

Journal Article

Psychometric properties of three measures of “Facebook engagement and/or addiction” among a sample of English speaking Pakistani university students

Turley, J., Lewis, C.A., Musharraf, S., Malik, J.A. and Breslin, M.J.

This article is published by Springer Verlag. The definitive version of this article is available at: <https://link.springer.com/article/10.1007/s11469-018-9963-z>

Recommended citation:

Turley, J., Lewis, C.A., Musharraf, S., Malik, J.A. and Breslin, M.J. (2018) 'Psychometric properties of three measures of “Facebook engagement and/or addiction” among a sample of English speaking Pakistani university students', *International Journal of Mental Health and Addiction*. Available online: 16 July 2018. doi: 10.1007/s11469-018-9963-z.

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20

Psychometric properties of three measures of “Facebook engagement and/or addiction”
among a sample of English speaking Pakistani university students

¹Joanne Turley, *²Christopher Alan Lewis, ³Sadia Musharraf, ⁴Jamil A. Malik,
and ¹Michael J. Breslin

¹Department of Psychology, Glyndŵr University, Plas Coch Campus, Mold Road, Wrexham,
LL11 2AW, Wales, UK.

²Warwick Religions & Education Research Unit, Centre for Education Studies, Faculty of
Social Sciences, University of Warwick, Coventry CV4 7AL, England, UK

³Department of Applied Psychology, The Women University, Multan, Pakistan.

⁴National Institute of Psychology, Quaid-i-Azam University Islamabad, Pakistan

Running Head: Measures of “Facebook addiction”

Address correspondence to: Warwick Religions & Education Research Unit, Centre for
Education Studies, Faculty of Social Sciences, University of Warwick, Coventry CV4 7AL,
England, UK. Email: christopher.lewis.1@warwick.ac.uk

21

22 Funding sources:

23 No financial support was received for this study.

24 Authors’ contribution:

25 JT – Study concept and design, analysis and interpretation of data, statistical analysis,
26 research of background literature, and drafting/writing of the manuscript.

27 CAL - Study concept and design, analysis and interpretation of data, statistical analysis,
28 research of background literature, and drafting/writing of the manuscript.

29 SM – Data collection, and drafting/writing of the manuscript.

30 JAM - Analysis and interpretation of data, statistical analysis, and drafting/writing of the
31 manuscript.

32 MJB - Analysis and interpretation of data, statistical analysis, and drafting/writing of
33 manuscript.

34 All authors had full access to all data in the study and take responsibility for the integrity of
35 the data and the accuracy of the data analysis.

36 Conflict of interest:

37 The authors declare no conflict of interest.

38

39

40

41 Psychometric properties of three measures of “Facebook engagement and/or addiction”
42 among a sample of Pakistani students

43 **Abstract**

44 For researchers interested in measuring the construct of “Facebook engagement and/or
45 addiction” there are a number of existing measures including the Bergen Facebook Addiction
46 Scale, the Facebook Intensity Scale, and the Addictive Tendencies Scale. Currently, there is
47 limited data on the psychometric properties of these three scales, especially among South Asian
48 samples. The present aim was to address this shortfall. A sample of 308 English speaking
49 Pakistani university students completed the scales, in their original English versions, on two
50 occasions separated by four weeks. Results demonstrated that for each of the scales, across
51 both administrations, satisfactory psychometric properties were found, including internal
52 reliability, temporal stability, and construct validity. Moreover, for these three scales, using
53 confirmatory factor analysis, a one-factor structure was generally found to be a good
54 description of the data for both male and female samples. These data provide further evidence
55 for the reliability and validity of three scales concerned with “Facebook engagement and/or
56 addiction”.

57

58 Keywords: Facebook, addiction, Pakistan, validity, reliability

59

60 **Introduction**

61 Over the last decade, computer-mediated communication has increased via a range of social
62 networking sites (SNSs) such as MySpace and Facebook. They provide a virtual platform
63 where users can create individual public profiles, establish or maintain social connections, and
64 join virtual groups based on common interests (Ellison, Steinfield, & Lampe, 2007). Launched
65 in 2004, Facebook is one of the most popular SNSs connecting over a billion people worldwide
66 in 2012 (Facebook, 2013). More recently, Facebook has announced that its global community
67 is continuing to grow, especially in countries such as India, Indonesia, and Brazil (Facebook,
68 2018a), with daily active users (DAUs) and monthly active users (MAUs) both showing an
69 increase of 13% in the first quarter of 2018 compared to 2017 (DAUs = 1.45 billion; MAUs =
70 2.20 billion) (Facebook, 2018b). With a growth in the use of the internet comes the potential
71 for concern as people engage in a variety of online activities that have the potential to become
72 addictive (Cash, Rae, Steel, & Winkler, 2012; Doan, 2012; Weinstein & Lejoueux, 2010).
73 Young (2000) maintains that there are five subcategories of internet addiction; cybersexual
74 addiction, net compulsions, information overload, computer overload, and cyber-relationship
75 addiction. It is the latter of these addictions that can be related to SNSs, or more specifically
76 “Facebook engagement and/or addiction”; since the main focus of Facebook appears to be the
77 creation and maintenance of social capital (Ellison et al., 2007).

