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Investigation of the Measurement Invariance of the Social Media Addiction Scale

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Abstract

This study aims to examine the measurement invariance of the Social Media Addiction Scale (SMAS) in terms of gender, time spent on social media accounts, and the number of social media accounts. Invariance analyses conducted within the scope of the research were carried out on 672 participants. Measurement invariance studies were examined separately for all measurement models presented in SMAS and for each sub-factor in the scale. As a result of the analyses, it was revealed that the psychometric properties obtained from the measurement model may show bias according to the relevant subgroups for the SMAS in cases where the model fits up to the configural and metric stages. A comparison of the scores obtained from this measurement tool can be made, but careful interpretation should be made, keeping in mind that the items may behave biasedly according to gender on an item basis. For the SMAS, it has been demonstrated that in cases where the model fits up to the configural, metric, and scalar invariance stages, comparisons of the psychometric properties obtained from the measurement model can be made without bias according to the relevant subgroups. In addition, in cases where scalar invariance is met, the scores obtained from the measurement tool can be compared, and comments can be made on an item basis according to the relevant subgroups. Finally, it could be stated that any comparison made according to the subgroups tested using the SMAS would be meaningless in cases where even configural invariance is not accepted.

Keywords: Measurement Invariance, Social Media Addiction Scale, Multiple Group Confirmatory Factor Analysis, Structural Equation Model (SEM)

Introduction

Interpersonal communication is the key to meeting humans' basic needs, such as belonging and establishing relationships. Interpersonal ways of communication have considerably changed along with the development of information technology in recent years, especially with the spread of internet-based social media networks (Facebook, Instagram, Twitter, etc.). Smith & Anderson, 2018; Hou, Xiong, Jiang, Song, & Wang, 2019). Being easily accessible and being able to access social media accounts from anywhere at any time brings about social media addiction, i.e., its excessive utilization affects and hinders other aspects of daily life (Griffiths, 2000). Before defining social media addiction, the concept of addiction needs to be explained. Addiction is defined as an individual's inability to survive without any object or action and to have control over it (TBM, 2015). Although social media addiction is not defined as a type of addiction in the DSM-V diagnostic criteria, it is considered one of the behavior-based addictions in the literature (Griffiths & Szabo, 2014; Kuss & Griffiths, 2011).

When one mentions addiction, chemical substances such as alcohol, cigarettes, and drugs come to mind first (Çakır, Horzum, & Ayas, 2013). In recent years, there have been behaviors that could be considered addictions in habits such as eating, shopping, the internet, mobile phones, and social media. Besides the substances that are physically taken into the body, there are also behavioral-based addictions (sex, internet, eating, games, television, etc.). Kim & Kim, 2002). Sussman (2012) identified 16 types of addiction based on substances taken into the body and behaviors (technology, gambling, drugs, internet, video games, shopping, eating, etc.) in his study. Research on social media addiction, which could be considered one of the behavior-based addictions, has been increasing in recent years (Özdemir, 2019; Çömlekçi & Başol 2019; Dijital, 2022a; Dijital, 2022b; Turel & Serenko, 2012; Şahin & Yağcı 2017).

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According to the Digital (2022a) Global World Report, social media users have increased by more than 10 percent in the last 12 months, with 424 million new users starting to use social media in 2021. However, according to the Digital (2022b) Turkey Report, there were 68.9 million social media users in Turkey in January 2022. At the beginning of 2022, the number of social media users in Turkey equaled 80.8 percent of the total population. It has been determined that the number of social media users in Turkey has grown by 8.9 million (14.8%) between 2021 and 2022. In addition, considering the daily rate of social media utilization at a global level, with two hours and 27 minutes a day, social media constitutes the largest share of internet utilization with a total of 35 percent. Time spent on social media has also increased by 1.4% per day compared to last year. As seen in the Digital Report (2022a), social media are the most used platforms in internet utilization. When the literature is examined, many studies have been conducted on social media utilization durations (Duman, 2022; Tutgun Ünal, 2015; Ehrenberg, Juckes, White, & Walsh, 2008; Karaiskos, Tzvellas, Balta, & Paparrigopoulos, 2010; Folaranmi, 2013) and the relationships between gender and social media addiction (Bayram Saptır, 2022; Turel Serenko, 2012; Wu, 2013; Tutgun Ünal, 2015; Göksu, 2019). However, few studies have examined the relationship between the number of social media applications and social media addiction (Tutgun Ünal, 2015). Marengo, Fabris Longobardi, and Settanni (2022) examined the relationship between the number of social media applications during the COVID-19 process, gender, time spent on social media, and social media addiction in their study and found that adolescents with more than one social media account (TikTok, WhatsApp, and YouTube) were more addicted. Therefore, conducting research on many sub-groups such as social media addiction, time spent on social media, the number of social media accounts (applications), gender, and education level gains significance.

In light of all this literature, the widespread use of social media and individuals' showing of addiction-like behaviors over time make it imperative to measure the concept of social media addiction and different subgroups (gender, number of applications (accounts), duration of use, purpose of use, etc.). Therefore, it is of primary importance to conduct measurement invariance studies of measurement tools used to measure social media addiction to obtain more reliable scientific results.

The measures obtained through the measurement may differ due to individual characteristics as well as the measurement tool (Vandenberg & Lance, 2000). Therefore, it is important to conduct measurement invariance studies in different subgroups (gender, socio-economic status, ethnicity, etc.) to comprehensively reveal the psychometric properties of the measurement tools developed to measure the characteristics subject to measurement. When deciding whether it can be accepted that the structure of a psychological variable functions in the same way between different sexes, countries, or cultures, the measurement invariance of the measurement tool developed to measure that psychological variable should be ensured. Here, it is assumed that a developed scale measures the same characteristic in all groups. However, the accuracy of comparisons and analyses made under this assumption is meaningful. As it is known, this characteristic is tried to be defined and discerned by comparing the averages in different subgroups with the scales developed to measure psychological variables. Unfortunately, definitions of structure in subgroups where measurement invariance has not been studied are a wasted effort.

