



Research article

Psychometric assessment of the Bangla version of the Bergen Social Media Addiction Scale

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ABSTRACT

Recently, researchers have raised their concern about problematic engagement in social media use that significantly impacted users' mental health and daily lives. Therefore, it is important to have a psychometrically sound assessment tool to assess social media addiction. The present study aimed to assess the reliability and validity of the Bangla version of the Bergen Social Media Addiction Scale (BSMAS) for assessing social media addiction among young Bangladeshi adults. In this study, we utilized secondary data that contained information from 577 Bangladeshi university students. Exploratory factor analysis explored a single latent factor, and confirmatory factor analyses supported this structure. Discrimination indices of items in both classical test theory (CTT) and item response theory (IRT) approach suggested that items could discriminate between low scorers and high scorers in this scale. This scale has good internal consistency, composite, and IRT reliability. Multigroup CFA and differential item functioning bias results suggested this scale would be assessed the same construct across gender and usage duration groups (5 h and more vs less than 5 h). Network analysis results suggested relapse following salience as the core symptoms of social media addiction among young Bangladeshi adults. Overall, results suggested the Bangla BSMAS as a psychometrically sound tool to assess symptoms of social media addiction among young Bangladeshi adults. This scale has practical utility to mental health practitioners as this scale provides information about the core symptoms of social media addiction.

1. Introduction

Over the last decade, social media are becoming an important part of our daily activities. Since there are several online platforms (i.e., Twitter, Facebook, Instagram, etc.), one can open public and private profiles by themselves (Kuss and Griffiths, 2011). Moreover, users can contact their real-life friends, share pictures and videos, play online games, etc (Allen et al., 2014; Griffiths, 2015). Griffiths (2000) reported that excessive use of social media (social networking, online gaming) is responsible for developing problematic or addictive behavior among users. Although there is the formal acceptance of behavioral addiction for some behaviors (i.e., gambling disorder and internet gaming disorder), some researchers have contravention to figure out problematic social media use as an addiction (Vaghefi and Lapointe, 2014). Behavioral addiction can be defined as the ingestion of and dependence on psychoactive drugs that differs entirely from the traditional definition of addiction (Charlton and Danforth, 2007). However, the possibility of developing social media addiction is denoted as a type of internet addiction (Griffiths, 1999)

characterized by uncontrolled usage of social media, which adversely affects the everyday life of users (Andreassen and Pallesen, 2014).

Problematic engagement in social sites is often referred to as social media addiction. It causes significant disruption in social and daily life activities (Griffiths et al., 2014). Addicted social media users showed complete behavioral and psychological dependency on social media that they try to conceal from others. Concerning such problematic behaviors, people usually experience several interpersonal problems in offline, physical, and psychological discomforts when trying to withdraw themselves from excessive use of social media (Griffiths et al., 2014).

In many social and personal areas, detrimental impacts were evident due to problematic social media use (Hormes et al., 2016; Ryan et al., 2014; Steers et al., 2014; Wu et al., 2013). Studies have suggested a significant negative relationship between Facebook use and poor psychological well-being (Rahman and Ahmed, 2018) and Facebook addiction to users' self-esteem (Rana et al., 2016). Similar findings extracted from other studies reported that self-esteem has a negative association with social media addiction, whereas anxiety, depression,

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loneliness, and stress showed a positive association with social media addiction (Atroszko et al., 2018; Hawi and Samaha, 2017; Primack et al., 2017; Shensa et al., 2017; Vanman et al., 2018). Studies have also suggested social media addiction is related to lower self-control (Cerniglia et al., 2019), poor time management capacity, emotional symptoms, hyperactivity, and reduced social behavior (Cao et al., 2007). In addition, an individual's personality is also responsible for predicting different patterns of engagement in social media (Ahmed et al., 2022; Andreassen et al., 2012, 2013; Hong et al., 2014; Wilson et al., 2010).

Due to considerable risks and detrimental health consequences (Brailovskaia and Margraf, 2017) of excessive social media use, it is often recommended that social media addiction need to be assessed primarily to potentially suggest immediate and potential interventions (Ryan et al., 2014). Research has already focused on developing theoretically sound and psychometrically robust tools to assess social media addiction. For example, the Bergen Facebook Addiction Scale (BFAS; Andreassen et al., 2012), the Facebook Intrusion Questionnaire (FIQ; Elphinston and Noller, 2011), the Internet Gaming Disorder Scales-Short Form (IGDS-SF9; Pontes et al., 2016), the Smartphone Application-Based Addiction Scale (SABAS; Csibi et al., 2016), the Bergen Social Media Addiction Scale (BSMAS; Andreassen et al., 2016), etc. The present study aimed to assess the psychometric properties of the BSMAS to assess social media addiction among young Bangladeshi adults.