78 Research examining the construct of “Facebook engagement and/or addiction” is still a
79 relatively new area of research and the self-report measures developed to measure the construct
80 have only been published comparatively recently. A recent review article of social network site
81 (SNS) addiction (Andreassen & Pallesen, 2014) reports seven self-report scales that have been
82 developed to assess SNS (predominately Facebook) addiction that have been published in the
83 peer-reviewed literature: Addiction Tendencies Scale (Wilson et al., 2010), Facebook Intrusion
84 Questionnaire (Elphinston & Noller, 2011), Bergen Facebook Addiction Scale (Andreassen et

85 al., 2012), Social Networking Website Addiction Scale (Turel & Serenko, 2012), Facebook
86 Dependence Questionnaire (Wolniczak et al., 2013), Facebook Addiction Scale (Koc &
87 Gulyagci, 2013), and Addictive Tendencies Towards SNSs (Wu, Cheung, Ku, & Hung, 2013).
88 In addition, there are four self-report scales that address related constructs to that of measuring
89 the addictive use of SNSs: the Addictive Tendencies Scale (ATS; Ellison et al., 2007), which
90 measures how emotionally connected individuals are to Facebook; the Facebook Intensity
91 Scale (FIS; Pelling & White, 2009), which measures the levels of usage of social networking
92 sites in general (e.g., Facebook, Bebo) along with any addictive tendencies towards their use;
93 the Online Sociability Test (Ross et al., 2009), which measures frequencies of different uses of
94 Facebook such as sending private messages and commenting on others photographs; and the
95 Motives for Facebook Usage Scale (Koc & Gulyagci, 2013), which measures the uses of
96 Facebook (e.g., social, academic, informational).

97 Such self-report scales of “Facebook engagement and/or addiction” have only been
98 developed comparatively recently and therefore there presently exists only limited
99 psychometric data on them. Moreover, most previous research has been undertaken in North
100 America and Europe and there exists little data on Facebook engagement and/or addiction in
101 developing countries despite the Asia-Pacific regions having the largest growth in DAUs and
102 MAUs each quarter since 2016 (Facebook, 2018c). In light of this, the present study, utilizing
103 a convenience sample of participants, sought to provide further data on the psychometric
104 properties of three scales measuring “Facebook engagement and/or addiction”, the ATS
105 (Ellison et al., 2007); the FIS (Pelling & White, 2009); and the Bergen Facebook Addiction
106 Scale (BFAS; Andreassen, Tosheim, Brunborg, & Pallesen, 2012) among a non-clinical sample
107 of English speaking Pakistani university students. No attempt was made to review cultural or
108 clinical factors within this study. The selection of these three scales was based on their known

109 availability when the study was being developed and perceived limitations of research
110 undertaken using them.

111 In light of previous research that has used the ATS, the FIS, and the **BFAS**, the present
112 study had three aims. The first aim was to test the unidimensionality of each of the three scales
113 using confirmatory factor analysis. It has been assumed by the developers and users of each of
114 the scales, that each unidimensional and therefore it was predicted that each of the measures
115 would be unidimensional. Further, the intention was to extend the validation evidence (external
116 validity) by testing the unidimensional factor structure for gender invariance. The second aim
117 was to examine the temporal stability of each of these three scales by reporting the Pearson’s
118 Product Moment Correlations between scores on each scale at Time 1 and then again at Time
119 2. Based on the findings of Andreassen et al. (2012), it was predicted that each of these three
120 scales would be temporally stable, as indicated by strong positive correlations between scores
121 at Time and Time 2. The third aim was to examine the construct validity of these three scales
122 by reporting the inter-correlations between them using Pearson’s Product Moment
123 Correlations. As each scale is concerned with “Facebook engagement and/or addiction” it was
124 therefore predicted that each of these three scales would be significantly positively associated
125 with each other and each would be positively associated with the two activity measures
126 embedded within the FIS (i.e., “number of friends” and “time spent”).

127 Therefore, it was hypothesized that in line with the assumptions of the developers of
128 the measures, each of the three measures of Facebook Addiction would be unidimensional,
129 temporally stable, and be significantly positively associated with each other.

130 **Method**

131 *Sample*

132 Three-hundred and eight undergraduate students (168 male and 140 female) were recruited
133 through a convenience sampling strategy all in attendance either at Bahauddin Zakariya
134 University, Multan or University of the Punjab, Lahore, Pakistan and enrolled on social science
135 courses. Their mean age was 21.90 years ($SD = 2.07$),. All respondents were proficient in
136 English as it is one of Pakistan’s official languages. English is taught to all school-level
137 Pakistani students. At college and university level, all instructions are in English. Therefore, it
138 is a common practice to use English version (measures) in regional research projects employing
139 college or university student sample in Pakistan. No credit was given for participation.

140 *Measures*

141 All students completed a questionnaire booklet containing three scales measuring:

142 i). The Bergen Facebook Addiction Scale (BFAS; Andreassen, Tosheim, Brunborg, & Pallesen,
143 2012) was designed to measure the possibility of an obsession with a specific area of the
144 Internet, the social networking site known as “Facebook”. The measure is a 6-item self-report
145 scale, containing one item for each of the six core features of addiction: salience, mood,
146 modification, tolerance, withdrawal, conflict, and relapse (Griffiths, 2005). The six items are
147 contained in Table 3. Each of the six items is scored on a 5-point Likert scale ranging from
148 “very rarely” (1), through “sometimes” (3), to “very often” (5). The higher the score the greater
149 the “Facebook addiction”. Scores can range between 6 and 30. The scale has been found to
150 have acceptable psychometric properties in terms of internal consistency (Cronbach’s alpha
151 coefficient = .83), factor structure (unidimensional), and temporal stability (test-retest
152 correlation .82 over 3 weeks; Andreassen et al., 2012). In a further study that looked at the
153 relationship between behavioural addictions and personality in 218 Norwegian university
154 students, the Cronbach’s alpha coefficient was found to be .86 (Andreassen et al., 2013).
155 However, it has been argued as there are a variety of activities that an individual can engage in,

156 such as communicating with others, playing games, gambling, watching videos or updating
157 profiles, the term Facebook addiction may already be obsolete (Griffiths, 2012).