Measurement invariance has gained significance with increasing momentum in recent years, especially in studies involving multi-group comparisons (Byrne, 2003). Although measurement invariance studies are significant in terms of multi-group comparisons, they are also critical in revealing the characteristic under measurement from a cultural perspective. In measurement invariance, the main thing is whether the measured construct has similar scope in different subgroups and whether it is interpreted in the same way.

After the definition of social media addiction as a behavior-based addiction (Griffiths & Szabo, 2014; Kuss & Griffiths, 2011; Sussman, 2012), different studies have been conducted abroad (Al-Menayes, 2015; Andreassen, Torsheim, Brunborg, & Pallesen, 2012; Liu & Ma, 2020; Stanculescu, 2022) and in our country on measuring social media addiction, and different measurement tools have been developed (Tutgun-Ünal & Deniz, 2015; Şahin & Yağcı, 2017; Taş, 2017; Şahin, 2018; Bakır Aygar & Uzun, 2018; Özgenel, Canpolat, & Ekşi,2019; Demirci, 2019). This research aimed to examine the "Social Media Addiction Scale" developed by Bakır Aygar and Uzun (2018) in terms of measurement invariance. This is because the measurement tool has sub-dimensions (control difficulty, deprivation, social isolation, and functional deterioration) that include the DSM-V diagnostic criteria. Therefore, for studies planned to measure social media addiction, conducting a measurement invariance study of this measurement tool before making comparisons in different groups is considered substantial in terms of making correct interpretations of the decisions taken regarding the comparisons in subgroups.

The absence of a measurement invariance study of social media addiction based on gender, time spent on social media, and the number of owned social media accounts, both in Turkey and abroad, makes this study significant. This study aimed to examine the decisions taken regarding the measurement invariance of the SMAS in terms of gender, time spent on social media accounts, and the number of social media accounts.

Method

2.1. Participants

This study included 690 participants. After examining the assumptions based on the analysis used within the scope of the study, the analyses were carried out with the remaining 672 observations. The distribution of 672 participants whose invariance analyses were conducted in this study is provided in Table 1.

Table 1. Demographic information of participants

Gender	Time spent on social media	Number of social media accounts
Female (358)	Less than 1 hour (81)	0–1 (8–76)
	1–2 hours (246)	2 (186)
Male (314)	2–4 hours (298)	3 (223)
	More than 4 hours (47)	4 and above (179)

2.2. Data Collection Tool

This study employed the SMAS developed by Bakır Aygar and Uzun (2018). The measurement tool consists of 26 items and three factors on a 5-point Likert-type scale. As a result of the exploratory factor analysis, of the three factors, "Functional Deterioration" alone accounted for 42.626% of the common variance, "control difficulty and Deprivation" alone accounted for 9.517% of the common variance, and "Social Isolation" alone accounted for 5.608% of the common variance. The factor loadings of the measurement tool ranged between .493 and .792. For criterion-related validity, the correlation between the SMAS and the problematic internet use scale was 0.75. The Cronbach internal consistency coefficient was α = .95 for the scale, α = .92 for the control difficulty and deprivation sub-dimension, α = .91 for the functional deterioration, and α = .81 for the social isolation.

The validity and reliability findings obtained within the scope of the study related to the SMAS used in the research are detailed in Table 2. Cronbach's alpha (CA) and composite reliability (CR) values of latent variables in the scale were addressed together for the reliability of the results obtained from the multi-group confirmatory factor analysis under measurement invariance. According to the literature (Hair, Black, Babin, & Anderson, 2010), calculating the construct reliability (CR) value besides Cronbach's Alpha coefficient is stated to be important in Structural Equation Modeling (SEM) and Confirmatory Factor Analysis (CFA). Under the validity findings, divergent and convergent validity evidence were obtained based on measurement models. In order to test convergent and divergent validity, Average Variance Extracted (AVE), Composite Reliability (CR), Maximum Squared Variance (MSV), and Average Shared Square Variance (ASV) coefficients were used. The Average Variation Extracted (AVE) values were examined to check whether convergent validity was satisfied. In order to ensure convergent validity, the condition of CR ≥ AVE ≥ 0.50 must be met (Fornell & Larcker, 1981). Divergent validity implies that statements regarding variables should be less correlated with factors other than the ones they represent (Yaşlıoğlu, 2017). As such, Maximum Square Variance (MSV) and Average Shared Square Variance (ASV) coefficient values were calculated to ensure divergent validity. In order to speak of the presence of divergent validity, the results should be MSV<AVE and ASV<MSV.

Table 2. Validity and reliability findings of the social media addiction scale

Sub-Dimensions	**CA**	**CR**	**AVE**	**MSV**	**ASV**
Control difficulty: deprivation	0.90	0.91	0.67	0.59	0.42
Functional Deterioration	0.89	0.89	0.67		
Social Isolation	0.81	0.82	0.72		

Considering the reliability values given in Table 2, the CA reliability coefficients for the sub-dimensions used in the study were 0.90, 0.89, and 0.81, respectively. According to these findings, the measurement tool used provided reliable measurements for the research participants. It was concluded that the CR values calculated within the scope of CFA satisfy the specified criteria. The CR values obtained within the scope of the study were 0.91, 0.89, and 0.82 for the control difficulty, functional deterioration, and social isolation sub-factors, respectively, and all these values were greater than the AVE values related to the relevant sub-dimensions. The AVE values were above 0.5 in all sub-factors, indicating that the items under the factor adequately represent the relevant latent variable and that convergent validity evidence has been obtained. Considering the resultant MSV, ASV, and AVE values, the MSV≤AVE and ASV≤MSV conditions have been met. In light of this information, the results obtained from the measurement tool used in the study may reveal valid and reliable results.

