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Are you "phubbing" me? The Determinants of Phubbing Behavior and Assessment of Measurement Invariance across Sex Differences

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Abstract

Phubbing behavior is pervasive but the examination of the determinants and measurement invariance remain deficient. The present study aims to investigate: (1) relationships between Big Five personality traits (i.e., open-mindedness, conscientiousness, extraversion, agreeableness, and negative emotionality), coping styles (i.e., problem-focused and emotional-focused), Internet addiction and phubbing behavior; (2) the mediating role of Internet addiction among these relationships; and (3) measurement invariance across sex groups. A total of 405 responses were included in the final analyses. Participants were sampled using a probability-proportionate-to-size (PPS) method. Data were collected using paper-and-pencil survey: Phubbing Scale, Internet Addiction Test, Big Five Inventory, and Simplified Coping Styles Questionnaire. Negative emotionality, open-mindedness, and Internet addiction were the significant determinants of phubbing behavior. Internet addiction partially mediates open-mindedness and phubbing behavior. As for measurement invariance across sex groups, conscientiousness, extraversion, negative emotionality, Internet addiction, and phubbing behavior constructs achieved full measurement invariance. The agreeableness construct showed partial measurement invariance. Three constructs (i.e., open-mindedness, problem-focused and emotional-focused coping) failed to achieve partial measurement invariance, signifying that male and female participants had different interpretations on the items of these constructs. This pervasive culture could be gradually weakened if in-person interaction is intensely promoted.

Keywords: phubbing behavior, Big Five personalities, coping styles, Internet addiction

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Me Estás Haciendo *Phubbing*? Los Determinantes del *Phubbing* y la Evaluación de la Medición de la Invariancia entre las Diferencias entre Sexos

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Resumen

Phubbing es un fenómeno omnipresente; pero, la identificación de los determinantes y la invarianza de la medición siguen siendo insuficientes. Esta investigación tiene como objetivo investigar: (1) la relación directa entre cinco grandes rasgos de personalidad (p.e., mentalidad abierta, escrupulosidad, extraversión, amabilidad, y emocionalidad negativa), formas de afrontamiento (centrado en problemas y emociones), adicción a Internet para y *phubbing*; (2) el rol mediador de la adicción a Internet entre estas relaciones; y (3) la medición de las diferencias entre sexos. Se incluyeron 405 respuestas en los análisis finales. Los participantes se seleccionaron con el método de probabilidad proporcional al tamaño (PPT). Los datos se recogieron mediante una encuesta: Escala de *Phubbing*, Test de Adicción a Internet, Inventario de los Grandes Cinco, y Cuestionario Simplificado de Formas de Afrontar el Estrés. La emocionalidad negativa, mentalidad abierta, y adicción a Internet fueron los factores determinantes del comportamiento de phubbing. En cuanto a la invarianza de medición a través de los grupos de sexo, la conciencia, la extraversión, la emocionalidad negativa, la adicción a Internet y los constructos del comportamiento de phubbing lograron la invarianza de medición completa. La construcción de conformidad mostró una invarianza de medición parcial. Tres construcciones (es decir, mentalidad abierta, afrontamiento centrado en el problema y centrado emocional) no lograron la invarianza de medición parcial, lo que significa que los participantes masculinos y femeninos tenían diferentes interpretaciones sobre los elementos de estos constructos. Esta cultura penetrante podría debilitarse gradualmente si se promueve intensamente la interacción en persona.

Palabras clave: comportamiento de phubbing, cinco grandes rasgos de personalidades, formas de afrontar el estrés, adicción a Internet

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Recent years have seen exponential communication technology advancement, specifically smartphones that now function much like computers. Smartphones, which have important features akin to pocket computers, enable users to perform a plethora of useful tasks, such as browsing the Internet, photographing and editing, playing games, drawing, instant messaging, downloading video clips, listening to songs, and more. However, the attractiveness of the smartphone has led to an unsound social trend: *phubbing. Macquarie Dictionary* coined the term Phubbing by merging the words *phone* and *snubbing*. Given this popular norm, phubbing can best be described as an act of snubbing someone in a social setting by focusing on one's mobile phone instead of communicating in close proximity. To date, very few research studies (e.g., Chotpitayasunondh & Douglas, 2016; Roberts & David, 2016, 2017; Ugur & Koc, 2015; Vanden Abeele, Antheunis & Schouten, 2016; Wang, Xie, Wang, Wang & Lei, 2017) have examined phubbing behavior. In short, despite this pervasive phenomenon, empirical research specifically examining the determinants of phubbing behavior remains deficient.

The determinants of phubbing behavior have not been widely researched, particularly across sex groups. Therefore, before comparing group differences using a multi-group analysis, the primary concern is to ensure measurement invariance, also known as measurement equivalence. By establishing measurement invariance, researchers can confidently claim that the group differences in the proposed model are not derived from the distinct content and/or meanings of the latent constructs across groups. According to Hair et al. (2017), respondents from different groups may contribute different meanings to various latent constructs being measured instead of the true differences. The different attributions to latent constructs may be due to cultural values, gender, ethnicity, or any other individual differences. It can also be explained from the different use of available options on a scale (e.g., avoid choosing or prefer choosing the extremes). Hult et al. (2008) suggested that failure to achieve measurement invariance might potentially cause measurement error, leading to the differences between what is actually measured and what should be measured. Prior to group comparison, measurement invariance is a pre-requisite criterion to ensure the validity of conclusions made.

