Measurement invariance of the Phubbing Scale across 20 countries

Measurment invariance of the Phubbing Scale across 20 countries

1. Agata Błachnio*, The John Paul II Catholic University of Lublin, Poland
2. Aneta Przepiórka, The John Paul II Catholic University of Lublin, Poland
3. Oleg Gorbaniuk, The John Paul II Catholic University of Lublin, Poland; Faculty of Psychology, University of Economics and Human Sciences in Warsaw, Poland
4. Rebecca Bendayan, University of Malaga, Spain,, [1]Department of Biostatistics and Health Informatics, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, United Kingdom
5. Monika McNeill, Glasgow Caledonian University, UK
6. Alan Angeluci, City University of São Caetano do Su, Brasil
7. Ana Maria Abreu, the University Universidade Europeia of Lisbon, Portugal
8. Menachem Ben-Ezra, Ariel University, Israel
9. Martina Benvenuti, Italian National Research Council (CNR) and University of Bologna, Italy
10. Maria J. Blanca, University of Malaga, Spain
11. Tihana Brkljacic, Institute of Social Sciences, Croatia
12. Nenad Čuš Babić University of Maribor, Slovenia
13. Julia Gorbaniuk, The John Paul II Catholic University of Lublin, Poland
14. Juraj Holdoš, Department of Psychology, Catholic University in Ruzomberok, Slovakia
15. Ana Ivanova, The John Paul II Catholic University of Lublin, Poland
16. Engin Karadağ, Industrial and Organizational Psychology & Educational Leadership and Policy Studies, Akdeniz University, Turkey
17. Sadia Malik, PhD, University of Sargodha, Pakistan
18. Elvis Mazzoni, University of Bologna, Italy
19. Anita Milanovic, Clinic for mental disorders „Dr Laza Lazarević", Belgrade, Serbia
20. Bojan Musil, University of Maribor, Slovenia
21. Igor Pantic, University of Belgrade, Serbia
22. Belen Rando, the University Universidade Europeia of Lisbon, Portugal
23. Gwendolyn Seidman, Albright College, US
24. Lancy D'Souza, University of Mysore, India
25. Mariek, M. P. Vanden Abeele, University of Tilburg, the Netherlands
26. Mariusz Wołonciej, The John Paul II Catholic University of Lublin, Poland
27. Anise M.S. Wu, University of Macau, China
28. Shu Yu, University of Macau, China

Corresponding author: Agata Błachnio, Institute of Psychology, The John Paul II Catholic University of Lublin, Poland, Al. Racławickie 14, 20-950 Lublin, Poland, +48 81 445 35 10, gatta@kul.pl

Author's contributions:

1 - idea of the paper, preparing research, supervising research in all countries, writing the paper

2 – preparing research, comments final version of the manuscript

3 – statistical analyses, preparing methods in Polish language, collecting data in Poland, comments final version of the manuscript

4 – preparing methods in their languages, collecting data in theirs countries, coding the data, giving comments on whale stages of writing paper

5 - preparing methods in their languages, collecting data in theirs countries, coding the data, comments final version of the manuscript, English proofreading.

6-28 – preparing methods in their languages, collecting data in theirs countries, coding the data, comments final version of the manuscript.

Measurement invariance of the Phubbing Scale across 20 countries

Abstract

Mobile phone addiction is a robust phenomenon observed throughout the world. The social aspect of mobile phone use is crucial; therefore, phubbing is a part of the mobile phone addiction phenomenon. Phubbing is defined as ignoring an interlocutor by glancing at one's mobile phone during a face-to-face conversation. The main aim of this study was to investigate how the Phubbing Scale (containing 10 items) might vary across countries, and between genders. Data were collected in 20 countries: Belarus, Brazil, China, Croatia, Ecuador, India, Israel, Italy, Netherlands, Pakistan, Poland, Portugal, Serbia, Slovakia, Slovenia, Spain, Turkey, UK, Ukraine, and USA. The mean age across the sample (N = 7,696, 65.8% women, 34.2% men) was 25.32 years (SD = 9.50). The cross-cultural invariance of the scale was investigated using multigroup confirmatory factor analyses (MGCFA) as well as the invariance analyses. Additionally, data from each country was assessed individually via the confirmatory factor analyses (CFAs) for evaluating the factorial structure of the questionnaire. We obtained two factors, based on only 8 of the items: 1) communication disturbances and 2) phone obsession. Phubbing Scale containing 8 items obtained metric invariance across 18 countries as well as scalar invariance across genders.

Keywords: phubbing, mobile phone addiction, invariance, countries, gender

Introduction

In recent years, mobile phones connected to the Internet have become an integral part of people's lives. Mobile phone use has grown since its inception and is expected to increase steadily (Statista, 2019). Smartphone use on one hand brings us closer to others, but on the other hand it makes us feel alienated, which can be called the present-absent paradox (alone together) (David & Roberts, 2017). Recently, the research literature has focused on a new phenomenon, called phubbing (Karadağ et al., 2015; Roberts & David, 2016; Benvenuti et al., 2019). The word "phubbing" is an amalgamation of two other words: "phone" and "snubbing." Phubbing is defined as ignoring an interlocutor by glancing at one's mobile phone during a face-to-face conversation (Karadağ et al., 2015; Vanden Abeele, Hendrickson, Pollmann, & Ling, 2019). A body of studies indicated that phubbing is strongly related to mobile phone addiction (e.g., Ivanova et al., 2020; Xie et al., 2019). Moreover, Karadağ (et al., 2015) claims that phubbing is a sum of different addictions e.g., mobile phone addiction and social networking sites addiction. Research has revealed some gender differences in individuals' reasons for phubbing. For women, phubbing was related to a particular aspect of mobile phone use, namely its social element (SMS, and social media), whereas for men, it was associated with entertainment and informative aspects of mobile phone use (Internet browsing and online gaming) (Karadağ et al., 2015). The studies indicated that phubbing is related to loneliness, low self-esteem, low life satisfaction as well as Facebook intrusion (Błachnio & Przepiorka, 2019; Blanca & Bendayan, 2018), anxiety and worry (Karadağ et al., 2015), poor quality and low satisfaction with romantic relationships (Roberts & David, 2016; Krasnova, Abramova, Notter, & Baumann, 2016) stress and depression (Davey et al., 2018)**,** and boredom (Al-Saggaf et al., 2019)**.** Phubbing is viewed as impolite that can have relational impact such as expectancy violations, ostracism, and attentional conflicts (Vanden Abeele, 2019~~,~~ Vanden Abeele et al., 2016).

