RISKS OF THE DIGITAL WORLD: DIGITAL RISK-TAKING SCALE (DRTS) VALIDITY AND RELIABILITY STUDY

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ABSTRACT

This study aims to conduct validity and reliability of a measurement tool developed to determine university students' levels of digital risk taking. 646 undergraduate students from 8 different universities voluntarily participated in the study. Exploratory and confirmatory factor analyses were conducted to reveal the factor structure of the measurement tool. Data were collected from two different sample groups sequentially. Item-total correlations and internal consistency values were considered to determine the reliability of the measurement tool. The analyses revealed that 12 items of the measurement tool clustered under two different factors. The item loadings ranged from .49 to .76. The results of the confirmatory factor analysis indicated a good fit for the measurement tool. The internal consistency coefficient of the measurement tool was calculated as .77 for the first sample and .76 for the second sample. Correlation analyses conducted to determine the criterion validity of the measurement tool revealed significant relationships between the scores obtained from the measurement tool and variables such as digital dependency, digital citizenship, cognitive flexibility, and emotion regulation. Based on the conducted analyses, it was determined that the measurement tool is a valid and reliable instrument that can be employed to assess the university students' levels of digital risk taking.

Keywords: Digital risks, online risk-taking, risk-taking behaviors, scale development.

INTRODUCTION

Digital Technologies, which present numerous risk factors along with their opportunities, hold significant importance in the daily lives of especially young individuals. One of the concepts used to represent the dangers introduced into our lives with the use of digital technologies is "digital risk." Individuals in today's younger age groups are the recipients of this risky content (Alsoubai et. al., 2024). Contents encountered in digital environments, such as sexually explicit risks, violence and hate speech, and harmful software, can have significant and critical consequences on young individuals (Organization for Economic Co-operation and Development-OECD, 2022). In recent years, as a result of the increasing digital socialization and communication among university students, new digital content and security risks have emerged. For example, personal information and data can be misused as a result of risky communications experienced by university students, especially on social networks (Lin et al., 2020; Purnama et al., 2021). These risks introduced into our lives with digital technologies result in psychological and physiological health problems, particularly among young age groups (OECD, 2022). It has been reported that individuals exposed to digital risks experience significant psychological problems such as depression and anxiety disorders (Mallik, 2020; Montreuil & Malikin, 2021).

Despite the awareness of the significant negative consequences of digital risks and threats, it is noteworthy that there are deficiencies in clear conceptualizations and measurement tools regarding digital risk taking. However, in the constantly evolving digital world, it is critically important to conceptualize and measure these risk factors clearly and explicitly (Strohmeier & Gradinger, 2022). When examining the relevant literature, it is possible to come across differentiated sub-concepts such as "online risk," "digital danger," and "online harm" used to represent these dangers (Livingstone et al., 2020). Similarly, measurement tools found to determine university students' levels of digital risk taking are limited and specific to online risks, internet, and social media risks, and they need to be continually updated to adapt to the ever-changing digital world. This is because digital risks encompass a wide range of content (Colak, 2019; Livingstone et al., 2009). However, in this study, the proposed concept of "Digital Risks" is considered more inclusive as it encompasses risks encountered in both online and offline contexts and various digital devices and usage durations. Therefore, in this study, the term digital risk, which expresses a broader and more inclusive meaning than online risks, is preferred (Inan-Kaya et al., 2018). From this perspective, the concept of "digital risk taking" has been preferred in this study to define risky behaviors that encompass various risks, both online and offline, with the aim of identifying risk levels among university students. These risk definitions inherently require updating due to the nature of digital technologies. However, updating measurement tools with every emerging technology may not be a functional and effective solution. Therefore, it is important for measurement tools to be nourished with expressions that encompass all digital technologies.

Due to the impact of the ongoing Covid-19 pandemic, university students' increased usage of digital technologies compared to previous generations is evident. This increase is considered a significant problem in the literature as it results in an increase in exposure to digital risks (Shen et al., 2021). Similarly, the increasing digital risks on campuses can disrupt the desired learning outcomes in higher education (Mahato et al., 2022). From this perspective, determining the levels of digital risks among university students is of utmost importance. Through a comprehensive review of the current literature, it has been observed that there is a need for a measurement tool that assesses digital risk-taking levels among university students and encompasses current risk-taking tendencies. In this study, aiming to address this gap, the steps outlined in the following methods section were followed to develop a valid and reliable measurement tool.