In the BSMAS, Andreassen et al. (2016) replaced 'social media' instead of 'Facebook' in the BFAS. The BFAS was developed to assess six basic addiction symptoms (salience, mood modification, tolerance, withdrawal, conflict, and relapse) suggested by Brown (1993) and Griffiths (1996). The BFAS, having the single factor structure, has good internal consistency reliability ($\alpha = .83$) and test-retest reliability (.82). Scores on this scale are associated with scores for the Addictive Tendencies Scale (Wilson et al., 2010), the Facebook Attitudes Scale (Ellison et al., 2007), and the Online Sociability Scale (Ross et al., 2009). The BFAS scores have a positive association with neuroticism and extraversion, and a negative association with conscientiousness. Besides, high scores on this scale go to bed lately and also rise lately. The BFAS contains six items. Each item assesses six core symptoms of addictive behavior. Andreassen et al. (2016) utilized the BFAS to assess social media addiction. For this purpose, they defined social media in the instructions for participants as 'Facebook, Twitter, Instagram, and the like' and replaced 'social media' instead of 'Facebook'. This scale was validated in several languages and cultures (i.e., Italian [Monacis et al., 2017], Persian [Lin et al., 2017], Greek [Dadiotis et al., 2021], etc.). Best to the authors' knowledge, the reliability and validity of the BSMAS are not examined yet in Bangladesh culture for assessing social media addiction among Bangladeshi people. Recently, several researchers utilized this scale to assess problematic social media use among Bangladeshi social media users (i.e., Ahmed et al., 2021, 2022; Islam et al., 2021, etc.). However, they did not assess the psychometric properties of this scale in detail. They reported internal consistency reliability and model fits of the Confirmatory factor analysis (CFA). It is important to know the psychometric details (e.g., factor structure, item difficulty and discrimination, invariance across different groups, reliability, validity, etc.) of a scale before utilizing it for a population. Therefore, the present study aimed to explore the psychometric properties of the Bergen Social Media Addiction Scale for Bangladeshi people, especially young adults. In this study, we assessed the psychometric properties of this scale utilizing both classical test theory (CTT) and item response theory (IRT) approaches. In addition, we assessed psychometric properties utilizing network analysis.

Classical test theory (CTT) and item response theory (IRT) are two commonly utilized approaches in test development and validation. The CTT focuses on the raw score as a whole that is obtained in a test or scale and treats all items of this scale or test as parallel. In CTT, the observed score is the sum of the true score and random error. The standard error of a measure is consistent across the population. In CTT, a longer test is more reliable. Item statistics (i.e., item difficulty, etc.) depend on the representativeness of the sample from the population. Test or scale properties

change with response options changes (e.g., from a five-point Likert-type scale to a nine-point Likert-type scale). The IRT is a new approach compared to CTT and has flourished with modern computer programming. The IRT focuses on response patterns to items of the test or scales and treat all items are not parallel. IRT models assume that "there is a linkage between a response to any item on a test and the characteristic being assessed by the test" (Kline, 2005, p. 108). In IRT, the error of measurement is not the same at all test score levels. Here, actual neutral response categories of the scale or test (i.e., 'neither agree nor disagree' response option in a five-point or seven-point, or nine-point Likert-type scale) can be determined. None of the models are superior to each other. Using both approaches simultaneously complements each other and provides more detailed information about the psychometric properties of a scale or test.

1.1. Objectives of the study

The main objective of the present study was to assess the psychometric properties of the Bergen Social Media Addiction Scale for Bangladeshi people. Specific objectives were the following –

- i) To assess the factor structure of the scale;
- ii) To assess item discrimination using both CTT and IRT approaches;
- iii) To assess the internal consistency reliability;
- iv) To assess invariance of the scale and items across gender and users who use social media less than five hours and use social media five hours or more;
- v) To assess the concurrent and convergent validity of the scale;
- vi) To assess the network structure of the scale.

2. Method

2.1. Participants

We utilized the data from the project titled 'Social Media Addiction among University Students: Role of Personality Traits, Social Need for Belongingness, Social Anxiety, and Loneliness' in this study. The sample ($n = 704$) of this project was university students recruited through the purposive sampling technique. The data were collected from students of two public universities in Bangladesh who were selected through the convenience sampling technique. The only inclusion criterion for the participants was that participants must use any social media for one year or more. In this project, the participants were interviewed using a structured questionnaire that took approximately 25–30 min to be completed. They received a wooden key ring as a token gift in exchange for participating in the survey. This project was carried out following the Declaration of Helsinki and its later amendments or comparable ethical standards. The present study included responses from 577 students. We excluded missing data ($n = 127$) from the project data. Participants' age mean was 20.95 years (standard deviation = 1.92 years). Participants' personal information is presented in Table 1.

2.2. Measures

2.2.1. Bergen Social Media Addiction Scale (BSMAS)

The BSMAS was adapted from the Bergen Facebook Addiction Scale (BFAS; Andreassen et al., 2012; Ahmed and Hossain, 2018 [Bangla version]) by replacing the word 'Facebook' with the words 'social media'. This six-item scale (i.e., "You spend a lot of time thinking about social media or planning how to use it") assesses six addiction symptoms. Participants rated their responses utilizing a five-point Likert-type scale, ranging from 'very rarely' to 'very often'. Total scores range between 6 and 30. Higher scores suggested being prone to addictive social use.