Phubbing can be related to mobile phone addiction and other behavioural addictions (Karadağ et al., 2015; Chotpitayasunondh & Douglas, 2016). Mobile phone addiction is defined as a social disorder and phobia connected with strong dependency on communication through virtual environments (Han, Kim, & Kim, 2017). The use of phones in many aspects of life has led to the emergence of the concept of problematic mobile phone use. Problematic mobile phone use can also be defined as a behavioural addiction (Takao et al., 2009) (Hao et al., 2019) (Haug et al., 2015) and in the literature is also called a nomophobia (Han et al., 2017), or smartphone addiction (Haug et al., 2015). It is a social disorder and phobia related to a strong dependency on communication through virtual environments (Han et al., 2017). It is also related to lack of impulse control that doesn't include intoxication (Hao et al., 2019). Lin et al. (2015) created twelve diagnostic criteria for smartphone addiction (e.g., preoccupation with smartphone use, tolerance, lack of time control in usage, physical and psychological effects of relying on a smartphone, deteriorating social relationships because of a smartphone use).

Aim of the study

The goal of this study was to provide evidence for measurement invariance across countries and for gender of the Phubbing Scale in samples from different countries. Phubbing Scale was primarily developed in a Turkish study by Karadağ et al. (2015). It was originally modelled in two dimensions based on classical conditioning theory. Further, the scale was developed based on the dimensions from the modelling and the data obtained from focus group interviews. After performing factor analysis, it was determined that both, the theoretical and data-focused approach of the draft scale, confirmed each other.

We hypothesised that the meaning and structure of all the scale items were similar in all countries where data was gathered. That would indicate the factor validity of scale, which

in turn would allow for future performance of multilevel modelling analyses. Our main emphasis was the measurement invariance, because it points towards the comparability factor when considering different countries. Phubbing Scale is of interest to researchers in many countries and is translated into various languages, such as Turkish (Çikrikci, et al., 2019; Argan, et al., 2019), Spanish (Blanca & Bendayan, 2019), Polish (Błachnio, & Przepiorka, 2019), Croatian (Brkljačić, et al., 2018), Persian (Zamani, et al., 2020), Indonesian (Latifa, et al., 2019), Italian (Guazzini, et al., 2019), and Ukrainian (Ivanova, et al., 2020). There is evidence that cultural factors play an important role in behaviors related to new media such as Facebook use or addiction (Błachnio et al., 2016; Abbas, Mesch, 2015; Qiu, et al., 2013), Internet use or addiction (Błachnio et al., 2017; Błachnio et al., 2019), and social networking sites use or addiction (Choi, et al., 2011). Based on our knowledge, the scale has not been used for an international comparison, which is an argument for the necessity of investigating the invariance of this tool for future research. Gender invariance (the extent to which the construct is generalisable) is important from a psychometric point of view; this was tested alongside the primary aim of the research, testing cross-cultural equivalence.

Moreover, it is also an indicator of the similarity of a construct meaning. Three aspects of measurement invariance were tested: (1) configural invariance, which implies stability and replicability of the construct (as measured by a scale) in the context of cultures; (2) metric invariance, which compares the construct between compared groups in terms of correlates and predictors; and (3) scalar invariance, which allows possibility of comparing latent means across countries (Davidov et al., 2014).

Statistical analyses

Multigroup confirmatory factor analyses (MGCFA) as well as invariance analyses were applied to assess the cross-cultural equivalence of the scale. Those calculations were

performed on data collected in 20 countries. Data from each country was assessed individually via the confirmatory factor analyses (CFAs), which allowed to evaluate the factorial structure of the questionnaire. Two models were tested: a two-factor model and an alternative one-factor model. The most frequently used criteria to evaluate the goodness of fit model include a comparative fit index (CFI) greater than .90, the root mean square error of approximation (RMSEA), and the standardized root-mean-square residual (SRMR) lower than .08 (optimally they should be lower than .05). This usually indicates that the model is well-fitted (e.g., Brown, 2015; Hu & Bentler, 1998; Schermelleh-Engel, Moosbrugger, & Müller, 2003; Konarski, 2010). On the other hand, if the sample sizes and the *df* are small, the RMSEA may stipulate that the model is not well fitted (Kenny et al., 2015). In light of the above, as well as following the suggestions by MacCallum, Browne, & Sugawara (1996), who stipulate a mediocre fit with RMSEA between .08 and .10, we decided to apply a more liberal criterion of RMSEA < .10. Because of non-normal distribution, we used the MLM (mean-adjusted maximum likelihood) estimator with robust standard errors to estimate CFA parameters in each country and MLR (robust maximum likelihood) estimator in 2-level confirmatory factor analysis (Muthén & Muthén, 2015).

Furthermore, we measured the invariance of the 10-item questionnaire across all the countries. Most frequently, MGCFA recognises the three types of measurement invariance (configural, metric and scalar). These types of measurement invariance require equal parameters across samples. Configural invariance implies an equal number of factor indicators and latent variables to be imposed in all countries. Metric invariance (also referred to as “weak invariance”) requirement assumes equality in all the country factor loadings. Scalar invariance (also referred to as “strong invariance”) takes place if all factor loadings and all the intercepts are equal across all countries (Milfont & Fischer, 2010).