A confirmatory factor analysis was performed to provide additional evidence for construct validity using data from 672 observations. According to the CFA results, χ^2/df = 5.99, RMSEA = 0.09, CFI = 0.96, NNFI (TLI) =

0.95, and SRMR = 0.062. As a result of the evaluations made based on multiple perspectives, it was concluded that the model-data fit of the measurement model was met at an acceptable level.

2.3. Data Analysis Techniques

Measurement invariance can be tested under item-response theory (IRT) or SEM. Some researchers conduct studies combining the two approaches (Reise, Widaman, & Pugh, 1993; Stark, Chernyshenko, & Drasgow, 2006; Widaman & Grimm, 2014). As SEM is used more widely than IRT, the analyses were performed based on SEM using CFA. The measurement invariance study performed in this study was based on the Multi-Group Confirmatory Factor Analysis (MGCFA) approach, where the equivalence of covariance structures was tested (Dimitrov 2010; Başusta 2010). MGCFA is a frequently used method in group comparisons where there is more than one group and ensures that the group parameters are equal and the latent factor averages are compared. The analyses conducted based on the means of latent factors are a more sensitive technique in MGCFA than traditional mean comparisons and reveal the differences in different subgroups more accurately (Thompson, 2004). Measurement invariance studies are conducted in a hierarchical structure with increased limitations. These studies require comparing the most basic level of structural invariance with the more restrictive models by developing hypotheses and testing them stepwise (Wu, Li, & Zumbo, 2007; Steenkamp & Baumgartner, 1998). Four types of invariance are taken into account in multi-group analyses (Byrne, 1998; Steenkamp & Baumgartner, 1998; Dimitrov, 2010). This study was conducted by testing four different hypotheses, namely configurational, Metric, Scalar, and Strict invariance. The data analyses were carried out using the Lisrel 8.7 program.

In decision studies concerning measurement invariance, the difference values between the comparative fit index (CFI) values have been used instead of the chi-square statistics, which produce more erroneous results because of the sample size-induced statistical weaknesses in evaluating the goodness-of-fit (Wu et al., 2007; Brown, 2006; Cheung & Rensvold, 2002). The ΔCFI fit index is preferred because the fit coefficients are more convenient to explain the relationship between latent and observed scores (Wu et al., 2007). The differences between the CFI values for the invariance stages examined hierarchically were examined under the "0.01>ΔCFI>0.01" condition, deciding whether the invariance conditions were satisfied. In addition, the model data goodness-of-fit criteria obtained at the decision stage regarding configural invariance were compared with the goodness-of-fit criteria presented in Table 2. At this stage, when at least three presented goodness-of-fit measures satisfied the conditions, the decision was made based on multiple perspectives that the configural invariance condition was satisfied.

Invariance studies were separately examined for all measurement models presented in SMAS and for each sub-factor in the scale. After the invariance study for the whole model, the decisions to be taken based on the sub-factors would be more appropriate when the convergent and divergent validity findings calculated based on the data used in the study are evaluated. In addition, since it is expected that considering these relatively independent factors under different subgroups may produce more valid and detailed results, the resultant findings were explained in detail in terms of measurement invariance.

To ensure the validity and reliability of study findings, various assumptions were tested, considering that the study employed multivariate analyses. The data were collected through the Google form within the scope of the study. Therefore, the missing data issue, considered a problem in the analysis by the researchers, was not found. In outlier analyses, Z values were calculated for univariate extreme values, and the results indicated that these values did not vary between -3.46 and 3.41 and that there was no univariate extreme value. When the Mahalanobis distance values calculated for multivariate extreme values were examined, 18 observations yielded values greater than $X^2_{26,\ .001} = 54.05$, and were excluded from the analysis. Considering the size of the dataset, 672 observations are large enough for this SEM-based study (Kline, 1998). The multicollinearity problem is another assumption in multivariate statistics. In order to determine whether this condition was met, the Durbin-Watson statistic, VIF, and Tolerance values were examined. Since the Durbin-Watson statistic obtained within the scope of the dataset was 1.95, it can be stated that the errors are independent. As such, since the VIF values ranged from 3.196 to 1.183 and the tolerance values ranged from 0.313 to 0.846, it was concluded that there was no multicollinearity problem. CFA results for SMAS were also reported separately for both the whole model and subscales before proceeding to the invariance tests. When evaluating the goodness-of-fit of the measurement models used in the study, the fit indices, considered stronger against statistical weaknesses and more appropriate to be used in large samples, were used. CFI, NNFI, RMSEA, and SRMR values were taken into account instead of the GFI value affected by the sample size. (Cheung & Rensvold, 2002; Wu et al., 2007). Some fit indices used in CFA analyses and their acceptable cut-off values are presented in Table 3.

Table 3. Perfect and Acceptable Fit Criteria for Fit Indices Used in CFA Studies

Fit Indices	Perfect Fit Criteria	Acceptable Fit Criteria
[1]$\chi 2/df$	$0 \leq \chi 2/df \leq 3$	$3 \leq \chi 2/df \leq 5$
[2]CFI	$.95 \leq$ CFI ≤ 1.00	$.90 \leq$ CFI $\leq .95$
[2]NNFI (TLI)	$.95 \leq$ NNFI (TLI) ≤ 1.00	$.90 \leq$ NNFI (TLI) $\leq .95$
[3-4]RMSEA	$.00 \leq$ RMSEA $\leq .05$	$.05 \leq$ RMSEA $\leq .10$
[3]SRMR	$.00 \leq$ SRMR $\leq .05$	$.05 \leq$ SRMR $\leq .10$

[1](Kline, 1998), [2] (Baumgartner & Homburg, 1994; Bentler & Bonett, 1980; Marsh, Hau, Artelt, Baumert, & Peschar, 2006), [3](Browne & Cudeck, 1992), [4](Byrne, 1998)

Results and Discussion

Statistics relating to the CFA analyses conducted in terms of the whole measurement scale structure and all sub-factors used in the study are presented in Table 4.