Literature Review

Internet Addiction and Phubbing Behavior

Karadağ et al. (2015) discovered that Internet addiction is a significant contributor to phubbing behavior. Internet addiction is defined as obsessive-compulsive, excessive, uncontrollable use of the Internet, leading to significant distress and impairments in daily functioning (i.e., family relationships, emotional stability, work, and study) (Young, 1998, 1999). The Internet is a boundless area of development, the content of which is supplied endlessly and abundantly from the intelligence and imagination of humans. Therefore, the future of the Internet is unpredictable. Additionally, there are several reasons that make individuals spend time on the Internet to satisfy their needs and desires e.g., sexual content (e.g., Bond, 2011; Ouytsel, Ponnet, Walrave & d'Haenens, 2016), communication and socialization (e.g., Shin, 2015; Tynes & Mitchell, 2014), games or entertainment (e.g., Batool & Mahmood, 2010; Doh & Whang, 2014) and online shopping (e.g., Huseynov & Yıldırım, 2016; Verma & Jain, 2015). Undoubtedly, increased time spent on the Internet (Lan & Lee, 2013), improved access to the Internet (Revilla, Cornilleau, Cousteaux, Legleye & de Pedraza, 2016), and a strong urge to access a variety of Internet content (Hawi, 2012) may have significantly led to the increased prevalence of Internet addiction and phubbing behavior.

Coping Styles, Internet Addiction, and Phubbing Behavior

Coping styles consist of problem-focused coping and emotion-focused coping. Individuals that adopt a problem-focused coping style tend to apply direct strategies to cope with problems that cause emotional distress. They are likely to seek social support and restructure their cognitions, which can subsequently lead to better problem-solving. In contrast, emotion-focused coping refers to one's use of strategies in regulating negative emotions. For instance, wishfully thinking that stressful situations will rectify themselves. Individuals that opt for this style of coping also tend to withdraw themselves from stressful situations and deny overwhelming facts (Zhou et al., 2016).

Subsequently, other studies (e.g., Li & Lei, 2005; Tang et al., 2014) have reported that one's coping style significantly impacts one's addictive behavior. Individuals with stronger emotion-focused coping style and weaker problem-focused coping style are found to be at higher risk of Internet addiction. This finding was also strengthened by the theory of personality coping outcome of Gallagher (1996), in which the theory emphasizes that when individuals encounter stressful conditions, one's personality may induce one's coping style in different ways, and this leads to various adjustment outcomes. Altogether, it is predicted that coping styles may greatly influence Internet addiction and phubbing behavior.

Big Five Personalities, Internet Addiction, and Phubbing Behavior

Most studies have focused on the association between the Big Five personalities and Internet addiction or smartphone addiction (e.g., Kayiş et al., 2016; Kuss et al., 2013b; Servidio, 2014; Zhou et al., 2016). For example, Zhou et al. (2016) found that agreeableness and conscientiousness were negatively correlated with Internet addiction. However, extraversion, openness, and neuroticism were positively linked with Internet addiction. Inconsistently, Zamani, Abedini and Kheradmand (2011) reported that agreeableness and openness were not found as significant predictors of Internet addiction, whereas extraversion, neuroticism, and conscientiousness were found as significant predictors.

An individual with greater agreeableness is likely to be more considerate of the wellbeing of others (Roberts, Pullig & Manolis, 2015). Agreeable individuals place more emphasis on honesty and equality in an interpersonal relationship (Phillips, Butt & Blasczynki, 2006). Ehrenberg et al. (2008) reported that participants with low agreeableness had a greater tendency to be addicted to instant messaging (one of the activities of phubbing). Consistently, Butt and Phillips (2008) also agree, and state that individuals with low agreeableness are more likely to use text messaging than their counterparts. As for extraversion, Andreassen et al. (2013) reported that extraverts were more likely to be addicted to their smartphones than individuals with lower extraversion. For example, extraverts tend to be easily under-aroused and are likely to gratify their high sensation seeking

personality by connecting with a larger group of virtual friends (Roberts et al., 2015).

In contrast, conscientious individuals show good self-discipline in monitoring their behaviors (Costa & McCrae, 1992). Conscientiousness was was found to be negatively associated with problematic smartphone use. Highly conscientious individuals are capable of controlling their urges by not habitually and frequently accessing their smartphones particularly in inappropriate settings (Kayiş et al., 2016). Furthermore, individuals with poorer emotional stability were associated with more problematic smartphone use. They would be more likely to use the smartphone as a means of dealing with stressful life events (Bianchi & Phillips, 2005). The personality trait of openness was positively associated with problematic smartphone use. Individuals with high openness are more likely to pursue and adopt up-to-date information technology, which are consistent with their high flexibility of thought and tolerance of new ideas (Devaraj, Easley & Crant, 2008). Given the past studies that have extensively examined the roles of Big Five personalities on Internet addiction and smartphone addiction but not on phubbing behavior, an examination of the selected key variables is called for, as a study such as this will shed light on how the personality traits predict technology-related behavior. In summary, the lack of comprehensive mapping of the extensive frameworks between personality traits and phubbing behavior has served as a strong impetus for the present study to fill the major literature gap.