Mplus was used to calculate a 2-level confirmatory analysis (Muthén & Muthén, 2015). To compute MGCFA, we applied an R environment software and the R packages lavaan (Rosseel, 2012), as well as semTools (Hirschfeld & Von Brachel, 2014). Some researchers believe that the number of groups drives relative fit indices (ΔCFI and ΔRMSEA). Rutkowski & Svetina (2014) suggest that in the case of data from over 20 countries being analysed, certain changes should be adopted as evidence of the lack of invariance. First of all, the comparative fit index (ΔCFI) should be equal to or greater than .02. Secondly, the root mean square error of approximation (ΔRMSEA) is required to be greater than or equal to .03.

METHOD

Participants and procedure

A sample of 7,696 (65.8% women and 34.2% men) mobile phone users took part in the study. Data were collected in 20 countries: Belarus, Brazil, China, Croatia, Ecuador, India, Israel, Italy, Netherlands, Pakistan, Poland, Portugal, Serbia, Slovakia, Slovenia, Spain, Turkey, UK, Ukraine, and USA. The mean age of all the participants was 25.32 years (*SD* = 9.50); 77.0% of them were students (15.4% of them worked), 19.6% were employed, 1.9% were unemployed, and 1.1% were retired.

The individuals invited to participate in the study were mobile users. The study was conducted in local languages, and back-translation procedures were used. The researchers from the relevant countries prepared translations of the methods based on the original English version, and each team followed the same guidelines. Snowball sampling was applied in order to recruit a large group of respondents varying in terms of socio-demographic characteristics. After the electronic version of the questionnaire was prepared, the link to the research site was

sent out via the Internet. The participants volunteered to take part in the study and received no monetary reward for doing so. They were informed about the anonymity of the study.

Measures

The Phubbing Scale was used in the study (Karadağ et al., 2015). It consists of 10 items (e.g., "My eyes start wandering on my phone when I'm together with others", "People complain about me dealing with my mobile phone"; see Table 1). Participants responded to the items using a 5-point scale (from 1 = strongly disagree to 5 = strongly agree). The original version of the scale contains two factors: (1) Communication disturbance, which is defined as disturbance in a face-to-face communication by dealing with one's mobile phone, as well as (2) Phone obsession, which is defined as constantly needing and desiring own mobile phone (Karadağ et al., 2015). Psychometrical values of the original Phubbing Scale are: for communication disturbance scale α = .87 and α = .85 for phone obsession scale (Karadağ et al., 2015).

Table 1

Items of Phubbing Scale and within-level standardized factor loadings in pooled international samples of 20 countries

RESULTS

First, goodness-of-fit was tested for the two-factor of Phubbing Scale structure based on two-level CFA, with group-mean centering, to control any between-group variability across the countries in testing for the validity of factorial structure. We used MLR estimator because of an abnormal distribution of items. The two-factor model was poorly fitted to within-level

data, as indicated by poor CFI: MLR χ^2 (34) = 952.70 (p < .001), CFI = .862, TLI = .817, RMSEA = .059, SRMR = .067[1]. The alternative one-factor model obtained a much worse fit: MLR χ^2 (20) = 2291.83 (p < .001), CFI = .571, TLI = .400, RMSEA = .121, SRMR = .096. Intraclass correlations and within-level standardized factor loadings are presented in Table 1. The refined two-factor model (without poorly loaded item 5 and item 10) was well fitted to data within-level: MLR χ^2 (19) = 347.78 (p < .001), CFI = .938, TLI = .909, RMSEA = .047, SRMR = .039. The alternative one-factor eight-item model, once again, obtained a much worse fit: MLR χ^2 (35) = 2320.32 (p < .001), CFI = .657, TLI = .559, RMSEA = .092, SRMR = .083.

Further, we also calculated CFAs for the 8-item model, descriptive statistics (mean, *SD*) and reliability (ω congeneric reliability, Cronbach's alpha) in every individual country. Table 2 illustrates that a two-factor model indicates good fit according to CFI, RMSEA and SRMR in nearly all the countries, with two exceptions of Pakistan (CFI = .886) and Serbia (RMSEA = 0.134), some of the fit indices were not satisfactory. Moreover, the one-factor model obtained unsatisfactory indices in all the 20 countries (see Table 3). Furthermore, as Cortina (1993) points out, with the Cronbach's alpha larger than .65 and a scale smaller than 5 items, a good internal consistency was observed in all the countries.

Table 2

Fit indices for the two-factor single sample CFAs, mean values, standard deviations, and Cronbach's alphas in Communication Disturbance and Phone Obsession scales for 20 countries

[1] CFA without considering the levels also indicates a poor fit as well two-factor model (MLR χ^2 (34) = 2410.63, CFI = .883, TLI = .845, RMSEA = .095 CI90 [.092; .099], SRMR = .066) as alternative one-factor model (MLR χ^2 (35) = 4619.09, CFI = .774, TLI = .710, RMSEA = .130 CI90 [.127; .134], SRMR = .079).

Table 3

Fit indices for the one-factor single sample CFAs for 20 countries

Lastly, we conducted a three-step measurement invariance test across 18 countries (out of the 20 countries in total we included those that had a good fit for the two-factor model) and across genders. Table 4 contains the global fit coefficients for configural, metric, and scalar measurement invariances. The results indicate that both configural and metric invariances were observed across all the explored countries according to Rutkowski and Svetina's (2014) liberal cut-off criteria (ΔRMSEA < .03 and ΔCFI < .02). On the other hand, changes in both, the comparative fit index and the root mean square error of approximation do not confirm scalar (strong) invariance (ΔRMSEA > .03 and ΔCFI > .02). We tried to obtain partial scalar invariance, however we did it without success. Therefore, results support the conclusion about the weak invariance of the tested scale across countries.