Table 4. Statistics relating to the CFA analyses

	χ^2	*Df*	χ^2/ *df*	RMSEA	SRMR	NNFI	CFI	Decision
Whole Scale Model	1354.22	296	4,57	0.087	0.062	0.95	0.96	Acceptable fit
Functional deterioration	197.34	35	5,63	0.10	0.047	0.96	0.97	Acceptable fit
Control difficulty and deprivation	602.79	54	11,16	0.15	0.066	0.91	0.92	Acceptable fit
Social isolation	2.59	2	1,29	0.022	0.011	1.00	1.00	Perfect fit

According to the results of Table 4, some conflicts may influence the decisions in the CFA fit indices obtained for measurement models from various aspects, except for the whole model and social isolation. In particular, the $\chi 2/df$ yielded values greater than the acceptable criterion values, and the values obtained for RMSEA either overlapped or exceeded the acceptable fit index limits, challenging the researchers at the decision stage. Therefore, decisions were made based on SRMR, another error value, and $\chi 2/df$ value was ignored in evaluating model-data fit since it is a sampling-based statistic (Muthen, 2001).

Due to this contradiction in the RMSEA, the model data fit was performed based on the SRMR value to be able to continue with the stages and perform detailed analysis in cases where the model and the configural invariance were satisfied and when the RMSEA yielded values greater than the criterion value. As seen in Table 5, the measurement invariance hypotheses were tested progressively in subgroups of gender, time spent on social media, and number of social media, respectively.

Table 5. Measurement Invariance Results for different subgroups based on the Whole Measurement Model

			χ^2	*df*	RMSEA	SRMR	NNFI	CFI	ΔCFI	Decision
Whole Measurement Model	**Gender**	Model A	2702.15	595	0.10	0.080	0.93	0.94	-	ACCEPT
		Model B (Metric)	2778.88	621	0.10	0.091	0.94	0.94	0.00	ACCEPT
		Model C (Scalar)	3386.72	670	0.11	0.13	0.93	0.92	0.02	REJECT
		Model D (Strict)	3518.26	696	0.11	0.13	0.93	0.92	0.02	REJECT
	Time Spent on Social Media	Model A	**3563.09**	**1193**	**0.11**	**0.13**	**0.86**	**0.87**	X	REJECT
		Model B (Metric)	3712.16	1271	0.11	0.22	0.86	0.87	X	REJECT
		Model C (Scalar)	4810.32	1372	0.12	0.36	0.83	0.82	X	REJECT
		Model D (Strict)	52325.49	1450	0.13	0.45	0.82	0.80	X	REJECT
	Number of Social Media Accounts	Model A	3696.77	1193	0,11	0.091	0.90	0,91	-	ACCEPT
		Model B (Metric)	3900.33	1271	0.11	0.12	0.90	0.91	0.00	ACCEPT
		Model C (Scalar)	4636.03	1372	0.12	0.14	0.89	0.90	0.01	ACCEPT
		Model D (Katı)	5048.50	1450	0.12	0.16	0.89	0.88	0.03	REJECT

Configural and metric invariance conditions were satisfied in subgroups examined according to gender in Table 5, but scalar and strict invariance were not within acceptable limits, and the hypothesis that the regression constants and error variances were the same in gender subgroups was rejected for these stages, respectively.

Measurement invariance stages based on time intervals spent on social media did not pass the invariance test, and metric, scalar, and strict invariance conditions were not met for this subgroup. This finding indicates that making comparisons based on time spent on social media through SMAS may not produce valid findings. The

suggested construct of the scale differs based on the time individuals spend on social media. Since this scale is different in terms of construct in these subgroups, limiting factor loadings, constants, and error variances may not make any sense.

When the measurement invariance stages were performed based on the number of social media accounts, the whole measurement model met all stages up to the strict invariance stage, where the error variances were fixed. According to this finding, it was concluded that the factor structure, factor loadings, and regression constant of SMAS were invariant, whereas the error variances were different in the number of social media account subgroups.

Table 6. Measurement invariance results obtained for different subgroups based on sub-factors