158 ii) The Facebook Intensity Scale (FIS; Pelling & White, 2009) was designed to measure how
159 emotionally connected individuals were to the social networking site “Facebook”, how they
160 incorporated it into their day to day lives, as well as measuring usage frequency and duration.
161 The measure contains six attitudinal items designed to measure the degree to which participants
162 are emotionally attached to Facebook and the extent to which it is embedded into daily life.
163 The measure also asks participants how many Facebook friends they have (“Approximately
164 how many total Facebook friends do you have?” [“number of friends”]) and their level of active
165 engagement on Facebook on a typical day “In the past week, on average, approximately how
166 much time per day have you spent using Facebook?” [“time spent”]). Each of the six attitudinal
167 items is scored on a 5-point Likert scale ranging from “strongly disagree” (1), through “neither
168 agree nor disagree” (3), to “strongly agree” (5). The higher the score the greater the emotional
169 attachment to Facebook. Scores can range between 6 and 30. Participants rate the level to which
170 they agreed or disagreed with a series of statements (see Table 4). The scale has been found to
171 have a satisfactory level of internal consistency among various samples. For example, .83
172 (Ellison et al., 2007), .84 and .88 (Steinfeld, Ellison, & Lampe, 2008), .89 (Valenzuela, Park,
173 & Kee, 2009), and .80 (Burke, Marlow, & Lento, 2010).

174 iii) The Addictive Tendencies Scale (ATS; Ellison et al., 2007) was designed to measure the
175 levels of usage of social networking sites in general (e.g., Facebook, Bebo) along with any
176 addictive tendencies towards their use. The measure is an 8-item self-report scale, based on
177 previous research by Ehrenberg, Juckes, White, and Walsh (2008), and is designed to measure
178 addictive tendencies towards SNSs. The items are contained in Table 5. Each item is scored on
179 a 7-point Likert scale ranging from “strongly disagree” (1), though “neither agree nor disagree”
180 (4), to “strongly agree” (7). Scores can range between 8 and 56. The scale has been found to

181 have acceptable psychometric properties in terms of internal consistency (Cronbach’s alpha
182 coefficient = .85). No further studies examining the reliability of the scale were identified (K.
183 White (personal communication, July 19, 2013)).

184 Demographic information (age and gender) was collected as were identifiers to
185 facilitate the collation of respondents’ questionnaire booklet at Time 1 and Time 2. All
186 measures were administered in English.

187 *Procedure*

188 The survey booklet was completed during class time and again four weeks later. Participants
189 recorded their names and age but were assured of confidentiality, and participation was
190 voluntary. None of the class declined to participate, and no credit was given for completing the
191 questionnaires on either occasion. Participants were not informed that the measure would be
192 re-administered.

193 *Missing Data*

194 Missing data ranged from a low of .09% for ATS to a high of 3% for BFAF. The missing
195 data were handled under the assumption of missing at random (MAR) using a full
196 information maximum likelihood (FIML) method. Studies demonstrate that FIML is a
197 preferred method to deal with missing data (Schlomer, Bauman, & Card, 2010). Further, it
198 has been shown to produce unbiased and more accurate parameter estimates across a variety
199 of conditions, particularly under MAR, missing completely at random and at small sample
200 sizes (Enders & Bandalos, 2001).

201 *Statistical Analyses*

202 Using SPSS v24, each variable (“number of friends”, “time spent”) and the three scales were
203 analysed using descriptive statistics (mean, confidence interval, and standard deviation). The

204 temporal stability of the three scales was assessed by calculating paired samples *t*-test to
205 compare the mean scores of each of the scales at Time 1 and Time 2 ($> .7$ for test-retest are
206 considered satisfactory; Kline, 2015). The reliability estimates of the three scales were assessed
207 using Cronbach’s alpha and Intraclass correlation coefficients ($> .7$ for test-retest are
208 considered satisfactory; Kline, 2015). The association between the two Facebook activity
209 questions (“number of friends” and “time spent”) and the three scales was assessed using
210 Pearson’s Product-Moment Correlation. The convergent validity of the three scales was
211 assessed using Pearson’s Product-Moment Correlation. Effects sizes for correlations range
212 from small $r = .10$, through medium $r = .30$, to large $r = .50$ (Cohen, 1992).

213 Confirmatory factor analysis (CFA) was conducted employing AMOS Version 22 to
214 test the specific hypotheses regarding the dimensional structure of the three scales. To evaluate
215 the overall fit of the CFA models under examination, the following indices were calculated;
216 the Sattora-Bentler scaled chi-square (Hoyle & Panter, 1995), the Root Mean Square Error of
217 Approximation with 90 percent confidence intervals (RMSEA; Steiger, 1990), the
218 Comparative Fit Index (CFI; Bentler, 1990), and the Standardized Root Mean Square Residual
219 (SRMR; Hu & Bentler, 1999). A non-significant chi-square is considered to reflect acceptable
220 fit (Jöreskog & Sörbom, 1993). However, as sample size increases the chi-square value is more
221 likely to become significant (Tanaka, 1987). For the RMSEA, A value less than .06 indicates
222 good fit while a value above .08 represents poor errors of approximation in the population
223 (Byrne, 1998). For the CFI value, at or above .95 is considered acceptable (Raykov &
224 Marcoulides, 2000). For the SRMR value, less than .08 is considered to be indicative of
225 acceptable model fit (Hu & Bentler, 1998).

226

227 **Results**

228 *Descriptive Statistics*

229 All of the respondents had Facebook accounts and all reported having Facebook friends with
230 the minimum number of friends being two, and the maximum being 4500 (mean 231.88, SD =
231 377.75). The daily amount of time spent on Facebook ranged from a minimum of five minutes
232 to a maximum of 500 minutes (mean 87.56, SD = 78.22).