In addition to the cross-cultural invariance, we also tested the cross-gender invariance, which may provide important information about the psychometric properties of the scale for future users. The results of MGCFA indicated configural, metric and scalar (full) invariances across genders (see Table 4). Moreover, we established residual invariance, which highlights the similarity across genders of the total specific variance and error variance.

Table 4

Measurement invariance of Communication Disturbance and Phone Obsession scales across 18 countries and genders

Communication disturbance is slightly higher among women (Cohen's d = 0.07, 99% CI[0.01; 0.13]), and is not related to age (r(6920) = -.01, 99% CI [–.04; .02]). Phone

Obsession is also higher among women (Cohen's d = 0.27, 99% CI [0.20; 0.33]), and correlates poorly with age ($r(6920) = -0.10$, 99% CI [–.13; –.07]), that is, younger people are slightly more likely to exhibit behaviour specific to phone obsession.

Discussion

The main aim of this study was to investigate the measurement invariance of the Phubbing Scale consisting of 10 items (Karadağ et al., 2015). We checked invariance across 18 countries and genders. We also developed a version of the scale that is valid for use in different countries and investigating the measurement invariance in samples from different countries. We obtained an eight-item questionnaire measuring two factors related to two aspects of mobile phone use. The first one is associated with disturbing the communication, namely using a mobile phone during a face-to-face contact (Karadağ et al., 2015). The second aspect is related to mobile phone dependence and the compulsion to have a phone in sight (Karadağ et al., 2015). The two-factor solution seemed to be better than a one-factor approach; it can indicate that mobile phone obsession is a separate phenomenon from communication disturbance.

Our results support the metric invariance of the eight-item Phubbing Scale across all of the 20 countries. This suggests that we cannot compare means, but we can compare correlations between phubbing and other variables across the countries (Milfont & Fischer, 2010). However, it should be noted that scalar invariance is difficult to achieve, as researchers often mention (Laguna et al., 2017; Zemojtel-Piotrowska et al., 2018; Gallardo-Pujol et al., 2019). We, however, have established full scalar (strong) invariance across genders. This indicates that the Phubbing Scale scores can be meaningfully compared across genders and predictors; the outcomes of phubbing can be added to the model and the resulting effects can be compared across genders (Milfont & Fischer, 2010; Van de Vijver et al., 1997).

It should be noted that items 5th and 10th were removed due to a poor correlation with the other items in the scale, resulting in poor loadings and unsatisfactory fit indexes. The average linear correlation between the full and abbreviated versions for: Scale 1

Communication disturbances is .95 (*min* = .92, *max* = .98); Scale 2 Phone Obsession is .95 (*min* = .93, *max* = .98). Owing to strong correlations between full and abbreviated versions of the scales, comparability with former results, should be very high in our opinion.

Limitations and future study

Specific limitations have to be acknowledged in this study. Foremost among them is a limited sample; most of our data were collected from students, which means different ages depending on the country (e.g., Ukraine – younger and Israel – older). Moreover, this also means that the reliability of this scale was tested in cross-cultural studies on a student population. However, it should be noted, that firstly, young people are more often involved in phubbing than older people (Al-Saggaf, et al., 2019). Secondly, the student sample makes a relevant comparison with other studies that recruited from within a similar population (Hamer et al., 2021). Therefore, our study contributes to a greater body of research on cross-cultural comparison and testing the reliability of the scale.

In the future research, caution should be applied when generalizing the student sample to the whole population. Moreover, it may be worth re-examining a relationship between phubbing and age, with more age-differentiated samples; the correlation may prove to be much stronger than that found in the current study. Finally, it is also important to note an uneven participant representation from the countries on different continents. The current participant group is dominated by samples from European countries, with a total absence of participants from Africa. We also need to underline that the obtained metric invariance only allows to examine the correlates and predictors. We obtained poor model of fit in some countries e.g., in Serbia. We suppose that it was due to an English version of the scale being used there, rather than a translation to the national language, which could have meant a poor understanding of some items.

Despite these limitations, we can express several salient findings. To our knowledge, the analyses we applied are novel in the literature that shows the invariance of Phubbing Scale. The results indicate that Phubbing Scale demonstrates good psychometric properties within the 18 countries (Belarus, Brazil, China, Croatia, Ecuador, India, Israel, Italy, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain, Turkey, UK, Ukraine, and USA). The results also indicate that Phubbing Scale can be used in cross-cultural studies for between-group comparisons of within-group correlations of phubbing and other variables. This is especially relevant, given the essential nature of replication studies and their role in developing research-based knowledge. Recent publications have inferred that there is a need to promote systematic approaches and replication efforts (Koole & Lakens, 2012; Open Science Collaboration, 2015).

Conclusions

Our research has shown the potential of Phubbing Scale to maintain metric equivalence across cultures due to the cross-cultural studies conducted. As with any other questionnaire, researchers using Phubbing Scale in cultures other than those tested with the intention of cross-cultural comparison, should additionally test for equivalence. Possible reasons for poor or low equivalence could be: (1) poorly translated items, (2) poor quality of data collected, (3) low motivation of respondents, etc.

In Summary, we aimed at investigating whether the structure of the phubbing phenomenon was the same in different cultures. Moreover, we intended to check the cultural invariance that would give us the possibility of using the tool in cross-cultural comparisons. We believe that with the current research we contribute to the body of cross-cultural studies by establishing the possibility of cultural comparison while using the same tool. Phubbing Scale is practical and simple to apply and assessing instruments with reduced cultural influence is important for comparing data collected in a number of different countries.