					χ2	***df***	**RMSEA**	**SRMR**	**NNFI**	**CFI**	**ΔCFI**	**Decision**
Gender	**Functional deterioration**		Model	A	443.40	70	0.13	0.060	0.94	0.95	-	ACCEPT
			Model B (Metric)		432.4	80	0.12	0.094	0.94	0.95	0.00	ACCEPT
			Model C (Scalar)		584.58	99	0.12	0.12	0.93	0.94	0.01	ACCEPT
			Model D (Strict)		649.8	109	0.12	0.12	0.91	0.92	0.03	REJECT
	Control difficulty and deprivation		Model	A	844.42	108	0.15	0.076	0.91	0.92	-	ACCEPT
			Model B (Metric)		861.77	120	0.14	0.12	0.91	0.92	0.00	ACCEPT
			Model C (Scalar)		1140.04	143	0.15	0.15	0.88	0.90	0.02	REJECT
			Model D (Strict)		1173.40	155	0.15	0.15	0.88	0.89	0.03	REJECT
	Social isolation		Model	A	5.03	4	0.029	0.018	1.00	1.00	-	ACCEPT
			Model B (Metric)		15.44	8	0.055	0.076	0.99	0.99	0.01	ACCEPT
			Model C (Scalar)		130.44	15	0.16	0.19	0.91	0.89	0.11	REJECT
			Model D (Katı)		170.34	19	0.16	0.17	0.85	0.86	0.14	REJECT
Time spent on social media	**Functional deterioration**		Model	A	537.04	140	0.13	0.080	0.88	0.91	-	ACCEPT
			Model B (Metric)		624.72	170	0.13	0.37	0.89	0.90	0.01	ACCEPT
			Model C (Scalar)		851.28	209	0.14	0.44	0.87	0.85	0.06	REJECT
			Model D (Strict)		1085.00	239	0.15	0.58	0.84	0.79	0.11	REJECT
	Control difficulty and deprivation		Model	A	1226.34	216	0.17	0.10	0.79	0.83	X	REJECT
			Model B (Metric)		1292.86	252	0.16	0.18	0.81	0.82	X	REJECT
			Model C (Scalar)		2050.76	299	0.19	0.45	0.73	0.70	X	REJECT
			Model D (Strict)		2213.13	335	0.18	0.54	0.714	0.67	X	REJECT
	Social isolation		Model	A	10.33	8	0.042	0.062	0.99	1.00	-	ACCEPT
			Model B (Metric)		31.42	20	0.058	0.086	0.99	0.99	0.01	ACCEPT
			Model C (Scalar)		214.12	35	0.18	0.14	0.89	0.80	0.20	REJECT
			Model D (Strict)		265.41	47	0.17	0.27	0.89	0.78	0.22	REJECT
Number of social media accounts	**Functional deterioration**		Model	A	568.65	140	0.14	0.065	0.91	0.93	-	ACCEPT
			Model B (Metric)		639.11	170	0.13	0.14	0.92	0.92	0.01	ACCEPT
			Model C (Scalar)		817.38	209	0.13	0.12	0.91	0.90	0.03	REJECT
			Model D (Strict)		957.50	239	0.13	0.16	0.90	0.87	0.06	REJECT
	Control difficulty and deprivation		Model	A	1272.73	216	0.17	0.12	0.85	0.88	X	REJECT
			Model B (Metric)		1414.81	252	0.17	0.13	0.84	0.87	X	REJECT
			Model C (Scalar)		1791.98	299	0.17	0.17	0.84	0.82	X	REJECT
			Model D (Strict)		2029.74	335	0,17	0.20	0.85	0.81	X	REJECT
	Social isolation		Model	A	11.88	8	0.054	0.032	0.99	1.00	-	ACCEPT
			Model B (Metric)		27.03	20	0.046	0.10	0.99	0.99	0.01	ACCEPT
			Model C (Scalar)		165.80	35	0.15	0.15	0.92	0.88	0.12	REJECT
			Model D (Strict)		182.66	47	0.13	0.17	0.93	0.87	0.13	REJECT

Configural and metric invariances were satisfied for the "control difficulty and deprivation" and "functional deterioration" sub-factors in the scale considering the gender subgroup in Table 6, whereas the constant obtained in the regression equation was different for groups as the scalar invariance condition was 0.01>ΔCFI, whereby

the scalar invariance condition was rejected. In other words, the factorial construct measured was similar in subgroups. It was concluded that the items constituting the construct had similar factor loadings in subgroups. However, the relationship between the observed variables and the latent construct was not similar in terms of gender. The scores of individuals with the same latent construct score regarding the observed construct differed by gender group. For the "social isolation" sub-factor, scalar invariance was satisfied, along with configural and metric invariance. Therefore, it could be stated that the constant in the regression equations created for the social isolation sub-dimension items is equal or invariant between the groups. In other words, there are no item-based biases for gender based on the data obtained from the social isolation sub-dimension.

As seen in Table 6, in subgroups examined according to the time spent on social media, the configural and metric invariances were achieved for the “functional deterioration” and “social isolation” sub-dimensions, but the scalar and strict invariances were not within acceptable limits. Therefore, the hypotheses that regression constants and error variances are the same for time spent on social media subgroups were rejected for these stages, respectively. The measurement invariance stages performed for the “functional deterioration” sub-dimension did not pass the invariance test based on time intervals spent on social media, where metric, scalar, and strict invariance conditions were not met for this sub-group. This finding indicates that making comparisons through SMAS based on time spent on social media may not yield valid findings. The suggested construct of the scale differs based on the time individuals spend on social media. Since this scale is different in terms of construct in these subgroups, it could be interpreted that limiting factor loadings, constants, and error variances will not make any sense.

In subgroups examined according to the number of social media accounts, the configural and metric invariances were achieved for the "functional deterioration" and "social isolation" sub-dimensions, but the scalar and strict invariances were not within acceptable limits, and thereby the hypotheses that regression constants and error variances are the same in the number of social media accounts subgroups were rejected for these stages, respectively. This finding is the same as the results obtained in the subgroups examined according to the time spent on social media. The measurement invariance stages performed for the “functional deterioration” sub-dimension did not pass the invariance test based on the number of social media accounts, and metric, scalar, and strict invariance conditions were not achieved for this sub-group. This finding indicates that making comparisons through SMAS based on the number of social media accounts may not yield valid findings. The structure of the scale presented differs based on the number of social media accounts individuals have. Since this scale is different in terms of construct in these subgroups, limiting factor loadings, constants, and error variances may not make sense.

Conclusion

The decisions for invariance stages, carried out based on both the whole model and the sub-factors, are summarized in Table 7.

Table 7. Comparative decisions for invariance stages

Factor	Invariance Hypotheses	Gender	Time Spent on Social Media	Number of Social Media Accounts
Whole Model	**Configural**	ACCEPT	REJECT	ACCEPT
	Metric Invariance	ACCEPT	REJECT	ACCEPT
	Scalar Invariance	REJECT	REJECT	ACCEPT
	Strict Invariance	REJECT	REJECT	REJECT
Functional Deterioration	**Configural**	ACCEPT	ACCEPT	ACCEPT
	Metric Invariance	ACCEPT	ACCEPT	ACCEPT
	Scalar Invariance	ACCEPT	REJECT	REJECT
	Strict Invariance	REJECT	REJECT	REJECT
Control Difficulty and Deprivation	**Configural**	ACCEPT	REJECT	REJECT
	Metric Invariance	ACCEPT	REJECT	REJECT
	Scalar Invariance	REJECT	REJECT	REJECT
	Strict Invariance	REJECT	REJECT	REJECT
Social Isolation	**Configural**	ACCEPT	ACCEPT	ACCEPT
	Metric Invariance	ACCEPT	ACCEPT	ACCEPT
	Scalar Invariance	REJECT	REJECT	REJECT
	Strict Invariance	REJECT	REJECT	REJECT

