Research Article

PSYCHO-EDUCATIONAL RESEARCH REVIEWS

Psycho-Educational Research Reviews
12(*3*), 2023, 599-611
www.perrjournal.com

Adaptation of Digital Addiction Scale for Children (DASC) into Turkish

Eyüp Yılmaz, Assoc. Prof. Dr., Aydın Adnan Menderes University, Türkiye, eyup.yilmaz@adu.edu.tr
0000-0002-0336-1747

Nihal Durmaz, Assoc. Prof. Dr., Gülhane Training and Research Hospital, Türkiye,drmznhl@gmail.com
0000-0002-3079-1769

Mark D. Griffiths, Prof. Dr., Nottingham Trent University, UK, mark.griffiths@ntu.ac.uk
0000-0001-8880-6524

Keywords

Digital addiction
Digital device
Child-digital device interaction
Turkish children

Article Info:
Received : 01-06-2023
Accepted : 04-10-2023
Published : 13-12-2023

DOI: 10.52963/PERR_Biruni_V12.N3.06

Abstract

Although, digital devices have numerous applications that children can benefit from, they may cause specific problems such as addiction. There are many empirical studies assessing digital addictions among Turkish adolescents and young adults. However, few empirical studies have been carried out among Turkish children probably due to the lack of an assessment tool. Therefore, the present study translated and validated the 25-item Digital Addiction Scale for Children (DASC) for Children into Turkish (DASTC). Data were collected from 694 Turkish schoolchildren aged 9-12 years (M=10.5 years; SD=0.92; 50.8% girls). The internal consistency of DASTC was calculated as α=0.92. The Videogame Addiction Scale for Children (VASC) was used to test for convergent validity and they were significantly correlated (r=0.75). Confirmatory factor analysis (CFA) showed that the established two-factor model had a near-perfect fit. In addition, digital addiction scores of boys and older aged children (11-12 years) were significantly higher than girls and younger aged children (9 years).

To cite this article: Yılmaz, E., Durmaz, N. & Griffiths M. D. (2023). Adaptation of Digital Addiction Scale for Children (DASC) into Turkish. *Psycho-Educational Research Reviews, 12*(3), 599-611. doi: 10.52963/PERR_Biruni_V12.N3.06

INTRODUCTION

Over the past three decades, the rapid development of digital technology has completely changed individuals' daily lives (Small et al., 2020). Around the world, individuals have started to spend more time on their digital devices (e.g., smartphones, tablets, laptops, game consoles, etc.). In particular, during the COVID-19 epidemic, the use of digital devices increased (Király et al., 2020; Nicola et al., 2020). Indeed, between 2019 and 2021, 800 million individuals went online for the first time (Organization for Economic and Co-operation Development, 2021) and global reports indicate that more than 4.5 billion individuals across the globe now use internet while social media users have passed 3.8 billion (We Are Social & Hootsuite, 2020).

Studies conducted with children either across nations or within them have reported that children's interest in and use of digital devices is also increasing. It was found that the estimated prevalence of 5-11 years old children who use computers outside of school more than one hour per day increased from 43% in 2001 to 56% in 2016 in the USA (Yang et al., 2019). In Turkey, the Turkish Statistical Institute (2021) reported that the frequency of internet use for Turkish children aged 6-15 years increased from 50.8% in 2013 to 82.7% in 2021. Even though the use of digital devices can be mandatory for children in some cases (e.g., doing research via internet or participating in an online course), in many cases they are used purely for entertainment and leisure activity (Christakis, 2019).

Although most digital device use is beneficial, the attachment to them and overuse of related activities on them (e.g., social media use, gaming, online shopping) can be problematic and lead to digital addiction among a small minority of children and adolescents (Cemiloglu et al., 2022; Hawi et al., 2019). The phenomenon of 'digital addiction' (DA) has emerged in the past few years and there is a lack of consensus on defining DA or the characteristic features of it. In general terms, addiction to digital technologies is defined as a type of addiction produced by excessive or problematic use of any type of digital technology (Almourad et al., 2020). However, more specifically, Alrobai et al. (2014) defined digital addiction as *"a significant degree of dependent behaviour that is triggered and facilitated by software products. It can lead to both pleasure and relief of discomfort, but unfortunately, in a way that can harm a person socially, physically and psychologically"* (p.112). There are no diagnostic criteria for digital addiction although internet gaming disorder (IGD) which is arguably related to digital addiction, was included in Section III of Diagnostic and Statistical Manual for Mental Disorders (DSM–5; American Psychiatric Association, 2013). However, internet use is not compulsory for DA because offline activities (i.e., videogame playing) can be problematic using digital devices (Griffiths, 2008; Miezah et al., 2020; van Rooij et al., 2012). However, Griffiths (2005) has argued that although all addictions have particular and idiosyncratic characteristics, they share more commonalities than differences (i.e., salience, mood modification, tolerance, withdrawal, conflict, and relapse).

Many studies have been conducted examining reasons for children's use of digital devices and related activities (videogame playing, social networking, internet use, etc.) and the consequences these interactions. While sensation seeking among adolescents was found a positive predictor of smartphone addiction (Wang et al., 2019), fear of missing out (FoMo), maladaptive cognitions and psychiatric distress were found the three strongest predictors of social networking addiction (Pontes et al., 2018). Furthermore, a positive association has been reported between DA and depression and anxiety (Ho et al., 2014), isolation/loneliness (Peper & Harvey, 2018), attention deficit and hyperactivity Disorder (ADHD) symptoms (Ko et al., 2012), inattention, hyperactivity, and impulsivity (Yoo et al., 2004), as well as relationship problems and low academic achievement (Kuss & Griffiths, 2011). Additionally, increased screen time on digital devices has been associated with poorer language development (Duch et al., 2013; Horowitz-Kraus & Hutton, 2018), and poorer cognition development (Tomopoulos et al., 2010).