Theoretical Framework

Mowen (2000) developed a Meta-theoretic Model of Motivation, also known as the 3M model, to describe the role of personality traits in particular behaviors. The 3M model highlights the need to identify more abstract traits underlying surface behavior prior to understanding the causes of behavioral tendencies. The 3M model was built upon the foundation of earlier works including Allport (1961), Buss (1989), Lastovicka (1982), and others, all of whom agreed that personality traits are formed in accordance to a hierarchical manner and vary in the extent of concreteness. Furthermore, four theoretical approaches were integrated to develop this 3M model:

control theory, hierarchical models of personality, evolutionary psychology, and trait theory. Control theory is a framework that describes the interaction between the hierarchical arrangement of personality traits, leading to the formation of goals, emotions, and ultimately behavior. Additionally, hierarchical models of personality show that traits are developed in an abstract manner. Meanwhile, evolutionary psychology and trait theory supply the ideas of personality traits.

In the 3M model, the first level corresponds to elemental traits. Mowen (2000) used a Five-Factor Model of personality as the foundation for developing this hierarchical model by incorporating this level (the most basic) into the model. The elemental traits refer to underlying predispositions of individuals that might be derived from genetics or during an early stage. The traits are used as the fundamental sources for shaping human behavior (Mowen, 2000). Specifically, in this present study, five elemental traits are examined: open-mindedness, conscientiousness, extraversion, agreeableness, and negative emotionality. The second level of the 3M model corresponds to compound traits. Compound traits are a result of the interaction between multiple elemental traits through one's learning of history and cultural factors. Compound traits and elemental traits are different in which the latter is narrower in application and function specifically to guide behavior. In the present study, coping styles (emotional-focused and problem focused) are selected as compound traits because the formation of coping styles is derived from several elemental traits as well as implications drawn from previous studies (e.g., Li & Lei, 2005; Zhou et al., 2016).

The subsequent level of the hierarchy is the situational trait. This trait describes one's predispositions that are exhibited during a given situational context. The situational trait is affected by the pressures of the situational environment and can influence the earlier levels (i.e., elemental and compound traits). Mowen and Sujan (2005) described that situational traits act as the motives for engaging in certain behavior. In the current research, Internet addiction is proposed as the situation trait because the wide-ranging and attractive features offered by the Internet can subsequently lead to smartphone users being more immersed in phone snubbing instead of engaging in face-to-face interaction. This situation might be intensified if

phubbing behavior is transformed into an acceptable norm in a given context. The final level of the 3M model is represented by surface traits. These traits are formed as the products of elemental, compound, and situational traits and the pressure of a particular context. Mowen (2000) suggested that mediation exists between traits at each level, and the integration of the traits predicts the surface trait. Comparing situational trait and surface trait, surface trait exists in a narrower context and could be classified under a category-specific disposition. In addition, surface traits are considered to be strong predictors of particular outcomes. In the present study, phubbing behavior is labeled as a surface trait, where this surface trait can significantly predict the development of one's mental health and physical health over one's lifetime.

Purpose of Study

Given the adverse consequences of phubbing culture, the present study aims to develop an exploratory model to investigate: (1) the direct relationships between the Big Five personalities (i.e., open-mindedness, conscientiousness, extraversion, agreeableness, and negative emotionality), coping styles, and Internet addiction in predicting phubbing behavior; (2) the mediating role of Internet addiction in the relationship between variables; and (3) measurement invariance of the proposed structural model. The participants of the present study consist of emerging adults (i.e., undergraduate students). Our research speculates that emerging adults have more purchasing power and thus are likelier to possess smartphone(s) and subscribe to Internet access compared to adolescents. Nowadays, there are more affordable and attractive Internet data packages offered by various telecommunication companies, leading to excessive and compulsive use of the Internet, and ultimately the formation of a phubbing culture. Furthermore, smartphones allow instant information access as well as the integration of multiple important features (e.g., instant messaging, social media apps, gaming, online shopping, and more) into a single device that is convenient, portable, and versatile (Elogie, 2015). From another perspective, undergraduate students that have left their neighborhood will have a higher need to stay connected with their family members, relatives, and friends.

Therefore, it is strongly believed that within this group, the use of smartphones will be increased and subsequently contribute to phubbing behavior. Taken together, the present study is keen to examine the phubbing trend amongst undergraduate students in Malaysia using the selected key determinants. The conceptual model for this study is illustrated in Figure 1.

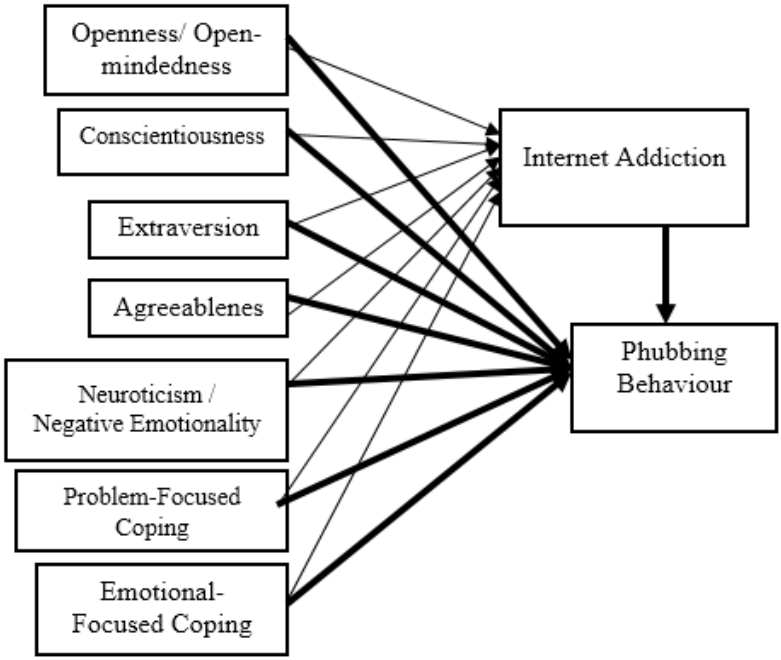

Figure 1. Conceptual Model for the Relationships between Big Five Personalities, Coping styles, Internet Addiction and Phubbing Behaviour