233 *Descriptive statistics*

234 Table 1 contains the means, standard deviations, and Cronbach’s alpha coefficients of the three
235 scales at both Time 1 and Time 2 testing periods. In addition, the Pearson’s Product-Moment
236 Correlation coefficient, intra-class correlation, and the paired samples *t*-tests are also included.
237 Satisfactory levels of internal reliability were found for the three scales at both Time 1 and
238 Time 2 ($> .7$; Kline, 2015).

239 *Temporal Stability*

240 For each of the three scales, scores at Time 1 were significantly associated with scores at Time
241 2 and exceeded the criteria of .7 as suggested by Kline (2000). Moreover, a repeated measures
242 *t*-test indicated that there were no significant differences in the mean scores between Time 1
243 and Time 2 for each of the three measures.

244 <INSERT TABLE 1 HERE>

245 *Convergent Validity*

246 Table 2 contains the Pearson Product Moment Correlations between each of the three scales,
247 as well as with the measures of Facebook “friends”, and “time spent” on Facebook. At both
248 Time 1 and Time 2, it was found that all three scales were significantly associated with each
249 other.

250 At both Time 1 and Time 2, each of the three scales was associated with scores on the Facebook
251 “friends” and “time spent” on Facebook.

252 <INSERT TABLE 2 HERE>

253 *Confirmatory Factor Analysis for the Bergen Facebook Addiction Scale*

254 Following Andreassen et al. (2012), a confirmatory factor analysis (CFA) was conducted on
255 items 1, 5, 7, 11, 13, and 16 of the BFAS (i.e., those items that were retained in the final scale
256 due to having the highest corrected item-total correlation within each of the six addiction
257 elements) with one-factor specified, using AMOS 22. Results presented in Table 6 showed a
258 non-significant chi-square ($\chi^2 = 13.65$, $df = 9$, $p = .14$). Other fit indices including CFI = .99,
259 TLI = .98, IFI = .99, and a non-significant RMSEA = .04 ($p = .59$) suggested an excellent fit
260 of the CFA model to the data (Hu & Bentler, 1999). Item loading ranging ($\lambda = .50$) to ($\lambda = .73$)
261 showed that all items are valid indicators of the underlying latent construct “Facebook
262 engagement and/or addiction”. The CFA model was further extended to test gender invariance.
263 For the purpose, the default model was first tested across gender with open estimates to test
264 configural invariance. A non-significant change in chi-square along with an excellent fit of the
265 model to the data supported configural invariance across gender. In the second step, metric
266 level invariance was tested and the model was reassessed by applying equality constraints for
267 male and female on factor loadings of all six items to the latent factor. A non-significant delta
268 chi-square ($\Delta\chi^2 = 7.53$, $df = 9$, $p = .58$) along with $\Delta CFI < .01$, and $\Delta RMSEA < .01$ showed that
269 CFA model with equality constraint across gender and is equally generalizable to both males
270 and females. In the last step, intercepts were constrained to be equal across gender to test scalar
271 level invariance. The result ($\Delta\chi^2 = 8.31$, $df = 12$, $p = .78$) further supported scalar level
272 invariance of BFAS. The negative values of delta CFI and a decrease in RMSEA rather showed
273 an improved model with metric and scalar level invariance.

274 <INSERT TABLE 3 HERE>

275 <INSERT TABLE 4 HERE>

276 *Confirmatory Factor Analysis for the Facebook Intensity Scale*

277 A one-factor CFA was conducted on the FIS. Results showed that the Satorra-Bentler scaled
278 chi-square was significant ($\chi^2 = 77.88$, $df = 9$, $p < .01$). Other fit indices including CFI = .86,
279 TLI = .68, IFI = .86, and a significant RMSEA = .16, $p < .01$ suggesting a reasonable error of
280 approximation in the population (Byrne, 1998) failed to establish good fit of the model to the
281 data (Hu & Bentler, 1999). A review of modification index suggested that residual of item six
282 co-vary with the residual of item-2, item-4, and item-5. Addition of the three residual
283 covariances resulted in a significant improvement of the model ($\Delta\chi^2 = 60.32$, $df = 3$, $p < .01$).
284 The fit indices of the revised model M1 ($\chi^2(df) = 17.16 (6)$ $p = .01$, CFI = .98, TLI = .92, IFI =
285 .98, and non-significant RMSEA = .08, $p = .11$) supported a good fit of the model to the data.
286 Factor loadings ranged from .45 to .82 and are shown in Table 4. These results suggest that a
287 one-factor structure was a good description of the data. The three-step analysis for testing
288 gender invariance further supported generalizability of the measure at configural, metric ($\Delta\chi^2$
289 = 4.77, $df = 6$, $p < .57$) and scalar ($\Delta\chi^2 = 7.61$, $df = 12$, $p < .83$). Negative Δ CFI (i.e., -.003, and
290 -.009) and a decrease in RMSEA (i.e., .016, and .029) showed even improved models
291 respectively for metric level and scalar level invariance.

292 <INSERT TABLE 5 HERE>

293 *Confirmatory Factor Analysis for the Addictive Tendencies Scale*

294 A one-factor CFA was also conducted on the ATS. Results presented in Table 6 showed a poor
295 fit of the default model. A review of modification index suggested the presence of residual
296 covariance among item-6, item-7, and item-8. Addition of the three residual covariances

297 resulted in a significant improvement ($\Delta\chi^2 = 48.46$, $df = 3$, $p < .01$) and an excellent fit of the
298 model (M1) to the data ($\chi^2(df) = 31.24 (17)$ $p = .02$, $CFI = .96$, $TLI = .92$, $IFI = .96$, and $RMSEA$
299 $= .05$, $p = .41$). Item loading ranging from ($\lambda = .30$ to $\lambda = .63$) presented in Table 5 showed that
300 all items are the valid indicator of the latent measure of the ATS. Gender invariance testing
301 with a good fit of the model at configural level invariance and non-significant delta chi-square
302 at metric level ($\Delta\chi^2 = 5.90$, $df = 8$, $p < .66$), and scalar level ($\Delta\chi^2 = 17.51$, $df = 15$, $p < .29$)
303 further supported the stability and generalization of one factor model for male and female
304 participants.