METHOD

In this study, the steps of developing a digital risk-taking scale for university students were implemented. This section provides information about the study group, data collection process, and the development of the measurement tool, which includes the construction of an item pool. The process also includes application and validity-reliability studies. Details of the steps involved in developing the scale are given under the heading 'Procedure'.

Study Group

The research included undergraduate students from 14 different departments of 8 different universities in Turkiye during the fall semester of 2022. The study was conducted sequentially with two different groups. Firstly, a total of 304 students participated in the Exploratory Factor Analysis (EFA) group, and then 342 students participated in the Confirmatory Factor Analysis (CFA) group, resulting in a total of 646 participants. In the EFA group, 61.8% (f=188) of the 304 students were female, and 38.2% (f=116) were male. The age of this group ranged from 17 to 36, with a mean age of 20.49 and a standard deviation (SD) of 2.05. In the subsequent CFA process, 64% of the 342 university students were female, and 36% were male. The age of the CFA group ranged from 18 to 39, with a mean age of 20.25 and a standard deviation (SD) of 2.35.

Data Collection Process and Tools

Data were collected in two different formats: face-to-face and online, for both the Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA) processes. This was done to avoid potential biases

associated with collecting data solely from online platforms. Information regarding the data collection tools used in this process is presented below.

Voluntary Participant Personal Information Form

This form, developed by the researchers, aims to determine various personal information of the study group participants. It includes inquiries about participants' voluntary participation consent and their "Gender," "Age," "University," "Faculty," and "Department" information.

Digital Risk-Taking Scale Draft Form

A draft item pool of 22 items was developed by the researchers. Opinions from experts and students were employed to determine the content and face validity of the draft scale. Detailed information about the development process of this form is provided in the data collection process. The tools for determining criterion validity are given below.

Digital Citizenship Scale (DCS)

The "Proper Use" dimension of the Digital Citizenship Scale, developed by Som Vural and Kurt (2018), was employed to determine the level of correct usage of digital technologies among university students participating in the research. The Digital Citizenship Scale consists of 23 items gathered under five sub-dimensions, and the "Proper Use" dimension contains a total of 11 items. The scale was designed in a five-point Likert type and reported a total explained variance of 41.43%. Fit indices obtained through DFA analysis (X2/df: 1.66; RMSEA: 0.052; SRMR: 0.056; AGFI: 0.86; CFI: 0.91; NNFI: 0.90; IFI: 0.91) were reported. According to reliability analysis conducted with three different samples, internal consistency coefficients were calculated as .74, .73, and .75, and .77 for the entire samples.

Cognitive Flexibility Scale (CFS)

Developed by Martin and Rubin (1995) and adapted into Turkish by Altunkol (2011), this scale consists of 11 items and a single dimension. It is responded to on a six-point Likert scale. The scale reported a total explained variance of 50%. Internal consistency coefficients of the scale were reported as .74, .73, .75 for three different samples and .77 for the entire sample. Test-retest analysis of the tool resulted in a relationship of .98 between the two applications. The lowest score a university student can receive on the CFS is 6, while the highest score is 72. It is accepted that as students' CFS scores increase, their cognitive flexibility also increases.

Emotion Regulation Scale (ERS)

The Emotion Regulation Scale (ERS), developed by Gross and John (2003) and adapted into Turkish by Yurtsever (2008), consists of 10 items grouped under two sub-dimensions. The scale is responded to on a seven-point Likert scale. The internal consistency coefficients for the dimensions of the scale were reported as .85 for the first sub-dimension and .78 for the second sub-dimension. Test-retest coefficients conducted by the researcher for the sub-dimensions were .88 and .82, respectively.

Procedure

This section provides details about the steps carried out in the development process of the measurement tool. Accordingly, information is provided regarding the creation of the item pool and the validity-reliability studies. The steps followed in the scale development process are presented in Figure 1.