As seen in Table 7, considering gender subgroups, the configural invariance was primarily achieved for the whole scale as well as for the control difficulty, deprivation, and social isolation sub-dimensions. This finding could be interpreted as indicating that the construct is invariant according to gender. In other words, the latent variables were similar in males and females, and both groups had the same conceptual perspectives when answering the scale questions (Vandenberg & Lance, 1998). In addition, metric invariance was also achieved. When metric invariance is achieved, comparing the scores obtained from the whole scale and two sub-dimensions based on gender would become meaningful (Byrne, 2003). In metric invariance, the hypothesis that the factor loadings or regression tendencies of the scale items are invariant among the mentioned groups is accepted. Therefore, when metric invariance is ensured, people from different groups may respond to the items in the same way when both the whole scale and its two sub-dimensions are considered. Table 7 shows that scalar and strict invariances are not achieved. Therefore, it could be argued that there may be item-based biases for gender based on the data obtained from the SMAS and its two sub-dimensions. However, when it comes to the functional deterioration sub-dimension of the scale in gender subgroups, the scalar invariance is met alongside the configural and metric invariances described above. Therefore, it could be stated that there would be no item-based biases for gender based on the data obtained from the functional deterioration sub-dimension of SMAS, and comparisons could be made on the basis of items. Although there is no research on the invariance of measurement tools on social media addiction in different subgroups in our country, invariance studies on different measurement tools related to social media addiction in different subgroups, such as gender and time, exist abroad. In their study, Yue, Zhang, Cheng, Liu, and Bao (2022) found that the "Bergen Social Media Addiction" scale satisfied measurement invariance according to gender up to the strict invariance stage. Considering that this is the first invariance study of the measurement tool used in our research, it was not possible to compare it with other studies. Therefore, future studies are needed to confirm and compare the findings. In a study conducted using the "Social Media Addiction Scale" employed in the study according to the demographic variables, Ganjayeva (2019) found no significant gender differences. However, considering that the items are biased in the research findings, the absence of gender differences in social media addiction should be interpreted more carefully. Considering that male and female subgroups have different perceptions of social media and that they have different utilization purposes, it could be seen as a possible reason why measurement invariance was not achieved.

Considering the subgroups of time spent on social media, the configural invariance was primarily achieved for both functional deterioration and social isolation sub-dimensions. This finding could be interpreted as meaning that the construct is invariant according to the time spent on social media; that is, the latent variables are similar in the relevant subgroups, and these subgroups have the same conceptual perspectives while responding to the scale questions (Vandenberg & Lance, 1998). In addition, metric invariance was also achieved in terms of time spent on social media in these sub-dimensions. When metric invariance is achieved, comparing the scores obtained from the two sub-dimensions based on the time spent on social media may become meaningful (Byrne, 2003). Further, when metric invariance is met, it is possible to say that people belonging to different groups respond to the items in the same way, considering the two sub-dimensions of the scale. Table 7 shows that scalar and strict invariance are not achieved according to the time spent on social media in any subgroup. Therefore, it could be stated that there may be item-based biases for the time spent on social media based on the data obtained from the SMAS and these two sub-dimensions. For the subgroups of time spent on social media, no invariance stage was achieved for both the whole scale and the control difficulty and deprivation sub-dimensions. Thus, the study concluded that it would not be meaningful to make comparisons for the subgroups of time spent on social media when it comes to both the whole scale and the control difficulty and deprivation sub-dimensions. Ganjayeva (2019) examined the relationship between social media addiction and time spent on social media and concluded that those who spend more than three hours on social media are more addicted than those who spend one hour. Considering the results of this measurement invariance study, it would be more appropriate to comment on the sub-dimensions when interpreting the time spent on social media.

Considering the number of social media account subgroups, the configural and metric invariances are primarily achieved for both the functional deterioration and social isolation sub-dimensions. This finding could be interpreted as meaning that the construct is invariant according to the number of social media accounts; that is, the latent variables are similar in relevant subgroups, and these subgroups have the same conceptual viewpoints while answering the scale questions (Vandenberg & Lance, 1998). In addition, it would be meaningful to compare the scores obtained from the two sub-dimensions based on the number of social media accounts (Byrne, 2003). It is seen that scalar invariance according to the number of social media accounts is achieved only when the whole measurement model is in question. Therefore, unbiased comparisons could be made for the number of social media accounts based on the data obtained from the SMAS and its sub-dimensions. Considering the control difficulty and deprivation subdimensions for the number of social media account subgroups, no invariance stage was met. Therefore, it was concluded that it would not be meaningful to make

comparisons for the number of social media accounts subgroups when the control difficulty and deprivation sub-dimensions are taken into account.

The study revealed that the psychometric properties obtained from the measurement model may show bias according to the relevant subgroups in cases where the model fits up to the configural and metric stages of the SMAS. The scores obtained from this measurement tool can be compared, but careful interpretation should be made, keeping in mind that the items may behave biasedly according to gender on an item basis. For the SMAS, the study revealed that in cases where the model fits up to the configural, metric, and scalar invariance stages, the psychometric properties obtained from the measurement model could be compared according to the relevant subgroups without bias. In addition, in cases where scalar invariance is met, the scores obtained from the measurement tool could be compared, and comments could be made on an item basis according to the relevant subgroups. Finally, any comparison made according to the subgroups tested using the SMAS would be meaningless in cases where even configural invariance is not accepted.

As in this study, there may be cases where the invariance of all items related to the measurement tool used cannot be achieved (Vandenberg & Lance, 2000; Cheung, 2007). When making comparisons using these scales, it is necessary to rearrange the items of the measurement tool and reanalyze the invariance according to the relevant group to eliminate the biases observed in these items. Despite all this, when it is observed that the bias persists for the items, it could be recommended to conduct a partial invariance study for the groups where the invariance is investigated. For future research, comparisons of the SMB scale can be made according to gender and the number of social media accounts, but interpretations should be made carefully as they will show bias on the basis of items. It can be said that it would not be appropriate to make a comparison according to the time spent on social media. In addition, variables such as social media usage purposes, age, and invariance studies can be suggested for future research.