Contributions of the Study

The present study makes several contributions to the current literature. The first contribution is the investigation into the important determinants of phubbing behavior. The examination of these determinants provides a vital reference for future researchers and practitioners to develop a clearer picture about the interaction between the selected key variables, particularly in a

non-Western context. The second contribution is that the present study examines an area of research (i.e., phubbing behavior), which has not been researched substantially. The findings of the present study may allow future researchers to further examine the potential impacts of this understudied phenomenon. The literature gap has also provided a great impetus for the present study to enrich the scarceness of research findings. The third contribution is the investigation of the potential mediating role of Internet addiction in the relationship between the selected determinants (i.e., personality traits and coping styles) and phubbing behavior. It also allows more insights for policy makers and mental health professionals to effectively implement the significant determinants when comparing the direct and mediated relationships between them. As for the fourth contribution, the present study has designed a structural model that assesses measurement invariance. As suggested by Hair et al. (2017), when measurement invariance was not examined and established, any conclusions about the model relationships would be questionable. Thereupon, prior to any group comparisons, an establishment of measurement invariance is important to ensure the results are not derived from the distinctive content and/or meanings of the latent variable across any groups.

Methodology

Research Design

The present study adopted a cross-sectional survey and correlational research design. In a cross-sectional survey, information concerning personal characteristics, Internet addiction, the Big Five personalities, coping styles, and phubbing behavior were obtained through structured and self-administered questionnaires all at one time.

Participants

A total of 421 undergraduate students (*Mage* = 20.9) were randomly selected from universities in Malaysia. However, only 405 (female = 72.1%) responses were included in the final analysis after excluding outliers and missing values. There are two inclusion criteria for a participant to be

selected: (1) must be a smartphone user, and (2) must be an undergraduate student from a university in Malaysia.

Location of Study

The present study focused on two main regions in Malaysia: northern and central Peninsular Malaysia. Two Private or Public universities from each region were selected as the sampling units. Participants that were from different regions could have contributed to the demographical differences leading to heterogeneity in research data.

Sampling Technique

Data were collected from undergraduate students across various States in Malaysia. As reported by the Ministry of Higher Education (2015), a total of 136,587 undergraduate students were enrolled in Private universities, whereas 324,894 undergraduate students were enrolled in Public universities. On the basis of the sampling frame, a list of Public and Private universities was obtained and a probability-proportionate-to-size (PPS) sampling method was used to systematically draw a sample from the selected universities. Additionally, Yamane (1967) suggested a simplified formula for calculating sample sizes. Given the formula, $= \frac{n}{1+N(e)^2}$, "n" refers to sample size; "N" refers to the entire population = 461, 481; "e" refers to level of precision, which is a 95% confidence level, and $p = 0.05$. The equation indicates that the minimal sample size should be 400 participants. In regard to the present study, a total of 405 responses were included for the final analyses, which fulfills the required sample size.

Measures

Phubbing Scale (PS)

Phubbing scale (PS) measures an individual's underlying tendency to look at his or her smartphone and detach oneself from social communication with

surrounding people. This inventory was first developed by Karadağ et al. (2015) and consists of ten items. It is administered via a 5-point Likert scale, graded from 1 (never) to 5 (always). Higher scores for the communication disturbance factor signify that individuals often interrupt their existing communications by focusing on their smartphones during face-to-face interaction with surrounding people. Examples of these items are: "I am always busy with my mobile phone when I'm with my friends" and "The time allocated for social, personal or professional activities decreases because of my mobile phone use." Additionally, higher scores of phone obsessions indicate that the individual repeatedly needs his or her mobile phone, which leads to a deficiency in the quality of face-to-face interaction. An example of this item is, "I feel incomplete without my mobile phone". The results show that the inventory exhibits a good composite reliability with a value of 0.858. In the present study, composite reliability (CR) was selected to measure reliability instead of Cronbach's Alpha because the latter has been censured for its lower bound value, which may underestimate true reliability (Peterson & Kim, 2013).

Internet Addiction Test (IAT)

The Internet Addiction Test (IAT) is one of the most common diagnostic instruments, which has been widely used in Internet addiction research. It measures the addictive use of the Internet, and was first developed by Young (1998). This inventory has a total of 20 items in which eight items are derived from the diagnostic criteria of pathological gambling and alcoholism from the Diagnostic and Statistical Manual of Mental Disorders, 4th Edition (DSM-IV). Examples of the items include, "How often do you find that you stay online longer than you intended?" and "How often do your grades or school work suffer because of the amount of time you spend online?" This instrument is administered on a 5-point Likert scale with 1= rarely and 5 = always. The total scores of this instrument allow the researcher to determine the Internet addiction levels of the users from mild (20-49 scores), moderate (50-79 scores), to severe (80-100 scores). In summary, the higher the score, the greater the level of addictive use of the Internet. This inventory demonstrates a sound composite reliability of 0.921.