In relation to Turkish samples, many empirical studies examining digital addiction have been conducted regarding adolescents (Altınok, 2021; Arseven, 2021; Arslan, 2020; Sarıca-Keçeci et al., 2021; Taşlıyan et al., 2021) and adults (e.g., Avcı & Er, 2019; Yıldırım, 2021). However, only one study (Canseven et al., 2021) recruiting younger aged children (10-11 years) has been published. Moreover, computer game addiction was considered a digital addiction in that study, and the lack of a scale for assessing children's digital addiction has limited empirical research (Horzum et al., 2008). As far as the present authors are aware, there is no digital addiction diagnostic tool developed for Turkish children and this may be the main reason for the scarcity of studies investigating digital addiction among Turkish children. The main aim of the present study was to adapt DASC into Turkish. In addition, digital device use and addiction levels among children by gender and age were also investigated.

Many studies regarding children’s digital usage or addiction levels by gender and age have been conducted all over the world. Systematic review and meta-analysis studies have reported that internet gaming disorder was more common among boys than among girls and that males (including children and adolescents) had higher risk for internet and game addiction than females (Kim et al., 2022; Paulus et al., 2018; Rehbein et al., 2015). Furthermore, being of older age has been associated with more severe addiction among males but not among females (Ko et al., 2005). However, since the phenomenon of digital addiction has only recently become a concern both in Turkey and elsewhere in the world (Kim et al., 2022), it is not clear whether digital addiction is more common in which gender or age group. Thereby, the present study also sought answers to two research questions (RQs): ‘Do the digital addiction scores of the participants significantly differ by gender?’ (RQ1) and ‘Do the digital addiction scores of the participants significantly differ by age?’ (RQ2).

METHOD

PARTICIPANTS

In the present study, 694 schoolchildren aged 9-12 years (M=10.5 years; SD=0.916; 50.8% girls) from Grades 4 to 6 were recruited. All participants were studying at public and private schools in Ankara, Turkey. Almost half of participants (47.9%) were 10 years old followed by those aged 11 years (22.7%), 12 years (19%) and 9 years (10.4%). Three-quarters of the participants were studying in public schools (76.8%). This is because the average number of students in public school classes (28-34 students) is much bigger than the number of students in private school classes (15-16 students).

DATA COLLECTION

DATA COLLECTION TOOLS

Data were collected using the *Digital Addiction Scale for Children (DASC)*, *Videogame Addiction Scale for Children (VASC)*, and *Personal Information Form*. Details of the measurement tools are given below.

DIGITAL ADDICTION SCALE FOR CHILDREN (DASC)

The DASC is a 25-item self-report instrument which was developed by Hawi et al. (2019) based on nine diagnostic DSM-5 IGD criteria (American Psychiatric Association, 2013) and six core addiction components (preoccupation, tolerance, withdrawal, mood modification, conflict and relapse) proposed by Griffiths (2005) as well as three additional criteria (problems, deception, and displacement). It comprises two subscales (interpersonal and intrapersonal). While the interpersonal subscale comprises 13 items, the intrapersonal subscale comprises the remaining 12 items. All items (*i.e., “I am sleeping less because I am using my device”*) are rated on a five-point Likert scale from 1 (*never*) to 5 (*always*). Higher scores indicate greater risk of digital addiction. The Cronbach alpha coefficient for whole scale was very good (α=.93). Furthermore, the correlations between nine criteria (0.38–0.69) presented good evidence for discriminant validity. The two-factor structure was confirmed by performing confirmatory factor analyses (CFA) (CMIN/DF=2.43, root mean square error of approximation (RMSEA)=0.041, standardized root mean square residual (SRMR)=0.033; normed fit index (NFI)=0.93, comparative fit index (CFI)=0.96, and Tucker–Lewis index TLI=0.95).

VIDEOGAME ADDICTION SCALE FOR CHILDREN (VASC)

The 21-item VASC which was developed in the Turkish language by Yılmaz et al. (2017), was used to assess videogame addiction and to test for convergent validity with the DASTC. The scale comprises four sub-scales (self-control, reward/reinforcement, problems, and involvement). Scale items (e.g., *"I forget my problems while playing videogames"*) are rated on a five-point Likert scale from 1 (*never*) to 5 (*always*). Scores range from 21 to 105, and higher scores indicate greater risk of being addicted to videogames. The internal consistency coefficient of VASC was very good (α=.89). The confirmatory factor analyses (CFA) model indicated that the four-factor structure found in the original validation study was confirmed and showed good fit (p<0.001; GFI=0.91, NNFI=0.96, CFI=0.96, SRMR=0.08, and RMSEA=0.05).

SOCIO-DEMOGRAPHICS FORM

The participants were asked to complete socio-demographic questions before completing the psychometric scales. Socio-demographics included: gender, age, and grade level at school (Grade 4, Grade 5 or Grade 6).

ADAPTATION PROCESS

A standard translation, back-translation, and comparison procedure was applied following the procedure outlined by Maneesriwongul and Dixon (2004). First, the DASC items were translated into Turkish by three bilingual experts who were fluent in both languages. Then the harmony between the translated items was examined and a common text was created by comparing the versions. The developed text was then translated back into original language (English) and it was found that the back-translated items were compatible with the original items.

PILOT STUDY

To test how comprehensible and applicable the items were, the draft scale was administered to 38 volunteer schoolchildren who were not included in the main study and participated with parental permission. The youngest age groups (Grade 4) were mostly recruited to the pilot group. This was because items that can be understood and answered by younger age groups are likely to be more easily understood and answered by older age groups. The results showed that the draft scale items were easily understood and answered by schoolchildren.