2.2.2. UCLA Loneliness Scale- Short Form

The UCLA Loneliness Scale – Short Form (Russell 1996; Bangla version: Ahmed, 2019) is an eight-item measure that assesses subjective

Table 1. Participants' distribution of the present study.

Variable	Group	Percentage/Mean (SD)
Gender	Male	61.9%
	Female	38.1%
Academic year	First year	34%
	Second year	20.7%
	Third Year	23.6%
	Fourth Year	16%
	Masters	5.7%
Residence type	With family	35.4%
	Private house (Mess)	40.8%
	University residence	23.8%
Family type	Nuclear	78.6
	Extended	21.4%
Favorite social media	Facebook	84.7%
	WhatsApp	4.9%
	Others	10.4%
Social media usage duration		3.41 (2.01)

feelings of loneliness. In this study, participants rated responses to each item (i.e., "How often do you feel that you lack companionship?", etc.) utilizing a four-point Likert-type scale, ranging from 'never' to 'always'. The total score ranges between 8 and 32. The higher scores suggest a higher level of subjective feelings of loneliness. In this study, only five items had acceptable corrected item-total correlation ($\geq .30$; Field, 2017). We excluded the rest of the three items from the analysis. This revised scale had acceptable internal consistency reliability in this study ($\alpha = .718$, $\omega = .724$). Confirmatory factor analysis results suggested good model fits of this scale ($\chi^2 = 4.646$, $df = 5$, $p = .461$, $CFI = 1.00$, $GFI = .999$, $RMSEA = .000$). Factor loadings ranged between .448 and .682. The average variance extracted was .343.

2.2.3. Social connectedness scale

The Social connectedness scale (Lee and Robbins, 1995; Bangla version: Alam and Ahmed, 2019) is an eight-item (i.e., "I feel so distant from people.", etc.) measure that assesses emotional distances between self and others. In the present study, participants rated their responses utilizing a six-point Likert-type scale, ranging from 'Strongly Agree' to 'Strongly Disagree'. Total scores ranged between 8 and 48. Higher scores suggested higher levels of social disconnectedness. This scale had good internal consistency reliability in this study ($\alpha = .829$, $\omega = .832$). Confirmatory factor analysis results suggested good model fits of this scale ($\chi^2 = 54.559$, $df = 20$, $p < .001$, $CFI = .954$, $GFI = .990$, $RMSEA = .055$). Factor loadings ranged between .461 and .720. The average variance extracted was .403.

2.2.4. Social anxiety scale - Short Form

The Social anxiety scale – Short Form (La Greca and Lopez, 1998; Bangla version: Alam et al., 2021) is a 12-item scale that assesses social anxiety symptoms. This scale has three subscales, and each subscale contains four items (i.e., "I worry what others say about me", "I get nervous when I meet new people", "I feel shy even with peers I know very well", etc.) in each subscale. In the present study, participants rated their responses utilizing a five-point Likert-type scale, ranging from 'totally not applicable for me' to 'totally applicable to me'. Total scores range from 0 to 48. Higher scores indicate a higher level of social anxiety. This scale had good internal consistency reliability in this study ($\alpha = .829$, $\omega = .830$). Confirmatory factor analysis results suggested good model fits of this scale ($\chi^2 = 57.361$, $df = 41$, $p = .046$, $CFI = .996$, $GFI = .994$, $RMSEA = .026$). Factor loadings ranged between .345 and .761. The average variance extracted by each factor ranged between .434 and .544.

In addition to the questionnaire mentioned above, participants were asked to report "how many hours you spent on social media daily?"

Besides, the study questionnaire included questions about socio-demographic variables (i.e., age, gender, academic year, residence type, the family type where you were brought up, etc.).

2.3. Statistical analysis

The psychometric properties of the Bangla version of the BSMAS were assessed through classical test theory (CTT), item response theory (IRT), and network analysis. Under CTT, item analysis (corrected item-total correlation ($\geq .30$; Field, 2017), internal consistency reliability (Cronbach's alpha, McDonald's omega, and Split-half reliability [$\geq .7$; Nunnally, 1978]), etc.), exploratory factor analysis (EFA), parallel analysis, confirmatory factor analysis (CFA), and multi-group confirmatory factor analysis (MGCFA) were run. The data were split into two halves randomly, and EFA was run on one and CFA was run on another data set. Before running EFA, determinant value ($> .0001$; Yong and Pearce, 2013), Kaiser-Meyer-Olkin [KMO] value ($> .60$; Hair et al., 2010), and Bartlett's test of sphericity value (significant; Hair et al., 2010) were estimated to assess the suitability of the data for EFA. Parallel analysis was run based on the reduced correlation matrix. In EFA, model fits were assessed through Tucker Lewis Index [TLI] ($\geq .90$), root mean square error of approximation [RMSEA] ($\geq .08$), etc (Hu and Bentler, 1998). In CFA, model fits were assessed through comparative fit index [CFI] ($\geq .90$), TLI ($\geq .90$), RMSEA ($\geq .08$), and standardized root mean squared residual [SRMR] ($\geq .08$) (Hu and Bentler, 1998). In MGCFA, $\Delta\chi^2$ and ΔCFI across models (configural > metric > scalar > strict) were utilized to assess the measurement invariance of the tool. Chen (2007) recommended $\Delta CFI \geq .010$ as evidence of measurement invariance. Under IRT, the Graded response model (GRM) was applied. In GRM, item fits, slope, and threshold parameters were estimated. Besides, differential item functioning (DIF) bias of items, IRT reliability, and Rho coefficient were also calculated. EFA, CFA, MGCFA, GRM, and DIF were run through RStudio.