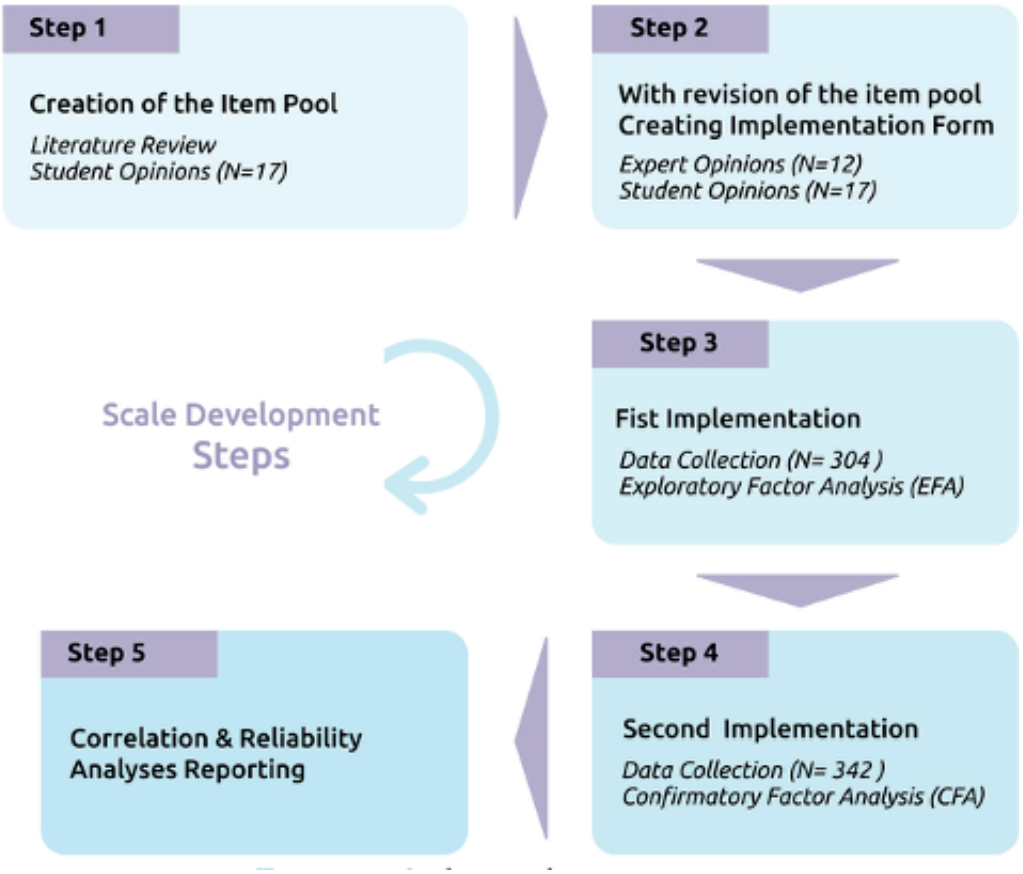

Figure 1. Scale Development Process

Creation of the Item Pool

As a result of the literature review conducted in line with the objectives of the current study, a draft item pool consisting of 32 items was created by the researchers. Expert and student interview forms were prepared to determine the content and face validity of the relevant draft scale. The items were revised based on the opinions of 12 experts (4 professors, 5 associate professors, and 3 doctoral lecturers conducting academic studies in the fields of Measurement and Evaluation, Computer and Instructional Technology Education, Turkish Language and Literature, and Psychology). Since the experts stated that different items measured similar characteristics, a total of 10 items were merged, and 2 items were revised for linguistic and load coherence. The revised items were then presented to 17 university students from different class levels, and they were asked to indicate any expressions that were difficult to understand. The students suggested providing examples of certain types of digital risks. The opinions and suggestions of experts and students were taken into account, and a pre-application form consisting of 22 items was prepared. Participants were expected to respond to the items on a five-point Likert scale, ranging from 1 ("Strongly Disagree") to 5 ("Strongly Agree").