PROCEDURE

Before the implementation process, necessary permissions and approvals were obtained from Gülhane Scientific Research Ethics Committee and Ankara Provincial Directorate of National Education (No:2020-478). To ensure maximum diversity, data were collected from the schools located in different socio-economic regions (low-medium-high). The students in private schools were regarded as high socio-economic status while students in public schools were regarded as having low to middle socio-economic status (and which was also the view of school administrations). The main recruitment process was planned with three private and four public school administrators who were interested in participating. Before completing the questions, the schoolchildren were informed about the study and how to complete the questions. Data were collected using a paper-pencil method in the classroom with the help of the classroom teachers, and support was provided to those who needed it during the process (e.g., having difficulty in reading or understanding).

DATA ANALYSIS

CFA was performed to verify the two-factor structure of DASC and measurement invariance of DASTC was provided to compare participants by gender and age. Both analyses were performed using Mplus (version 8.3) statistical software. Configural, metric, and scalar invariance were tested to ensure measurement invariance across the compared groups. SPSS statistical software (version 23) was used for *t*-tests, one-way ANOVAs, correlations, and reliability analyses. Correlations were calculated between DASTC and VASC to test for convergent validity. For reliability and internal consistency, the Cronbach's alpha coefficient (α) was calculated. The missing value proportions of the data ranged between 0 and 1.9 which is very low (MCAR: chi-square=1008.96, df=837, *p*<0.001). The full information maximum likelihood (FIML) estimation method was utilized for CFA. The FIML estimation is one of the most powerful methods to obtain lowest proportion of convergence failure and providing near-optimal Type-1 error rates (Enders & Bandalos, 2001). The multivariate normality test, which is assumed for FIML, indicated that the higher critical chi-square value (11.74) was lower than maximum Mahalanobi's Distance (MD) critical value for two degrees of freedom (13.82) and that the data were normally distributed.

RESULTS

VALIDITY

STRUCTURAL VALIDITY

After performing CFA, only Item 23 ("*I spend too much money on things for my device"*) that had low standardized factor load (<.32) was removed from the scale and two-factor model was obtained. The factor loadings of the remaining items ranged between .38 and .72. Comrey and Lee (1992) suggest that loading in excess .71 are considered excellent, .63 very good, .55 good, .45 fair, and .32 acceptable. With .32 and higher factor loadings, at least 10% variance can be explained.

As a result of CFA, RMSEA, SRMR, CFI, and TLI values were also obtained. Below .08 for RMSEA and SRMR fit indices indicates perfect harmony between .90 and .95 for CFI and TLI fit indexes indicates good harmony, and over .95 on these indexes is considered perfect harmony (Byrne 1998; Hooper et al. 2008; Miles & Shevlin 2007). The TLI (.94) fit index of the model had good fit, and the indexes of CFI (.95), RMSEA (.032) and SRMR (.041) had excellent fit. All these results show that the established two-factor model had a near-excellent fit, confirming the two-factor structure obtained in the original scale. While the standardized results of the two-factor structure model are shown in Figure 1, Table 1 presents the Turkish item model of the DASC, the components on which items are based, and descriptive statistics.