Specifically, being able to measure phubbing across countries is necessary in order to gain better knowledge about this emerging construct across the world. Crucially, the phubbing phenomenon hinders personal relations, possibly altering the fabric of social interactions. Phubbing may affect different social players differently, as their cultural background might mediate the social meaning attributed to the phenomenon. Armed with this knowledge, adjusted social etiquette policies might take place to improve the populations' quality of life. Future studies could investigate just that.

Funding: The study was financed by the National Science Centre, Poland, grant no. NCN UMO-2017/26/M/HS6/00779

Compliance with Ethical Standards: All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Conflicts of Interest: The authors declare that they have no conflict of interest.

Informed Consent: Informed consent was obtained from all individual adult participants included in the study.

References

Abbas, R., & Mesch, G. S. (2015). Cultural values and Facebook use among Palestinian youth in Israel. *Computers in Human Behavior*, *48*, 644-653.

Abeele, M. M. V., Hendrickson, A. T., Pollmann, M. M., & Ling, R. (2019). Phubbing

behavior in conversations and its relation to perceived conversation intimacy and distraction: An exploratory observation study. *Computers in Human Behavior*, *100*, 35-47.

Al-Saggaf, Y., MacCulloch, R., & Wiener, K. (2019). Trait Boredom Is a Predictor of Phubbing Frequency. *Journal of Technology in Behavioral Science*, *4*(3), 245–252. https://doi.org/10.1007/s41347-018-0080-4

Argan, M., Köse, H., Özgen, C., & Yalınkaya, B. (2019). Do sports, take photo and share: Phubbing, social media addiction and narcisism of body builders. European Journal of Physical Education and Sport Science. ADD: 5, 79-94. http://dx.doi.org/10.5281/zenodo.3242601

Benvenuti, M., Błachnio, A., Przepiorka, A. M., Daskalova, V. M., & Mazzoni, E. (2019). *Factors Related to Phone Snubbing Behavior in Emerging Adults: The phubbing phenomenon.* In The psychology and dynamics behind social media interactions. 164–187. https://doi.org/10.4018/978-1-5225-9412-3.ch007

Błachnio, A., & Przepiorka, A. (2019). Be Aware! If You Start Using Facebook Problematically You Will Feel Lonely: Phubbing, Loneliness, Self-esteem, and Facebook Intrusion. A Cross-Sectional Study. *Social Science Computer Review*, *37*(2), 270–278. https://doi.org/10.1177/0894439318754490

Błachnio, A., Przepiorka, A., Benvenuti, M., Cannata, D., Ciobanu, A. M., Senol-Durak, E., ... & Ben-Ezra, M. (2016). Cultural and personality predictors of Facebook intrusion: A cross-cultural study. *Frontiers in Psychology*. 7:1895. doi: 10.3389/fpsyg.2016.01895.

Błachnio, A., Przepiórka, A., Gorbaniuk, O., Benvenuti, M., Ciobanu, A. M., Senol-Durak, E., ... & Ben-Ezra, M. (2019). Cultural Correlates of Internet Addiction. *Cyberpsychology, Behavior, and Social Networking*, *22*(4), 258-263.

Błachnio, A., Przepiorka, A., Senol-Durak, E., Durak, M., & Sherstyuk, L. (2017). The role of personality traits in Facebook and Internet addictions: A study on Polish, Turkish, and Ukrainian samples. *Computers in Human Behavior*, *68*, 269-275.

Blanca, M. J., & Bendayan, R. (2018). Spanish version of the Phubbing Scale: Internet addiction, Facebook intrusion, and fear of missing out as correlates. *Psicothema*, *30*(4), 449-454.

Brkljačić, T., Šakić, V., & Kaliterna-Lipovčan, L. J. (2018). Phubbing among Croatian students. In Protection and Promotion of the Well-Being of Children, Youth, and Families: Selected Proceedings of the 1st International Scientific Conference of the Department of Psychology at the Catholic University of Croatia (Ed S Nakić Radoš) (pp. 109-126).

Choi, S. M., Kim, Y., Sung, Y., & Sohn, D. (2011). Bridging or bonding? A cross-cultural study of social relationships in social networking sites. *Information, Communication & Society*, *14*(1), 107-129.

Chotpitayasunondh, V., & Douglas, K. M. (2016). How "phubbing" becomes the norm: The antecedents and consequences of snubbing via smartphone. *Computers in Human Behavior*, *63*, 9–18. https://doi.org/10.1016/j.chb.2016.05.018

Çikrikci, Ö., Griffiths, M. D., & Erzen, E. (2019). Testing the mediating role of phubbing in the relationship between the Big Five personality traits and satisfaction with life. *International Journal of Mental Health and Addiction*, 1-13.

Davey, S., Davey, A., Raghav, S. K., Singh, J. V., Singh, N., Blachnio, A., & Przepiórka, A. (2018). Predictors and consequences of "Phubbing" among adolescents and youth in India: An impact evaluation study. *Journal of Family and Community Medicine*, *25*, 35–42. https://doi.org/10.4103/jfcm.JFCM_71_17

David, M. E., & Roberts, J. A. (2017). Phubbed and Alone: Phone Snubbing, Social

Exclusion, and Attachment to Social Media. *Journal of the Association for Consumer Research*, *2*(2), 155–163. https://doi.org/10.1086/690940

Davidov, E., Meuleman, B., Cieciuch, J., Schmidt, P., & Billiet, J. (2014). Measurement Equivalence in Cross-National Research. *Annual Review of Sociology*, *40*(1), 55–75. https://doi.org/10.1146/annurev-soc-071913-043137

Gallardo-Pujol, D., Penelo, E., Sit, C., Jornet-Gibert, M., Suso, C., Buades-Rotger, M., Maydeu-Olivares, A., Andrés-Pueyo, A., & Bryant, F. B. (2019). The meaning of aggression varies across culture: Testing the measurement invariance of the refined Aggression Questionnaire in samples From Spain, the United States, and Hong Kong. *Journal of Personality Assessment*, *101*(5), 515–520. https://doi.org/10.1080/00223891.2019.1565572

Guazzini, A., Duradoni, M., Capelli, A., & Meringolo, P. (2019). An explorative model to assess individuals' phubbing risk. *Future Internet*, *11*(1), 21.