305 **Discussion**

306 The present study sought to provide further evidence of the psychometric properties of the three
307 existing measures of “Facebook engagement and/or addiction”, the BFAS, the FIS, and the
308 ATS, among a convenience non-clinical sample of English speaking Pakistani university
309 students. Specifically, the present aims were to examine the dimensionality and construct
310 validity of the three measures. From the results of this study, five points are worthy of
311 discussion.

312 First, all respondents had a Facebook account, attesting to the fact that Facebook is a
313 popular vehicle for the respondents to enable social interaction. Moreover, for some
314 respondents their Facebook account was used for a considerable amount of time each day,
315 thereby indicating evidence of possible addiction.

316 Second, satisfactory levels of internal consistency were found for each of the three
317 scales at both Time 1 and Time 2 ($>.7$; Kline, 2015). These findings are in line with those
318 obtained by previous researchers in a range of different samples. For example, the BFAS
319 (Cronbach’s alpha = .83; Andreassen et al., 2012), the FIS (Cronbach’s alpha = .83; Ellison et
320 al., 2007), and the ATS (Cronbach’s alpha = .85; Pelling & White, 2009).

321 Third, satisfactory levels of temporal stability were found for each of the three scales
322 over the four weeks. These findings are in line with those obtained by previous researchers, for
323 example, with the BFAS (.82 for test-retest over three weeks; Andreassen et al., 2012).
324 However, as no previous research was found on the temporal stability of the FIS (Ellison et al.,
325 2007), or the ATS (Pelling & White, 2009), the present findings provide some consensus in the
326 consistency over time of such measures of “Facebook engagement and/or addiction”.

327 Fourth, it was found that at both Time 1 and Time 2, all three scales were significantly
328 inter-correlated with each other. It can be argued therefore that this provides support for the
329 construct validity for each of the scales, as each was developed to measure different aspects of
330 “Facebook engagement and/or addiction”, and therefore should be positively associated,
331 indicating these measures are tapping the same underlying construct of “Facebook engagement
332 and/or addiction”, but not strongly associated as they are measuring different facets. That is,
333 with the BFAS measuring the possibility of an obsession with Facebook, the FIS measuring
334 how emotionally connected individuals were to Facebook and the ATS measuring the levels of
335 usage of social networking sites in general (e.g., Facebook, Bebo) along with any addictive
336 tendencies towards their use. It is interesting to note that the two measures that were the most
337 strongly associated were the BFAS and the ATS, whilst results for the FIS indicated weaker
338 relationships. Furthermore, in terms of the association between the activity measures of
339 Facebook “friends” and average daily “time spent” on Facebook, at both Time 1 and Time 2,
340 both measures were significantly associated with each other, whilst also being significantly
341 associated with both the BFAS and the FIS. However, at both Time 1 and Time 2, the average
342 daily time spent on Facebook was significantly associated with the ATS, while the number of
343 Facebook “friends” was not.

344 Fifth, a one-factor structure was found to be a good description of the data for each of
345 the three measures. For the BFAS, Andreassen et al. (2012) did not report a factor analysis to

346 investigate if their 18-item pool constituted six factors, which in turn constituted a single factor.
347 Rather, they used item-total correlations to create the six-item scale. The present results
348 extended psychometric support for BFAS by providing evidence regarding the validity of all
349 the six items to measure a single factor representing “Facebook Addiction”. The study further
350 extended what is known about the psychometric properties of the three scales by testing gender
351 invariance of the factor structure at configural, metric, and scalar level. Adding evidence to
352 external validity, the results supported the generalizability of the factor structure even at the
353 scalar level, showed that the measures are invariant at a stronger level, and suggested that
354 measures are equally useful for both male and female participants.

355 There were several limitations to the methodology employed in the present study. The
356 sample employed was a small ($N = 308$) convenience sample of Pakistani students and was
357 therefore not representative of the wider Pakistani population. The interval period between the
358 administration and re-administration of the measure was relatively brief i.e., four weeks (cf.
359 Andreassen et al., 2012), and falls somewhat short of the three-month period typically
360 employed (Kline, 2015). Although this study utilised a sample of Pakistani students, the effect
361 of culture was not considered. Furthermore, clinical implications and response bias were also
362 not considered.

363 However, notwithstanding these points, for the three scales of “Facebook engagement
364 and/or addiction”, the data demonstrated satisfactory psychometric properties, including
365 internal consistency, temporal stability, and construct validity. Moreover, for these measures,
366 a one-factor structure was found to be a good description of the data. These findings build on
367 the satisfactory psychometric properties previously reported in Western and North American
368 samples (Ellison et al., 2007; Steinfield, Ellison, & Lampe, 2008; Valenzuela, Park, & Kee
369 2009), as well as samples recruited from the internet (Burke, Marlow, & Lento, 2010), and

370 further support the use of these three measures in research settings to examine the
371 psychological consequences of social media.

372 No attempt was made to review cultural or clinical factors within this study. Future
373 work may wish to translate the three measures of facebook addiction into the official language
374 of Pakistan, that of Urdu, or indeed any of the regional languages.

375

376

377 **References**

378 Andreassen, C.S., Tosheim, T., Brunborg, G.S., & Pallesen, S. (2012). Development of a
379 Facebook Addiction Scale. *Psychological Reports, 110*(2), 501-517.

380 doi:10.2466/02.09.18.PR0.110.2.501-517

381 Andreassen, C.S., Griffiths, M.D., Gjertsen, S.R., Krossbakken, E., Kvam, S., & Pallesen, S.

382 (2013). The relationships between behavioural addictions and the five-factor model of
383 personality. *Journal of Behavioral Addictions, 2*(2), 90-99.