Validity and Reliability Studies

SPSS v25 and AMOS v247 software programs were used for data analysis in this phase of the research. Initially, exploratory factor analysis (EFA) was conducted to determine the factor structure of the candidate measurement tool consisting of 22 items, followed by confirmatory factor analysis (CFA) with a different sample group. It was observed that the kurtosis and skewness values of some items were greater than 2, indicating that these items did not meet the assumption of normality (Tabachnick & Fidell, 2013). Therefore, the principal component analysis, a commonly used factor extraction technique in the social sciences, was employed (Cokluk et al., 2012; Tabachnick & Fidell, 2013). Considering the interrelatedness

of the factors in this scale developed in the social sciences, the promax rotation technique, one of the oblique rotation methods, was used (Cokluk et al., 2012; Field, 2009). The adequacy of the sample and the dataset was determined by conducting Kaiser-Meyer-Olkin (KMO) and Bartlett's tests. In this context, a KMO value of .60 or above and a significant chi-square value in Bartlett's test were considered as criteria to test the suitability of the dataset for factor analysis (Buyukozturk, 2010). Additionally, factor loading values and the explained variance values of the items were taken into account (Cokluk et al., 2012; Stevens, 2009). In order to determine the reliability of the instrument, the Cronbach alpha values of the factors and the Composite Reliability (CR) values were also analyzed. The findings of the conducted EFA, CFA, correlation analyses, and reliability analyses are presented in the next section.

FINDINGS

This section presents the results of the exploratory factor analysis (EFA), confirmatory factor analysis (CFA), reliability, and correlation analyses conducted for the 22-items draft form.

Validity Analysis Results for the Digital Risk-Taking Scale (DRTS)

Before conducting the factor analysis for the candidate measurement tool, the assumptions of the analysis were examined. The Kaiser-Meyer-Olkin value was calculated as .83, indicating sampling adequacy, and the Bartlett's test yielded a significant result (Bartlett's $\chi^2 = 1365.148$, df = 231, $p < .001$). Based on KMO results, it was determined that the dataset was suitable for factor analysis (Field, 2013). When all 22 items included in the candidate form were analyzed, it was found that the measurement tool explained approximately 54% of the total variance. Subsequently, attention was paid to the explained variance values and eigenvalues being above 1 to determine the factor structure of the measurement tool. Additionally, the scree plot for the 22 items included in the EFA process (See Figure 2) was evaluated (Cokluk et al., 2012).

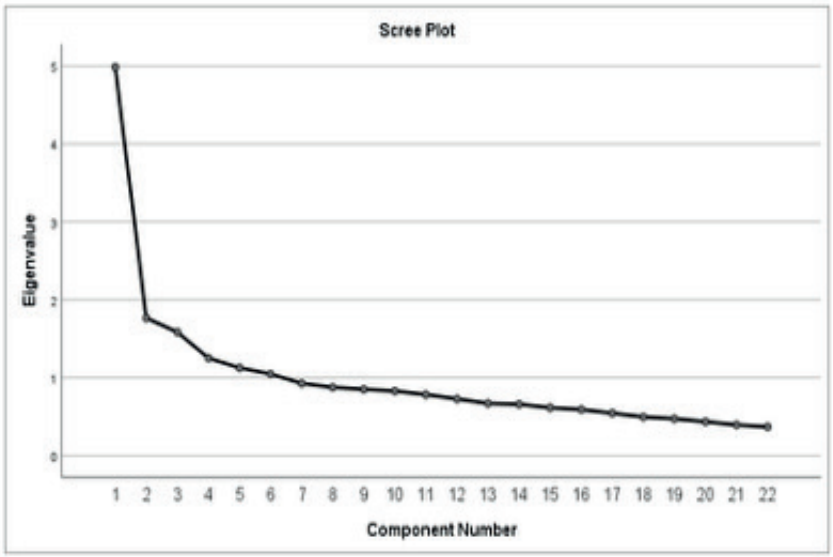

Figure 2. Scree Plot for Factor Analysis

In the conducted factor analysis process, initially all items were included, and a six-dimensional structure with eigenvalues exceeding 1 was observed. It was observed that the eigenvalues related to the scale decreased from 1.765 to 1.585 after the third dimension. With the fourth dimension, this value was observed to be 1.252. Additionally, the substantial concentration of explained variance in the first three dimensions, the number of items in the dimensions, and the variation in eigenvalues indicated a three-dimensional structure of the measurement tool. Furthermore, after examining the slope-intercept graph, explained variance, and eigenvalues, factor loadings of the scale items were taken into consideration. A factor loading value of .40

and above is considered good for sample groups ranging from 200 to 350 (Cokluk et al., 2012). Therefore, items with factor loading values of .40 and below were not included in the analysis.