Hamer, K., Penczek, M., McFarland, S., Wlodarczyk, A., Łużniak-Piecha, M., Golińska, A., ... & Delouvée, S. (2021). Identification with all humanity—A test of the factorial structure and measurement invariance of the scale in five countries. International Journal of Psychology, 56(1), 157-174.

Han, S., Kim, K. J., & Kim, J. H. (2017). Understanding Nomophobia: Structural Equation Modeling and Semantic Network Analysis of Smartphone Separation Anxiety. *Cyberpsychology, Behavior, and Social Networking*, cyber.2017.0113. https://doi.org/10.1089/cyber.2017.0113

Hao, Z., Jin, L., Li, Y., Akram, H. R., Saeed, M. F., Ma, J., Ma, H., & Huang, J. (2019). Alexithymia and mobile phone addiction in Chinese undergraduate students: The roles of mobile phone use patterns. *Computers in Human Behavior*, *97*(February), 51–59. https://doi.org/10.1016/j.chb.2019.03.001

Haug, S., Paz Castro, R., Kwon, M., Filler, A., Kowatsch, T., & Schaub, M. P. (2015). Smartphone use and smartphone addiction among young people in Switzerland. *Journal of Behavioral Addictions*, *4*(4), 299–307. https://doi.org/10.1556/2006.4.2015.037

Hirschfeld, G., & Von Brachel, R. (2014). Multiple-group confirmatory factor analysis in R - A tutorial in measurement invariance with continuous and ordinal indicators. *Practical Assessment, Research and Evaluation*, *19*(7), 1–12.

Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods*, *3*(4), 424–453. https://doi.org/10.1037//1082-989X.3.4.424

Ivanova, A., Gorbaniuk, O., Błachnio, A., Przepiórka, A., Mraka, N., Polishchuk, V., & Gorbaniuk, J. (2020). Mobile Phone Addiction, Phubbing, and Depression Among Men and Women: A Moderated Mediation Analysis. *Psychiatric Quarterly*, 1-14.

Karadağ, E., Tosuntaş, Ş. B., Erzen, E., Duru, P., Bostan, N., Şahin, B. M., Çulha, İ., & Babadağ, B. (2015). Determinants of phubbing, which is the sum of many virtual addictions: a structural equation model. *Journal of Behavioral Addictions*, *4*(2), 60–74. https://doi.org/10.1556/2006.4.2015.005

Karadağ, E., Tosuntaş, Ş. B., Erzen, E., Duru, P., Bostan, N., Şahin, B. M., ... & Babadağ, B. (2015). Determinants of phubbing, which is the sum of many virtual addictions: A structural equation model. *Journal of behavioral addictions*, *4*(2), 60-74.

Kenny, D. A., Kaniskan, B., & McCoach, D. B. (2015). The performance of RMSEA in models with small degrees of freedom. *Sociological Methods & Research*, *44*(3), 486–507.

Konarski, R. (2010). Modele równań strukturalnych. Teoria i praktyka. Warszawa: PWN.

Koole, S. L., & Lakens, D. (2012). Rewarding replications: A sure and simple way to improve

psychological science. *Perspectives on Psychological Science*, *7*(6), 608–614. https://doi.org/10.1177/1745691612462586

Krasnova, H., Abramova, O., Notter, I., & Baumann, A. (2016). Why phubbing is toxic for your relationship: Understanding the role of smartphone jealousy among "Generation Y" users. *24th European Conference on Information Systems, ECIS 2016, 2016*.

Laguna, M., Mielniczuk, E., Razmus, W., Moriano, J. A., & J. Gorgievski, M. (2017). Cross-culture and gender invariance of the Warr (1990) job-related well-being measure. *Journal of Occupational and Organizational Psychology*, *90*(1), 117–125. https://doi.org/10.1111/joop.12166

Latifa, R., Mumtaz, E. F., & Subchi, I. (2019, November). Psychological Explanation of Phubbing Behavior: Smartphone Addiction, Emphaty and Self Control. In *2019 7th International Conference on Cyber and IT Service Management (CITSM)* (Vol. 7, pp. 1-5). IEEE.

Lin, Y. H., Lin, Y. C., Lee, Y. H., Lin, P. H., Lin, S. H., Chang, L. R., Tseng, H. W., Yen, L. Y., Yang, C. C. H., & Kuo, T. B. J. (2015). Time distortion associated with smartphone addiction: Identifying smartphone addiction via a mobile application (App). *Journal of Psychiatric Research*, *65*(2015), 139–145. https://doi.org/10.1016/j.jpsychires.2015.04.003

MacCallum, R. C., Browne, M. W., & Sugawara, H. M. (1996). Power analysis and determination of sample size for covariance structure modeling. *Psychological Methods*, *1*(2), 130–149. https://doi.org/10.1037/1082-989X.1.2.130

Milfont, L. T., & Fischer, R. (2010). Testing measurement invariance across groups: applications in cross-cultural research. *International Journal of Psychological Research*, *3*(1), 111. https://doi.org/10.21500/20112084.857

Muthén, L. K., & Muthén, B. O. (2015). Mplus User's Guide Seventh Edition ed. *Los*

Angeles: CA: Muthén & Muthén.