384 doi:10.1556/JBA.2.2013.003

385 Andreassen, C. S., & Pallesen, S. (2014). Social network site addiction - An overview.

386 *Current Pharmaceutical Design, 20*(25), 4053-4061.

387 doi:10.2174/13816128113199990616

388 Bentler, P. M. (1990). Comparative fit indices in structural models. *Psychological Bulletin,*

389 *107*(2), 238-246. doi:10.1037/0033-2909.107.2.238

390 Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. London: The

391 Guilford Press.

392 Burke, M., Marlow, C., & Lento, T. (2010). *Proceedings of the SIGCHI Conference on*

393 *Human Factors in Computing Systems. 1909 – 1912*. New York, NY:

394 <http://dl.acm.org/citation.cfm?id=1753613>

395 Byrne, B. (1998). *Structural equation modelling with Lisrel, Prelis, and Simplis*. London:

396 Lawrence Erlbaum Associates.

- 397 Cash, H., Rae, C. D., Steel, A. H., & Winkler, A. (2012). Internet addiction: A brief summary
398 of research and practice. *Current Psychiatry Reviews*, 8(4), 292-298.
399 doi:10.2174/157340012803520513
- 400 Cohen, J (1992). A power primer. *Psychological Bulletin*, 112(1), 155–159.
401 doi:10.1037/0033-2909.112.1.155
- 402 Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*,
403 16(3), 297-334. doi:10.1007/BF02310555
- 404 Doan, A. P. (2012). *Hooked on games: The lure and cost of video game and internet*
405 *addiction*. Coralville, IA: F.E.P. International, Inc.
- 406 Ehrenberg, A. L., Juckes, S. C., White, K. M., & Walsh, S. P.(2008). Personality and self-
407 esteem as predictors of young people’s technology use. *CyberPsychology and*
408 *Behavior* 11(6), 739-741. doi:10.1089/cpb.2008.0030
- 409 Ellison, N. B., Steinfield, C., & Lampe, C. (2007). The benefits of Facebook “friends:” Social
410 capital and college students’ use of online social network sites. *Journal of Computer-*
411 *Mediated Communication* 12(4), 1143-1168. doi:10.1111/j.1083-6101.2007.00367.x
- 412 Elphinston, R. A., & Noller, P. (2011). Time to face it! Facebook intrusion and the
413 implications for romantic jealousy and relationship satisfaction. *Cyberpsychology,*
414 *Behavior, and Social Networking*, 14(11), 631-635. doi:10.1089/cyber.2010.0318
- 415 Enders, C. K., & Bandalos, D. L. (2001). The relative performance of full information
416 maximum likelihood estimation for missing data in structural equation
417 models. *Structural Equation Modeling: A Multidisciplinary Journal*, 8(3), 430-457.
418 doi:10.1207/S15328007SEM0803_5

- 419 Facebook. (2013, January 30). *Facebook reports fourth quarter and full year 2012 results*.
 420 Retrieved from Facebook.com:
 421 <http://investor.fb.com/releasedetail.cfm?ReleaseID=736911>
- 422 Facebook. (2018a, January 31). *Facebook Q4 2017 earnings*. Retrieved from
 423 investor.fb.com: [https://s21.q4cdn.com/399680738/files/doc_financials/2017/Q4/Q4-](https://s21.q4cdn.com/399680738/files/doc_financials/2017/Q4/Q4-17-Earnings-call-transcript.pdf)
 424 [17-Earnings-call-transcript.pdf](https://s21.q4cdn.com/399680738/files/doc_financials/2017/Q4/Q4-17-Earnings-call-transcript.pdf)
- 425 Facebook. (2018b, April 25). *Facebook reports first quarter 2018 results*. Retrieved from
 426 investor.fb.com: [https://investor.fb.com/investor-news/press-release-](https://investor.fb.com/investor-news/press-release-details/2018/Facebook-Reports-First-Quarter-2018-Results/default.aspx)
 427 [details/2018/Facebook-Reports-First-Quarter-2018-Results/default.aspx](https://investor.fb.com/investor-news/press-release-details/2018/Facebook-Reports-First-Quarter-2018-Results/default.aspx)
- 428 Facebook. (2018c, April 25). *Facebook Q1 2018 results*. Retrieved from
 429 investor.fb.com.com:
 430 [https://s21.q4cdn.com/399680738/files/doc_financials/2018/Q1/Q1-2018-Earnings-](https://s21.q4cdn.com/399680738/files/doc_financials/2018/Q1/Q1-2018-Earnings-Presentation-(1).pdf)
 431 [Presentation-\(1\).pdf](https://s21.q4cdn.com/399680738/files/doc_financials/2018/Q1/Q1-2018-Earnings-Presentation-(1).pdf)
- 432 Griffiths, M. D. (2005). A “components” model of addiction within a biopsychosocial
 433 framework. *Journal of Substance Use, 10*(4), 191-197.
 434 doi:10.1080/14659890500114359
- 435 Griffiths, M. D. (2012). Facebook addiction: Concerns, criticism, and recommendations - A
 436 response to Andreassen and colleagues. *Psychological Reports, 110*(2), 518-520.
 437 doi:10.2466/01.07.18.PR0.110.2.518-520
- 438 Hoyle, R. H., & Panter, A. T. (1995). Writing about structural equation models. In R.H.
 439 Hoyle (Ed.) *Structural equation modeling: Concepts, issues and applications* (pp.
 440 158-198). London: Sage.
- 441 Hu, L. T., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity
 442 to underparameterized model misspecification. *Psychological Methods, 3*(4), 424-
 443 453. doi:10.1037/1082-989X.3.4.424
- 444 Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure
 445 analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling,*
 446 *6*(1), 1-55. doi:10.1080/10705519909540118