Figure 1. *The Standardized Results of the Two-Factor Structure Model of DASTC*

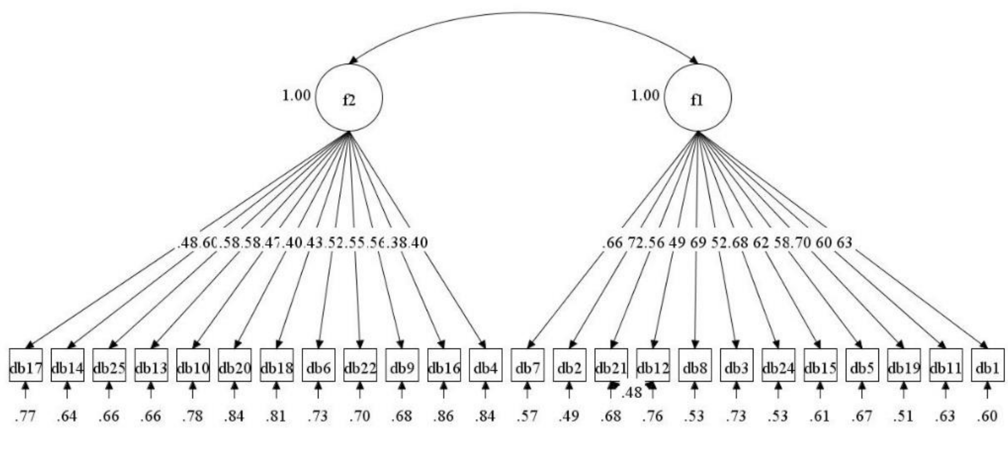

Table 1. *Turkish Item Model of DASTC and Descriptive Statistics*

Subscale	*Criteria on which items are based*	*Items (Turkish)*	*M*	*SD*	*Factor Loading*
Interpersonal	Displacement	6. I do not spend time with my family members because I prefer using my device (Cihazımı kullanmayı tercih ettiğim için aile bireyleriyle vakit geçiremem).	1.70	.97	.52
		18. I have lost interest in hobbies or other activities because I prefer using my device (Cihazımı kullanmayı tercih ettiğim için hobilerime veya diğer etkinliklere olan ilgimi kaybettim).	1.46	.89	.43
		20. I check my device when I am doing homework or other important things (Ödev veya diğer önemli şeyleri yaparken cihazımı kontrol ederim).	1.80	1.20	.40
	Problems	10. I am sleeping less because I am using my device (Cihazımı kullanmaktan dolayı daha az uyurum).	1.54	.96	.47
		13. I have problems with my parents about the amount of time I spend using my device (Cihazımı kullanma sürem ile ilgili ailemle sorunlar yaşarım).	1.54	.96	.58
		25. I continue using my device despite that my grades at school are getting lower and lower (Okul başarımın gitgide düşmesine rağmen cihazımı kullanmaya devam ederim).	1.36	.77	.58
	Deception	4. I lie to my parents about the amount of time I spend using my device (Cihazımla ne kadar vakit geçirdiğim hakkında aileme yalan söylerim).	1.13	.48	.40
		16. I lie to my parents about what I do on my device (Cihazımla neler yaptığım konusunda aileme yalan söylerim).	1.14	.53	.38
	Conflict	9. My parents try to stop or limit me using my device, but they fail (Ailem cihazımı kullanmamı bıraktırmaya ya da sınırlandırmaya çalışır ancak başarısız olur).	1.58	1.02	.56
		22. I argue with my parents when they ask me to stop using my device (Cihazımı kullanmayı bırakmamı istediklerinde ailemle tartışırım).	1.45	.85	.55
	Relapse	17. I am not able to control using my device (Cihazımı kullanma konusunda kendimi kontrol edemiyorum).	1.97	1.12	.48
	Preoccupation	14. Using my device is the most important thing in my life (Cihazımı kullanmak hayatımdaki en önemli şeydir)	1.50	1.00	.60
Intrapersonal	Preoccupation	1. When I am not at school, I spend a lot of time using my device (Okulda olmadığım zamanlarda, cihazımla çok vakit geçiririm).	2.69	1.10	.63
		11. When I do not have my device, I think about what I do on it (video games, social media, texting, etc.) (Cihazım yanımda olmadığı zamanlarda, onunla yaptığım şeyleri (oyun oynama, sosyal medya, mesajlaşma vb.) düşünürüm).	1.95	1.19	.60
	Relapse	19. When I stop using my device, it is not long before I start using it again (Cihazımı kullanmayı bıraksam da çok geçmeden tekrar kullanmaya başlarım).	2.00	1.17	.70
	Mood modification	5. Using my device helps me to forget my problems (Cihazımı kullanmak, sorunlarımı unutmama yardımcı olur).	2.34	1.36	.58
		15. Using my device is more enjoyable than doing other things (Cihazımı kullanmak yaptığım diğer şeylerden daha eğlencelidir).	2.14	1.26	.62
		24. Using my device makes me feel better when I feel bad (Kendimi kötü hissettiğimde cihazımı kullanmak daha iyi hissetmemi sağlar).	2.43	1.38	.68
	Withdrawal	3. I feel upset when I am not able to use my device (Cihazımı kullanamadığım zaman üzgün hissederim).	1.73	1.04	.52
		8. I feel upset when I am asked to stop using my device Cihazımı kullanmayı bırakmam istendiğinde üzülürüm.	1.93	1.25	.69
		12. I feel frustrated when I cannot use my device (Cihazımı kullanamadığım zaman sinirli hissederim).	1.52	1.01	.49
		21. I feel frustrated when I am asked to stop using my device (Cihazımı kullanmayı bırakmam istendiğinde sinirlenirim).	1.44	.95	.56
	Tolerance	2. I feel the need to spend more time using my device (Cihazımla daha çok vakit geçirme isteği duyarım).	2.56	1.26	.72
		7. I have spent more and more time on my device (Cihazımla gittikçe daha fazla zaman geçiriyorum).	1.98	1.15	.66

CONVERGENT VALIDITY

To test the convergent validity of the DASTC, the VASC, which assesses a related type of behavior structure and was developed for the same age groups (9-12 years), was used. Both scales were completed by 396 students (M_{age}=10.6; SD=0.93; 50.3% girls). A highly significant relationship was found between the DASTC and VASC (*r*=.75, *p*<.001). These results can be accepted as an indication of the convergent validity of the DASTC. The correlations are shown in Table 2.

Table 2. *Correlation Coefficient and Descriptive Statistics Between DASTC and VASC*

	DASTC	*VASC*	*M*	*SD*	*N*
DASTC	1	.75***	45.37	15.56	396
VASC		1	42.85	15.17	

****p* < .001

RELIABILITY

The Cronbach's alpha reliability coefficients for the DASTC (α=0.92), the intrapersonal subscale (α=0.89), and the interpersonal subscale (α=0.80) were all found to be very good.

GROUP COMPARISONS

The present study also explored if digital addiction scores of the participants significantly differed by gender and age. Findings addressing the research questions are presented below.

GENDER

The findings indicated that the DASTC scores of boys (M=46.48, SD=15.96) were significantly higher than the addiction scores of girls (M=42.40, SD=13.55) (*t*=3.63, *p*<0.001). The effect size was small: Cohen's *d*=0.28 (Becker, 2000).

AGE

The one-way ANOVA showed that the DASTC scores of schoolchildren were significantly different by age ($F_{(3,678)}$=3.735, *p*<0.05). The Scheffe post-hoc analysis showed the DASTC scores of 11-year-olds students (M=45.53, SD=15.58, *t*=2.99) and 12-year-olds students (M=46.43, SD=16.96, *t*=3.18) were significantly higher than those scores of 9-year-olds students (M=39.89, SD=11.90) (p<0.05). Medium effect sizes were found for both groups (Cohen's *d* was 0.40 for those aged 9-11 years and as 0.45 for those aged 9-12 years). Furthermore, there was no significant difference between 10-year-old students (M=43.33, SD=14.15) and other groups.