In the network analysis, the Association between items (edges weights), the accuracy of the edge weights [estimated through non-parametric bootstrap method], standardized estimates of centrality indices (betweenness, closeness, and strength), and stability of centrality indices [estimated through case-drop bootstrap method] were calculated. Among centrality measures, we utilized strength as the measure of centrality in this study. The cut-off of stability of strength is .7 (Gomez et al., 2021). Item analysis and network analysis were run through JASP. Besides, IBM SPSS v26 and Microsoft Excel 365 were utilized for data management.

2.4. Ethics

This study was approved the Ethical Review Committee, Department of Psychology, University of Chittagong, Bangladesh (ERB-PSY-CU-54-2021).

3. Results

Table 2 presents the item-level psychometric properties of BSMAS. Table 2 shows that skewness (ranging between -.018 and .144) and kurtosis (ranging between -.764 and -.426) values are between the recommended ranges suggested by Kim (2013); < 2 for skewness and < 7 for kurtosis). Table 2 shows factor loadings of the items obtained through both EFA and CFA. Determinant value (.193), Kaiser-Meyer-Olkin [KMO] value (.850), and Bartlett's test of sphericity value (469.345, $p < .001$) suggest the suitability of the data for exploratory factor analysis (EFA) (Table 3). Parallel analysis with the 95% threshold based on the reduced correlation matrix suggests a single-factor structure (Reduced eigenvalue = 1.338, 95% random reduced eigenvalue = .308). In EFA, all the items clustered into a single factor (Eigenvalue = 3.08, Variance = 51.40; Table 3). Model fits TLI = .977, RMSEA = .049) of the EFA suggest a good fit of this single factor structure of the Bangla version of the BSMAS.

Table 2. Item-level information of the Bangla version of the Bergen Social Media Addiction Scale.

Items	M	SD	Skewness	Kurtosis	CITC	Factor loading		Slope (α)	Threshold			
						EFA	CFA		b ₁	b ₂	b ₃	b ₄
Item 1	2.80	.99	.099	-.426	.569	.631	.685	1.586	-1.986	-.410	1.056	2.579
Item 2	2.76	1.00	.108	-.496	.533	.590	.617	1.430	-2.007	.336	1.144	2.815
Item 3	2.65	1.09	.092	-.764	.558	.615	.659	1.517	-1.383	-.191	1.095	2.704
Item 4	2.79	1.14	.104	-.721	.570	.710	.584	1.600	-1.528	-.360	.895	2.110
Item 5	2.69	1.04	.144	-.469	.526	.607	.575	1.415	-1.713	-.263	1.265	2.710
Item 6	3.11	1.15	-.018	-.726	.604	.714	.674	1.844	-1.906	-.701	.503	1.462

M = mean, SD = standard deviation, CITC = corrected item-total correlation, EFA = exploratory factor analysis, CFA = confirmatory factor analysis.

Table 3. Scale-level information of the Bangla version of the Bergen Social Media Addiction Scale.

Psychometric properties	Scores	Suggested cut off
Mean inter-item correlation	.405	Between .15 and .50
Cronbach's alpha	.803	$\geq .7$
McDonald's Omega	.805	$\geq .7$
Split-half reliability (odd-even)	.794	$\geq .7$
Composite reliability	.811	$\geq .7$
Standard error of measurement	2.022	Smaller than SD (4.556)/2
Rho coefficient	.810	$\geq .7$
IRT reliability	.803	$\geq .7$
Results of exploratory factor analysis		
Determinant	.193	$> .0001$
Kaiser-Meyer-Olkin (KMO) measure of sample adequacy	.850	.50
Bartlett's test of sphericity	469.345 (<.001)	Significant
Eigen value	3.08	1 or above
Variance	51.40	
Model fits of confirmatory factor analysis		
χ^2 (df, p value)	6.617 (9, .677)	Nonsignificant
Comparative fit index (CFI)	1.000	$> .95$
Tucker Lewis Index (TLI)	1.007	$> .95$
Root mean square error of approximation (RMSEA)	.000	$< .08$
Standardized root mean squared residual (SRMR)	.035	$< .08$

Factor loadings of items in EFA ranged between .590 and .714. Confirmatory factor analysis (CFA) results showed that the single factor structure of the Bangla version of the BSMAS had good model fits ($\chi^2 = 6.617$, $df = 9$, $p = .677$, $CFI = 1.000$, $TLI = 1.007$, $RMSEA = .000$, $SRMR = .035$). Factor loadings in CFA range between .575 and .685. Figure 1 shows the factor structure of the Bangla version of the BSMAS.