Big Five Inventory (BFI-II)

The Big Five Inventory (BFI-II) measures the five personality domains: open-mindedness, conscientiousness, extraversion, agreeableness, and negative emotionality. This inventory was developed by Soto and John (2016) and comprises 60 items in phrase form, which are administered in a 5-point Likert scale with 1 indicating "disagree strongly" and 5 indicating "agree strongly". Examples of the items are: "I am someone who is …" "outgoing, sociable"; "is compassionate, has a soft heart"; "has few artistic interests". This inventory demonstrates good composite reliabilities for all the five domains: open-mindedness (0.747), conscientiousness (0.847), extraversion (0.801), agreeableness (0.803), and negative-emotionality (0.876).

Simplified Coping Styles Questionnaires (SCSQ)

The Simplified Coping Styles Questionnaire (SCSQ) measures problem-focused coping and emotion-focused coping styles. This inventory was developed by Xie (1999) and was originally developed in the Chinese language. Therefore, the researchers in the present study recruited linguistic and psychology experts to conduct back-and-forth translations. Prior to the actual study, a pilot study was conducted to ensure the fulfillment of adequate reliability estimates. The factor of problem-focused coping consists of 12 items, whereas emotion-focused coping consists of 8 items. All items were measured on a 4-point Likert scale where 1= "never" and 4 = "always". Examples of the items are: "When I face life challenges, I will try to stand firm on my ground and fight for my own benefits"; "When I face life challenges, I will try to communicate with others to share my problems" and "When I face life challenges, I will try to look at the positive side of the issue". Higher scores indicate the most frequently used coping style (i.e., problem-focused coping or emotion-focused coping). Nevertheless, participants were not categorized into a mutually exclusive group. It was also predicted that individuals could exhibit both coping styles while facing life challenges. This inventory demonstrated sound composite reliabilities

for the two coping styles: problem-focused style (0.889) and emotion-focused style (0.844).

Statistical Analyses

In order to assess the links between all study variables, SmartPLS version 3.0 was used for data analysis. SmartPLS is a prominent software application that employs Partial Least Squares Structural Equation Modeling (PLS-SEM) developed by Ringle, Wende, and Becker (2015). The Partial Least Squares path models consist of two sets of linear equations, which are the measurement model and structural model. The measurement model shows the associations between a construct and its observed indicators. The structural model displays the associations between exogenous and endogenous constructs. In the present study, the measurement model was formed to assess the composite reliabilities, convergent validity, and discriminant validity. The structural model comprised the constructs of the Big Five personalities, coping styles, Internet addiction, and phubbing behavior. Upon the completion of the structural model analysis, the procedure for measurement invariance of composite models (MICOM) was applied.

Results

The Measurement Model

In the measurement model, the composite reliabilities, convergent validity, and discriminant validity were analyzed. In Table 1, the data indicate that all the latent constructs show sound internal consistency, as indexed by the composite reliability. The composite reliabilities range from 0.747 to 0.921, which meet the threshold value of 0.70. The average variance extracted (AVE) of the latent constructs ranged from 0.359 to 0.506 after deleting indicators with less than 0.50 outer loadings (refer to Table 1). Table 2 shows that each of the outer loadings was found highly significant with $p<0.0001$. Given the exploratory nature of this study and a higher number of indicators (total = 110), most of the latent constructs achieved more than 0.40 but did not exceed 0.50 of AVE. Although the measurement model

showed below threshold values of convergent validity, this did not hamper the soundness of the discriminant validity of the measure scales with all values being lower than the threshold of 0.85 (refer to Table 3).

Table 1
Composite Reliabilities and Average Variance Extracted (AVE)

Latent Constructs	Composite Reliability (Internal Consistency)	Average Variance Extracted (AVE)
Agreeableness	.803	.369
Conscientiousness	.847	.359
Extraversion	.801	.404
Negative emotionality	.876	.506
Open-mindedness	.747	.372
Internet Addiction	.921	.441
Problem-Focused	.889	.404
Emotional-Focused Coping	.844	.441
Phubbing Behaviour	.858	.464

Table 2.
Outer Loadings of Latent Constructs

	Negative-Emotionality	Agreeableness	Extraversion	Conscientiousness	Open-mindedness	Problem-Focused Coping	Emotional-Focused Coping	Internet Addiction	Phubbing behaviour
AB12r		.663							
AB2		.545							
AB22r		.572							
AB32		.601							
AB37r		.572							
AB52		.590							
AB7		.695							
NE14	.771								
NE29r	.709								
NE34	.634								
NE39	.755								
NE44r	.539								
NE54	.780								
NE59	.758								
EV1			.655						
EV21			.631						
EV26r			.750						
EV41			.615						
EV51r			.578						
EV6			.566						
CS18				.646					
CS23r				.586					
CS33				.636					
CS38				.538					
CS3r				.664					
CS43				.533					
CS48r				.672					
CS53				.574					
CS58r				.547					
CS8r				.572					
OM25r					.622				
OM30r					.620				
OM35					.571				
OM45r					.647				
OM50r					.586				
PF1						.568			
PF10						.714			

Table 2 (cont.)