Open Science Collaboration. (2015). An open, large-scale, collaborative effort to estimate the reproducibility of psychological science. *Perspectives on Psychological Science*, *7*(6), 657–660. https://doi.org/10.1126/science.aac4716

Qiu, L., Lin, H., & Leung, A. K. Y. (2013). Cultural differences and switching of in-group sharing behavior between an American (Facebook) and a Chinese (Renren) social networking site. *Journal of Cross-Cultural Psychology*, *44*(1), 106-121.

Roberts, J. a., & David, M. E. (2016). My life has become a major distraction from my cell phone: Partner phubbing and relationship satisfaction among romantic partners. *Computers in Human Behavior*, *54*, 134–141. https://doi.org/10.1016/j.chb.2015.07.058

Rosseel, Y. (2012). lavaan : An R Package for Structural Equation. *Journal of Statistical Software*, *48*(2).

Rutkowski, L., & Svetina, D. (2014). Assessing the hypothesis of measurement invariance in the context of large-scale international surveys. *Educational and Psychological Measurement*, *74*(1), 31–57. https://doi.org/10.1177/0013164413498257

Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research Online*, *8*(2), 23–74.

Statista. (2019). *Retrieved from http://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/*. 07.07.2020

Takao, M., Takahashi, S., & Kitamura, M. (2009). Addictive personality and problematic mobile phone use. *Cyberpsychology & Behavior : The Impact of the Internet, Multimedia and Virtual Reality on Behavior and Society*, *12*(5), 501–507. https://doi.org/10.1089/cpb.2009.0022

Van de Vijver, F. J. R., Leung, K., & Leung, K. (1997). *Methods and data analysis for cross-cultural research* (Vol. 1). Sage.

Vanden Abeele, M. M. P. (2019). The social consequences of phubbing: A framework and research agenda. In *Handbook of mobile communication, culture, and information* (Oxford Uni, pp. 1–28).

Vanden Abeele, M. M. P., Antheunis, M. L., & Schouten, A. P. (2016). The effect of mobile messaging during a conversation on impression formation and interaction quality. *Computers in Human Behavior*, *62*(2016), 562–569. https://doi.org/10.1016/j.chb.2016.04.005

Vanden Abeele, M. M. P., Hendrickson, A. T., Pollmann, M. M. H., & Ling, R. (2019). Phubbing behavior in conversations and its relation to perceived conversation intimacy and distraction: An exploratory observation study. *Computers in Human Behavior*, *100*(February 2018), 35–47. https://doi.org/10.1016/j.chb.2019.06.004

Xie, X., Chen, W., Zhu, X., & He, D. (2019). Parents' phubbing increases Adolescents' Mobile phone addiction: Roles of parent-child attachment, deviant peers, and gender. *Children and Youth Services Review*, *105*, 104426.

Zamani, F., Talepasand, S., & Taghinezhad, A. (2020). Psychometric Properties of the Phubbing Scale among Iranian Students. *Health Education and Health Promotion*, *8*(1), 25-30.

Żemojtel-Piotrowska, M. A., Piotrowski, J. P., Cieciuch, J., Calogero, R. M., Van Hiel, A., Argentero, P., Baltatescu, S., Baran, T., Bardhwaj, G., Bukowski, M., Chargazia, M., Clinton, A., Halik, M. H. J., Ilisko, D., Khachatryan, N., Klicperova-Baker, M., Kostal, J., Kovacs, M., Letovancova, E., . . . Wills-Herrera, E. (2018). “Measurement of psychological entitlement in 28 countries”: Correction to Żemojtel-Piotrowska et

al., 2015. European Journal of Psychological Assessment, 34(4), 283.

https://doi.org/10.1027/1015-5759/a000354

Table 1

Item	M	SD	ICC	10-item model		8-item model	
				2-factor	1-factor	2-factor	1-factor
Factor 1: Communication disturbance							
1. My eyes start wandering on my phone when I'm together with others	2.469	1.006	.159	.712	.707	.715	.721
2. I am always busy with my mobile phone when I'm with my friends	2.020	0.906	.137	.804	.759	.817	.777
3. People complain about me dealing with my mobile phone	1.804	0.989	.070	.664	.657	.655	.650
4. I'm busy with my mobile phone when I'm with friends	2.030	0.935	.102	.773	.740	.773	.746
10. The time allocated to social, personal or professional activities decreases because of my mobile phone	2.150	1.143	.059	.426	.468	—	—
Factor 2: Phone obsession							
5. I do not think that I annoy my partner when I'm busy with my mobile phone	2.352	1.270	.051	.265	.334	—	—
6. My phone is always within my reach	3.770	1.150	.106	.583	.411	.591	.404
7. When I wake up in the morning, I first check the messages on my phone	3.439	1.369	.108	.623	.435	.632	.423
8. I feel incomplete without my mobile phone	2.960	1.313	.092	.726	.499	.740	.480
9. My mobile phone use increases day by day	2.450	1.154	.104	.588	.504	.574	.470