- 447 Jöreskog, K. G., & Sörbom, D. (1993). *Structural equation modeling with the SIMPLIS*
448 *command language*. Chicago, IL: Scientific Software Inc.
- 449 Jöreskog, K. G., & Sörbom, D. (2005a). *LISREL 8.73*. Chicago, IL: Scientific Software Inc.
- 450 Jöreskog, K. G., & Sörbom, D. (2005b). *PRELIS 2.73*. Chicago, IL: Scientific Software Inc.
- 451 Kline, P. (2015). *A handbook of test construction (Psychology Revivals): Introduction to*
452 *psychometric design*. London: Methuen.
- 453 Kline, P. (2000). *The handbook of psychological testing (2nd ed.)*. London: Routledge.
- 454 Kuss, D. J., & Griffiths, M. D. (2011). Online social networking and addiction - A review of
455 the psychological literature. *International Journal of Environmental Research and*
456 *Public Health* 8(9), 3528-3552. doi:10.3390/ijerph8093528
- 457 Koc, M., & Gulyagci, S. (2013). Facebook addiction among Turkish college students: The
458 role of psychological health, demographic, and usage characteristics.
459 *Cyberpsychology, Behavior, and Social Networking* 16(4), 279-284.
460 doi:10.1089/cyber.2012.0249
- 461 Pelling, E., & White, K. M. (2009). The theory of planned behaviour applied to young
462 people's use of social networking websites. *Cyberpsychology & Behavior*, 12(6), 755-
463 759. doi:10.1089/cpb.2009.0109
- 464 Raykov, T., & Marcoulides, G. A. (2000). *A first course in structural equation modeling*.
465 Mahwah, NJ: Lawrence Erlbaum.
- 466 Ross, C., Orr, E. S., Sisic, M., Arseneault, J. M., Simmering, M. G., & Orr, R. R. (2009).
467 Personality and motivations associated with Facebook use. *Computers in Human*
468 *Behavior*, 25(2), 578-586. doi:10.1016/j.chb.2008.12.024

- 469 Schlomer, G. L., Bauman, S., & Card, N. A. (2010). Best practices for missing data
470 management in counseling psychology. *Journal of Counseling Psychology*, 57(1), 1-
471 10. doi:10.1037/a0018082
- 472 Steiger, J. H. (1990). Structural model evaluation and modification: An interval estimation
473 approach. *Multivariate Behavioral Research*, 25(2), 173–180.
474 doi:10.1207/s15327906mbr2502_4
- 475 Steinfield, C., Ellison, N. B., & Lampe, C. (2008). Social capital, self-esteem, and use of
476 online social network sites: A longitudinal study. *Journal of Applied Developmental
477 Psychology*, 29(6), 434-445. doi:10.1016/j.appdev.2008.07.002
- 478 Tanaka, J. S. (1987). How big is enough? Sample size and goodness-of fit in structural
479 equation models with latent variables. *Child Development*, 58(1), 134-146.
480 doi:10.2307/1130296
- 481 Turel, O., & Serenko, A. (2012). The benefits and dangers of enjoyment with social
482 networking websites. *European Journal of Information Systems*, 21(5), 512-528.
483 doi:10.1057/ejis.2012.1
- 484 Valenzuela, S., Park, N., & Kee, K. F. (2009). Is there social capital in a social network site?:
485 Facebook use and college students’ life satisfaction, trust and participation. *Journal of
486 Computer-Mediated Communication*, 14(4), 875-901. doi:10.1111/j.1083-
487 6101.2009.01474.x
- 488 Weinstein, A., & Lejoyeux, M. (2010). Internet addiction or excessive use. *The American
489 Journal of Drug and Alcohol Abuse*, 36(5), 277-283.
490 doi:10.3109/00952990.2010.491880

- 491 Wolniczak, I., Cáceres-DelAguila, J. A., Palma-Ardiles, G., Arroyo, K. J., Solís-Visscher, R.,
492 Paredes-Yauri, S., ... & Bernabe-Ortiz, A. (2013). Association between Facebook
493 dependence and poor sleep quality: A study in a sample of undergraduate students in
494 Peru. *PloS ONE*, 8(3). doi:10.1371/journal.pone.0059087.
- 495 Wu, A. M., Cheung, V. I., Ku, L., & Hung, E. P. (2013). Psychological risk factors of
496 addiction to social networking sites among Chinese smartphone users. *Journal of*
497 *Behavioral Addictions*, 2(3), 160-166. doi:10.1556/JBA.2.2013.006
- 498 Young, K. S. (2000). Internet addiction: Evaluation and treatment. *Student British Medical*
499 *Journal*, 7, 394-436.
- 500

501 Table 1. Means, Standard Deviations, and Reliabilities of The Bergen Facebook Addiction
 502 Scale, The Facebook Intensity Scale, and The Addictive Tendencies Scale at both Time 1 and
 503 Time 2 Testing Periods (N = 142).

Measures	Time 1		Time 2		<i>r</i>	ICC	<i>t</i>
	Alpha	Mean (SD)	Alpha	Mean (SD)			
Bergen Facebook Addiction Scale	.79	17.27 (5.30)	.68	17.03 (4.37)	.82**	.232	-6.566***
Facebook Intensity Scale	.79	18.24 (4.72)	.86	18.73 (4.90)	.98**	.065	.466
Addictive Tendencies Scale	.74	33.98 (8.82)	.76	32.40 (7.19)	.80**	.268	.016

504 ** $p < 0.01$; *** $p < 0.001$

505 *r* = Pearson’s Product-Moment Correlation Coefficient

506 ICC = Intraclass Correlation Coefficient

507 *t* = Paired Samples T-Test

508

509

Table 2. Correlations between The Bergen Facebook Addiction Scale, The Facebook Intensity Scale, and The Addictive Tendencies Scale (N = 142).