MEASUREMENT INVARIANCE

In order to be able to compare participant scores by gender and age groups, DASTC measurement invariance was examined with multi-group CFA in three stages: configural, metric, and scale invariance. Table 3 and Table 5 show the goodness of fit indices obtained in the configural, metric and scale invariance stages while Table 4 and Table 6 show the SRMR, RMSEA and CFI index differences (ΔSRMR, ΔRMSEA, ΔCFI), which is a statistical comparison of the chi-square values obtained at these stages.

Table 3. *Fit Indices for Stages of Measurement Variance of Turkish Version of the Digital Addiction Scale for Children by Gender*

Stages	*SRMR*	*RMSEA*	*CFI*	*TLI*
Model A (configural invariance)	0.06	0.07	0.88	0.86
Model B (metric invariance)	0.066	0.07	0.88	0.87
Model C (scale invariance)	0.07	0.07	0.87	0.87

Model A shows that the configural invariance was achieved by gender which means that the factor structure of the DASTC is the same for boys and girls. The fit indices can be considered as acceptable for metric invariance. The difference between the chi-square values obtained for configural and metric invariance was not significant, and the ΔSRMR, ΔRMSEA and ΔCFI values were lower than the critical values (Table 3). Therefore, factor loadings of the DASTC for boys and girls were equal and that the metric invariance was achieved by gender. The fit indices can also be considered as acceptable for scale invariance. The chi-square difference between scale, metric, and configural invariance was significant for gender, but the calculated ΔSRMR, ΔRMSEA and ΔCFI values were relatively low (Table 4). Considering that the chi-square statistic is affected by the sample size, scale invariance between groups (boys and girls) was achieved by gender. This results indicated that both factor loading and intercepts were the same for boys and girls.

Table 4. *Measurement Invariance Model Comparisons by Gender*

Compared models	$\Delta\chi^2$	*SD*	*p*	*ΔSRMR*	*ΔRMSEA*	*ΔCFI*
Model B (metric) - Model A (configural)	14.31	12	.281	.006	-.002	-.001
Model C (scale) - Model A (configural)	40.17	24	.021	.008	-.002	-.010
Model C (scale) - Model B (metric)	28.65	12	.004	.002	.000	-.009

The chi-square difference between scale, metric and configural invariance was not significant for age (Table 5), and the calculated ΔSRMR, ΔRMSEA and ΔCFI values were relatively low (Table 6). These results show that scale invariance between groups (boys and girls) was also achieved by age. Chen (2007) suggests that .01 for CFI change, .015 for RMSEA change, and .030 (for metric invariance) or .015 (for scale invariance) for SRMR change can be used.

Table 5. *Fit Indices for Stages of Measurement Variance of Turkish Version of the Digital Addiction Scale for Children by Age*

Stages	*SRMR*	*RMSEA*	*CFI*	*TLI*
Model A (configural invariance)	0.07	0.07	0.87	0.85
Model B (metric invariance)	0.08	0.07	0.88	0.87
Model C (scale invariance)	0.08	0.07	0.87	0.87

Table 6. *Measurement Invariance Model Comparisons by Age*

Compared models	$\Delta\chi^2$	*SD*	*p*	*ΔSRMR*	*ΔRMSEA*	*ΔCFI*
Model B (metric) - Model A (configural)	34.92	36	. 520	.012	-.005	.002
Model C (scale) - Model A (configural)	79.93	72	. 244	.013	-.006	-.005
Model C (scale) - Model B (metric)	47.15	36	. 101	.001	-.001	-.007

DISCUSSION, IMPLICATIONS, AND CONCLUSIONS

Today's children have been raised in the digital age. Moreover, they are able to frequently access digital devices and spend more time on them. Although, digital devices have numerous applications that children can benefit from, they may cause specific problems to a minority of individuals such as addiction. However, the lack of a diagnostic tool developed or adapted for Turkish children has led to the inability to conduct studies examining digital addiction among Turkish children. Therefore, the present study translated and validated the Digital Addiction Scale for Children (DASC) into Turkish.

After performing CFA, a two-factor structure comprising 24 items (12 items for the 'intrapersonal' factor and 12 items for 'interpersonal factor) was obtained. Only Item 23 ("*I spend too much money on things for my device"*) that had low standardized factor load (<.32) was removed from the scale. One possible explanation for why this item did not load well is that in Turkish culture, the allowances given to children in this age group do not allow them to spend a lot of money on digital devices. In addition, the economic conditions of the families (especially those with middle and lower socio-economic status) may also be another important reason for this issue. The Cronbach's Alpha reliability coefficient was found .92 for the DASTC (α=.89 for intrapersonal factor; α=.80 for interpersonal factor) which means that the adapted instruments had high reliability coefficients. The high significant correlation between DASTC and VASC (r = 0.75) indicated very good convergent validity. To compare Turkish children's scores on the DASTC by gender and age groups, measurement invariance analysis was conducted across three types (i.e., configural, metric, and scale). This indicated that measurement invariance was achieved for both gender and age across all three types.

The DASTC scores among boys were found to be significantly higher than girls' scores. This finding was also found in the original validation study by Hawi et al. (2019). In a study conducted with Turkish adolescents, it was found that digital addiction scores of boys were significantly higher than girls' scores (Arslan, 2020). However, girls had significantly higher digital addiction scores than boys in another study conducted with Estonian children (Seema et al., 2022). These results indicate that more research is needed to have more generalizable findings. Furthermore, it is seen that the results can be divergent according to the type of activity (i.e., game, social media, internet) performed in the digital environment. For example, meta-analysis studies have reported that gaming disorder rates are approximately 2.5:1 in favor of males compared to females (Kim et al., 2022; Stevens et al., 2020). Moreover, many systematic review and meta-analysis studies have reported that males tend to have higher prevalence of internet addiction than females (Ko et al., 2005; Kuss et al., 2014; Meng et al., 2022). Finally, many meta-analysis studies have reported that gender is not a significant predictor of social media addiction even there is often an imbalanced gender ratio (mostly in favor of females) reported in studies (Cheng et al., 2021; Huang, 2022; Shannon et al., 2022; Yang et al., 2022).