After these processes, the factor loadings were reconsidered in terms of overlapping items. Accordingly, a factor loading value of .30 and above in another component was considered as an overlapping item (Stevens, 2009). Considering this criterion, 10 items were removed from the analysis one by one on the grounds that they showed an item loading value of .30 and above under more than one dimension at the same time, and then the factor analysis was repeated each time in turn. Before discarding items, experts were consulted about whether the removal of these items would threaten the content validity.

After the factor analyses repeated one by one, it was determined that the measurement tool exhibited a structure consisting of two dimensions in total, with 6 items in each sub-dimension. The EFA results for the two-dimensional and 12-item structure of the measurement tool are given in Table 1.

Table 1. Exploratory Factor Analysis (EFA) Results for the Factor Structure of the Measurement Tool

	Components		Common factor variance	Item-total correlation
	Dimension 1	Dimension 2		
DR12	**,767**	-,063	.551	.535
DR10	**,684**	,032	.448	.513
DR13	**,646**	-,058	.389	.426
DR1	**,634**	-,091	.362	.401
DR21	**,583**	-,018	.331	.395
DR11	**,568**	,227	.482	.497
DR14	-,023	**,736**	.529	.511
DR15	,021	**,639**	.420	.391
DR2	-,100	**,638**	.363	.355
DR5	-,072	**,627**	.360	.374
DR8	-,013	**,554**	.301	.373
DR7	,199	**,496**	.367	.413
Eigenvalue	3.488	1.456	—	—
Explained variance	29.064	12.130	41.194	—
Cronbach alfa (α)	.72	.66		
Composit Reliability (CR)	.81	.77		

According to the findings obtained from the final factor analysis, it is observed that the first dimension of the measurement tool consists of 6 items with factor loadings ranging from .568 to .767, explaining approximately 29% of the total variance. In the second dimension of the measurement tool, six items are clustered, explaining approximately 12% of the total variance, and the factor loadings of these items range from .496 to .736. It is determined that the scale explains approximately 41% of the total variance. After determining the factor structure of the scale, a confirmatory factor analysis (CFA) was conducted on the model consisting of 12 items with two dimensions. Examining the Cronbach alpha scores, the first dimension was calculated as .72 and the second as .66. These values provide clues about the reliability of the scale (Kartal & Dirlik, 2016). Composit Reliability (CR) was calculated as 0.81 for the first factor and 0.77 for the second factor. CR value above 0.70 indicates that the items represent the construct they are trying to measure well and that there is consistency between these items (Kline, 2015).

Results of Confirmatory Factor Analysis for DRTS

In order to reassess the structure consisting of 12 items and two dimensions obtained during the CFA process of the study, commonly used model fit indices in the literature were considered. One of the values taken into account in the process of deciding on model fit is the chi-square (χ^2) statistic. However, since the chi-square

(χ^2) statistic is sensitive to sample size, the ratio of the chi-square value to the degrees of freedom (df) was considered (Cokluk et al., 2012; Hooper et al., 2008; Kline, 2015). In addition, commonly recommended fit indices such as CFI, TLI, RMSEA, and SRMR were also taken into account. The decision-making process regarding fit indices was based on the criteria provided below (Cokluk et al., 2012; Hooper et al., 2008; Kline, 2015; Mueller & Hancock, 2008). In this context, Table 2 presents the fit indices and the results of the measurement model conducted within the scope of the study.

Table 2. Chi-Square Test and Fit Indices for the Measurement Model

Model	χ2/sd	RMSEA (90% C.I.)	CFI	TLI	SRMR
Indices	(χ2/sd <3): Good Fit	(RMSEA<5): Good Fit	>0.95	>0.90	<.10
DRTS Model Results	1.657 (87.799/53)	.044 (.027 – .060)	0.95	0.94	.046

In line with this, when examining the fit indices presented in Table 2, it can be observed that the ratio of χ^2/df is 1.657 (87.799/53), indicating a good fit. The TLI value for the measurement model is .94, the CFI value is .95, the RMSEA value is .044 (LO-HI 90= .027 - .060), and the SRMR value is .046. These findings indicate that the two-dimensional model proposed during the CFA process exhibits a good fit. Subsequently, considering the factor loadings of the measurement items, the relevant values for the model are presented in Figure 3.