Table 2

Country	N	Female	Age		MLM	CFI	TLI	RMSEA [95% CI]	SRMR	Comm Dist		Phone Obs		M (SD)	
			M	SD	χ^2 (df = 19)					ω	α	ω	α	Comm Dist	Phone Obs
Belarus	400	38.0	23.53	5.10	57.497	.969	.954	.071 [.053, .090]	.045	.90	.89	.80	.81	1.59 (0.71)	2.54 (1.06)
Brazil	311	53.4	23.52	6.05	60.581	.942	.915	.084 [.061, .107]	.064	.81	.80	.74	.74	2.03 (0.76)	3.61 (0.92)
China	441	79.1	–	–	59.759	.943	.916	.070 [.052, .088]	.059	.76	.75	.76	.72	2.19 (0.63)	3.66 (0.86)
Croatia	688	52.6	21.81	2.38	126.809	.924	.888	.091 [.077, .105]	.055	.82	.81	.72	.74	1.92 (0.68)	3.30 (0.83)
Ecuador	415	66.5	21.87	4.26	53.275	.965	.948	.069 [.048, .092]	.048	.81	.79	.75	.73	2.01 (0.68)	3.32 (0.90)
India	126	52.4	25.28	8.03	35.246	.924	.888	.082 [.042, .120]	.071	.73	.71	.73	.76	2.15 (0.82)	2.60 (1.00)
Israel	390	62.8	37.32	12.33	63.427	.959	.939	.077 [.059, .097]	.051	.87	.86	.76	.75	2.59 (0.93)	3.29 (0.96)
Italy	639	82.6	22.34	4.78	69.088	.957	.936	.064 [.049, .080]	.046	.78	.76	.72	.71	1.96 (0.58)	3.27 (0.81)
Netherlands	322	57.4	42.48	18.12	30.765	.986	.979	.044 [.009, .071]	.035	.85	.84	.70	.71	2.18 (0.67)	3.23 (0.76)
Pakistan	410	69.0	22.31	3.72	94.035	.886	.832	.098 [.080, .118]	.080	.72	.72	.70	.71	2.35 (0.78)	3.21 (0.90)
Poland	409	78.5	23.51	5.04	44.165	.974	.962	.057 [.037, .077]	.049	.85	.84	.76	.74	1.62 (0.59)	2.81 (0.90)
Portugal	400	66.0	26.08	8.76	26.151	.991	.988	.031 [.000, .056]	.031	.81	.80	.73	.71	2.21 (0.67)	3.04 (0.89)
Serbia	365	63.0	26.17	5.60	144.089	.937	.907	.134 [.116, .154]	.082	.95	.95	.78	.79	2.26 (1.13)	3.28 (0.89)
Slovakia	182	40.1	24.97	8.95	33.305	.947	.922	.064 [.028, .097]	.054	.77	.77	.68	.68	1.89 (0.65)	3.09 (0.86)
Slovenia	434	78.9	22.11	4.50	54.868	.953	.930	.066 [.048, .085]	.054	.82	.81	.64	.66	1.95 (0.66)	3.11 (0.76)
Spain	511	57.1	30.16	12.66	70.339	.951	.928	.073 [.056, .090]	.044	.81	.80	.69	.73	2.17 (0.72)	2.96 (0.81)
Turkey	517	71.2	23.45	6.41	92.175	.941	.913	.086 [.071, .103]	.052	.84	.84	.75	.73	2.66 (0.85)	3.56 (0.88)
UK	126	84.4	32.03	14.07	17.815	.998	.998	.015 [.000, .070]	.043	.81	.80	.77	.76	1.83 (0.67)	2.61 (0.90)
Ukraine	402	75.1	20.96	3.36	28.154	.991	.987	.035 [.000, .059]	.033	.85	.84	.75	.76	1.76 (0.58)	2.91 (0.95)
USA	208	74.0	20.98	5.26	43.493	.943	.917	.079 [.050, .108]	.060	.83	.81	.67	.68	2.37 (0.71)	3.35 (0.79)

Table 3

Country	**Language of the study**	**χ^2 (df = 20)**	**CFI**	**TLI**	**RMSEA [90% CI]**	**SRMR**
Belarus	Russian	243.313	.807	.730	.199 [.177, .222]	.121
Brazil	Portuguese	168.001	.772	.680	.167 [.144, .191]	.108
China	Chinese	379.732	.534	.348	.217 [.198, .237]	.168
Croatia	Croatian	352.463	.766	.672	.168 [.153, .183]	.101
Ecuador	Spanish	174.228	.846	.794	.129 [.112, .147]	.077
India	Hindi	132.232	.863	.808	.137 [.115, .159]	.083
Israel	Hebrew	173.023	.855	.797	.155 [.134, .177]	.085
Italy	Italian	204.507	.705	.587	.158 [.139, .178]	.105
Netherlands	Dutch	237.898	.784	.698	.175 [.156, .195]	.114
Pakistan	Urdu	128.785	.874	.823	.122 [.102, .143]	.073
Poland	Polish	400.172	.803	.724	.243 [.223, .264]	.155
Portugal	Portuguese	124.165	.859	.803	.124 [.103, .145]	.082
Serbia	English	99.885	.812	.737	.148 [.120, .178]	.105
Slovakia	Slovak	287.715	.755	.669	.156 [.141, .173]	.095
Slovenia	Slovenian	208.997	.816	.742	.158 [.139, .178]	.104
Spain	Spanish	66.405	.764	.670	.151 [.112, .192]	.092
Turkey	Turkish	84.660	.771	.679	.142 [.111, .174]	.097
UK	English	88.273	.764	.669	.178 [.141, .217]	.110
Ukraine	Ukrainian	199.299	.803	.724	.160 [.140, .180]	.088
USA	English	202.319	.853	.794	.147 [.129, .166]	.077

Table 4

	χ^2	df	CFI	RMSEA	SRMR	ΔCFI	ΔRMSEA	ΔSRMR
Measurement invariance across 20 cultures								
Configural invariance (equal form)	1129.30	342	.959	.075	.045	—	—	—
Metric (weak) invariance (equal factor loadings)	1513.41	444	.943	.077	.051	.015	.002	.006
Scalar (strong) invariance (equal indicator intercepts)	5171.13	546	.739	.148	.067	.204	.071	.016
Measurement invariance across genders								
Configural invariance (equal form)	808.50	38	.951	.076	.038	—	—	—
Metric (weak) invariance (equal factor loadings)	828.50	44	.951	.075	.039	.000	.001	.001
Scalar (strong) invariance (equal indicator intercepts)	928.53	50	.946	.074	.042	.005	.001	.003
Residual invariance (equal measurement residuals)	933.44	58	.944	.070	.043	.002	.004	.001