The findings also showed that DASTC scores of the children in the older ages (11-12 years) were significantly higher than lower age group (9 years). Similarly, Kırık et al. (2015) indicated that social media addiction level among Turkish adolescents increased from 14 years to 17 years. Longobardi et al. (2020) found a positive association between Italian adolescents' age and their time spent using smartphone daily and using *Instagram* daily (i.e., as the age of the adolescents increased, the time they spent on their smartphone and on *Instagram* also increased). Tsai et al. (2020) reported in their study conducted with Taiwanese children that sixth grade students had significantly higher digital game/internet addiction scores than fifth grade students. One possible explanation for this is that as children grow older, their experience with digital devices and related activities (e.g., social media, video gaming, and online shopping) increases and they have the opportunity to act more independently from their families may have been a factor in the increase of their digital addictions.

The studies examining Turkish participants' digital addiction levels shows that the present study's findings make important contributions to the literature in two aspects. First, there are very few studies examining digital addiction among Turkish children. This is most likely because there have been digital addiction scales developed for both Turkish young adults and Turkish adolescents but not for Turkish children (Dilci, 2019; Kesici & Tunç, 2018). Second, in the literature, only one study (Canseven et al., 2021) examining the digital addiction levels of Turkish children has been carried out previously. However, in that study, children's digital addiction levels were determined using the Computer Game Addiction Scale which does not actually assess digital addiction. Given these weaknesses, there is clearly the need for a new scale to assess digital addiction among Turkish children.

LIMITATIONS AND CONCLUSION

As far as the present authors are aware, the DASTC is the first psychometric instrument that has been validated for Turkish children and provides a valuable tool to adequately assess and monitor digital addiction among Turkish children. However, the following limitations should be considered when interpreting the findings. More specifically, the data collected from the participants were entirely self-report. Self-report data are subject to accuracy of memory recall biases and issues related to social desirability biases. Further studies from different languages and cultures may be beneficial to re-test whether two-factor structure of the DASC can be confirmed among non-Turkish samples. Future psychometric testing could also examine other types of reliability (e.g., test-retest reliability) and other types of testing at item level (e.g., Rasch analysis) as well as examining convergent and discriminant validity using other measures (such as instruments assessing psychological distress including depression and anxiety). Furthermore, given the scale was developed to be utilized in epidemiological studies rather than in a clinical context, the scale should be psychometrically tested in a clinical context to get a more detailed picture of the psychosocial impact of digital addiction in children's lives. Despite these limitations, the present study demonstrated that the DASTC is an instrument that can assess for the risk of digital addiction among younger-aged Turkish schoolchildren. The validation of the scale will hopefully encourage other studies of digital addiction among Turkish children.

ACKNOWLEDGEMENT

The authors would like to thank all participants for their contribution to the present study

DECLARATION OF CONFLICTING INTEREST

The authors declare that they have no conflict of interest except MDG. MDG has received research funding from *Norsk Tipping* (the gambling operator owned by the Norwegian government). MDG has received funding for a number of research projects in the area of gambling education for young people, social responsibility in gambling and gambling treatment from *Gamble Aware* (formerly the *Responsibility in Gambling Trust*), a charitable body which funds its research program based on donations from the gambling industry. MDG undertakes consultancy for various gambling companies in the area of player protection and social responsibility in gambling.

AUTHOR CONTRIBUTIONS

- The first author made substantial contributions to conception, design, analysis and interpretation of data.
-The second author collected the data and made contributions to conceptualization of digital addiction phenomenon.
-The third author critically appraised, revised, and edited the manuscript.

REFERENCES

Almourad, M. B., McAlaney, J., Skinner, T., Pleya, M., & Ali, R. (2020). Defining digital addiction: Key features from the literature. *Psihologija*, *53*(3), 237-253.

Alrobai, A., Phalp, K., & Ali, R. (2014). Digital addiction: A requirements engineering perspective. In: *International working conference on requirements engineering: Foundation for software quality* (pp. 112-118). Springer.

Altınok, M. (2021). Investigation of high school students' digital addiction and life satisfaction. *The Journal of Turkish Educational Sciences, 19*(1), 262-291.

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Arlington, VA: Author.

Arseven, İ. (2020). Examinatıon of the correlation between digital addiction levels and self-regulated learning abilities of high school students. *EKEV Akademi Dergisi*, (82), 173-196.

Arslan, A. (2020). Determination of digital dependency levels and violence tendencies of the high school students. *Journal of Computer and Education Research, 8*(15), 86-113.

Avcı, F. & Er, H. (2019). Investigation of teacher views on digital addiction and suggestions for solution. *Language Teaching and Educational Research, 2*(2), 132-159.

Becker, L. A. (2000). *Effect size (ES).* Retrieved from https://www.uv.es/~friasnav/EffectSizeBecker.pdf

Byrne, B. M. (1998). *Structural equation modeling with Lisrel, Prelis and Simplis: Basic concepts, applications and programming.* Mahwah, NJ: Lawrence Erlbaum Associates.

Canseven, A., Rudarlı-Nalçakan, G., Varol, S. R., & Saracaloğlu, A. S. (2020). The relationship between coordinative and conditional skills and digital addiction of children. *International Journal of Sport Exercise and Training Sciences*, *7*(4), 127-137.

Cemiloglu, D., Almourad, M. B., McAlaney, J., & Ali, R. (2022). Combatting digital addiction: Current approaches and future directions. *Technology in Society, 68*, 101832.