Author (s) Contribution Rate

NBU and MA contributed equally to designing, conducting the research, and collecting the data. NBU and MA analyzed the data, and MA created the figures. NBU, MA, and BBA carried out the literature review and wrote and prepared the manuscript. NBU provided insight and edited the manuscript. MA and BBA contributed equally to the discussion and conclusion parts of the manuscript. All authors read and approved the final manuscript.

Conflicts of Interest

The authors declared no conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Approval

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

References

Al-Menayes, J. J. (2015). Social media use, engagement and addiction as predictors of academic performance. *International Journal of Psychological Studies*, *7*(4), 86–94.

Andreassen, C. S., Torsheim, T., Brunborg, G. S., & Pallesen, S. (2012). Development of a Facebook addiction scale. *Psychological reports*, *110*(2), 501–517.

Bakır Aygar, B., & Uzun, B. (2018). Sosyal Medya Bağımlılığı Ölçeği'nin geliştirilmesi: Geçerlik ve güvenirlik çalışmaları. *Addicta: The Turkish Journal on Addictions*. http://dx.doi.org/10.15805/addicta.2018.5.3.0046

Başusta, N. B. (2010). Ölçme eşdeğerliği. *Eğitimde ve Psikolojide Ölçme ve Değerlendirme Dergisi*, *1*(2), 58–64.

Baumgartner, H., & Homburg, C. (1996). Applications of structural equation modeling in marketing and consumer research: a review. *International Journal of Research in Marketing*, *13*(2), 139–161.

Bayram Saptır, A. (2022). *Sosyal medya bağımlılığı ve kendini sansürleme: bazı değişkenler açısından incelenmesi* (Unpublished master's thesis) Sakarya University, Institute of Educational Sciences, Sakarya.

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin*, *88*, 588–606.

Brown, T. A. (2006). *Confirmatory factor analysis for applied research*. New York, NY: The Guilford Press.

Browne, M., & Cudeck, R. (1992). Alternative ways of assessing model fit. *Sociological Methods and Research*, *21*, 230–258.

Byrne, B. M. (1998). *Structural equation modeling with LISREL, PRELIS, and SIMPLIS: Basic concepts, applications, and programming*. New Jersey: Lawrence Erlbaum.

Byrne, B. M. (2003). The issue of measurement invariance revisited. *Journal of Cross-Cultural Psychology*, *34*(2), 155–175.

Çakır, Ö., Horzum, M. B., & Ayas, T. (2013). İnternet bağımlılığının tanımı ve tarihçesi. *İnternet Bağımlılığı: Sorunlar ve Çözümler* (pp. 1–16). *Ankara: Anı yayıncılık*.

Cheung, G. W. (2007). Testing equivalence in the structure, means, and variances of higher-order constructs with structural equation modeling. *Organizational Research Methods*, *11*(3), 593–613.

Cheung, G., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling: A Multidisciplinary Journal*, 233–255.

Çömlekçi, M. F., & Başol, O. (2019). Gençlerin sosyal medya kullanım amaçları ile sosyal medya bağımlılığı ilişkisinin incelenmesi. *Manisa Celal Bayar Üniversitesi Sosyal Bilimler Dergisi*, *17*(4), 173–188.

Demirci, İ. (2019). Bergen Sosyal Medya Bağımlılığı Ölçeğinin Türkçeye uyarlanması, depresyon ve anksiyete belirtileriyle ilişkisinin değerlendirilmesi. *Anadolu Psikiyatri Dergisi*, *20*, 15–22.

Digital (2022a) Küresel Genel Bakış Raporu, (2022) Retrieved from: https://wearesocial.com/uk/blog/2022/01/digital-2022-another-year-of-bumper-growth-2/

Digital (2022b) Türkiye Raporu, (2022). Retrieved from: https://datareportal.com/reports/digital-2022-turkey

Dimitrov, D. M. (2010). Testing for factorial invariance in the context of construct validation. *Measurement and Evaluation in Counseling and Development*, *43*, 121–149.

Duman, D (2022). *Sosyal medya bağımlılığı görülen ergenlerde bireysel ve sosyal sorunların incelenmesi* (Unpublished master's thesis). Institute of Health Sciences, Ufuk University, Ankara.

Ehrenberg, A., Juckes, S., White, K. M., & Walsh, S. P. (2008). Personality and self-esteem as predictors of young people's technology use. *Cyber Psychology & Behavior, 11*, 739–741.

Folaranmi, A. O. (2013). A survey of Facebook addiction level among selected Nigerian university undergraduates. *New Media and Mass Communication*, *10*, 70–80.

Fornell, C., & D. F. Larcker (1981). Evaluating Structural Equation Models with Unobservable Variables and Measurement Error. *Journal of Marketing Research*, *18*, 39–50.

Ganjayeva, N. (2019). *Üniversite öğrencilerinde sosyal medya bağımlılığı, Eysenckin kişilik envanteri ve özgüven arasındaki ilişkinin incelenmesi* (Master's thesis). Institute of Social Sciences.

Göksu, H. (2019). *Ergenlerin sosyal medya bağımlılığının akademik başarılarıyla ilişkisi ve çeşitli değişkenler açısından incelenmesi* (Unpublished master's thesis). Institute of Education Sciences, Afyon Kocatepe University, Afyonkarahisar.

Griffiths, M. (2000). Internet addiction-time to be taken seriously? *Addiction research*, *8*(5), 413–418.

Griffiths, M. D., & Szabo, A. (2014). Is excessive online usage a function of medium or activity? An empirical pilot study. *Journal of behavioral addictions*, *3*(1), 74–77.

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). *Multivariate data analysis* (7th Ed.). Englewood Cliffs: Prentice Hall.