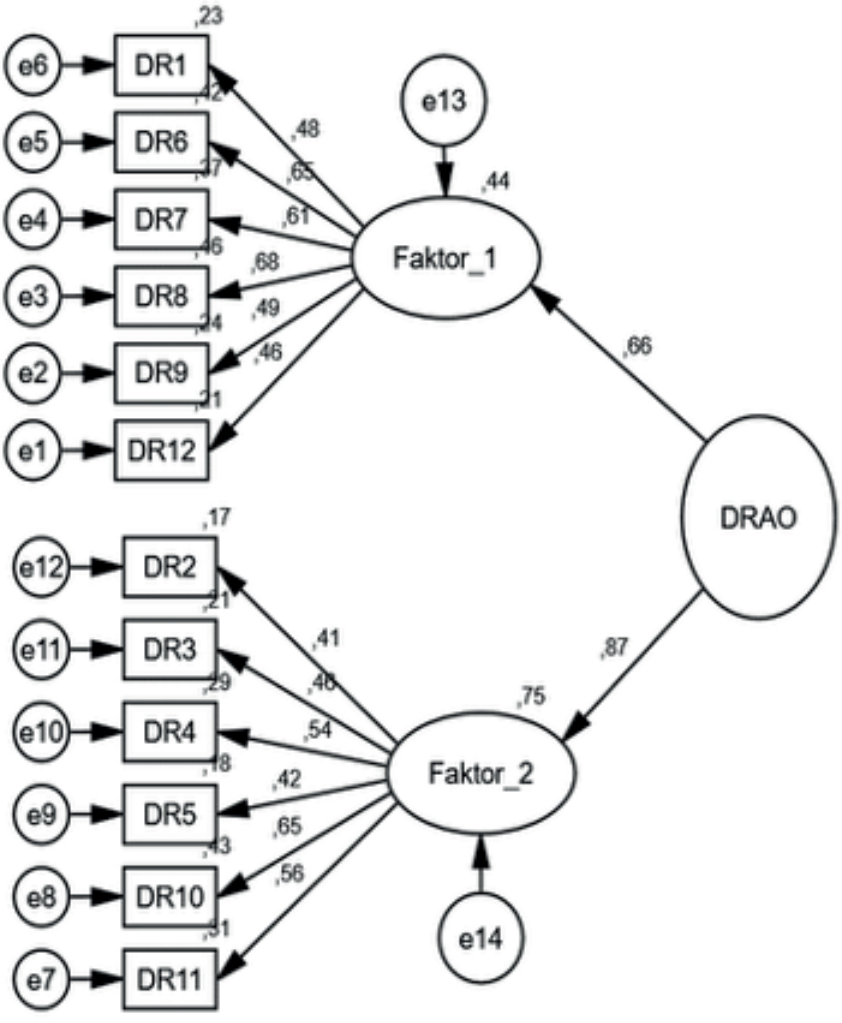

Figure 3. Results of Confirmatory Factor Analysis for Digital Risk-Taking Scale

Upon inspection of Figure 3, it is evident that the factor loadings for the items within the primary dimension span a range of 0.46 to 0.68. Conversely, the factor loadings for items belonging to the secondary dimension exhibit a range of 0.41 to 0.65. Given these observations, it can be concluded that the factor loadings associated with the scale items surpass the established threshold of 0.40 as outlined in the extant literature (Cokluk et al., 2012; Stevens, 2009). Subsequent to this analysis, consultations were conducted with six experts who had previously been involved in delineating the names of the two dimensions. Furthermore, a comprehensive review of the pertinent literature was undertaken, culminating in the decision to designate these sub-dimensions as "digital content risk" and "digital security/privacy risks," respectively.

Findings of Reliability Analysis for DRTS

To examine the reliability of the measurement instrument, the Cronbach alpha values (α) were investigated for each sub-dimension and the total score using the data obtained from both the EFA and CFA samples. As a result, the internal consistency values for the first sub-dimension of the scale were determined as .72 and .73 for the two different samples, respectively. For the second sub-dimension of the scale, the internal consistency value was calculated as .66 in both samples. Regarding the total scale score, the internal consistency value was found to be .77 in the first sample and .76 in the second sample. According to the relevant literature, an internal consistency value of .60 or higher is considered acceptable for reliability (Buyukozturk, 2010; Taber, 2018). McDonald's Omega test result for the total scale was calculated as .76. In order to strengthen estimates of the reliability of the scale, two split-half reliability and Composit Reliability (CR) analyses were conducted. Spearman-Brown coefficient for equal groups consisting of six items each was determined as .73.