	Negative-Emotionality	Agreeable-ness	Extra-version	Conscientious-ness	Open-mindedness	Problem-Focused Coping	Emotional-Focused Coping	Internet Addiction	Phubbing behavior
PF11						.510			
PF12						.556			
PF2						.642			
PF3						.664			
PF4						.713			
PF5						.643			
PF6						.565			
PF7						.640			
PF8						.670			
PF9						.700			
EF14							.574		
EF15							.608		
EF16							.698		
EF17							.795		
EF18							.726		
EF19							.673		
EF20							.534		
IA11								.671	
IA13								.701	
IA14								.568	
IA15								.770	
IA16								.493	
IA17								.595	
IA18								.659	
IA19								.738	
IA20								.749	
IA3								.638	
IA4								.581	
IA5								.729	
IA6								.726	
IA8								.694	
IA9								.585	
PB1									.689
PB10									.714
PB2									.661
PB3									.713
PB4									.737
PB8									.614
PB9									.628

Table 3
Heterotrait-Monotrait Ratio (HTMT) between Latent Constructs

	Original Correlation	Correlation Permutation Mean	5.0% quantile	Permutation p-Values	Compositional Invariance
Agreeableness	.909	.925	.799	.221	Yes
Conscientiousness	.959	.941	.839	.474	Yes
Extraversion	.950	.929	.797	.467	Yes
Internet Addiction	.999	.999	.997	.473	Yes
Negative emotionality	.966	.961	.894	.271	Yes
Open-mindedness	.897	.964	.904	.039	No
Phubbing Behaviour	.997	.994	.985	.759	Yes
Problem-Focused Coping	.480	.926	.742	.023	No
Emotional-Focused Coping	.973	.991	.979	.019	No

The Structural Model

The results in Figure 2 show that the strongest determinant of phubbing behavior is Internet addiction (0.481), followed by negative emotionality (0.173), and open-mindedness (-0.158) at $p<0.05$. However, agreeableness, conscientiousness, extraversion, emotion-focused coping, and problem-focused coping have not been found to significantly predict phubbing behavior. Additionally, the significant determinants of Internet addiction are: emotion-focused coping (0.384), open-mindedness (-0.214), agreeableness (-0.110), and conscientiousness (-0.095) with $p<0.05$, while the other determinants were not significant. In regard to mediating effect, the direct and indirect effects of open-mindedness and phubbing behavior with Internet addiction as a mediator were found significant. The variance accounted for (VAF) indicates that 36.4% of the effect of open-mindedness on phubbing behavior could be explained by Internet addiction, with a 36.4% VAF, signifying a partial mediation effect. There were no mediating effects found in other relationships. In regard to R^2, a total of 28.5% variance in phubbing behavior and 37.9% of variance in Internet addiction could be explained by all determinants.

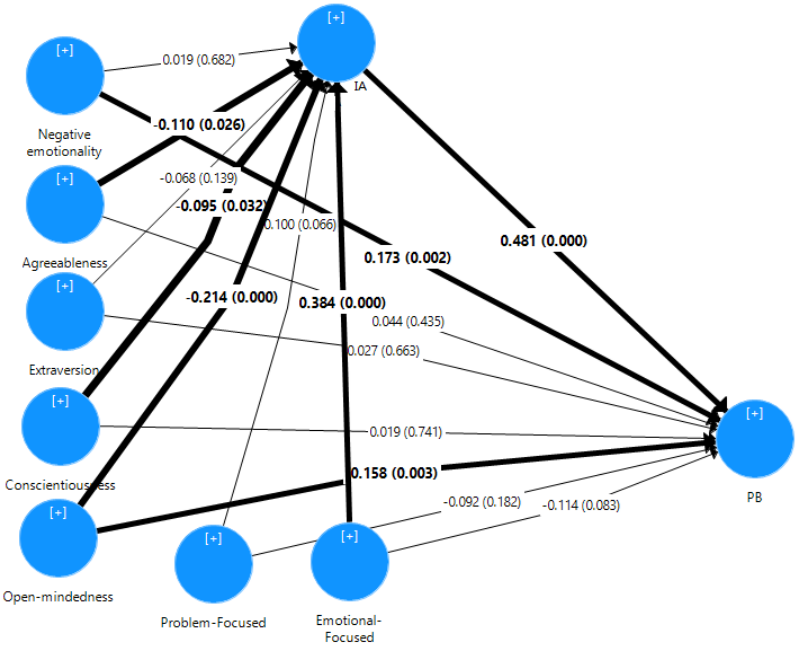

Figure 2. The Structural Model with Direct Relationships and Mediated Relationships.

Note: The bolded path signifies a significant path coefficient (*p*-value). IA= Internet Addiction; PB= Phubbing Behaviour.

Measurement Invariance

In PLS-SEM, Henseler, Ringle, and Sarstedt (2016) developed a procedure known as measurement invariance of composite models (MICOM). The latent variables are presented as composites, in terms of linear combinations of indicators and indicator weights. The MICOM procedure involves three steps: configural invariance, compositional invariance, and equality of composite mean values and variances. All three steps are connected in a hierarchical manner. Partial measurement invariance is achieved if configural invariance and compositional invariance are established. Multi-group analysis can be performed when all latent variables exhibit partial

measurement invariance. In order to confirm full measurement invariance, the equality of composite mean values and variances has to be attained.

Step 1: Configural Invariance

Configural invariance is established when constructs are equally parametrized and measured across groups (Hair et al., 2017). In the present study, the measurement invariance was analyzed with two groups (male and female groups). Across the two groups, all the indicators were treated similarly in terms of reverse coding and standardization of missing value treatment. For the algorithm settings, both groups were treated identically. Each measurement model of the groups was assigned the same indicators and scale. Through the above-mentioned practice, configural invariance was established in the structural model. The second step is the assessment of compositional invariance.