Hou, Y., Xiong, D., Jiang, T., Song, L., & Wang, Q. (2019). Social media addiction: Its impact, mediation, and intervention. *Cyberpsychology: Journal of psychosocial research on cyberspace*, *13*(1).

Karaiskos, D. & Tzavellas, E., Balta, G., & Paparrigopoulos, T. (2010). Social network addiction: A new clinical disorder? *European Psychiatry*, 25, 855.

Kim, S. W., & Kim, R. D. (2002). A study of Internet addiction: Status, causes, and remedies-focusing on the alienation factor. *International Journal of Human Ecology*, *3*(1), 1–19.

Kline, R. B. (1998). *Principles and practice of structural equation modeling*. New York: The Guilford Press.

Kuss, D. J., & Griffiths, M. D. (2011). Online social networking and addiction—a review of the psychological literature. *International journal of environmental research and public health*, *8*(9), 3528–3552.

Liu, C., & Ma, J. (2020). Social media addiction and burnout: The mediating roles of envy and social media use anxiety. *Current Psychology*, *39*(6), 1883–1891.

Marengo, D., Fabris, M. A., Longobardi, C., & Settanni, M. (2022). Smartphone and social media use contributed to individual tendencies towards social media addiction in Italian adolescents during the COVID-19 pandemic. *Addictive Behaviors*, *126*, 107204.

Marsh, H. W., Hau, K.-T., Artelt, C., Baumert, J., & Peschar, J. L. (2006). OECD's brief self-report measure of educational psychology's most useful affective constructs: Cross-cultural, psychometric comparisons across 25 countries. *International Journal of Testing*, *6*, 311–360.

Muthen, B. O. (2001). Latent Variable Mixture Modeling. In: Marcoulides G. A., & Schumacker R. E. (Eds.). *New Developments and Techniques in Structural Equation Modeling* (1st Ed.) London: Lawrence Erlbaum Associates.

Özdemir, Z. (2019). Üniversite öğrencilerinde sosyal medya bağımlılığı. *Beykoz Akademi Dergisi*, *7*(2), 91–105.
Özgenel, M., Canpolat, Ö., & Ekşi, H. (2019). Ergenler için sosyal medya bağımlılığı ölçeği (ESMBÖ): Geçerlik ve güvenirlik çalışması. *Addicta: The Turkish Journal on Addictions*.
Reise, S. P., Widaman, K. F., & Pugh, R. H. (1993). Confirmatory factor analysis and item response theory: Two approaches for exploring measurement invariance. *Psychological Bulletin*, *114*, 552–566.
Şahin, C. (2018). Social Media Addiction Scale-Student Form: The Reliability and Validity Study. *Turkish Online Journal of Educational Technology-TOJET*, *17*(1), 169–182.
Şahin, C., & Yağcı, M. (2017). Sosyal Medya Bağimliliği Ölçeği-Yetişkin Formu: Geçerlilik Ve Güvenirlik Çalişmasi. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi*, *18*(1), 523–538.
Smith, A., & Anderson, M. (2018). Social media use in 2018. Pew Research Center. http://www.pewinternet.org/2018/03/01/social-media-use-in-2018/
Stanculescu, E. (2022). The Bergen social media addiction scale validity in a Romanian sample using item response theory and network analysis. *International Journal of Mental Health and Addiction*, 1–18.
Stark, S., Chernyshenko, O. S., Drasgow, F., Williams, B. A. (2006). Examining assumptions about item responding in personality assessment: Should ideal point methods be considered for scale development and scoring? *J. Appl. Psychol*., *91*, 25–39
Steenkamp, E. M., & Baumgartner, H. (1998). Assessing Measurement Invariance in cross-national consumer research. *Journal of Consumer Research*, *25*(1).
Sussman, S. (2012). Steve Sussman on Rudolf H. Moos's "Iatrogenic Effects of Psychosocial Interventions: Treatment, Life Context, and Personal Risk Factors"—A Clarification. *Substance Use & Misuse*, *47*(13–14), 1601–1602.
TBM (Türkiye Bağımlılıkla Mücadele Eğitim Programı) (2015). Teknoloji canavara dönüşmeden. İstanbul: Şekil Ofset. https://tbm.org.tr/media/kitaplar/TBM_ortaokul_teknoloji_icerik_web.pdf
Thompson, B. (2004). *Exploratory and confirmatory factor analysis*. Washington: America Psychological Association.
Turel, O., & Serenko, A. (2012). The benefits and dangers of enjoyment with social networking websites. *European Journal of Information Systems*, *21*(5), 512–528.
Tutgun-Ünal, A., & Deniz, L. (2015). Development of the social media addiction scale. *AJIT-e: Bilişim Teknolojileri Online Dergisi*, *6*(21), 51–70.
Vandenberg, R. J. & Lance, C. E. (1998). A summary of the issues underlying measurement equivalence and their implications for interpreting group differences. In 1998 Research Methods Forum, 3, 1–10.
Vandenberg, R. J., & Lance, C. E. (2000). A review and synthesis of the measurement invariance literature: Suggestions, practices,
Widaman, K. F., & Grimm, K. J. (2014). Advanced psychometrics: Confirmatory factor analysis, item response theory, and the study of measurement invariance. In: Reis H. T., Judd C. M. (Eds). *Handbook of research methods in social and personality psychology* (2nd Ed.). New York: Cambridge University Press; p. 534–70.
Wu, Amery D., Li, Zhen and Zumbo, Bruno D. (2007). Decoding the meaning of factorial invariance and updating the practice of multi-group confirmatory factor analysis: A demonstration with TIMSS data. *Practical Assessment Research & Evaluation*, *12*(3).
Wu, Pi-Chu (2013). Addictive behavior in relation to the happy farm Facebook application. *Social Behavior and Personality*, *41*(4), 539–554.
Yue, H., Zhang, X., Cheng, X., Liu, B., & Bao, H. (2022). Measurement Invariance of the Bergen Social Media Addiction Scale Across Genders. *Frontiers in Psychology*, *13*, 879259.