Chen, F. F. (2007). Sensitivity of goodness of fit indexes to lack of measurement invariance. *Structural Equation Modeling: A Multidisciplinary Journal, 14*(3), 464-504.

Cheng, C., Lau, Y. C., Chan, L., & Luk, J. W. (2021). Prevalence of social media addiction across 32 nations: Meta-analysis with subgroup analysis of classification schemes and cultural values. *Addictive Behaviors, 117*, 106845.

Christakis, D. A. (2019). The challenges of defining and studying “digital addiction” in children. *JAMA*, *321*(23), 2277-2278.

Comrey, A. L., & Lee, H. B. (1992). A first course in factor analysis (2nd. ed.). Psychology Press.

Dilci, T. (2019). A study on validity and reliability of digital addiction scale for 19 years or older. *Universal Journal of Educational Research, 7(*1), 32-39.

Duch, H., Fisher, E. M., Ensari, I., Font, M., Harrington, A., Taromino, C., ... & Rodriguez, C. (2013). Association of screen time use and language development in Hispanic toddlers: A cross-sectional and longitudinal study. *Clinical Pediatrics*, *52*(9), 857-865.

Enders, C. K., & Bandalos, D. L. (2001). The relative performance of full information maximum likelihood estimation for missing data in structural equation models. *Structural Equation Modelling, 8*(3), 430-457.

Griffiths, M. (2005). A ‘components’ model of addiction within a biopsychosocial framework. *Journal of Substance Use*, *10*(4), 191-197.

Griffiths, M. (2008). Internet and video-game addiction. In: Essau, C. A. (Ed.) *Adolescent addiction* (pp. 231-267). Academic Press.

Hawi, N. S., Samaha, M., & Griffiths, M. D. (2019). The Digital Addiction Scale for Children: Development and validation. *Cyberpsychology, Behavior, and Social Networking*, *22*(12), 771-778.

Ho, R. C., Zhang, M. W., Tsang, T. Y., Toh, A. H., Pan, F., Lu, Y., ... & Mak, K. K. (2014). The association between internet addiction and psychiatric co-morbidity: A meta-analysis. *BMC Psychiatry*, *14*, 183.

Hooper, D., Coughlan, J., & Mullen, M. (2008). Structural equation modelling: Guidelines for determining model fit. *Electronic Journal of Business Research Methods, 6*(1), 53–60.

Horowitz-Kraus, T., & Hutton, J. S. (2018). Brain connectivity in children is increased by the time they spend reading books and decreased by the length of exposure to screen-based media. *Acta Paediatrica*, *107*(4), 685-693.

Horzum, M. B., Ayas, T., & Balta-Çakır, Ö. (2008). Computer Game Addiction Scale for Children. *Turkish Psychological Counseling and Guidance Journal, 3*(30), 76-88.

Huang, C. (2022). A meta-analysis of the problematic social media use and mental health. *International Journal of Social Psychiatry, 68*(1), 12-33.

Kesici, A., & Tunç, N. F. (2018). The development of the Digital Addiction Scale for the university students: Reliability and validity study. *Universal Journal of Educational Research, 6*(1), 91-98.

Király, O., Potenza, M. N., Stein, D. J., King, D. L., Hodgins, D. C., Saunders, J. B., ... & Demetrovics, Z. (2020). Preventing problematic internet use during the COVID-19 pandemic: Consensus guidance. *Comprehensive Psychiatry*, *100*, 152180.

Kırık, A. M., Arslan, A., Çetinkaya, A., & Gül, M. (2015). A quantitative research on the level of social media addiction among young people in Turkey. *International Journal of Sport Culture and Science, 3*(3), 108-122.

Kim, H. S., Son, G., Roh, E. B., Ahn, W. Y., Kim, J., Shin, S. H., ... & Choi, K. H. (2022). Prevalence of gaming disorder: A meta-analysis. *Addictive Behaviors, 126*, 107183.

Ko, C. H., Yen, J. Y., Chen, C. C., Chen, S. H., & Yen, C. F. (2005). Gender differences and related factors affecting online gaming addiction among Taiwanese adolescents. *Journal of Nervous and Mental Disease, 193*(4), 273-277.

Ko, C. H., Yen, J. Y., Yen, C. F., Chen, C. S., & Chen, C. C. (2012). The association between internet addiction and psychiatric disorder: A review of the literature. *European Psychiatry*, *27*(1), 1-8.

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.

Kuss, D. J., Griffiths, M. D., Karila, L., & Billieux, J. (2014). Internet addiction: A systematic review of epidemiological research for the last decade. *Current Pharmaceutical Design, 20*(25), 4026-4052.

Longobardi, C., Settanni, M., Fabris, M. A., & Marengo, D. (2020). Follow or be followed: Exploring the links between Instagram popularity, social media addiction, cyber victimization, and subjective happiness in Italian adolescents. *Children and Youth Services Review, 113*, 104955.

Maneesriwongul, W., & Dixon, J. K. (2004). Instrument translation process: A methods review. *Journal of Advanced Nursing, 48*(2), 175-186.

Meng, S. Q., Cheng, J. L., Li, Y. Y., Yang, X. Q., Zheng, J. W., Chang, X. W., ... & Shi, J. (2022). Global prevalence of digital addiction in general population: A systematic review and meta-analysis. *Clinical Psychology Review, 92,* 102128.

Miezah, D., Batchelora, J., Megreyab, A. M., Richardc, Y., & Moustafac, A. A. (2020). Video/computer game addiction among university students in Ghana: Prevalence, correlates and effects of some demographic factors. *Psychiatry and Clinical Psychopharmacology*, *30*(1), 17-23.

Miles, J., & Shevlin, M. (2007). A time and a place for incremental fit indices. *Personality and Individual Differences, 42*(5), 869–874.