	FB Friends ¹	Time on FB ¹	BFAS ¹	FIS ¹	ATS ¹	FB Friends ²	Time on FB ²	BFAS ²	FIS ²	ATS ²
FB Friends ¹	-									
Time on FB ¹	.11	-								
BFAS ¹	.15**	.26**	-							
FIS ¹	.09	.23**	.42**	-						
ATS ¹	.13*	.17**	.42**	.35**	-					
FB Friends ²	.98**	.42**	.23**	.97**	.17*	-				
Time on FB ²	.25**	.69**	.19*	.41**	.25**	.28**	-			
BFAS ²	.20*	.24**	.82**	.25**	.19*	.20*	.29**	-		
FIS ²	.96**	.52**	.26**	.98**	.21*	.98**	.45**	.24**	-	
ATS ²	.11	.22**	.28*	.17*	.80**	.13	.24**	.26**	.17	-

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

Key:

BFAS¹ = Bergen Facebook Addiction Scale at Time 1

FIS¹ = Facebook Intensity Scale at Time 1

ATS¹ = Addictive Tendencies Scale at Time 1

FB Friends¹ = Total number of Facebook Friends at Time 1

BFAS² = Bergen Facebook Addiction Scale at Time 2

FIS² = Facebook Intensity Scale at Time 2

ATS² = Addictive Tendencies Scale at Time 2

FB Friends² = Total number of Facebook Friends at Time 2

Time on FB¹ = Average time spent on Facebook per day at Time 1

Time on FB² = Average time spent on Facebook per day at Time 2

Table 3. Factor Loadings, employing CFA, for The Bergen Facebook Addiction Scale (N = 308).

Item No.	Statements	Factor Loadings (λ)		
		Whole	Male	Female
1	Spent a lot of time thinking about Facebook.	.50	.66	.42
5	Felt an urge to use Facebook more and more.	.64	.65	.65
7	Used Facebook to forget about personal problem.	.63	.63	.66
11	Cut down on the use of Facebook without success.	.73	.74	.76
13	Restless if prohibited from using Facebook.	.61	.61	.64
16	Negative impact on your job/studies.	.64	.66	.64

Table 4. Factor Loadings, employing CFA, for The Facebook Intensity Scale (N = 308).

Item No.	Statements	Factor Loadings (λ)		
		Whole	Male	Female
1	Facebook is part of my everyday activity.	.72	.74	.70
2	I am proud to tell people I'm on Facebook.	.46	.48	.43
3	Facebook has become part of my daily routine.	.82	.82	.81
4	Out of touch when haven't logged onto Facebook.	.54	.58	.52
5	I feel I am part of the Facebook community.	.56	.56	.55
6	I would be sorry if Facebook shut down.	.45	.47	.41

Table 5. Factor Loadings, employing CFA, for The Addictive Tendencies Scale (N = 308)

Item No.	Statements	Factor Loadings (λ)		
		Whole	Male	Female
1	I often think about social network sites.	.63	.63	.63
2	I often use social networking sites.	.62	.62	.63
3	Arguments have arisen with others.	.63	.62	.64
4	I interrupt whatever else I am doing to check.	.51	.51	.55
5	I feel connected to others.	.48	.49	.47
6	I lose track of how much I am using sites.	.30	.29	.29
7	Unable to use social networking websites/distressed	.30	.29	.28
8	Unable to reduce my social networking website.	.39	.41	.39

Table 6. Model fit indices of CFAs, for The Bergen Facebook Addiction Scale, The Facebook Intensity Scale, and The Addictive Tendencies Scale (N = 308)

Scale	Models	$\chi^2(df)$	<i>p</i>	CFI	TLI	IFI	RMSEA	<i>p</i> -close	$\Delta\chi^2$			
									$\Delta\chi^2(df)$	<i>p</i>	Δ CFI	Δ RMSEA
BFAS	Default	13.65(9)	.14	.99	.98	.99	.04	.59	-	-	-	-
	Configural	22.41(18)	.21	.99	.98	.99	.03	.84	-	-	-	-
	Metric	27.51(24)	.28	.99	.98	.99	.03	.89	5.10(6)	.53	-.002	.006
	Scalar	30.73(30)	.43	1.00	1.00	1.00	.01	.98	8.31(12)	.78	-.008	.019
FBIS	Default	77.88(9)	.00	.86	.68	.86	.16	.00	-	-	-	-
	M1	17.56(6)	.01	.98	.92	.98	.08	.11	-	-	-	-
	Configural	35.63(12)	.00	.95	.84	.96	.08	.05	-	-	-	-
	Metric	40.40(18)	.00	.96	.90	.96	.06	.18	4.77(6)	.57	-.003	.016
	Scalar	43.24(24)	.01	.96	.93	.96	.05	.43	7.61(12)	.83	-.009	.029
ATS	Default	79.70(20)	.00	.84	.72	.85	.10	.00	-	-	-	-
	M1	31.24(17)	.02	.96	.92	.96	.05	.41	-	-	-	-

Measures of “Facebook engagement and/or addiction” 31

Configural	50.90(34)	.03	.96	.91	.96	.04	.74	-	-	-	-
Metric	56.80(42)	.06	.96	.93	.96	.03	.89	5.90(8)	.66	-.006	.006
Scalar	68.41(49)	.04	.95	.92	.95	.04	.88	17.51(15)	.29	.007	.004

BFAS: Bergen Facebook Addiction Scale, ATS: Addictive Tendencies Scale, FIS: Facebook Intensity Scale

Default: CFA for proposed structure of the scale

M1: Addition of residual covariances in default model