Step 2: Compositional Invariance

The results in Table 4 reveal that the original correlation values of these constructs (i.e., agreeableness, conscientiousness, extraversion, Internet addiction, negative emotionality, and phubbing behavior) are within the corresponding permutation-based confidence interval with a lower boundary (refer to the column of 5% quantile); accordingly, a significant *p*-value must be larger than 0.05. Thereupon, the original correlations of these constructs are not significantly different than 1, which supports the conclusion that compositional invariance has been established. Nevertheless, three constructs (i.e., open-mindedness, problem-focused coping, and emotional-focused coping) showed 5% quantile values greater than the original correlation values, consistent with significant *p*-values of lesser than 0.05, signifying the correlation of the constructs, which are different than 1. To summarize, most of the constructs supported partial measurement invariance except for the three constructs. However, it is important to examine whether full measurement invariance holds for constructs that attained partial measurement invariance. Next, the composite means and variances across the groups is assessed and subsequently presented.

Table 4
Compositional Invariance across Groups (Male vs Female)

	Original Correlation	Correlation Permutation Mean	5.0% quantile	Permutation p-Values	Compositional Invariance
Agreeableness	.909	.925	.799	.221	Yes
Conscientiousness	.959	.941	.839	.474	Yes
Extraversion	.950	.929	.797	.467	Yes
Internet Addiction	.999	.999	.997	.473	Yes
Negative emotionality	.966	.961	.894	.271	Yes
Open-mindedness	.897	.964	.904	.039	No
Phubbing Behaviour	.997	.994	.985	.759	Yes
Problem-Focused Coping	.480	.926	.742	.023	No
Emotional-Focused Coping	.973	.991	.979	.019	No

Step 3: Equality of Composite Mean Values and Variances

As presented in Table 5, all constructs (except negative emotionality and problem-focused coping constructs) reveal that the original difference mean values are within the confidence interval (lower and upper boundaries), indicating that there are no significant differences in the mean values across sex groups. Permutation *p*-values further support the findings with values considerably greater than 0.05. In regard to variances (Table 6), all the confidence intervals including the original value and all the *p*-values are clearly larger than 0.05. However, only the agreeableness construct failed to achieve this equality in variances. In light of these results, a total of three constructs (i.e., open-mindedness, problem-focused coping, and emotional-focused coping) failed to attain partial measurement invariance (significant *p*-values of compositional invariances). In contrast, the other constructs were able to attain full measurement invariance across sex groups except for the agreeableness construct due to inequality in variances.

Table 5
Invariance of Composite Mean Values across Groups (Male vs Female)

	Mean - Original Difference	Mean - Permutation Mean Difference)	95% Confidence Interval		Permutation p-Values	Invariance of Means
			2.5%	97.5%		
Agreeableness	-.196	-.001	-.223	.217	.088	Yes
Conscientiousness	-.083	-.001	-.216	.227	.460	Yes
Extraversion	.024	-.002	-.218	.224	.801	Yes
Internet Addiction	.221	.001	-.215	.218	.047	Yes
Negative emotionality	-.323	.004	-.213	.220	.003	No
Open-mindedness	.088	.000	-.220	.212	.427	Yes
Phubbing Behaviour	-.064	.000	-.219	.213	.567	Yes
Problem-Focused Coping	.226	-.001	-.215	.208	.037	No
Emotional-Focused Coping	-.080	.002	-.215	.220	.458	Yes

Table 6
Invariance of Variances across Groups (Male vs Female)

	Variance - Original Difference)	Variance - Permutation Mean Difference)	95% Confidence Interval		Permutation p-Values	Invariance of Variances
			2.5%	97.5%		
Agreeableness	.385	-.016	-.353	.319	.016	No
Conscientiousness	.190	-.013	-.331	.301	.220	Yes
Extraversion	.277	-.011	-.318	.291	.065	Yes
Internet Addiction	-.011	-.016	-.320	.277	1.000	Yes
Negative emotionality	.237	-.014	-.339	.283	.106	Yes
Open-mindedness	-.070	-.013	-.302	.272	.691	Yes
Phubbing Behaviour	.144	-.010	-.296	.258	.281	Yes
Problem-Focused Coping	.127	-.014	-.340	.299	.380	Yes
Emotional-Focused Coping	-.176	-.012	-.307	.263	.280	Yes

Discussion

Personality traits can be classified as both risk factors (Kuss, Griffiths & Binder, 2013a) and protective factors (Kuss et al., 2013b). In regard to the findings of the present study, negative emotionality functions as a positive determinant of phubbing behavior, whereas open-mindedness functions as a

negative determinant. It is likely that individuals with high negative emotionality may refrain from having face-to-face interaction and might prefer to focus on their smartphones to alleviate unpleasant feelings derived from social settings. Individuals with high emotional instability are likely to be more vulnerable towards negative feedbacks from the physical world; thus, involvement with smartphones is a safer platform to present their ideal self. The involvement is predicted to intensify with the use of social media applications that allow the establishment of virtual relationship(s), which can be initiated and terminated easily. In the present study, open-mindedness predicts phubbing behavior negatively. Individuals with high open-mindedness tend to have high curiosity and interest to explore their environment (Costa & McCrae, 1992). For example, involvement in face-to-face interaction may fulfill greater sensory needs than virtual interaction, which is restricted to visual and auditory stimuli. In the present study, agreeableness, extraversion, and conscientiousness were not found as significant determinants of phubbing behavior. More studies are therefore needed to consolidate the findings of the present study.