Table 2 also presents the graded response model outputs (slope and threshold parameters). Supplementary Table 1 shows that the p -values of all the items are non-significant at .05 except for item 1. If we determine the significance level at .01, all p -values are non-significant. This result suggested that all items belong to the Bangla version of the BSMAS. In Table 2, slope parameters are ranged between 1.415 and 1.844 (mean $\alpha = 1.565$). All the slope parameters are high except item 6. The slope parameter of item 6 is very high. This result suggested that all items efficiently assess the latent trait assessed by the Bangla version of BSMAS. Threshold parameters (Table 2) suggested that an above-average latent trait or theta is required to endorse response options 'often' and 'always'. Threshold characteristics curves (Figure 2) and scale information curves (Figure 3) provide a clear picture. The scale information curve suggests

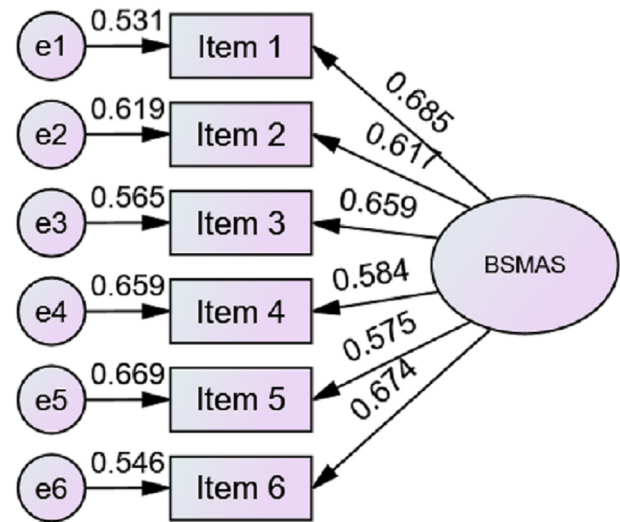


Figure 1. Factor structure of the Bangla of Bergen Social Media Addiction Scale.

that this scale is more efficient and provides good information about people between -2.5 and 3.5 theta levels.

Table 2 also shows that corrected item-total correlations of items are between .526 and .604. These values are also above the recommended cut-off ($\geq .4$). Table 3 presents scale-level information of the Bangla version of the BSMAS. This scale has good internal consistency reliability ($\alpha = .803$, $\omega = .805$, and split-half reliability [odd-even] = .794). Mean inter-item correlation (.405) is also between the recommended range (.15 -.50). Composite reliability (.859), Rho coefficient (.810), and IRT reliability (.803) are also above the recommended cut-off ($\geq .7$). The standard error of measurement (SEM) score (2.022) is also below half of the standard deviation (4.556).

Multi-group confirmatory factor analysis results in Supplementary Table 2 show strict invariance between males and females ($\Delta CFI = 0$), and between those who use social media for less than 5 h and those who use social media for 5 h or more ($\Delta CFI = -.003$). Supplementary Table 3 and Supplementary Figures 1-4 present differential item functioning (DIF) information of the Bangla BSMAS through likelihood ratio. Non-significant p -values suggested the absence of DIF bias between males and females and between users using social media for less than five hours and users using social media for five hours or more. Supplementary Figure 1 displays DIF information between threshold levels, and Supplementary Figure 2 displays DIF information at scale level between males and females. Similarly, Supplementary Figure 3 displays DIF information between threshold levels. Supplementary Figure 4 displays DIF information at scale level between users who use social media for less than five hours and use social media for five hours or more.

Table 4 shows moderate positive correlation between social media usage duration and the Bangla BSMAS scores ($r = .311$, $p < .001$, 95% CI