Nicola, M., Alsafi, Z., Sohrabi, C., Kerwan, A., Al-Jabir, A., Iosifidis, C., ... & Agha, R. (2020). The socio-economic implications of the coronavirus pandemic (COVID-19): A review. *International Journal of Surgery*, *78*, 185-193.

Organization for Economic and Co-operation Development (2021). *Development Co-operation Report 2021: Shaping a Just Digital Transformation.* Paris: OECD Publishing.

Paulus, F. W., Ohmann, S., Von Gontard, A., & Popow, C. (2018). Internet gaming disorder in children and adolescents: A systematic review. *Developmental Medicine & Child Neurology, 60*(7), 645-659.

Peper, E., & Harvey, R. (2018). Digital addiction: Increased loneliness, anxiety, and depression. *NeuroRegulation, 5*(1), 3-8.

Pontes, H. M., Taylor, M., & Stavropoulos, V. (2018). Beyond "Facebook addiction": The role of cognitive-related factors and psychiatric distress in social networking site addiction. *Cyberpsychology, Behavior, and Social Networking, 21*(4), 240-247.

Rehbein, F., Kliem, S., Baier, D., Mößle, T., & Petry, N. M. (2015). Prevalence of internet gaming disorder in German adolescents: Diagnostic contribution of the nine DSM-5 criteria in a state-wide representative sample. *Addiction, 110*(5), 842-851.

Sarıca-Keçeci, H., Kahya-Özyirmidokuz, E., & Özbakır, L. (2021). Digital addiction and relationship between FOMO, personality factors and happiness: An application in university students. *Journal of Dependence, 22*(4), 379-394.

Seema, R., Heidmets, M., Konstabel, K., & Varik-Maasik, E. (2022). Development and validation of the Digital Addiction Scale for Teenagers (DAST). *Journal of Psychoeducational Assessment, 40*(2), 293-304.

Shannon, H., Bush, K., Villeneuve, P. J., Hellemans, K. G., & Guimond, S. (2022). Problematic social media use in adolescents and young adults: Systematic review and meta-analysis. *JMIR Mental Health, 9*(4), e33450.

Small, G. W., Lee, J., Kaufman, A., Jalil, J., Siddarth, P., Gaddipati, H., ... & Bookheimer, S. Y. (2020). Brain health consequences of digital technology use. *Dialogues in Clinical Neuroscience*, *22*(2), 179-187.

Stevens, M. W., Dorstyn, D., Delfabbro, P. H., & King, D. L. (2021). Global prevalence of gaming disorder: A systematic review and meta-analysis. *Australian & New Zealand Journal of Psychiatry, 55*(6), 553-568.

Taşlıyan, M., Karakuş, F. N., & Çakıroğlu, Z. (2021). Investigation of the relationship between digital addiction and creative thinking tendency: A research on university students. *Journal of Academic Researches and Studies, 13*(25), 503-517.

Tomopoulos, S., Dreyer, B. P., Berkule, S., Fierman, A. H., Brockmeyer, C., & Mendelsohn, A. L. (2010). Infant media exposure and toddler development. *Archives of Pediatrics & Adolescent Medicine*, *164*(12), 1105-1111.

Tsai, S. M., Wang, Y. Y., & Weng, C. M. (2020). A study on digital games internet addiction, peer relationships and learning attitude of senior grade of children in elementary school of Chiayi county. *Journal of Education and Learning, 9*(3), 13-26.

Turkish Statistical Institute (2021). Survey on household information technologies (IT) usage. Retrieved from: https://data.tuik.gov.tr/Bulten/Index?p=Hanehalki-Bilisim-Teknolojileri-(BT)-Kullanim-Arastirmasi-2021-37437

van Rooij, A. J., Schoenmakers, T. M., van den Eijnden, R. J. J. M., Vermulst, A. A., & van de Mheen, D. (2012). Video game addiction test: Validity and psychometric characteristics. *Cyberpsychology, Behavior, and Social Networking*, *15*(9), 507-511.

Wang, J., Wang, P., Yang, X., Zhang, G., Wang, X., Zhao, F., ... & Lei, L. (2019). Fear of missing out and procrastination as mediators between sensation seeking and adolescent smartphone addiction. *International Journal of Mental Health and Addiction*, *17*(4), 1049-1062.

We Are Social & Hootsuite (2020). Global Digital Overview: *Essential insights into how people around the world use the internet, mobile devices, social media, and ecommerce*. Retrieved from: https://wearesocial-net.s3-eu-west-1.amazonaws.com/wp-content/uploads/common/reports/digital-2020/digital-2020-global.pdf

Yang, L., Cao, C., Kantor, E. D., Nguyen, L. H., Zheng, X., Park, Y., ... & Cao, Y. (2019). Trends in sedentary behavior among the US population, 2001-2016. *JAMA, 321*(16), 1587-1597.

Yang, Q., Liu, J., & Rui, J. (2022). Association between social network sites use and mental illness: A meta-analysis. *Cyberpsychology: Journal of Psychosocial Research on Cyberspace, 16*(1), Article 1.

Yıldırım, İ. (2021). An evaluation on the changing family relationships on the axis of the social media, digital addiction and cyberbullying. *Journal of Social Sciences of Mus Alparslan University*, *9*(5), 1237-1258.

Yılmaz, E., Griffiths, M. D., & Kan, A. (2017). Development and validation of Videogame Addiction Scale for Children (VASC). *International Journal of Mental Health and Addiction*, *15*(4), 869-882.

Yoo, H. J., Cho, S. C., Ha, J., Yune, S. K., Kim, S. J., Hwang, J., ... & Lyoo, I. K. (2004). Attention deficit hyperactivity symptoms and internet addiction. *Psychiatry and Clinical Neurosciences*, *58*(5), 487-494.