From another perspective, Internet addiction was found as the greatest determinant of phubbing behavior. Considering that Internet and mobile phones are integrated into one device, this enhances the frequency of phubbing behavior. However, the limited number of phubbing research has restricted the interpretations and comparisons across findings. Nevertheless, it is predicted that with an increasing tendency of Internet addiction, the foundation of phubbing behavior may likely strengthen. To date, Karadağ et al. (2015) reported that Internet addiction has a positive influence on phubbing behavior. A mobile phone without Internet access has features that are largely similar to previous generation mobile phones. The present study speculates that Internet addiction yields greater impact on phubbing behavior. As for coping styles, both styles investigated in this study were not found to be significant determinants of phubbing behavior. In the mediation analysis, Internet addiction was found to have a partial mediation effect on open-mindedness and phubbing behavior. This signifies that open-mindedness has both direct and indirect effects on phubbing behavior. The direct effect is not fully mediated, whereas the indirect effect is transferred through Internet addiction. Overlooking the mediating effect of Internet

addiction may lead to a misleading conclusion, which can significantly diminish the effectiveness of intervention aiming to reduce the negative impacts of phubbing behavior.

The structural model was analyzed using measurement invariance across sex differences (male and female groups). The latent constructs of the structural model were found to have AVE threshold values of below 0.5, so the interpretation of the structural model may be provisional. Conscientiousness, extraversion, negative emotionality, Internet addiction, and phubbing behavior achieved full measurement invariance across sex groups. However, the agreeableness construct showed partial measurement invariance due to failure to achieve invariance of variances. It is believed that male and female respondents contribute different interpretations to the latent constructs (i.e., open-mindedness, problem-focused coping, and emotional-focused coping). In short, more studies are needed to consolidate this measurement invariance prior to group comparisons, particularly across sex groups.

Implications

Phubbing is perceived as disrespectful behavior; it may undermine any emotional closeness in human interaction, which may subsequently deter relationships. The ubiquitous role of smartphones in daily life has gradually demanded a great deal of attention. The attention given on smartphones may not be constructive but could still satisfy the constant and unrealistic desire to post on social media, go for online shopping, virtually communicate, and engage in gaming activities. Given the scant existing research on this pervasive cultural trend, the present study has successfully filled an important gap in the current literature by examining the determinants of this behavior using an exploratory model. In practical implication, public areas such as restaurants, companies, colleges, and universities could consider displaying positive messages such as "hands off your smartphone" or "interact with humans and not smartphones". These messages may directly or indirectly encourage mobile phone users to become aware of the importance of having social interaction in the present moment. It is crucial for policy makers in various social settings and mental health professionals

to work hand-in-hand to enhance the awareness of the public on this issue. It is strongly believed that when individuals are constantly exposed to phubbing behavior around them, they are likely to assume the behavior as socially acceptable. However, the power of this norm can be gradually diminished if public awareness is gradually strengthened.

In addition, phubbing behavior can bring detrimental effects on one's safety. Du, Xing and Gong (2017) conducted an experiment to warn phubbing walkers if they had suddenly walked into unsafe conditions. A Global Positioning System (GPS) was applied with a digital map in a smartphone application to identify the location of phubbing walkers whenever phubbing walking was detected. Once the phubbing walker approaches a potentially risky area, the smartphone will display a warning message on the screen to remind phubbing walkers of potential dangers such as traffic signals, crossing roads, and other harmful areas. This novel solution has provided an efficient system that alerts phubbing walkers whenever dangers are approaching. More insightful interventions are needed in diminishing the intensity of phubbing culture, which can potentially bring negative impacts to societal functioning.

Limitation and Future Directions

Although the present study serves as the first of its kind that investigates the determinants of phubbing behavior and that has examined measurement invariance via a structural model, its interpretation and conclusions are still affected by some limitations. For instance, the discriminant validity was established, however, the construct validity of most constructs revealed slightly below 0.5 AVE. This may be due to the high number of items used or the nature of this exploratory study. Therefore, the AVE may be labeled as "provisional" and is in need of more replication to consolidate the findings. Future researchers are therefore encouraged to conduct a comparative study to examine the differences between respondents that live in rural and urban areas. This may determine whether or not geographical areas yield a different acceptance level of phubbing culture and different ways of exhibiting phubbing behavior.

Furthermore, a qualitative research can be carried out to examine sex differences to obtain more useful information, which may be restricted by quantitative data. An integration of quantitative and qualitative responses will allow for better comparisons across sex differences and provide suggestion of more beneficial implications for future researchers. From another perspective, future researchers are encouraged to include more determinants (e.g., social anxiety, attachment styles, fear of missing out, or sensation seeking) and consequences (i.e., relationship satisfaction, job performance, or academic performance) across populations in various social settings, such as secondary schools, colleges, universities, and workplaces. Existing predictors could only explain a total of 28.5% of phubbing behavior. It is believed that the unexplained variance may be attributed to other unidentified predictors. This strongly signifies that more studies are needed to consolidate the conceptual model in this study. Additionally, the participants of the present study did not consist of various age groups, which may be one of the contributors to the low variance in the results. The data may also not be sufficiently heterogeneous, as the responses were obtained within one country and generalizability of the findings is thus constrained. The present study adopted a correlational design, but experimental and longitudinal studies are also good to understand causal flow. In summary, phubbing behavior has created an unsound culture in society, which may subsequently function as an obstacle to attain high quality wellbeing. More studies are suggested to investigate the determinants and impacts of smartphone use, which may subsequently contribute to more effective phubbing interventions.

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