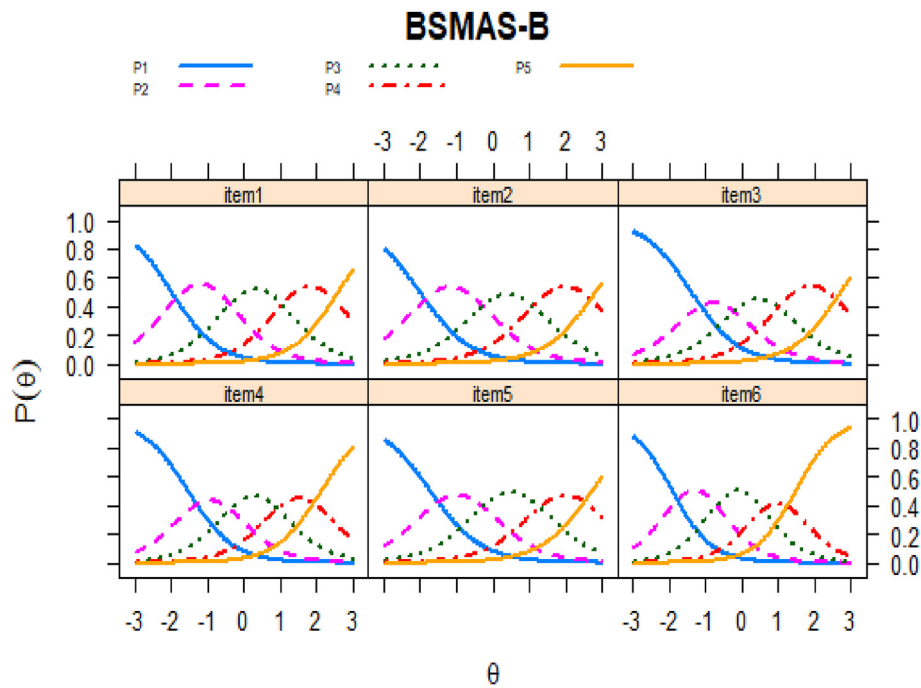


Figure 2. Threshold curves of items of the Bangla BSMAS.

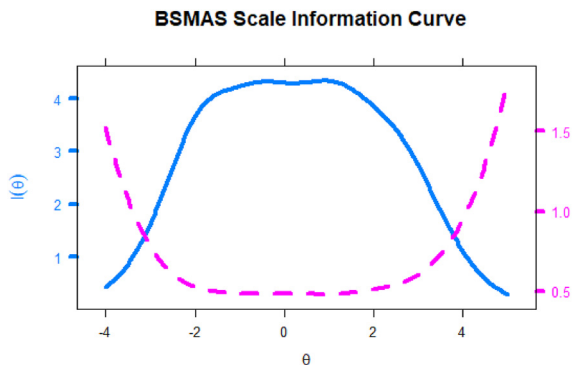


Figure 3. Scale information curve of the Bangla BSMAS.

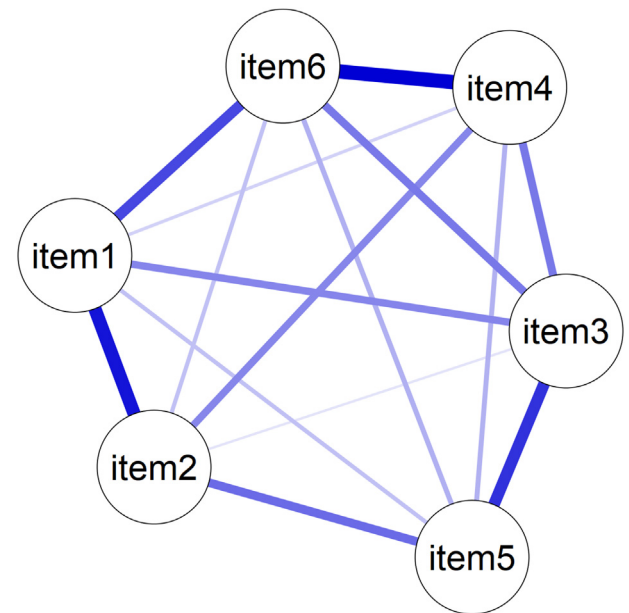


Figure 4. Network of items of the Bangla BSMAS.

Table 4. Correlation coefficients of the Bangla BSMAS scores with social media usage duration, Big-Five personality traits, social connectedness, loneliness, and social anxiety.

Variables	Correlation coefficient
Social media usage duration	$r = .311, p < .001, 95\% \text{ CI } [.235, .383]$
Social connectedness	$r = .161, p < .001, 95\% \text{ CI } [.080, .240]$
Loneliness	$r = .403, p < .001, 95\% \text{ CI } [.332, .469]$
Social anxiety	$r = .234, p < .001, 95\% \text{ CI } [.155, .309]$

[.235, .383]). The Bangla BSMAS scores also have positive correlation with social connectedness ($r = .161, p < .001, 95\% \text{ CI } [.080, .240]$), loneliness ($r = .323, p < .001, 95\% \text{ CI } [.248, .395]$), and social anxiety ($r = .234, p < .001, 95\% \text{ CI } [.155, .309]$).

Figure 4 shows the network of the six symptoms of social media addiction that the BSMAS assessed. In this Figure, all the blue edges suggest that all nodes (items) are positively associated with each other. Table 5 demonstrates the weights matrix between nodes (items of the Bangla BSMAS). However, all the edges are significant but not the same in effect size. Edges between item 1 and item 2 (.299), item 1 and item 6 (.234), item 3 and item 5 (.261), and item 4 and item 6 (.324) have

moderate effect sizes. The rest of the edges have a smaller effect size. Supplementary Figure 5 shows the accuracy of the edge weights (estimated through the non-parametric bootstrap method). Here, six

Table 5. Weights matrix of items of the Bangla BSMAS from the network analysis.

Variable	item 1	item 2	item 3	item 4	item 5	item 6
item 1	0.000					
item 2	0.299	0.000				
item 3	0.156	0.036	0.000			
item 4	0.057	0.154	0.172	0.000		
item 5	0.079	0.188	0.261	0.098	0.000	
item 6	0.234	0.079	0.170	0.324	0.101	0.000

Table 6. Centrality indices the Bangla BSMAS from the network analysis.

