N. Dilbaz, "Smartphone addiction and its relationship with social anxiety and loneliness," *Behaviour & Information Technology*, vol. 35, no. 7, pp. 520-525, 2016/07/02 2016, doi: 10.1080/0144929X.2016.1158319.
[18] J.-H. Kim, "Smartphone-mediated communication vs. face-to-face interaction: Two routes to social support and problematic use of smartphone," *Computers in Human Behavior*, vol. 67, pp. 282-291, 2017, doi: 10.1016/j.chb.2016.11.004.
[19] G. Dikec, "Relationship between Smartphone Addiction and Loneliness among Adolescents," *Bağımlılık Dergisi,* 2018.
[20] J.-H. Kim, M. Seo, and P. David, "Alleviating depression only to become problematic mobile phone users: Can face-to-face communication be the antidote?," *Computers in Human Behavior*, vol. 51, pp. 440-447, 2015, doi: 10.1016/j.chb.2015.05.030.
[21] S. X. Zhou and L. Leung, "Gratification, loneliness, leisure boredom, and self-esteem as predictors of SNS-game addiction and usage pattern among Chinese college students," *International Journal of Cyber Behavior, Psychology and Learning*, vol. 2, no. 4, pp. 34-48, 2012, doi: 10.4018/ijcbpl.2012100103.
[22] J. D. Elhai, J. K. Vasquez, S. D. Lustgarten, J. C. Levine, and B. J. Hall, "Proneness to boredom mediates relationships between problematic smartphone use with depression and anxiety severity," *Social Science Computer Review*, vol. 36, no. 6, pp. 707-720, 2018, doi: 10.1177/0894439317741087.
[23] J. Skues, B. Williams, J. Oldmeadow, and L. Wise, "The effects of boredom, loneliness, and distress tolerance on problem internet use among University Students," *International Journal of Mental Health and Addiction*, vol. 14, no. 2, pp. 167-180, 2016/04/01 2016, doi: 10.1007/s11469-015-9568-8.
[24] Y. Wang, H. Yang, C. Montag, and J. D. Elhai, "Boredom proneness and rumination mediate relationships between depression and anxiety with problematic smartphone use severity," *Current Psychology*, 2020/09/08 2020, doi: 10.1007/s12144-020-01052-0.
[25] D. Kim, Y. Lee, J. Lee, J. K. Nam, and Y. Chung, "Development of Korean smartphone addiction proneness scale for youth," *PLOS ONE*, vol. 9, no. 5, p. e97920, 2014, doi: 10.1371/journal.pone.0097920.
[26] World Health Organization. "Adolescent health in the South-East Asia Region." [Online]. Available: https://www.who.int/southeastasia/health-topics/adolescent-health (accessed May 14, 2022).
[27] N. Ithnain, S. Ghazali, and N. Jaafar, "Relationship between smartphone addiction with anxiety and depression among undergraduate students in Malaysia," *International Journal of Health Science Research*, vol. 8, pp. 163-171, 01/01 2018.
[28] W. S. Wan Ismail *et al*., "The relations of internet and smartphone addictions to depression, anxiety, stress, and suicidality among public university students in Klang Valley, Malaysia," *Perspectives in Psychiatric Care*, vol. 56, no. 4, pp. 949-955, 2020, doi: 10.1111/ppc.12517.
[29] C.-S. Tan, X.-Y. Tee, N. A. B. A. Rahim, Y.-H. Siah, and P.-C. Siah, "Assessing the psychometric properties of the smartphone addiction inventory and development of a new short-form among young adults in Malaysia," *International Journal of Mental Health and Addiction*, 2022/01/07 2022, doi: 10.1007/s11469-021-00721-w.
[30] R. D. Hays and M. R. DiMatteo, "A short-form measure of loneliness," *Journal Personality Assessment*, vol. 51, no. 1, pp. 69-81, 1987, doi: 10.1207/s15327752jpa5101_6.
[31] S. H. Lovibond and P. F. Lovibond, *Manual for the Depression Anxiety Stress Scales. (2nd. Ed.)*. Sydney: Psychology Foundation of Australia, 1995.
[32] A. A. Struk, J. S. A. Carriere, J. A. Cheyne, and J. Danckert, "A short boredom proneness scale:development and psychometric properties," *Assessment*, vol. 24, no. 3, pp. 346-359, 2017, doi: 10.1177/1073191115609996.
[33] K. Schermelleh-Engel, H. Moosbrugger, and H. Müller, "Evaluating the Fit of structural equation models: tests of significance and descriptive goodness-of-fit measures," *Methods of Psychological Research Online*, vol. 8, pp. 23–74, 05/25 2003.

[34] L. t. Hu and P. M. Bentler, "Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives," *Structural Equation Modeling: A Multidisciplinary Journal*, vol. 6, no. 1, pp. 1-55, 1999/01/01 1999, doi: 10.1080/10705519909540118.
[35] D. Child, *Essentials of factor analysis*. New York: Continuum. 2008.
[36] R. Larson and M. H. Richards, "Daily companionship in late childhood and early adolescence: changing developmental contexts," *Child Development*, vol. 62, no. 2, pp. 284-300, Apr 1991, doi: 10.1111/j.1467-8624.1991.tb01531.x.
[37] S. Shulman, B. Laursen, Z. Kalman, and S. Karpovsky, "Adolescent intimacy revisited," *Journal Youth Adolescence*, vol. 26, no. 5, pp. 597-617, 1997, doi: 10.1023/A:1024586006966.
[38] S. Mahapatra, "Smartphone addiction and associated consequences: role of loneliness and self-regulation," *Behaviour & Information Technology*, vol. 38, no. 8, pp. 833-844, 2019, doi: 10.1080/0144929X.2018.1560499.
[39] K. E. Lee *et al.*, "Dependency on smartphone use and its association with anxiety in Korea," *Public Health Reports*, vol. 131, no. 3, pp. 411-419, 2016/05/01 2016, doi: 10.1177/003335491613100307.
[40] G. Bassi, A. Lis, T. Marci, and S. Salcuni, "The Italian Version of Smartphone Addiction Inventory (SPAI-I) for Adolescents: Confirmatory Factor Analysis and Relation with Self-Control and Internalized-Externalized Symptoms," *International Journal of Mental Health and Addiction*, 2021, doi: 10.1007/s11469-021-00705-w.
[41] American Psychiatric Association, *Diagnostic and statistical manual of mental disorders: DSM-5* (no. Accessed from https://nla.gov.au/nla.cat-vn6261708). Arlington, VA: American Psychiatric Association, 2013.

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