Findings of Correlation Analysis

Pearson correlation analysis was conducted to examine the relationship between digital risk-taking behaviors and digital addiction, correct usage, cognitive flexibility, and emotion regulation, which are known to be associated with digital risk-taking behaviors. The findings of the relevant analysis are presented in Table 3.

Table 3. Results of Correlation Analysis for Research Variables

	DRT	DA	CU	ER	CF
Digital Risk-Taking (DRT)	1				
Digital Addiction (DA)	,.18**	1			
Correct Usage (CU)	-.389**	-.273**	1		
Emotional Regulation (ER)	-.171**	-.240**	.292**	1	
Cognitive Flexibility (CF)	-.113**	-.322**	.389**	.469**	1

When examining Table 3, it is evident that there is a positive and significant relationship between the scores of university students participating in the study on the DRTS and their levels of digital addiction. Furthermore, a negative and significant relationship was observed between the variables of Correct usage (CU), emotion regulation (ER), and cognitive flexibility (CF) with the scale. The presence of significant relationships between the variables provides evidence for the criterion validity of the DRTS scale. The observation of significant, albeit not strong, relationships between these variables and DRTS scores provides clues about the criterion validity of the instrument. Indeed, the relevant literature emphasizes that there are significant relationships between digital risk-taking behavior and the variables listed in Table 3. (Cudo & Zabielska-Mendyk, 2019; Li et al., 2020; Liu et al., 2023). The score obtained from the DRTS has a significant correlation with the variables related in the literature.

DISCUSSIONS AND CONCLUSION

In this study, a measurement instrument was developed to determine university students' levels of digital risk-taking behavior. In this process, considering the steps of scale development, a preliminary item pool was created, and through expert and student opinions, as well as item analyses, an item pool consisting

of 12 items with 2 sub-dimensions was developed. The sub-dimensions of the scale were named "*digital security/privacy risks*" and "*digital content risks*" with the guidance of expert opinions. The analyses conducted resulted in the determination that DRTS is a valid and reliable measurement instrument. Furthermore, correlation analyses were performed to determine the criterion validity of the instrument by examining its relationships with various variables associated with digital risk-taking behaviors in the literature. In line with this purpose, the relationship between the scores obtained from the DRTS and the variable of proper usage of digital technologies was examined, revealing a significant negative relationship between these variables. Similar findings can be found in the literature regarding the relationships between online risk-taking, proper usage of digital technologies, and digital literacy (Helsper & Smahel, 2020; Purnama et al., 2021; Qiu et al., 2022; Wang et al., 2021).

Another variable expected to be associated with digital risk-taking in the literature is digital addiction (Davis et al., 2023; Jalil & Sinnamon, 2019; Nwanosike et al., 2022). In this research, a significant relationship was observed between university students' levels of digital addiction and scores on the DRTS scale through correlation analysis. Risk-taking behaviors are influenced by psychosocial variables (Bilgic et al., 2021). In this study, a negative and significant relationship was found between students' DRTS scores and their levels of cognitive flexibility and emotion regulation. Similarly, in the relevant literature, studies reporting relationships between online risk-taking behaviors and emotion regulation (Dawson et al., 2019; Li et al., 2020; Turliuc et al., 2020; Uddin & Rahman, 2022) and cognitive flexibility (Raj et al., 2023; Ryu et al., 2021; Tanhan et al., 2023) variables can be found.

In conclusion, the developed DRTS within the scope of this research can be used to determine university students' levels of digital risk-taking behavior. Digital technologies are constantly and rapidly changing. Therefore, specifying certain social media names or limiting them with specific tools may not be an effective approach in measurement instruments. Additionally, digital risks are constantly evolving and transforming. It is expected that the developed DRTS will fill the gap in the current literature and serve as a valuable and reliable tool for research on digital risks.

Authors' Note: This measurement instrument was developed within the framework of a doctoral dissertation written by the first author under the supervision of the second author. A significant portion of the research report is taken from the relevant doctoral dissertation work.

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