Variable	Betweenness	Closeness	Strength	Expected influence
item 1	0.000	0.952	0.342	0.342
item 2	0.000	-0.064	-0.744	-0.744
item 3	1.581	0.518	-0.108	-0.108
item 4	-1.581	-0.220	0.048	0.048
item 5	0.000	-1.832	-1.220	-1.220
item 6	0.000	0.645	1.681	1.681

estimated edge-weights (item 5 – item 6, item 4 – item 5, item 2 – item 6, item 1 – item 5, item 1 – item 4, and item 2 – item 3) include zero. While interpreting these edge-weights, potential users need to be cautious. The rest of the edge weights do not have zero, which suggests good precision for these edge weights.

We assessed the stability of centrality indices (betweenness, closeness, and strength) before estimating the centrality of items (using the case-dropping bootstrap method). Supplementary Figure 6 displays the stability of centrality indices. This Figure shows the correlation stability coefficient for all the centrality indices from subsets of data representing 95%–25% of the overall sample. There is a large drop in the correlation between subsample estimates and the estimates from the original sample. However, none of the indices' stability dropped below .5. The stability of the strength is approximately .7 for a decrease of the sample from 95% to 25%. Therefore, we assessed the centrality of items using strength only. Overall, Supplementary Figure 6 suggests the stability of centrality indices, especially strength. Table 6 demonstrates the standardized estimates of the centrality indices, and Figure 5 displays these centrality measures. Both Table 6 and Figure 5 show that item 6 has the highest strength centrality value (descending order), and item 5 has the lowest. Therefore, item 6 has more relative importance in the network compared to other items of the Bangla BSMAS.

4. Discussion

The psychometric properties of the Bergen Social Media Addiction Scale (BSMAS) for assessing social media addiction among young Bangladeshi adults is still unassessed. Therefore, this study aimed to assess the reliability and validity of the Bangla version of the BSMAS. Exploratory factor analysis explored that all six items clustered into one factor, and confirmatory factor analysis results confirmed it. Studies that have assessed factor structures of the scale in different cultures also explored the single-factor structure (i.e., Lin et al., 2017 [Persian version]; Monicas et al., 2017 [Italian version], etc.). Results also explored that the Bangla version of the BSMAS had good item discrimination indices (corrected item-total correlations). These discrimination indices suggested that scale items can differentiate between low scorers and high scorers on this scale. The Persian BSMAS (Lin et al., 2017) also had good item discrimination indices. Results showed that this scale had good internal consistency reliability. Other studies that utilized this scale or validated this scale also reported good internal consistency (i.e., Andreassen et al., 2016; Bányai et al., 2017; Monicas et al., 2017, etc.). Similar to Persian (Lin et al., 2017) and Italian versions (Monicas et al., 2017), the Bangla version of the BSMAS had acceptable average variance, composite reliability, and standard error of measurement.

One of the major strengths of this study is that the psychometric properties of the Bangla version of the BSMAS were assessed through an IRT model (graded response model). This model is suitable for the Likert-type scale and provides information about how Likert-type response options are performing. Item fit values suggested that all the items belong to the latent construct assessed by these items. All the items had high slope parameters and moderately difficult items. The Bangla version of this scale efficiently assessed social media addiction among people ranging between -2.5 and 3.5 theta or latent trait level. Threshold characteristics curves suggested no overlapping between Likert-type response options and five-point response options is suitable for the Bangla version of this scale. In a recent study, Stanculescu (2022)

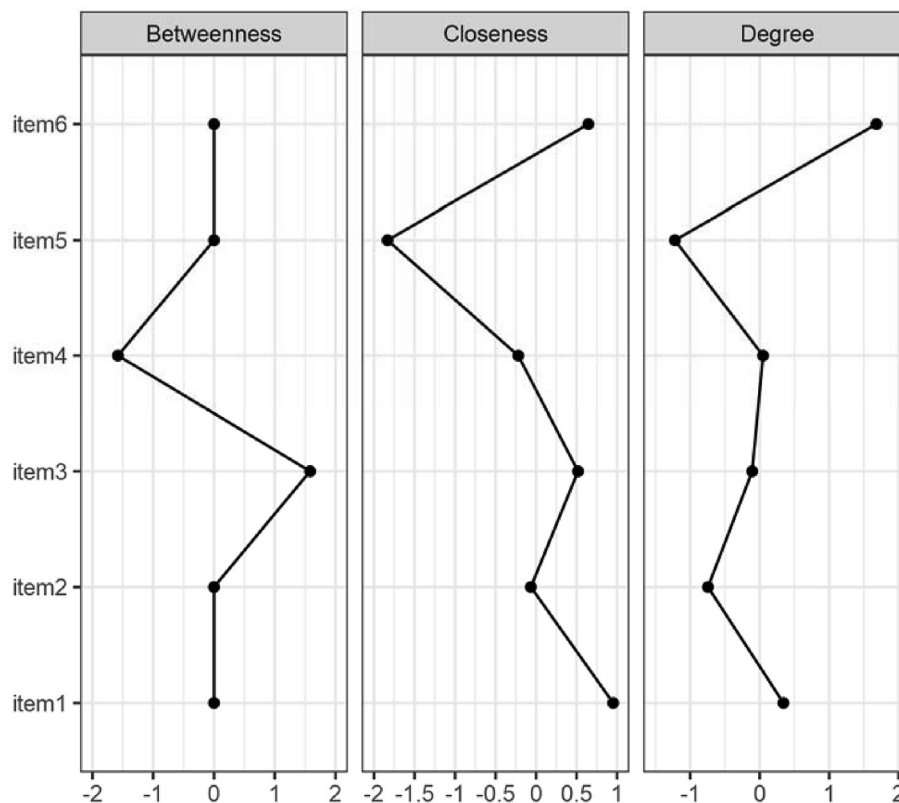


Figure 5. Centrality Plots (Betweenness, Closeness, and Degree/strength) in the Network for the Association in the Network of Each Node of the Bangla BSMAS.

assessed the psychometric properties of Romanian BSMAS through GRM. The Romanian BSMAS (Stanculescu, 2022) had higher discrimination and difficulty indices than Bangla BSMAS. Another strength of this study is that IRT reliability was estimated. The Bangla version of the BSMAS had good IRT reliability. This reliability is different from most used internal consistency reliability in classical test theory approaches (i.e., alpha, omega, etc.). This reliability is the ratio between explained variance and error in the response patterns (Kim and Feldt, 2010; Sireci et al., 1991).

Multi-group CFA results showed strict measurement invariance of this scale between males and females, and users use social media for five hours or more and use less than five hours. These invariance results suggested that this scale assesses the same construct across gender and usage duration (Using social media for 5 h or more vs using social media for less than 5 h). The Persian BSMAS (Lin et al., 2017) had scalar level invariance, and the Italian BSMAS (Monicas et al., 2017) had metric level invariance between males and females. DIF results show the absence of DIF bias in both item level and scale level across gender and usage duration. This result about DIF is consistent with Lin et al. (2017) study that reported no DIF contrast among items of the Persian BSMAS. Both measurement invariance and DIF results suggested the efficiency and utility of this scale to assess social media addiction among different groups of Bangladeshi young social media users. This scale would perform the same across gender and users classified by usage duration.

Low to moderate correlations (both positive and negative) of the Bangla BSMAS with social connectedness, loneliness, and social anxiety suggest its concurrent validity. Besides, the moderate Association between social media usage duration and the Bangla BSMAS scores suggests its convergent validity. Other versions (i.e., Greek version [Dadiotis et al., 2021], Italian version [Monicas et al., 2017], Persian version [Lin et al., 2017], etc.) of the BSMAS also had both convergent and concurrent validity.

Another major strength of this study is the network analysis. This analysis has clinical implications. For example, this analysis can identify the core or central symptom in a psychopathological test or scale. In this study, the centrality result suggested relapse (item 6) as the core symptom of the social media addiction followed by salience (item 1). The stability of strength was approximately .7 which is the recommended value for the stability of centrality (Cohen, 1977). This stability of the centrality measures suggests the finding of the core symptom is reliable. However, Stanculescu (2022) reported salience (item 1) and withdrawal (item 5) as core symptoms. The stability of edge weights shows that only some low edge weights contains zero. The rest of the edge weights did not include zero. Therefore, findings of edge weights (Association between symptoms of social media addiction) can be considered reliable.

The present study has some practical utilities. Reliability and validity information about the Bangla version of the BSMAS suggests that this scale is a good assessment tool for assessing social media addiction among Bangladeshi young adults, especially university students. Researchers can use this scale to assess problematic social media use and its association with other variables. Besides utility in research, this study also has a clinical implication, although this study did not include a clinical sample. A variable with a high centrality value is highly influential among other variables in a network. Network analysis revealed relapse symptom as highly influential among the core six symptoms of social media addiction. This symptom is essential for understanding and managing social media addiction. Mental health professionals would consider this symptom as core while formulating intervention for the client having social media addiction.

4.1. Limitations and recommendations

First, the present study included data from university students only. Therefore, this finding may not generalise to other groups, especially less-educated groups in the age range. Second, the data of this study is self-rated that might be subjected to biases like social desirability bias,

etc. Third, there is no clinical sample in the data. Fourth, the cut-off score of this scale was not estimated in this study. Therefore, it would be difficult to identify social media dependence. We can only rely on high scores to indicate social media addiction. Several further studies with a representative sample of all ages and groups, including clinical samples, would be designed to overcome these limitations.

5. Conclusions

Despite these limitations, the present study suggested the Bangla version of the Bergen Social Media Addiction Scale as a reliable and valid psychological tool for assessing the social media addiction of young Bangladeshi adults. This scale will help mental health practitioners to assess social media addiction. Besides, this would help them to formulate the necessary interventions to reduce social media dependency and control problematic use of social media.

Declarations

Author contribution statement

Lutfun Naher: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

Fatema Akhter Hiramoni: Conceived and designed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Najifa Alam: Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Oli Ahmed: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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Data availability statement

Data will be made available on request.

Declaration of interests statement

The authors declare no conflict of interest.

Additional information

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